

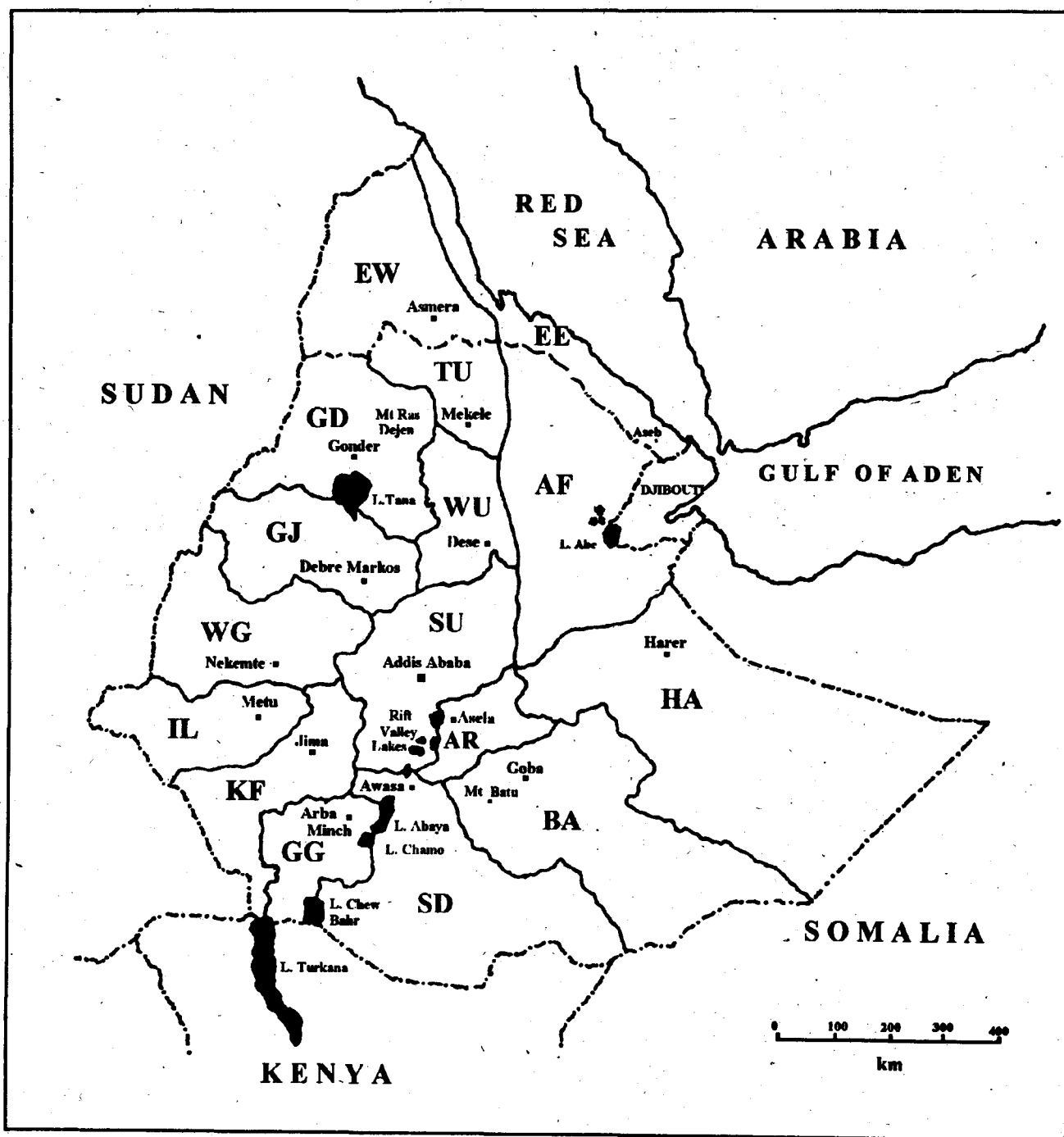
**FLORA OF
ETHIOPIA AND ERITREA**

VOLUME 7

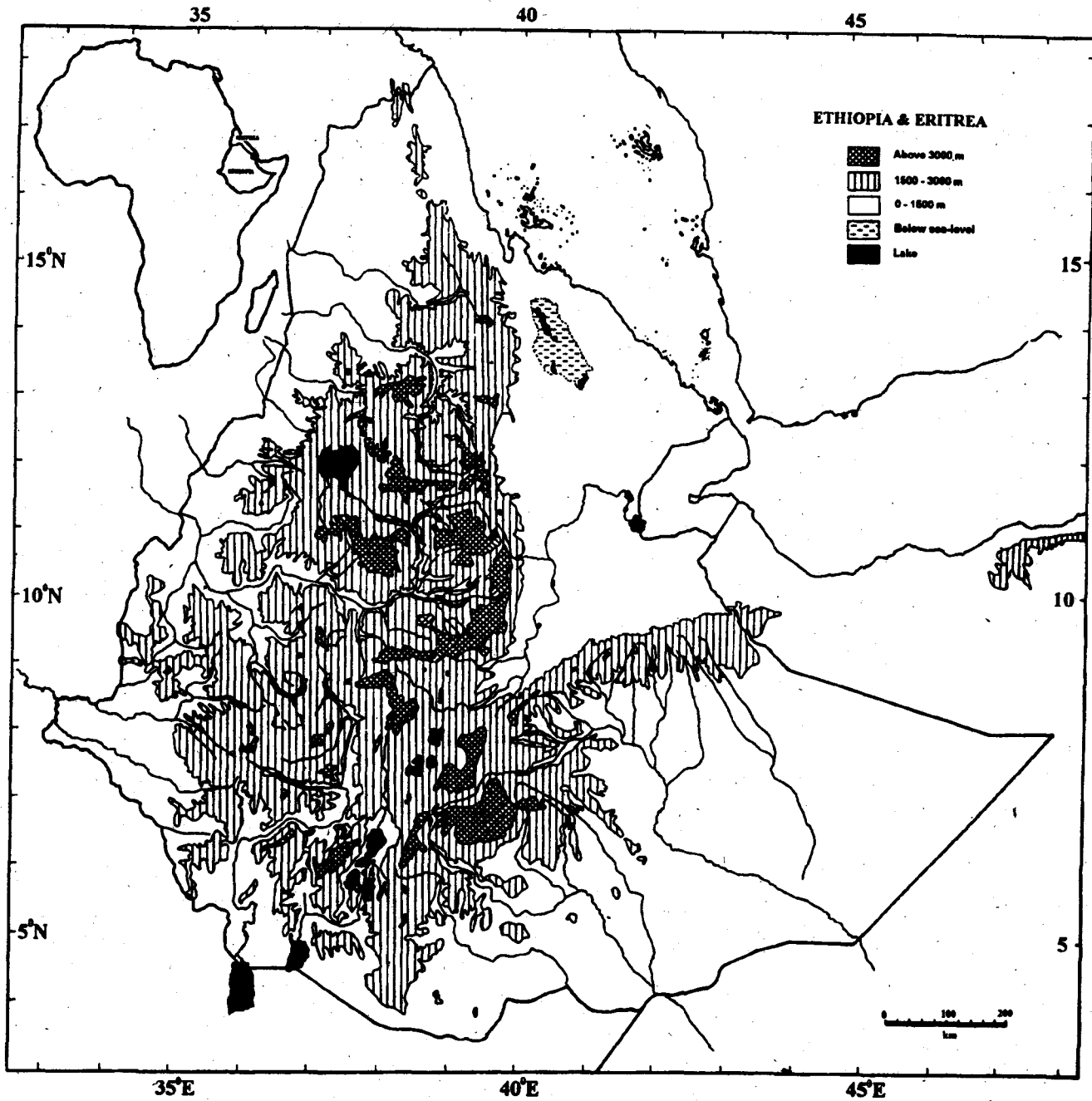
MAP OF THE FLORISTIC REGIONS OF ETHIOPIA AND ERITREA

(These are the regions used in Volume 3 and adopted in this Volume for continuity. They do not bear any relation to the new administrative structures.)

- | | |
|--|-----------------------|
| EE - Eritrea East, below and to the east of the 1000 m contour | AR - Arsi region |
| EW - Eritrea West, above and to the west of the 1000 m contour | WG - Welega region |
| AF - Afar region, below and to the east of the 1000 m contour to the Eritrean border in the east and the Harerge border in the south | IL - Illubabor region |
| TU - Tigray region, above and to the west of the 1000 m contour | KF - Kefa region |
| GD - Gonder region | GG - Gamo Gofa region |
| GJ - Gojam region | SD - Sidamo region |
| WU - Welo region, above and to the west of the 1000 m contour | BA - Bale region |
| SU - Shewa region, above and to the west of the 1000 m contour | HA - Harerge region |



MAP OF ETHIOPIA AND ERITREA SHOWING MAJOR PHYSIOGRAPHIC FEATURES



FLORA OF ETHIOPIA AND ERITREA

VOLUME 7

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**FLORA OF
ETHIOPIA AND ERITREA
VOLUME 7**

Editors: Inga Hedberg & Sue Edwards

**POACEAE
(GRAMINEAE)**

by

Sylvia Phillips

*Addis Ababa, Ethiopia
Uppsala, Sweden
1995*

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Cover illustrations:

Front: Inflorescence and involucre of *Pennisetum setaceum* and inflorescence of *P. villosum*

Back: *Hyparrhenta anthistirioides* and *H. claytonii*

Spine: Detail of *Hackelochloa granularis* inflorescence

all drawn by Eleanor Catherine

FLORA OF ETHIOPIA AND ERITREA, VOL. 7

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PREFACE

The first volume of Flora of Ethiopia, Volume 3, was prepared by the Ethiopian Flora Project and published over five years ago by Addis Ababa University in Ethiopia and Uppsala University in Sweden. The objectives of, and a brief historical background to, the Project were given in the Preface to Volume 3 and there is therefore no need to repeat it here. However, we feel that it may be appropriate to include a brief account of the eminent Ethiopian and international support which the Project has enjoyed, and the good fortune it has had in being able to continue through the final difficult years of the civil war in Ethiopia.

The Ethiopian Flora Project has received and expects to continue to enjoy financial support from the Ethiopian Government through Addis Ababa University, and from the Swedish Government through the Swedish Agency for Research Cooperation with Developing Countries (SAREC). It has also continuously received the support of all the institutions and scientists acknowledged in Volume 3.

When Volume 3 was published Ethiopia was undergoing a very difficult period. The situation worsened as the civil war approached its end, which came in May 1991. Though life returned quickly to near normal in the towns after the the civil war ended and the Transitional Government of Ethiopia was established, field work continued to be hampered in the western, southern and eastern parts of the country owing to the slow return to stabilized political conditions. The North was, however, already at peace before the Ethiopian Peoples' Revolutionary Democratic Front (EPRDF) forces took over Addis Ababa from the former military government. This opened the northern parts of Ethiopia to field work but difficulties were caused by the run-down infrastructure, especially roads, resulting from the many years of war in the North. By 1993 the infrastructure had improved significantly and the stress of political upheaval had ceased, making it possible to organize field trips to important sites. However, much of the country is still not served by roads and many areas are difficult to reach. Field work has therefore suffered. The editorial work in Ethiopia has also suffered, with difficulties of access to adequate desk top publishing equipment. Overall, it was a period when personal security was threatened and morale needed boosting with little in sight to achieve this.

Though all this has now passed, it caused the work of the Ethiopian Flora Project to lag behind the initial schedule. We are grateful that no loss has occurred of life, herbarium material or the supporting infrastructure which the Project has developed in the National Herbarium. Of crucial importance has been the assistance and support given by friends, both individuals and institutions in Ethiopia and abroad.

In spite of the problems of the last few years and the resulting delay, there has been a steady growth in the activities of the Project. The first volume published of the Flora (Volume 3) included the economically very important family of legumes. The family covered in this volume (Volume 7) deals with an equally important family, that of the grasses, the representation of which in Ethiopia is so large that it merits a separate volume.

It gives us great pleasure to thank the institutions and individuals who have supported and continue to support the Ethiopian Flora Project. The Ethiopian Science and Technology Commission, in particular the Commissioner, Dr Kebede Tadesse, and the Deputy Commissioner, Ato Asrat Bulbula, and SAREC in Sweden, deserve special thanks for the financial input that has made the Project and the publishing of this volume possible. The Addis Ababa University, especially its president, Dr Duri Mohammed, the Research and Publications Officer, Dr Berhanu Abegaz, the Dean of the Faculty of Science, Dr Zemedede Asfaw, and the Head of the Department of Biology, Dr Yalemtehay Mekonnen, deserve unreserved thanks for the administrative and supervisory guidance they have been giving to the Project. We are also very grateful to the Kew Herbarium, in particular to Professor Gren Ll. Lucas, and to the scientific and technical staff, for their most invaluable support, to Professor Ib Friis, University of Copenhagen, Denmark, and to Professor Christian Puff, University of Vienna, Austria, as well as to the many other institutions and individuals supporting us from the launching of the Project and still supporting us.

The present volume is a testimony to the input made by Kew and Uppsala as Mrs Sylvia Phillips prepared the manuscript at Kew, supported by money made available from SAREC, and the final editing and preparing of camera-ready pages were done by Dr Inga Hedberg at the Department of Systematic Botany in Uppsala and verified in Addis Ababa. The dedication of Ms Sue Edwards and her colleagues in the Department of Biology, Addis Ababa University, who also compiled, edited and produced the final pages of the section on vernacular names is gratefully acknowledged.

The immediate and unconditional acceptance by Dr Inga Hedberg to take over the responsibility for the present volume, which has implied an undertaking far beyond her normal work load, is deeply appreciated. The volume was printed in Addis Ababa.

FOREWORD

This volume could not have been prepared without the support and assistance of the Royal Botanic Gardens, Kew, England, where the author has been based. For a large part of the time space was found for her at Kew's outstation at Wakehurst Place in Sussex, when family commitments made it impossible for her to travel to the Herbarium at Kew on a daily basis. This was despite the limited office space at Wakehurst and the fact that this is the home of the Kew seed bank and physiology section, not taxonomy. Especial thanks are due to Mr Roger Smith, Head of Physiology, for his help and forbearance over an extended period. The latter part of the work was carried out at Kew itself, in the Grass Section of the Herbarium. The help received from the staff members, Dr Derek Clayton, Mr Steve Renvoize and Dr Tom Cope, has been invaluable both in terms of facilities provided, and especially in their ever ready willingness to discuss taxonomic problems and provide useful advice during the whole course of the preparation of this volume.

In Ethiopia, Ms Sue Edwards, who herself has a long-standing interest in and wide knowledge of the grasses of Ethiopia, has given the author much encouragement and helpful advice. Dr Jean Hanson, Head of Forage Genetic Resources at the International Livestock Centre for Africa, has given much valuable assistance by making the ILCA Herbarium available for consultation, and by generally helping the author during her visits to Ethiopia in every way she could. In the final stages of preparation of the manuscript in Addis Ababa Ato Yilma Tesfaye assisted with herbarium and computer work. The list of vernacular names was compiled by Ato Mirutse Giday, and Drs Zemedet Asfaw and Ensermu Kelbessa assisted in co-editing the list. A few of the illustrations are taken from *Flora of Tropical East Africa* and *Flora Zambesiaca* with the kind permission of the Editors. However, the great majority of the illustrations have been prepared by Eleanor Catherine Huxley, with whom it has been a pleasure to collaborate, and whose work adds immeasurably to the appearance and usefulness of this volume.

The final editing of the volume was largely done at the Department of Systematic Botany, Uppsala University, where invaluable assistance in various respects was provided by Ms Eva Persson.

Finally, we wish to thank Professor Olov Hedberg for his unstinting help throughout the preparation of this volume.

I. H. & S. M. P., January 1995

ABBREVIATIONS

(excluding authorities for names)

All units of measurement are given with SDI abbreviations.

Herbarium abbreviations are according to *Index Herbariorum* ed. 8, 1990.

AF - Afar region, Ethiopia

Afr. - Africa

ALF - Herbarium, Institut d'Élevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons Alfort, France

alt. - altitude

Amer. - American

AR - Arsi region, Ethiopia

auct. - 'auctorum' Latin, meaning 'of authors'; used to show that a name has been commonly misapplied to a different species from that to which it was originally given

B - Botanischer Garten und Botanisches Museum, Berlin, West Germany

BA - Bale region, Ethiopia

BM - Herbarium, British Museum (Natural History), London, U. K.

Bot. - botany

BR - Herbarium, Jardin Botanique National de Belgique, Meise, Belgium

C - (before a place name) central

C - Botanical Museum and Herbarium, Copenhagen, Denmark

c - 'circa' Latin, meaning 'about' or 'approximately'

cf. - 'confer' Latin for 'compare'

CGE - Herbarium, Botany School, University of Cambridge, England

Cuf., Enum. - Cufodontis '*Enumeratio Plantarum Aethiopiae*'

destr. - destroyed

diam. - diameter

E - east

e.g. - 'exempli gratia' Latin for 'for example'

EA (also sometimes mistakenly as EAH) - East African Herbarium, Nairobi, Kenya

ed. - edition or edited by

EE - Eritrea east, below 1000 m contour to Red Sea in the east

Eng. - English

et al. - 'et alii' Latin for 'and others'

etc. - 'et cetera' Latin for 'and the rest'

ETH - The National Herbarium, Addis Ababa University, Ethiopia

EW - Eritrea west, above 1000 m contour to Sudan in the west

f. - 'filius' Latin for 'son'

FI - Herbarium Universitatis Florentinae, Museo Botanico, Firenze, Italy

fig. - figure

Fl. Trop. Afr. - *Flora of Tropical Africa*

Fl. Trop. East Afr. - *Flora of Tropical East Africa*

Fl. Zamb. - *Flora Zambesiaca*

FR - Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt, Germany

FT - Erbario Tropicale di Firenze, Firenze, Italy

G - Herbarium, Conservatoire et Jardin botaniques, Geneve, Switzerland

GD - Gondar region, Ethiopia

GE - Erbario dell' Instituto Botanico "Hanbury" e Orto Botanico dell' Università di Genova, Genova, Italy

GG - Gamu Gofa region, Ethiopia

GJ - Gojam region, Ethiopia

GOET - Systematisch-Geobotanisches Institut, Göttingen, Germany

HA - Harerge region, Ethiopia

HBG - Herbarium, Institut für Allgemeine Botanik und Botanischer Garten, Hamburg, Germany

Herb. - herbarium

holo. - holotype

hort. - 'hortorum' Latin for 'of gardens'; a name used in horticulture

I.A.R. - Institute of Agricultural Research, Ethiopia

IECAMA - Imperial Ethiopian College of Agriculture and Mechanical Arts, now Alemaya University of Agriculture, Ethiopia

IL - Ilubabor region, Ethiopia

ILCA - International Livestock Centre for Africa, Addis Ababa, Ethiopia

III. Guide Grasses Eth. - '*An Illustrated Guide to the Grasses of Ethiopia*' by Fröman and Persson (1974)

in sched. - 'in schedula' Latin for 'on a herbarium label'

in syn. - in synonymy

ined. - 'ineditus' Latin, meaning that the item is being prepared for publication

Is. - islands

iso. - isotype

isolecto. - isolectotype

isosyn. - isosyntyte

JE - Herbarium Haussknecht, Friedrich-Schiller-Universität, Jena, Germany

K - The Herbarium, Royal Botanic Gardens, Kew, U.K.

Kew Bull. - *Kew Bulletin*

KF - Kefa region, Ethiopia

L - Rijksherbarium, Leiden, Netherlands

L. - lake

l. c. - 'loco citato' Latin for 'in the place cited'

LD - Botanical Museum, Lund, Sweden

LE - Herbarium of the Department of Higher Plants, V.L. Komarov Botanical Institute of the Academy of Sciences, St. Petersburg (Leningrad), Russia

lecto. - lectotype

leg. - 'legit' Latin for 'collected by'

LINN - Herbarium, The Linnean Society of London, London, England

LISU - Herbário, Instituto Botânico, Faculdade de Ciências, Lisboa, Portugal

LUB - Herbarium, Naturhistorisches Museum zu Lübeck, Lübeck, Germany

LY - Herbiers de l' Université de Lyon, Villeurbanne, France

M - Museum, Botanische Staatssammlung, München, Germany

MA - Herbarium, Jardin Botánico, Madrid, Spain

MPU - Institut de Botanique, Montpellier, France

Mt - Mount

- N - north
 NE - north east
 neo. - neotype
 nom. - 'nomen' Latin for name
 nom. confus. - 'nomen confusum' Latin for 'confused name'
 nom. cons. or nom. conserv. - 'nomen conservandum' Latin for 'conserved name'
 nom. illegit. - 'nomen illegitimum' Latin for 'illegitimate name'
 nom. nov. - 'nomen novum' Latin for 'new name'
 nom. nud. - 'nomen nudum' Latin for 'naked name', a name published without a description of the taxon
 nom. superfl. - 'nomen superfluum' Latin for a name superfluous when published
 NTM - Herbarium, Muséum d'Histoire Naturelle, Nantes, France
 NW - north west
 op. cit. - 'opere citato' Latin, meaning 'in the work already quoted'
 OXF - Herbarium, Department of Botany, University of Oxford, England
 P - Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie, Paris, France
 p.p. - 'pro parte' Latin for in part; used to show that only a part of the group as circumscribed by the original author is being used by the later author
 PAL - Erbario Siculo e Erbario Generale, Palermo, Italy
 PAT - Laboratoire d'Ethnobotanique, Muséum National d'Histoire Naturelle, Paris, France
 R. - river
 RO - Erbario dell' Instituto Botanico dell' Università di Roma, Roma, Italy
 S - Herbarium, Naturhistoriska Riksmuseet, Stockholm, Sweden
 S - south
 s. lat. - 'sensu lato' Latin for 'in a broad sense'
 s.n. - 'sine numero' Latin for 'without a number'
 SD - Sidamo region, Ethiopia
 SE - south east
 Sect. - section
 sp. - species (singular)
 spp. - species (plural)
 STR - Institute de Botanique de l' Université Louis Pasteur, Strasbourg, France
 SU - Shewa upland, above 1000 m contour in the west, Ethiopia
 subsp. - subspecies (singular)
 SW - south west
 syn. - synonym
 t., tab. - 'tabula' Latin for illustration
 TO - Herbarium, Museum Botanicum Horti Taurinensis, c/o Istituto ed Orto Botanico dell' Università, Torino, Italy
 Trop. - tropical
 TU - Tigray region, Ethiopia
 TUB - Herbarium, Institut für Biologie I, Tübingen, West Germany
 UPS - The Herbarium, Uppsala University, Uppsala, Sweden
 US - United States National Herbarium, Smithsonian Institution, Washington, U.S.A.
 var. - variety
 vol. - volume of a book
 W - Naturhistorisches Museum, Wien, Austria
 W - west
 WG - Welega region, Ethiopia
 WIR - Herbarium, The All-Union Institute of Plant Industry, St. Petersburg, Russia
 WU - Welo region, Ethiopia
 Z - Institut für Systematische Botanik der Universität Zürich, Zürich, Switzerland
 ± - more or less
 < - smaller than
 > - larger than

NOTES ON GRASSES AND GRASS IDENTIFICATION

Grassland in Ethiopia

Grasses are found throughout Ethiopia and Eritrea from sea level to the highest points in the Afro-alpine zone above 3500 m. The most extensive areas of grassland are in the uplands of the central plateau, some of it on land cleared from forest, and the western and southern lowlands. Afro-alpine grassland occurs above the tree line making a short turf or intermingled with herbs, particularly species of *Helichrysum* and *Ericaceae*. These are important grazing areas for sheep and cattle.

The plateau grassland forms a mosaic with remnants of the dry evergreen forest dominated by *Juniperus procera*, *Acacia* woodland and evergreen bushland and scrub. The wide valleys on the plateau are on seasonally waterlogged black clays (vertisols) which are unsuitable for the growth of trees and other woody plants. Grass is well adapted to grow naturally on such soils and these areas have been called edaphic grasslands. *Acacia* woodland occurs in the ecotone between these grasslands and the forest. The edaphic grasslands are the most important grazing areas for the domestic animals of the highland peasant farmers. It should be recalled that Ethiopia has the highest domestic animal population in Africa and the tenth highest in the world.

Below the plateau, at around 1500 m, the vegetation passes into wooded grassland where *Combretum* and *Terminalia* are common. The grasses of these areas are characteristically tall in the western lowlands and the river valleys dissecting the plateau. This type of vegetation is regularly burned and has developed its own distinct flora. Large areas of bushland, dominated by *Acacia* and *Commiphora* with a cover of short grass, occur in the lower rainfall regime of the southeast, the Ogaden.

There are also patches of grassland in the semi-arid areas of the Awash valley and along the Red Sea coast with their own characteristic species.

Grass Morphology

The grasses are a very natural family, and can usually be recognized without difficulty even by non-botanists due to their distinctive and uniform morphology. However, they have elaborated upon their basic structural plan in a myriad of different ways, leading to fascinating variations and adaptations of the general theme, but also resulting in increasing complexity through modification and reduction of the spikelet parts. Thus grass identification is not simple, and a successful identification rests upon a thorough understanding of spikelet structure.

A $\times 10$ hand-lens and a pair of dissecting needles are essential equipment for anyone wishing to accurately identify grasses from keys. The beginner is advised to

start by practicing the dissection of a TEF (*Eragrostis tef*) spikelet, which has a simple unmodified structure. Once the various spikelet parts have been identified (Fig. 1) and their arrangement understood, progress can be made to other grasses with simple spikelets (common examples can be found in *Sporobolus*, *Eleusine* and *Panicum*). In time, sufficient confidence will be gained to tackle the identification of more complex genera, and some of the tribes will become recognizable on sight. Measurements should be made on a spikelet taken from the middle of a well-developed inflorescence. The lemma measurements refer to the lowest lemma in a normal unmodified spikelet.

The following morphological notes are intended to amplify the family description, and to give guidance to beginners in the main key characters, with some shortcuts to recognizing the commoner and more distinctive tribes. It is recommended that these notes are read before attempting the key to tribes. Students wishing to gain a comprehensive knowledge of the grasses should consult *Genera Graminum* by Clayton & Renvoize (1986), where grass structure is elucidated in depth and the anatomical and physiological basis for the modern tribal classification is explained.

Habit

A frequent key character is the distinction between annual and perennial grasses. In annuals there is only a relatively small fibrous root system and all the shoots develop into flowering culms terminating in an inflorescence. In perennials the flowering culms are fewer and are accompanied by leafy vegetative shoots; there is frequently a basal rootstock or rhizome and perennating buds occur at the base of the plant. Some grasses which may persist for more than one season without developing a true perennial habit are termed short-lived perennials.

Culms

The culm-internodes extend from a basal meristem at each node, the young developing tissue being protected and supported by the leaf-sheath. The internodes are usually hollow, but are solid in some bamboos (e.g. *Oxytenanthera*) and are frequently solid in *Andropogoneae* (e.g. *Saccharum*, sugar cane). Culms may be erect, ascending, or decumbent or stoloniferous and rooting at the lower nodes. Tall erect grasses, especially those from moist or shady habitats, may develop supporting stilt roots from the lower nodes.

Leaves

The leaves (Fig. 1) are usually crowded on short internodes at the base of the plant, forming a tuft, but

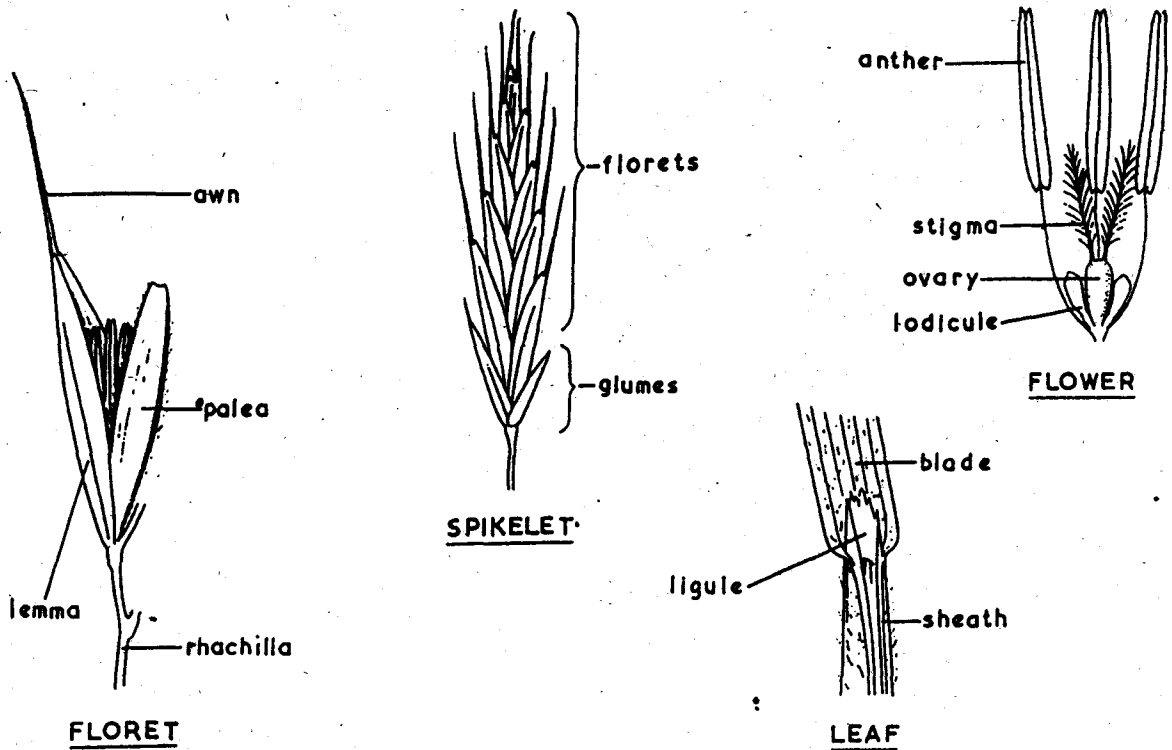


Figure I. Schematic diagram showing parts of leaf, spikelet, floret and flower. (Reproduced from *Fl. Trop. E. Afr.* with permission of the Editors.)

become spaced out up the culm. The leaf-sheath usually has free overlapping margins, but rarely the margins are connate to form a tube (e.g. *Streblochaete*). Small projections sometimes developed at the sheath-mouth are termed auricles. The leaf-blades may be constricted at the sheath junction, and in extreme cases, may be narrowed to a false petiole (e.g. *Pennisetum petiolare*). In some desert grasses the blade is articulated with the sheath, soon falling to leave the sheath as the photosynthetic organ (e.g. *Eragrostis mahrana*).

The ligule is a small flap of tissue or a fringe of hairs on the inner side of the junction of sheath and blade. Very rarely it is absent (e.g. *Echinochloa colona*) or an additional external ligule may occur (e.g. *Andropogon gayanus*).

Inflorescence

Inflorescence structure (Fig. II) is one of the most easily observed and useful sources of variation in grasses, and features frequently in keys. However, the terms used to describe the inflorescence can include forms of very varied appearance, and care is often needed in their interpretation. A panicle is typically open with the spikelets spaced on definite pedicels (e.g. most *Panicum* and *Eragrostis*), but its structure can become obscured when the spikelets are crowded on very short branches (spiciform panicle). Sparsely branched panicles with some branches simple lie on the border with racemes. Highly evolved specialised inflorescences, such as in

Setaria and *Pennisetum* with many branches transformed into bristles, are still technically panicles. The distinction between racemes with shortly pedicelled spikelets and spikes with sessile spikelets is also not clear-cut. Species with a flattened rhachis, or with the spikelets partially sunk into cavities in the axis, are generally referred to here as having spikes. Members of the tribe *Andropogoneae* have very distinctive inflorescences composed of racemes of paired spikelets, one sessile and the other pedicelled. At maturity the spikelets do not break up, but instead the raceme-axis fractures into units composed of a spikelet-pair and a small section of axis (Group 3 in Key to Tribes). Additionally, axillary inflorescences in a spathate compound panicle are common in this tribe.

Spikelet

The basic spikelet structure of 2 sterile glumes supporting one or more florets (Fig. I) is remarkably uniform throughout the family, but has been modified in an astonishing variety of ways associated with protection of the flower and dispersal of the fruit. The glumes have a protective role and enclose the young developing florets.

One of the commonest modifications is sterility of some of the florets, which may differ in size or texture from the fertile floret or florets and are frequently reduced, which may lead to difficulty in interpretation of the spikelet parts. The number and position of sterile florets is frequently fixed, and hence is a useful key

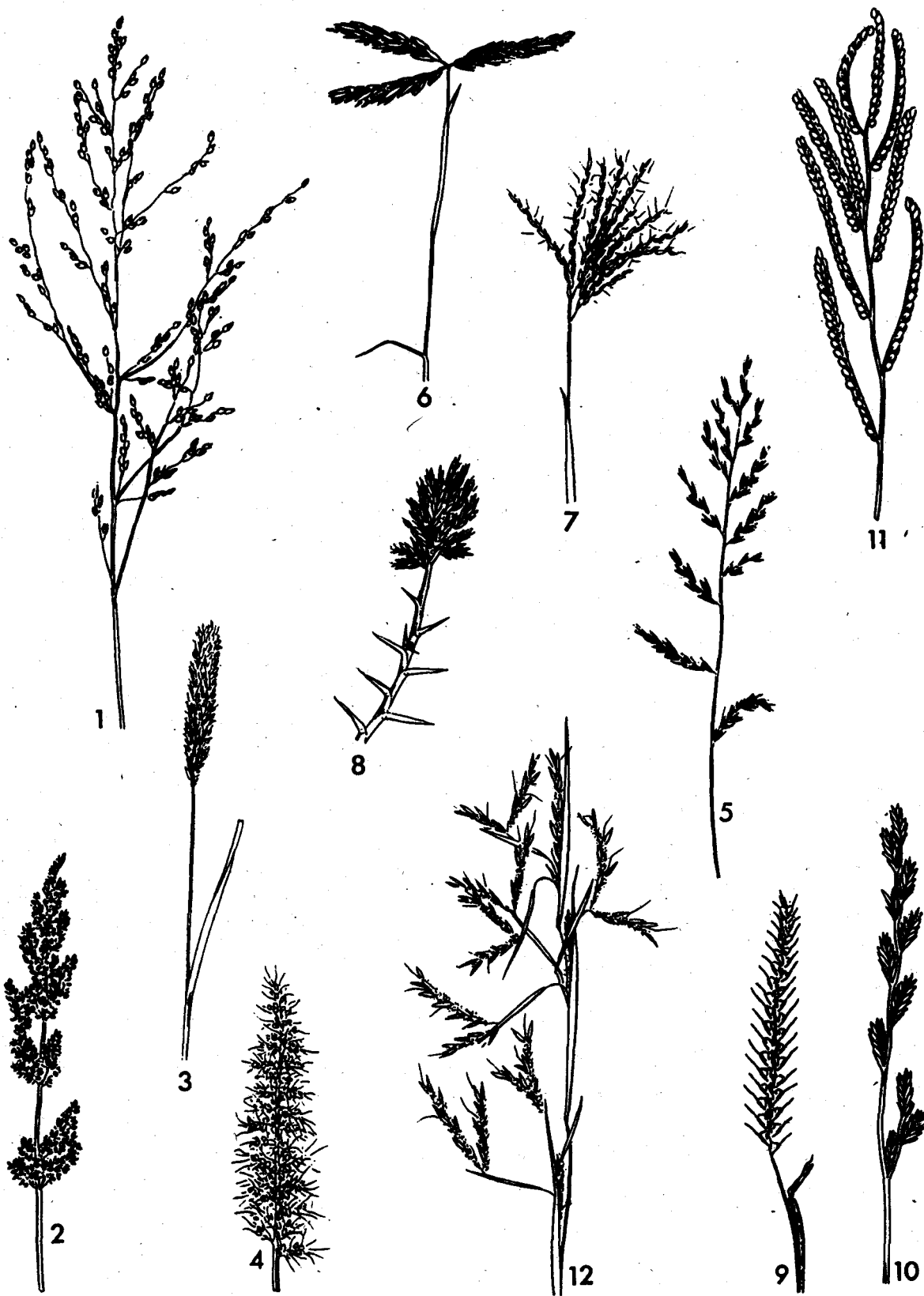


Figure II. INFLORESCENCE STRUCTURE: 1 - open panicle with spaced spikelets (*Panicum monticola*); 2 - contracted panicle with clustered spikelets (*Polypogon viridis*); 3 - spiciform panicle with tightly crowded spikelets (*Rostraria cristata*); 4 - contracted panicle, the spikelets mixed with bristles (*Setaria verticillata*); 5 - racemes spread along a common axis, spikelets shortly pedicelled (*Trichoneura mollis*); 6 - digitately arranged spikes (*Ochthochloa compressa*); 7 - subdigitately arranged racemes (*Bothriochloa insculpta*); 8 - head of short crowded racemes (*Odyssea mucronata*); 9 - simple spike, spikelets sessile (*Tetrapogon tenellus*); 10 - spike with branch at base (*Castellia tuberculosa*); 11 - spikes spread along a common axis (*Urochloa trichopus*); 12 - Compound or false spathate panicle of paired racemes, common in tribe *Andropogoneae* (*Cymbopogon commutatus*). (Compiled from drawings by Eleanor Catherine.)

character. The very large and common tropical tribe *Panicaceae* always has 2-flowered spikelets with the lower floret resembling the upper glume and only the upper floret fertile (Group 3 in Key to Tribes). Members of this tribe, with their awnless, dorsally flattened spikelets which fall entire when ripe, are easy to recognize (e.g. the common pasture grass *Panicum maximum*). The *Andropogoneae* also have strictly 2-flowered spikelets, but this tribe is most easily recognized by its distinctive inflorescence type (see above), and it is very seldom necessary to dissect the spikelets. An extreme case of reduction is seen in *Oryza* (rice), which has 3-flowered spikelets with the glumes scarcely discernible and the 2 lower lemmas reduced to small glume-like scales at the base of the single fertile floret.

A second major source of variation in spikelets is how they break up at maturity, for only very rarely is dispersal effected by the seed alone. Normally the ripe seed is dispersed whilst still invested with various spikelet or inflorescence parts. Very commonly the rachilla fractures beneath each floret so that these fall individually, leaving the persistent glumes on the inflorescence (e.g. the cosmopolitan weed *Poa annua*). Awnless spikelets that fall entire usually belong to *Panicaceae*. Both *Pappophoreae* and most *Cynodonteae* are characterised by spikelets which disarticulate above the glumes but not between the florets, these all falling as one unit. Lemmas with 5-9 awns, often also with terminal lobes, occur only in *Pappophoreae*. Lemmas with a 3-branched awn occur only in *Aristideae*.

Flower

Nearly all grasses are wind-pollinated, and at anthesis the 2-locular anthers are exerted from the floret on long slender filaments. Generally the plumose stigmas are exerted later to effect cross-pollination, but in a few genera (e.g. *Anthoxanthum*) the stigmas are exerted first. In some grasses, especially annuals, the anthers are never exerted and self-pollination takes place within the floret (cleistogamy).

Stipeae possess 3 lodicules instead of the usual 2; in *Anthoxanthum* and *Alopecurus* lodicules are absent.

Rarely stamens are reduced to 2 from the usual 3 (e.g. a few *Eragrostis*); *Vulpia* (in Ethiopia) has only 1 stamen; *Oryza*, *Leersia* and the bamboo *Oxytenanthera* have 6. The common pasture grass *Pennisetum clandestinum* has a single, exceptionally long stigma.

Fruit

The grass "seed" or "grain" is technically a 1-seeded fruit in which the thin dry pericarp has become fused to the testa wall (a caryopsis). The point of attachment of ovule to carpel is visible on the mature fruit (the hilum). In a few genera (e.g. *Eleusine*) the pericarp is free and ruptures to release the seed, whilst in *Sporobolus* it becomes mucilaginous and the seed is extruded from the floret.

Economic importance*

The economically most important members of the grass family in Ethiopia include the following genera and species. *Eragrostis tef* (TEF); the seeds of this species are finely ground or milled and from the flour the Ethiopians prepare thin and flat pancake- or chappati-like "bread" called INJERA or YETEF INJERA. INJERA is utilized throughout highland Ethiopia and currently also it is gaining ground in certain lowlying parts of the country, e.g. among the Somali population in eastern Ethiopia. The chaff is also used in the construction of wall material for mud houses in rural Ethiopia. No part of this plant is thus wasted. The seeds of *Hordeum vulgare* and *Sorghum bicolor* are likewise prepared and consumed with stew but their use is commonly restricted to inhabitants of high and low elevations, respectively. These are called YEGEBS and YEMASHLA INJERA, respectively. Both species are also utilized in the preparation of local drinks such as TELLA and KATIKALA. *Eleusine coracana* is used in the making of local beverages in northern Ethiopia. Other members of the genus such as *E. floccifolia* and *Pennisetum sphacelatum* are much used in the making of household craft articles and in embroidery. *Hyparrhenia rufa*, *Arundinaria alpina* and *Arundo donax* are used in the construction of dwellings in rural Ethiopia.

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214. POACEAE

(GRAMINEAE)

by Sylvia Phillips*

Cufodontis, *Enum.*: 1206–414 (1968–70); *Fl. Trop. E. Afr. Gramineae* 1 (1970), 2 (1974), 3 (1982); *Fl. W. Trop. Afr.* ed. 2, 3(2): 349–512 (1972); *Fl. Zamb.* 10,1 (1971), 10,3 (1989); Fröman & Persson, *An Illustrated Guide to the Grasses of Ethiopia* (1974); Scholz & Scholz, *Graminées et Cypéracées du Togo* (1983); Clayton & Renvoize, *Genera Graminum, Grasses of the World* (1986); Troupin, *Poaceae in Flore du Rwanda* 4: 147–397 (1988); Gibbs Russell et al., *Grasses of southern Africa* (1990); Van der Zon, *Graminées du Cameroun, Wageningen Agric. Univ. Papers* 92,1 (1992).

Herbaceous annuals or perennials, sometimes rhizomatous or stoloniferous; or tall woody bamboos. Flowering stems (culms) jointed, typically with cylindrical hollow internodes and solid nodes but sometimes solid throughout; branches arising singly from the nodes and subtended by a leaf-sheath and a 2-keeled prophyll (branches often fascicled in bamboos). Leaves arranged alternately in 2 ranks, differentiated into a sheath, ligule and blade; leaf-sheath surrounding and supporting the culm-internode; leaf-blade divergent, usually linear and flat, but varying from filiform and inrolled to ovate, the parallel nerves infrequently with cross-connections; ligule membranous or a line of hairs. Inflorescences terminal or axillary, composed of spikelets in an open or contracted panicle, or in racemes or spikes, these arranged along an elongate central axis or digitate or paired at the culm tip, occasionally solitary; axillary inflorescences often many, subtended by a spatheole (specialized leaf-sheath with reduced or absent blade) and gathered into a leafy compound panicle. Spikelets composed of distichous bracts arranged along a slender jointed axis (rachilla); 2 lowest bracts (glumes) empty, subtending 1 to many florets. Each floret composed of 2 bracts and enclosing a small flower, the outer bract (lemma) embracing the opposing, more delicate, usually 2-keeled inner bract (palea); base of floret often with a thickened prolongation articulated with the rachilla (callus); lemma often with an apical or dorsal bristle (awn), glumes also sometimes awned. Flowers usually bisexual, sometimes unisexual, consisting of 2(–3) hyaline or fleshy small scales representing the perianth (lodicules), 3 (rarely 1, 2 or 6) hypogynous stamens, and a 1-locular ovary with (1–)2 styles topped by plumose stigmas. Fruit a caryopsis, embryo large or small, hilum punctiform to linear.

About 650 genera and 10,000 species. The grass family is widely distributed throughout the world, and covers a greater land area than any other family of flowering plants. Grasses are essential to man as they include the cereals which provide the staple food for most of the world's population, and also provide pasture and fodder for domesticated animals.

The cited specimens are all in the Kew herbarium (K) unless stated otherwise; many are also present in the Addis Ababa herbarium (ETH).

Key

- | | |
|--|---|
| 1. Bamboos with woody culms up to 15 m high; lower culm-sheaths broad with rudimentary blade. Bambuseae p. 3 | |
| – Herbs, occasionally cane-like or reed-like; lower culm-sheaths with fully developed blade. 2 | |
| 2. Spikelets 1 to many-flowered, breaking up at maturity above the glumes (rarely falling entire, but then not 2-flowered with only upper floret fertile). 3 | |
| – Spikelets strictly 2-flowered, lower floret male or sterile and often reduced to an empty lemma, upper floret fertile; falling entire at maturity, either singly or with other spikelets and inflorescence parts attached. GROUP 3 32 | |
| 3. Spikelets with 1 fertile floret, sometimes with additional male or sterile florets. GROUP 1 4 | |
| – Spikelets with 2 or more fertile florets. GROUP 2 18 | |
| | GROUP 1 |
| | 4. Spikelets unisexual, dissimilar, the sexes mixed or in different parts of the inflorescence. 5 |
| | – Spikelets bisexual, similar. 6 |
| | 5. Leaf-blades parallel nerved; female lemma ovate, indurated and glossy, enclosed by the glumes. Olyreae p. 6 |
| | – Leaf-blades obliquely nerved; female lemma utriculate, covered in hooked hairs, much bigger than the glumes. Phareae p. 8 |
| | 6. Glumes absent or minute (2 basal sterile lemmas simulate glumes in <i>Oryza</i>); palea 1-keeled; stamens often 6. Oryzae p. 9 |
| | – Glumes well developed, at least the upper, palea 2-keeled; stamens 2–3. 7 |
| | 7. Inflorescence an open or contracted panicle. 8 |
| | – Inflorescence composed of racemes or spikes. 17 |

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8. Spikelets 2-flowered, lower floret male or sterile, upper floret fertile; lower lemma resembling upper glume. **Arundinelleae p. 284**
 - Spikelets 1- to many-flowered, if 2-flowered lower floret fertile, upper floret male or sterile. 9
9. Ligule membranous. 10
 - Ligule a line of hairs. 14
10. Lemma indurated at maturity, terete, often enclosing palea; spikelets strictly 1-flowered without a rhachilla-extension; awn terminal. **Stipeae p. 12**
 - Lemma not indurated, the palea exposed. 11
11. Spikelets 3-flowered, 2 sterile lemmas below the fertile floret. 12
 - Spikelets 1-flowered (rarely a sterile lemma above the fertile floret). 13
12. Sterile lemmas coriaceous, at least the upper longer than the fertile floret and transversely wrinkled. **Ehrharteae p. 10**
 - Sterile lemmas membranous, sometimes short and subulate, pubescent. **Aveneae p. 30**
13. Glumes longer than floret; lemma usually awned from the back, awn often geniculate. **Aveneae p. 30**
 - Glumes shorter than floret (lemmas awnless if slightly longer); lemma awnless or a straight awn from the tip. **Poeae p. 15**
14. Lemma deeply cleft into 7-9 lobes or awns. **Pappophoreae p. 87**
 - Lemma 0-3-awned. 15
15. Lemma awnless, at most mucronate. **Eragrostideae p. 91**
 - Lemma (1-)-3-awned. 16
16. Awn 3-branched; lemma inrolled, becoming indurated. **Aristideae p. 74**
 - Awn simple, short; lemma not inrolled, membranous. **Arundineae p. 63**
17. Spikelets usually in triads; lemma 5- or more-nerved. **Triticeae p. 58**
 - Spikelets single; lemma 1-3-nerved (if spikelets sunk in rhachis see 59. *Oropetium*; if numerous racemes of small spikelets on long axis and single floret with long glumes see 61. *Leptochloa*). **Cynodonteae p. 157**
- GROUP 2**
18. Leaf-blades with distinct cross-nerves, broad. 19
 - Leaf-blades lacking cross-nerves. 20
19. Inflorescence a dense 1-sided raceme; stigmas long and tangled, retrorsely barbed. **Streptogyneae p. 8**
 - Inflorescence a panicle (branches sometimes simple); stigmas not as above. **Centothecae p. 63**
20. Spikelets strictly 2-flowered; lemmas rounded, awnless, one or both often indurated. **Isachneae p. 283**
 - Spikelets 2- to several-flowered; lemmas membranous or awned. 21
21. Tall reed-like grasses with large plumose panicles; lemmas surrounded by long silky hairs. **Arundineae p. 63**
 - Slender grasses, inflorescence not a large plumose panicle. 22
22. Lemmas deeply cleft into 7-9 lobes or awns. **Pappophoreae p. 87**
 - Lemmas awnless or 1-3-awned. 23
23. Spikelets borne on opposite sides of a solitary spike or raceme, spikelets placed broadside to rhachis; ovary with a hairy apical appendage, styles arising beneath it. 24
 - Spikelets in panicles, 1-sided spikes or racemes, or if spike solitary spikelets placed edgewise to rhachis; ovary glabrous, or if rarely hairy lacking an apical appendage, styles terminal (except 34. *Bromus* with paniculate inflorescence). 25
24. Spikelets shortly pedicellate, cylindrical. **Brachypodiaceae p. 55**
 - Spikelets sessile, laterally compressed. **Triticeae p. 58**
25. Lemmas long-awned; awn flexuous, coiling and entangled with awns from other lemmas (in Ethiopian genus); upper florets sterile and clustered together. **Meliceae p. 29**
 - Lemmas awnless or the awns not coiling and entangled; upper sterile florets if present evenly reduced. 26
26. Ligule membranous; lemma 5- or more-nerved. 27
 - Ligule ciliate (very rarely membranous and then lemma 3-nerved). 30
27. Spikelets disarticulating above the glumes but not between the florets (if inflorescence a panicle see 22. *Avena*). **Cynodonteae p. 157**
 - Spikelets disarticulating above the glumes and between the florets, or rarely falling entire. 28
28. Glumes usually as long as spikelet, always longer than lowest lemma; lemmas usually awned, often a geniculate awn arising from the lemma back, occasionally awnless. **Aveneae p. 30**
 - Glumes shorter than spikelet, usually shorter than lowest lemma; lemmas awnless or with a straight awn arising at or near the tip. 29
29. Ovary glabrous or hairy, styles arising from its tip; lemmas awnless or awned from the tip (awn rarely subapical, but then leaf-sheaths glabrous and palea-keels scabrid). **Poeae p. 15**
 - Ovary with a hairy apical appendage, styles arising beneath it; lemmas awned from just below the tip; leaf-sheaths hairy; palea-keels ciliate. **Bromeae p. 53**
30. Lemmas 7-11-nerved, geniculately awned (if awnless see 55. *Aeluropus*). **Arundineae p. 63**
 - Lemmas 3-nerved (rarely weak additional nerves present), awnless or straight-awned. 31
31. Inflorescence of globose spikelet-clusters, or a panicle of awned spikelets. **Arundineae p. 63**
 - Inflorescence of spikes or racemes, or a panicle of awnless spikelets. **Eragrostideae p. 91**

GROUP 3

32. Spikelets solitary, or if paired both spikelets alike; glumes thinner than the fertile floret, lower glume usually short or even suppressed; fertile floret chartaceous to coriaceous or crustaceous, usually awnless, never geniculately awned. **Panicaceae p. 184**
- Spikelets paired, one sessile the other pedicelled, usually dissimilar and arranged in fragile racemes; glumes as long as the spikelet, tougher than and enclosing the hyaline florets; fertile floret often with a geniculate awn (spikelets rarely single, but then either in fragile racemes or geniculately awned). **Andropogoneae p. 289**

BAMBUSEAE Nees (1829)

Shrubby or arborescent, very rarely perennial herbs. Culms woody, erect or sometimes climbing, rising to 40 m or more from an underground rhizome, hollow or solid, bearing specialized broad leaf-sheaths with reduced blades in the lower part ("culm-sheaths"), copiously branched and leafy above. Leaf-blades on the leafy shoots flat, narrow, many-nerved with transverse veinlets, tapering to a fine tip, narrowed into a false petiole, deciduous from the sheath. Inflorescences paniculate or racemose, borne at the tips of the lateral branches, the spikelets often gathered into dense clusters. Spikelets all alike, 1 to many-flowered, usually disarticulating below the lemmas; glumes 2 or sometimes grading into sterile lemmas below the fertile florets, several-nerved; lemmas longer than the glumes, several- to many-nerved, acute, acuminate or awn-pointed; paleas 2-keeled, keelless or suppressed; stamens 3 or 6 (rarely more), filaments free or connate; stigmas 1-3; lodicules usually 3; caryopsis sometimes with a fleshy pericarp.

About 50 genera, widespread in forests of tropical and warm temperate regions, especially in Asia and America. Bamboos are frequently planted, either as ornamentals or for their canes which are often used in constructional work.

The floral structure of the *Bambuseae* is often held to be the most primitive in the *Poaceae*, those genera with 3 lodicules, 6 stamens and 3 stigmas suggesting a link between the typical grasses and the petaloid Monocotyledons. Vegetatively however, they have specialized along their own lines, the tall woody culms and complex branching of most genera rendering the tribe instantly recognizable.

The flowering of bamboos is a fascinating and as yet imperfectly understood phenomenon. Whilst some flower every year, many species flower only very infrequently at intervals of 20-100 years or more. Then all plants in a locality flower together, producing copious quantities of seed, after which the colony dies. Between these periods of gregarious flowering it is not uncommon for the odd culm to produce flowering shoots, but

nevertheless there is a great paucity of flowering material in herbaria available for study.

1. Leaf-blades conspicuously cross-veined, 8-16 mm wide, the tip extended into a flexuous bristle up to 2 cm long; inflorescence an open panicle. **1. *Arundinaria***
- Leaf-blades barely cross-veined, 18-30 mm wide, the tip acuminate; inflorescence a spiky globose head. **2. *Oxytenanthera***

1. *ARUNDINARIA* Michx. (1803)

Clump forming bamboos with tall woody culms; culms hollow or solid; 3-7 subequal primary branches at the mid-culm nodes. Leaf-blades linear-lanceolate, cross-veined. Inflorescence paniculate or racemose, the spikelets pedicellate. Spikelets 1-several-flowered with the uppermost florets reduced and sterile; glumes 2; lemmas 7-nerved, sometimes awned; palea several-nerved, 2-keeled; stamens 3; stigmas 2.

About 50 species, mostly in tropical Asia and Madagascar, but 2 in Central America and one on tropical African mountains; many are montane bamboos, often forming extensive bamboo forests at high altitudes.

The circumscription of *Arundinaria* has been altered and in a strict sense now only includes bamboos with spreading monopodial (or leptomorph) rhizomes. As *A. alpina* has clump-forming sympodial (or pachymorph) rhizomes the Chinese genera *Fargesia* (syn. *Sinarundinaria*) and *Yushania* seem more appropriate. However, *A. alpina* is excluded from these genera in some bamboo treatments and very probably represents a different genus altogether. The old familiar name is retained here until the taxonomy has been clarified.

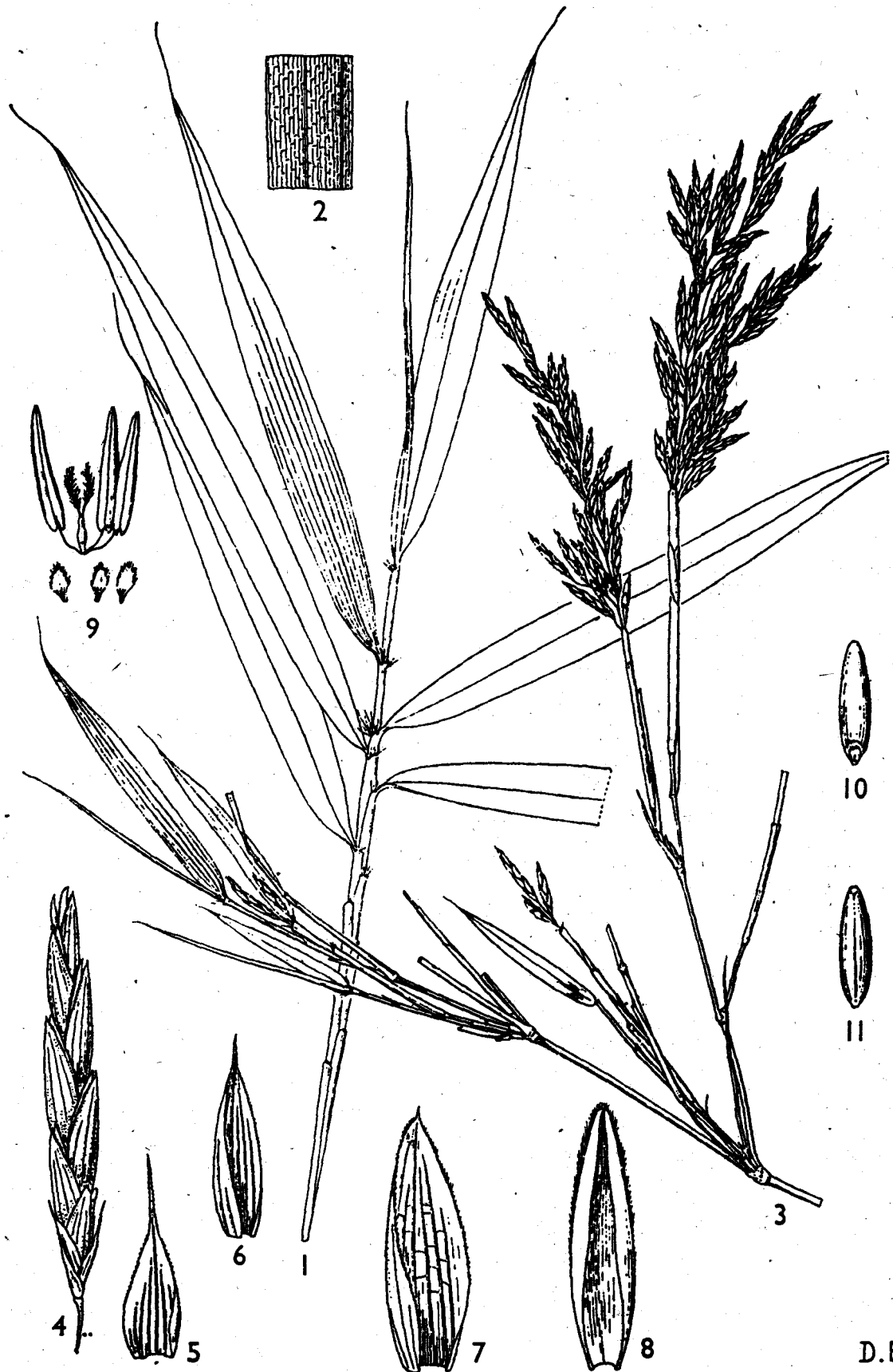
A. alpina K. Schum. (1895);

Sinarundinaria alpina (K. Schum.) Chao & Renv. (1989); *Yushania alpina* (K. Schum.) W. C. Lin (1974) - type: Kenya, Fischer 672 (B holo., destr.?).

Friis, I. *Forests and Forest Trees of Northeast Tropical Africa*: 268 (1992).

Robust clump-forming bamboo, the erect culms up to 12 cm in diameter at the base and rising to 15 m from a stout branching rhizome, thick-walled but clearly hollow, green becoming yellow. Culm-sheaths densely pubescent with reddish-brown bristles, tipped with a linear blade c 6 cm long and fimbriate auricles. Leaf-blades linear-lanceolate, 13-20 cm long and 8-16 mm wide, conspicuously cross-veined, the tip extended into a fine flexuous bristle up to 2 cm long, blades and the prominent fimbriate auricles tardily disarticulating from the sheaths. Inflorescence paniculate, panicles 10-15 cm long, loose to fairly compact; spikelets 4-11-flowered, linear to linear-elliptic, 1.5-4.8 cm long; glumes ovate; lemmas lanceolate-oblong, 8-12 mm long, pubescent, acute, acuminate or awn-pointed. Fig. 1.

Montane forest, often on volcanic soils and forming extensive pure stands; occurring with *Podocarpus* in



D.E.

Figure 1. *ARUNDINARIA ALPINA*: 1 - leafy shoot x 1/2; 2 - part of underside of leaf-blade showing cross veins x 3½; 3 - flowering shoot x 1/2; 4 - spikelet x 3½; 5 - lower glume x 7; 6 - upper glume x 7; 7 - lemma x 7; 8 - palea x 7; 9 - flower with lodicules dissected free x 7. All from Glover, Gwynne & Samuel 1187. Drawn by D. Erasmus. (Reproduced from *Fl. Trop. E. Afr. Gramineae 1*: Fig. 1, with permission of the Editors).

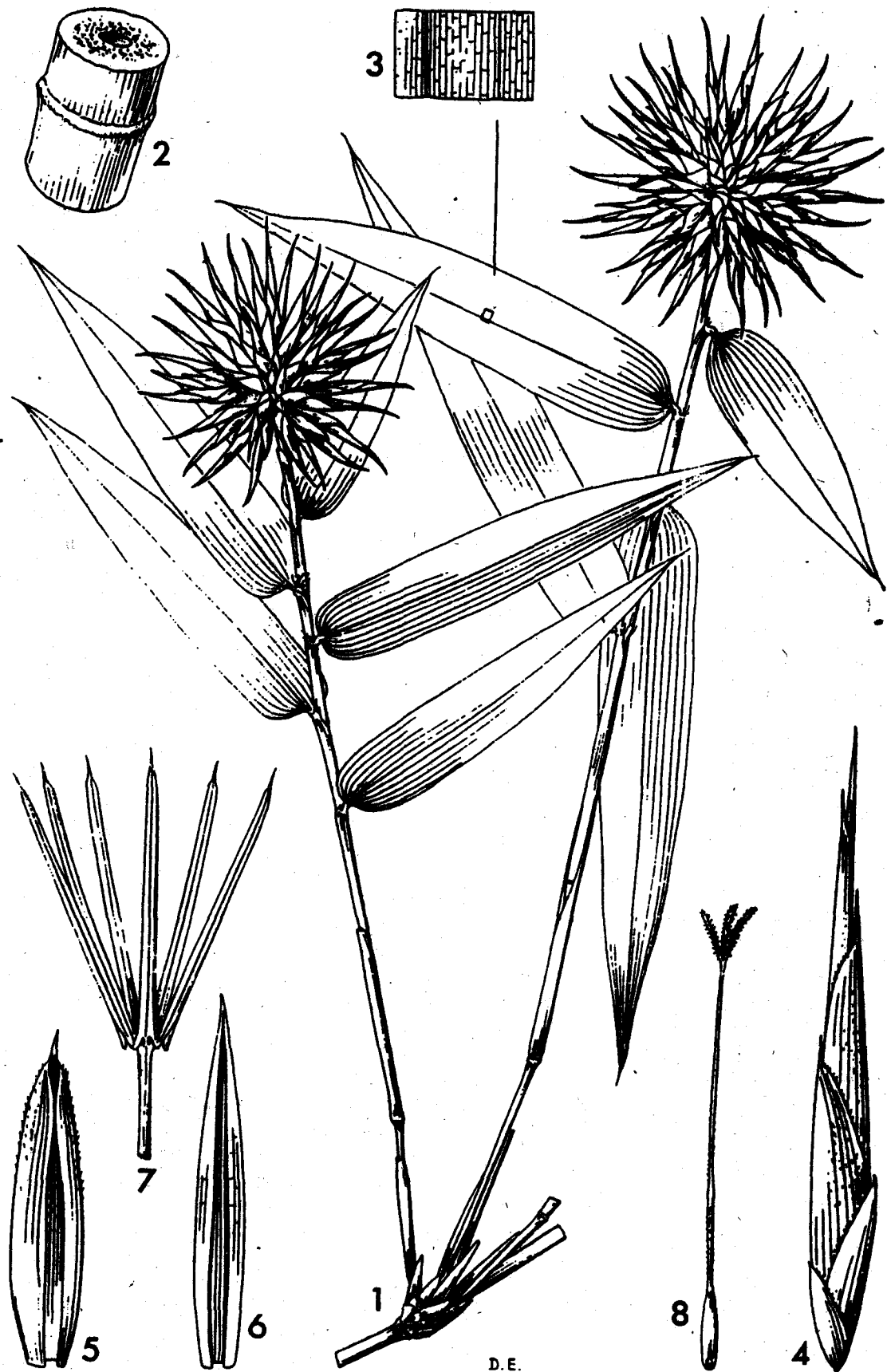


Figure 2. *OXYTENANTHERA ABYSSINICA*: 1 - leafy branchlets with inflorescences x 2/3 ; 2 - piece of culm from 6 m above ground level x 2/3, 3 - part of underside of leaf-blade showing cross veins x 6; 4 - spikelet x 3; 5 - lemma x 3; 6 - palea x 3; 7 - stamens x 3; 8 - ovary with style and stigmas x 3. 1, 3-8 from *Balsinhas & Marrime in A.B. 343*; 2 from *Snowden s.n.* Drawn by D. Erasmus. (Reproduced from *Fl. Trop. E. Afr. Gramineae 1*: Fig. 3, with permission of the Editors).

upland rainforest and with *Juniperus* in drier forest; frequently planted along roads and in villages; 2200–4000 m. GJ SU KF GG SD BA; Cameroon Mt, Zaire (Kivu), Rwanda, Burundi, Sudan (Imatong Mts.), the East African mountains and Malawi (Nyika Plateau). *Burger* 3424; *Friis et al.* 1451; *Meyer* 9077.

2. *OXYTENANTHERA* Munro (1868)
Houzeaubambus Mattei (1910)

Bamboo with tall woody culms. Inflorescence composed of dense heads of spikelets terminating short leafy branches, each head consisting of several spikelet clusters subtended by papery ovate sheaths with reduced blades, the individual spikelets subtended by several small papery bracts often bearing secondary spikelets in their axils. Spikelets long, ± terete, consisting of a series of scales of increasing length, the upper 1–2 fertile; glumes multi-nerved, grading into sterile lemmas, 2–4 scales persistent, 1–4 deciduous with the 1–2 fertile florets; lemmas increasing in length up the spikelet, multi-nerved, convolute; uppermost palea resembling the lemma, tightly convolute; lodicules absent; stamens 6, filaments connate; stigmas 3 on a tall stylar column.

A monotypic genus confined to Africa.

O. abyssinica (A. Rich.) Munro (1868);

Bambusa abyssinica A. Rich. (1850) - types: Ethiopia, TU, banks of R. Tacazze, *Quartin Dillon & Petit* & Aderbati, *Quartin Dillon & Petit* (both P syn.) & near Djeladjerranne [Tchélatchékanné], *Schimper* 501 (P syn., K isosyn.).

O. borzii Mattei (1909); *Houzeaubambus borzii* (Mattei) Mattei (1910) - type: Eritrea, Dambasen, Mt Anfalo, *Senni* 792 (?PAL holo.).

Clump-forming bamboo, the woody culms erect or ascending, 3–13 m high and 5–10 cm in diameter, nearly solid, silky-pubescent at first. Culm-sheaths hispid with brown hairs, lacking auricles, tipped by an involute pungent blade 1–2 cm long. Leaf-blades narrowly lanceolate-oblong, 10–26 cm long and 1.8–3 cm wide, only inconspicuously cross-veined, base broadly rounded with a brief petiole-like connection to the sheath, tip finely acuminate; leaf-sheaths bearing a few deciduous setae on the shoulders. Inflorescence a spiky globose head 7–9 cm across; spikelets narrowly lanceolate, pungent, 1.5–4.5 cm long; glumes and sterile lemmas much shorter than the spikelet, hispidulous, ciliate on the margins, mucronate; fertile lemma(s) linear-lanceolate, ± as long as the spikelet, narrowing to a pungent awn-point up to 7 mm long. Fig. 2.

Savanna woodland, favouring river valleys, often forming extensive stands; 1200–1800 m. EW TU GD GJ WG; westwards to Senegal and southwards to Zimbabwe. *Ash* 3076; *Meyer* 8168.

OLYREAE Spenner (1825)

Perennials, low-growing or with tall bamboo-like culms. Leaf-blades broad and flat, narrowed at the base into a short false petiole, the longitudinal nerves connected by transverse veinlets; ligule scarious. Inflorescence a panicle or raceme, monoecious. Spikelets 1-flowered, unisexual, male and female spikelets either both in the same inflorescence with the female usually above the male, or borne in separate inflorescences. Male spikelets much smaller than the female; glumes vestigial or absent; lemma membranous, 3-nerved, often acuminate or caudate-aristate; anthers usually 3; lodicules 3. Female spikelets with large, papery, often caudate-aristate glumes enclosing the floret, these mostly 3–7-nerved; lemma usually awnless, mostly 5–7-nerved, indurated at maturity; palea resembling the lemma, 2–9-nerved; lodicules 3; stigmas 2(–3). Grain with a small embryo and linear hilum.

16 genera; a tribe of forest grasses mainly confined to tropical America, one genus extending to Africa and one endemic in New Guinea.

The tribe is allied to *Bambuseae*, and can usually be recognised by the monoecious inflorescence and conspicuous indurated floret of the female spikelet.

3. *OLYRA* L. (1759)

Tall, erect or climbing perennials. Inflorescence a panicle with both male and female spikelets, the male spikelets just below the female on the panicle branchlets, but much more numerous in the lower part of the inflorescence. Male spikelets narrow, fusiform, lacking glumes, readily deciduous; female spikelets elliptic to ovate, much larger than the male with a conspicuously caudate-aristate lower glume, the single floret crustaceous.

23 species, all confined to tropical America except *O. latifolia*, which has probably been introduced to Africa.

O. latifolia L. (1759);

- type: Jamaica, *Sloane* s.n. (BM holo.).

Tall bamboo-like perennial from a knobly rhizome; the cane-like culms rising to 3 m or more, erect or scandent, often purple-blotched below, the lower nodes with papery bladeless sheaths, the upper nodes branching. Leaf-blades ovate-oblong, mostly 11–18 cm long and 2–5 cm wide (leaves on the side branches sometimes much smaller), abruptly acuminate, the base asymmetrically rounded to a short false petiole. Inflorescence a rather compact panicle 6–20 cm long, the lower branches predominantly male with a number of male spikelets below a large terminal female spikelet, the upper branches shorter with proportionally fewer male spikelets below the conspicuous female spikelets. Male spikelets borne on filiform, often convolute pedicels; lemma membranous, 3-nerved, 4.5 mm long,



Figure 3. *OLYRA LATIFOLIA*: 1 - base of plant x 3/4; 2 - inflorescence and leaves x 3/4; 3 - male and female spikelets x 4; 4 - fertile floret x 4. *LEPTASPIS ZEYLANICA*: 5 - habit x 1/5; 6 - leaf x 3/4; 7 - female spikelet x 4. 1 from Meyer 8026; 2-4 from Pirozynski 263; 5-7 from Friis et al. 4114. Drawn by Eleanor Catherine.

drawn out into an awn of equal length. Female spikelets on stout clavate pedicels; glumes membranous, tardily deciduous; lower glume lanceolate, 8–9 mm long, 7–9-nerved, caudate-aristate with an awn up to 15 mm long; upper glume similar but only shortly caudate; lemma ovate, 4–6 mm long, obtuse; palea equalling the lemma, the whole floret becoming plump, indurated and shiny white or pale brown at maturity. Fig. 3:1–4.

Forest shade; 1000–1400 m. WG IL KF; throughout the African and American tropics. *Gilbert & Thulin* 730; *Meyer* 8026; *Friis et al.* 3915 (ETH).

PHAREAE Stapf (1898)

Perennials. Leaf-blades broad, narrowly oblong to oblanceolate, obliquely nerved from the midrib with transverse connecting veinlets, narrowed into a false petiole twisted through 180°, thus reversing the upper and lower leaf surfaces. Inflorescence monoecious, an open panicle, the spikelets paired or in groups of 3. Spikelets unisexual, 1-flowered, the lower 1–2 of a group female, sessile or shortly pedicelled, the upper male, pedicelled; glumes 2, shorter than the floret. Male spikelets lanceolate, smaller than the female; stamens 6. Female spikelets inflated, involute or utriculate, becoming coriaceous, covered in hooked, adhesive hairs; palea long and narrow, lodicules absent; stigmas 3; grain with a filiform hilum and very small embryo.

2 genera in tropical forests, *Leptaspis* in the Old World and *Pharus* in America.

A small tribe of Bambusoid grasses, easily recognized by the broad, obliquely nerved leaf-blades with transverse veinlets.

4. LEPTASPIS R. Br. (1810)

Lemma of the female spikelet shell- or urn-shaped, closed except for a tiny pore through which the 3 stigmas and palea-tip protrude.

5 species in the Old World tropics (one species in Africa).

L. zeylanica Nees ex Steud. (1854);

L. cochleata Thwaites (1864) - type: Sri Lanka, *Thwaites* C.P.896 (B neo.).

Culms 30–100 cm high, ascending from a shallow rhizome, rooting at the lower nodes. Leaf-blades asymmetrical, 10–30 cm long and 2.5–6 cm wide, abruptly acute. Panicle ovate, stiff, up to 45 cm long, the branches in whorls of 2–3, spiculate mainly in the distal half. Male spikelets 4 mm long, the glumes half as long, the floret soon falling. Female spikelets 4–6 mm long; glumes ovate, 2–3 mm long; lemma shell-like, prominently 5-ribbed, the pore lateral. Fig. 3:5–7.

Forest undergrowth; 1000–1300 m. IL KF; tropical Africa, Madagascar, Sri Lanka and eastwards to the Solomon Is. *Friis, Gilbert & Vollesen* 4004, 4108.

STREPTOGYNEAE Calderón & Soderstr. (1980)

Perennial herbs. Leaf-blades broad, flat, narrowed at the base into a false petiole, the nerves connected by transverse veinlets; ligule membranous, a small rim-like outer ligule also present. Inflorescence an erect secund raceme. Spikelets several-flowered with the upper florets sterile, disarticulating between the florets, subterete; glumes chartaceous, shorter than the lemmas, persistent; lemmas many-nerved, elongate, coriaceous and convolute at maturity, bidentate, awned from the tip; palea 2-nerved, with the nerves contiguous; lodicules 3; stamens 2; stigmas 2–3, growing into tendrils after fertilization; grain linear, terete with a small embryo and linear hilum.

A monotypic forest tribe allied to *Bambuseae*, remarkable for its persistent barbed stigmas, which play a part in seed dispersal.

5. STREPTOGYNA P. Beauv. (1812)

Rhizomatous or tufted perennials. Inflorescence a solitary secund raceme, the spikelets shortly pedicellate. Spikelets narrow; glumes membranous, unequal, acute; lemmas firmly coriaceous when mature, completely enclosing the palea; palea linear with the keels tightly appressed; stigmas long-exserted and tangled at maturity.

2 species, one in tropical Africa extending to India and Sri Lanka, the other in tropical America.

S. crinita P. Beauv. (1812);

- type: Nigeria, *Palisot de Beauvois* (G holo.).
S. gerontogaea Hook.f. (1900).

Erect perennial spreading by scaly rhizomes; culms 45–150 cm high, unbranched. Leaf-blades narrowly elliptic, 15–40 cm long and 1.5–3.5 cm wide, scattered-pilose, margins scabrid, tip finely acuminate. Raceme stiffly erect, 15–30 cm long, the spikelets ascending and overlapping by half their length. Spikelets 5–7-flowered, linear-oblong, 23–27 mm long (excluding awns); lower glume 5–10 mm long, the upper 17–23 mm long; lemmas linear-oblong, 18–22 mm long, finely scabrous, puberulous towards the base, emarginate to 2-lobed; awn scabrid, spreading, 10–20 mm long; callus bearded; stigmas 1–2 cm long, retrorsely spinulose; ovary villous below the stigmas. Fig. 4.

In the shade of forest undergrowth; 550–650 m. IL; westwards to Senegambia; Uganda and Tanzania; India and Sri Lanka. *Chaffey* 908; *Friis et al.* 2448.

The long-exserted spinulose stigmas become spirally coiled and tangled at maturity, the disarticulated florets hanging together in bunches by their stigmas. The rhachilla segment at the base of each floret forms a little hook, which acts as a trap for hairs and thus effects dispersal.

The name *S. gerontogaea* has often been used for this grass in the past, the name *S. crinita* being applied erroneously to the American species *S. americana* C.E. Hubb. *S. americana* is a tufted grass lacking scaly rhi-

zomes, also distinguished by its narrower leaf-blades and 3 scaberulous stigmas.

ORYZAE Dumort. (1824)

Slender to robust annuals or perennials. Leaf-blades usually linear; ligule membranous. Inflorescence paniculate, the branches sometimes simply racemose with the spikelets imbricate and shortly pedicellate. Spikelets 1-flowered or 3-flowered with the 2 lower florets sterile and reduced to narrow lemmas resembling glumes, mostly laterally compressed, disarticulating from the pedicel; glumes absent or vestigial and remaining as a minute frill on the pedicel tip; lemma keeled, membranous to coriaceous, 5–10-nerved, often scabrid to pectinate on the keel and nerves, awnless or awned from the tip; palea resembling the lemma but narrower, 3–7-nerved with a central keel; lodicules 2; stamens usually 6; stigmas 2.

12 genera; a tribe of aquatic or marshland grasses widespread in tropical and warm temperate regions. The tribe is allied to *Bambuseae*, with specialized spikelets characterised by the lack of glumes, a multi-nerved palea and usually the presence of 6 stamens.

1. Spikelets 1-flowered, lacking sterile lemmas.

6. *Leersia*

– Spikelets 3-flowered, the 2 lower florets reduced to narrow lemmas at the spikelet base. 7. *Oryza*

6. LEERSIA Sw. (1788), *nom. conserv.*

Slender rhizomatous or stoloniferous perennials, or rarely annual; leaf-blades flat or convolute. Inflorescence paniculate, the branches sometimes racemose with the spikelets shortly pedicelled and imbricate. Spikelets 1-flowered, strongly laterally compressed; glumes absent or barely discernable at the tip of the pedicel; lemma chartaceous, prominently 5-nerved and strongly keeled, scabrid to pectinate-ciliate on the keel and margins, acute, rostrate or rarely awned; palea usually 3-nerved; stamens 1, 2, 3 or 6; stigmas 2.

18 species, mostly from aquatic or marshland habitats; mainly tropical but a few species from temperate zones.

L. hexandra Sw. (1788);

– type: Jamaica, Swartz (BM holo.).

L. abyssinica Hochst. ex A. Rich. (1851) – type:

Ethiopia, TU, Shire, Schimper 1823 (K iso.).

Slender stoloniferous perennial; culms decumbent and rooting at the lower nodes, ascending to 1 m, the nodes silky-pubescent. Leaf-blades sharply acute, up to 22 cm long and 15 mm wide but often much shorter and narrower, strongly scabrid on the midrib beneath; ligule 1–3 mm long, truncate, sometimes obliquely. Panicle 7–17 cm long, lanceolate-oblong, the branches often simply racemose and densely clothed with spikelets. Spikelets pale green or purple-tinged, narrowly elliptic to elliptic-oblong, 3.5–5 mm long; glumes absent; lemma con-

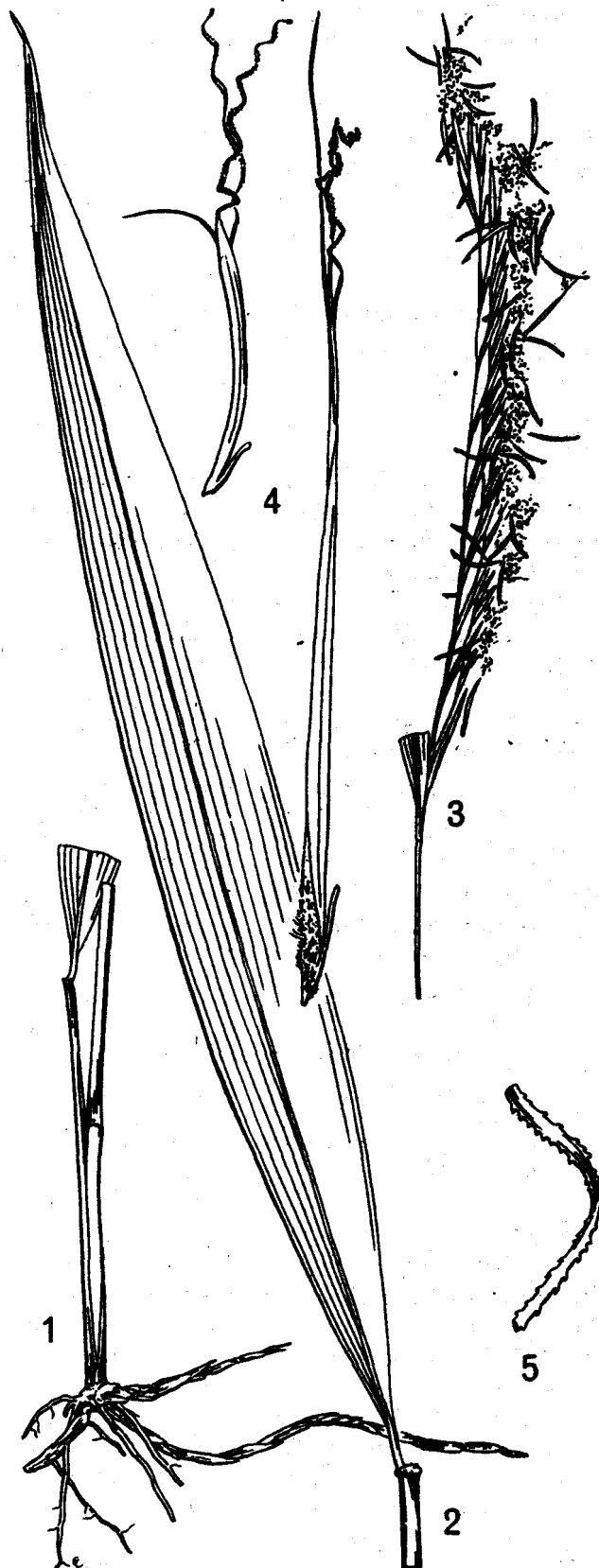


Figure 4. *STREPTOGYNA CRINITA*: 1 - base of plant showing rhizomes x 3/4; 2 - leaf x 3/4; 3 - inflorescence x 3/4; 4 - two disarticulated lemmas x 3; 5 - detail of spinulose stigma x 17. 1 from Chaffey 908; 2 from Tuley 1777; 3–5 from Morton 9788. Drawn by Eleanor Catherine.

spicuously pectinate-ciliate on the keel and margins, strigillose on the back, contracted into a narrow obtuse tip. Fig. 5:6-9.

Aquatic grass of shallow water and marshland, forming dense floating mats where there is sufficient depth of water; 1200-2600 m. EW TU GD GJ WG SU IL KF GG SD HA; throughout the tropics; a weed of rice fields. *Ash* 2754; *Gilbert & Getachew* 3040; *Gilbert & Phillips* 9051.

7. *ORYZA* L. (1753)

Tateoka in *Bot. Mag. Tokyo* 76: 165 (1963); *Clayton* in *Kew Bull.* 21: 488 (1968).

Aquatic annuals or perennials; leaf-blades linear, flat. Inflorescence paniculate, the branches mostly racemose with the spikelets shortly pedicellate. Spikelets 3-flowered with the 2 lower florets reduced and sterile and the upper floret fertile, strongly laterally compressed, disarticulating below the sterile lemmas; glumes absent or vestigial and remaining after disarticulation as a frill at the tip of the pedicel; sterile florets reduced to 2 small lemmas at the base of the fertile floret; fertile lemma coriaceous, keeled, prominently 5-nerved, sometimes awned from the tip; palea resembling the lemma, coriaceous, 3-nerved; stamens 6; stigmas 2.

20 species; marsh plants from the tropics and subtropics of both hemispheres.

Cultivated rice (*O. sativa* L.) is only grown on a small scale as a minor crop in Ethiopia.

The two reduced sterile lemmas at the spikelet base are often mistaken for glumes.

1. Ligule of lower leaves 2-6 mm long, rounded.
 1. *O. barthii*
 - Ligule of lower leaves 15-45 mm long, acute. 2
2. Rhizomatous perennial; spikelets deciduous, awned (wild).
 2. *O. longistaminata*
 - Annual; spikelets persistent, usually awnless (cultivated). *O. sativa* (see note above)

1. *O. barthii* *A. Chev.* (1911);
- type: Chad, *Chevalier* 9615 (P holo., K iso.).

Annual; culms erect or decumbent and rooting at the lower nodes, up to 1.5 m high; ligule 2-6 mm long, rounded or truncate. Panicle 20-30 cm long, rather dense, the branches erect to ascending. Spikelets narrowly oblong, 7-11 mm long, obliquely articulated with the pedicel; fertile lemma strigose, particularly over the nerves; sterile lemmas lanceolate, 2.5-4 mm long; awn 4-16 cm long, harshly scabrid, rigid. Fig. 5:5, 6.

Shallow water and marshy ground bordering pools; 600 m. IL; westwards to Mauretania; also in Tanzania and Zambia. *Gilbert & Friis* 8395.

When the basal portions are missing, *O. barthii* can still easily be distinguished from *O. longistaminata* by its much shorter ligule, and spikelets with generally

longer, conspicuously scabrid awns and less obvious bands of bristles along the lemma nerves.

2. *O. longistaminata* *A. Chev. & Roehr.* (1914);
- type: Chad, *Chevalier* 10306 (P lecto.).
[*O. barthii* auct., non *Chev.*].
[*O. perennis* sensu *Cuf.*, *Enum.* 39: 1304 (1969) non *Moench* (1794)].

Robust perennial from a creeping rhizome; culms up to 170 cm high, thick and spongy, rooting at the lower nodes; ligule 15-45 mm long, acute but often splitting. Panicle 17-30 cm long, compact, the branches ascending. Spikelets narrowly oblong, 7-9 mm long, obliquely articulated with the pedicel; fertile lemma finely scabrid, hispid around the nerves, awned; sterile lemmas lanceolate, 2-4 mm long; awn 3.5-8 cm long, rigid. Fig. 5:1-4.

Swamps around the edges of open water, sometimes forming pure stands; c 1800 m. GD GJ IL; throughout tropical Africa to Namibia and South Africa (Transvaal); Madagascar. *Parker* E49; *Pichi-Sermolli* 1873; *Mesfin T. & Kagnew* 1770 (ETH).

Readily distinguished from other wild species of *Oryza* by its very long, pointed ligule.

EHRHARTEAE *Nevski* (1937)

Annuals or perennials. Leaf-blades linear; ligule usually membranous, sometimes ciliate. Inflorescence usually a panicle. Spikelets laterally compressed, 3-flowered with the 2 lower florets reduced to sterile lemmas, the upper floret fertile, disarticulating above the glumes but not between the florets. Glumes shorter than or exceeding the florets, membranous, persistent; sterile lemmas subequal, keeled, coriaceous, enclosing the fertile floret, sometimes awned; fertile lemma 5-7-nerved, cartilaginous to coriaceous, keeled, entire, awnless; palea hyaline, 2-nerved and 2-keeled, occasionally only 1-nerved or rarely 3-5-nerved; lodicules 2, elliptic or 2-lobed; stamens 1, 2, 3, 4 or 6; stigmas 2. Grain with a small embryo and linear hilum.

1 genus in warm temperate regions of the Old World, mainly in Australia and South Africa.

8. *EHRHARTA* *Thunb.* (1779), *nom. conserv.*

Annuals or perennials. Leaf-blades flat or rolled, sometimes much reduced. Inflorescence a panicle, often contracted, or reduced to a raceme or rarely a solitary spikelet. Glumes shorter than, or as long as the spikelet; sterile lemmas glabrous or hairy, one or both often transversely wrinkled, awned or not, the upper hooked at the base, often also with basal appendages and tufts of hair; palea 2-nerved, the nerves very close together and forming a single keel. About 35 species; about 25 in South Africa with *E. erecta* extending to Ethiopia, the rest in SE Asia from Indonesia to New Zealand.

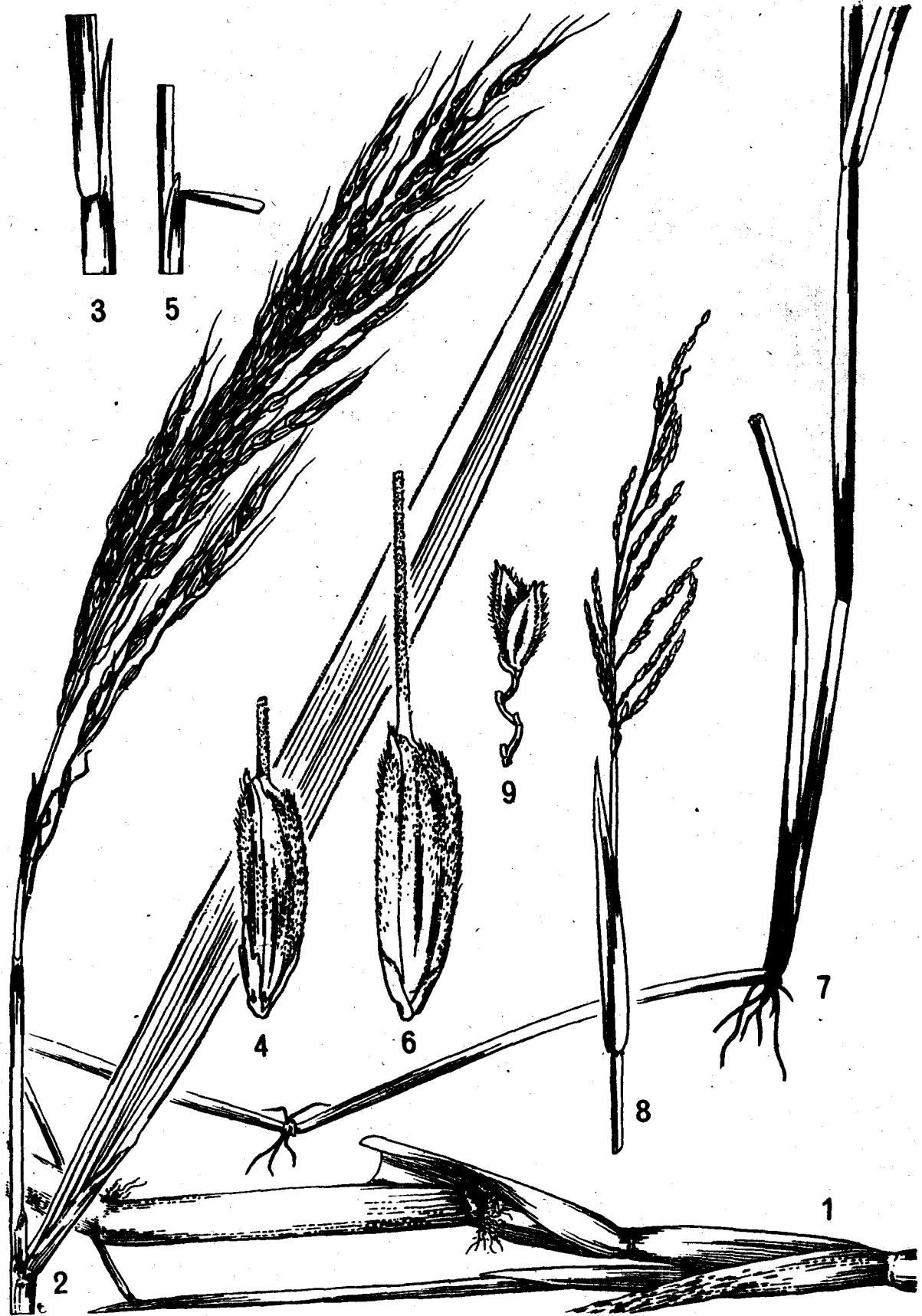


Figure 5. *ORYZA LONGISTAMINATA*: 1 - base of plant x 3/4; 2 - inflorescence and leaf x 3/4; 3 - ligule x 3/4; 4 - spikelet x 4. *O. BARTHII*: 5 - ligule x 3/4; 6 - spikelet x 4. *LEERSIA HEXANDRA*: 7 - base of plant x 3/4; 8 - inflorescence x 3/4; 9 - spikelets and rachis x 4. 1 from Tadesse & Kognew 1770; 2-4 from Schimper 1365; 5 from Gilbert & Friis 8395; 6 & 7 from Ash 2754; 8 & 9 from Friis et al. 2183. Drawn by Eleanor Catherine.

E. erecta Lam. (1786);

- type: South Africa, *Sonnerat* (P holo.).

var. *abyssinica* (Hochst.) Pilg. in *Notizbl. Bot. Gart.*

Berlin 9: 508 (1926); *E. abyssinica* Hochst. (1855) -
type: Ethiopia, TU, Aman-Eski, *Schimper* in Herb.
Buchinger 1460 (STR holo.).

Slender tufted perennial; culms straggling, loosely ascending, 40–100 cm high. Leaf-blades flat, rather thin; ligule triangular, 3.8–5 mm long. Panicle 8–20 cm long, narrow, the branches ascending or often \pm erect and lying close to the main axis. Spikelets oblong, 5.7–6.2 mm long, pale green; glumes 5-nerved, unequal, subacute, the upper ovate-oblong and about half as long as the spikelet, the lower ovate, shorter; lemmas chartaceous, 7-nerved, subacute; sterile lemmas narrowly elliptic-oblong in profile, finely pilose to almost glabrous, the upper transversely rugose (occasionally indistinctly so), with 2 frill-like appendages on the basal hook and a conspicuous tuft of hairs on either side of the keel towards the base; fertile lemma lanceolate in profile, smooth, glabrous. Fig. 6.

Shade of scrubland, forest margins and plantations; 2100–3070 m. EW TU SU AR SD BA HA; southwards through East Africa to Zimbabwe; also in Yemen. *Friis* et al. 1325; *Gillett* 14258; *IECAMA* H-50.

Var. *abyssinica* is replaced in South Africa by var. *erecta*, which is distinguished by its smaller spikelets about 4 mm long. The two varieties are linked by a range of intermediates occurring over a wide geographical range.

STIPEAE Dumort. (1824)

Freitag in Kit Tan (ed.). *Davis & Hedge Festschrift. Edinburgh*, 1989.

Tussocky perennials, or rarely annual. Leaf-blades often tough and wiry, flat or more usually convolute or folded; ligule membranous. Inflorescence an open or contracted panicle. Spikelets all alike, 1-flowered without a rachilla extension, disarticulating above the persistent glumes; glumes 1–3(–7)-nerved, hyaline to membranous, exceeding the floret, mostly acute to long-acuminate; lemma 3–9-nerved, tough, becoming indurated at maturity, often terete and enclosing the palea, awned from the entire, emarginate or rarely bifid tip; awn caducous or persistent, straight or geniculate with a twisted, often plumose column; palea usually equalling the lemma, lacking keels; stamens 3, glabrous or apically bearded; lodicules (2–)3, large, hyaline; callus small or long and pungent; grain fusiform with a small embryo and linear hilum.

9 genera of mainly xerophytic grasses, occurring throughout the world in temperate and warm temperate regions; typical of dry-open areas, particularly grassland steppe.



Figure 6. *EHRHARTA ERECTA* var. *ABYSSINICA*: 1 - habit x 3/4; 2 - inflorescence x 3/4; 3 - spikelets x 4; 4 - florets removed from glumes x 5. 1, 3 & 4 from *Phillips* 9; 2 from *M.G. & S.B. Gilbert* 1922. Drawn by *Eleanor Catherine*.

Stipeae is characterized by its single indurated floret without a rhachilla-extension, which is often terete, enclosing the palea, and with a terminal awn.

1. Lemma plump, lanceolate to ovate, dorsally compressed, the margins not enclosing the palea; callus very short, glabrous. 9. *Oryzopsis*
- Lemma narrow, cylindrical, the margins convolute over the palea; callus distinct, pungent to obtuse, bearded. 10. *Stipa*

9. ORYZOPSIS Michx. (1803)

Piptatherum P. Beauv. (1812)

Tufted perennials; leaf-blades flat or inrolled. Inflorescence an open panicle. Spikelets 1-flowered, dorsally compressed; glumes 3–5-nerved, subequal, membranous, exceeding the floret; lemma lanceolate to ovate, coriaceous, becoming indurated at maturity, usually dark coloured, pilose or rarely glabrous, usually awned from the acute tip; awn short, straight, usually caducous; anthers apically bearded; callus very short, glabrous.

35 species in temperate and subtropical regions of the northern hemisphere, centred in the dry parts of the Middle East and central Asia.

O. holciformis (M. Bieb.) Hack. (1885);

Agrostis holciformis M. Bieb. (1808); *Piptatherum holciforme* (M. Bieb.) Roem. & Schult. (1817) - type: Crimea, *M. v. Bieberstein* (LE holo.).

Tufted perennial; culms erect or ascending, slender to moderately robust, 45–125 cm high. Leaf-blades flat or convolute, up to 30 cm long, 2–7 mm wide; ligule 6–16 mm long. Panicle 15–25 cm long, narrow with ascending branches or lax and open, the spikelets clustered towards the tips of the branches. Spikelets broadly lanceolate or gaping with green or purple-tinged glumes and a brown floret, becoming blackish at maturity; glumes 6–13 mm long, lanceolate, firmly membranous with hyaline margins and tip, acuminate; lemma narrowly lanceolate-oblong, 4–8 mm long, pilose, glabrescent around the midnerve, acute; awn caducous, 6–10 mm long, slightly flexuous, scabrid; palea equalling and resembling the lemma; anthers 2.2–5 mm long. Fig. 7:9,10.

E Mediterranean, SW Asia, Middle East eastwards to Iran and Afghanistan.

As is general in *Oryzopsis* species, the size of the spikelet and its parts is very variable in *O. holciformis*. Plants from Ethiopia, Eritrea and Yemen lie at the extreme lower end of the range of variation and are recognised as a distinct subspecies:

subsp. *abyssinica* (Freitag) D. Heller, *Consp. Fl.*

Orient. t: 186 (1991);

Piptatherum holciforme subsp. *abyssinicum* Freitag in Kit Tan (ed.), *Davis & Hedge Festschrift*: 117 (1989) - type: Eritrea, EW, Oculé Cusai, Mt Mamahot, *Pappi* 1240 (FT holo.).

[*O. paradoxa* sensu Chiov. (1908), non (L.) Nutt. (1812)].

Spikelets 6–7(–8) mm long; lemma 4–4.5(–5) mm long.

Thin soils in rocky places in upland evergreen forest; 2500–3100 m. EW TU HA; Saudi Arabia, N Yemen. *Burger* 1268, 1482; *Gillett* 5362.

10. STIPA L. (1753)

Freitag in *Notes Roy. Bot. Gard. Edinb.* 43: 355–489 (1985).

Tufted, often tough perennials, rarely annual; leaf-blades flat or more often inrolled and leathery; ligule membranous. Inflorescence an open or contracted panicle. Spikelets 1-flowered; glumes 1–3-nerved, subequal, delicate, often with fine tapering tips; lemma firmly membranous to coriaceous, narrow, cylindrical, the margins convolute over, and usually enclosing the palea, often hairy, the tip convolute, truncate, emarginate or rarely bifid; awn usually persistent, conspicuous, straight or more often 1–2-geniculate with a twisted column, the column sometimes plumose; callus bearded, usually long and pungent, rarely obtuse.

About 300 species in temperate and warm temperate regions, especially steppe and dry rocky slopes.

Stipa tenacissima L. (Esparto Grass) is native to the Iberian Peninsula and is often cultivated, especially in Spain and North Africa, for its tough fibre used in the manufacture of paper and rope. There is no record of its use in Ethiopia. The specimen *Mooney* 8541 “from denuded soils over limestone in montane steppe on a Jebel near Tarkuna” [not from Kofole as in *Cufodontis*, *Enum.*: 1245 (1968)] comes from Tripolitania in Libya.

1. Awn geniculate with a twisted plumose column. 2
- Awn straight, not plumose. 1. *S. keniensis*
2. Culms slender, to 70 cm high; glumes 7–11 mm long; lemma tip obscurely bi-auriculate. 2. *S. tigrensis*
- Culms robust, to 1.5 m high; glumes c 30 mm long; lemma tip bifid.

S. tenacissima (see note above)

1. *S. keniensis* (Pilg.) Freitag (1989);

Oryzopsis keniensis Pilg. (1926) - type: Kenya, Aberdare, R.E. & Th.C.E. *Fries* 248 (UPS holo., B iso.).

Lasiagrostis elongata Nees (1841); *Stipa dregeana* Steud. (1854) var. *elongata* (Nees) Stapf in Dyer, *Fl. Cap.* 7: 573 (1898); de Winter in *Bothalia* 8: 216 (1965); - type: South Africa, Cape Province, *Drège* s.n. (B holo., destr.).

Perennial forming a compact tussock from a short knotty rhizome; culms erect, 80–140 cm high. Leaf-blades linear, flat, up to 50 cm long, 5–14 mm wide, scattered-pilose above, smooth below, strongly scabrid on the margins; ligule 0.2–0.4 mm long. Panicle ample, open, 30–50 cm long, the slender branches ascending or widely spreading, the spikelets clustered on the distal



Figure 7. *STIPA KENIENSIS*: 1 - base of plant x 3/4; 2 - inflorescence x 3/4; 3 - spikelet x 4; 4 - floret x 7. *S. TIGRENSIS*: 5 - habit x 3/4; 6 - inflorescence x 3/4; 7 - spikelet x 4; 8 - floret x 7. *ORYZOPSIS HOLCIFORMIS*: 9 - group of spikelets x 4; 10 - mature floret with disarticulating awn x 7. 1 from Clayton 65; 2-4 from Bogdan 732; 5 from Pappi 1180; 6-8 from Wilson 1461; 9 from Gillett 5362; 10 from Burger 1268. Drawn by Eleanor Catherine.

half. Spikelets green; glumes 3-nerved, 5.5–7.5 mm long, linear-oblong, thinly membranous, densely scaberrulous, acute; floret callus obtuse, 0.5 mm long; lemma linear-elliptic, 5–6 mm long, loosely pilose, the tip narrowly bi-auriculate; awn 1–1.5 cm long, straight, scaberrulous, persistent; palea subequalling and similar to the lemma, not completely covered by the lemma margins; anthers 2.5–4 mm long, glabrous. Fig. 7:1–4.

In the shade of montane forest; 2100 m. HA; East Africa and South Africa. *Gillett* 5422.

Stipa is not clearly delimited from *Oryzopsis*, and this species exhibits several intermediate features, in particular the straight awn and short callus.

2. *S. tigreensis* *Chiov.* (1905);

- type: Ethiopia EW, Oculé Cusai, Mt Mamahot, Pappi 1180 (FT holo., K iso.).

Densely tufted perennial; culms erect, 30–70 cm high. Leaf-blades filiform, tightly convolute, 5–25 cm long, up to 2 mm wide, tough, smooth and glabrous on the outer (lower) surface, often somewhat glaucous; leaf-sheaths bearded at the mouth; ligule 0.5–1 mm long. Panicle linear, contracted, 10–20 cm long, the long awns of succeeding spikelets often twisting together. Spikelets pale silvery-green, sometimes purple-tinged; glumes 3-nerved, delicate, linear-lanceolate, finely acuminate, the lower 11–15 mm long, the upper somewhat shorter; floret callus pungent, 1.2–1.5 mm long; lemma linear, 5–5.5 mm long, pilose except near the minutely bi-auriculate tip; awn 3–7 cm long, bigeniculate, the column loosely villous with hairs 1–1.5 mm long, the bristle minutely puberulous, finally disarticulating from the lemma tip; palea half as long as the lemma; anthers 3–3.5 mm long, bearded. Fig. 7: 5–8.

In rock crevices on exposed cliffs, or in montane grassland; 2800–3000 m. EW; Sudan (Jebel Marra), Saudi Arabia (Asir), N Yemen, Uganda (Mt Moroto).

Although known at present in Ethiopia only from the type collection, the presence of this grass on Mt Moroto in Uganda suggests that it probably also occurs elsewhere in Ethiopia on suitable dry, rocky mountain ledges.

POEAE

Annuals or perennials. Leaf-blades linear, filiform or setaceous; ligule membranous. Inflorescence usually an open or contracted panicle, rarely a raceme or spike. Spikelets (1–)2- to many-flowered with the uppermost florets reduced, mostly laterally compressed, usually all alike, rarely dimorphic with mixed fertile and sterile spikelets, disarticulating above the glumes and between the florets (rarely falling entire); glumes usually shorter than the lemmas, persistent; lemmas 5–13-nerved (3-nerved in *Colpodium*); herbaceous, awnless or with a straight or curved awn arising at or near the tip; palea 2-keeled, ± equalling the lemma; lodicules 2 (rarely 0); stamens 3 (1 in *Vulpia*); stigmas 2. Grain tightly en-

closed within the lemma and palea, with a small embryo and linear or punctiform hilum.

A large tribe of predominantly temperate grasses, divided into about 50 genera. The tribe is usually recognisable by its paniculate inflorescence, simple several-flowered spikelets with the florets exerted from the glumes, and by the 5- or more nerved lemmas. However, a number of genera deviate in various ways from this general pattern. Anatomy is non-Kranz and physiology C3.

1. Spikelets all alike. 2
- Spikelets dimorphic, each fertile spikelet surrounded by several sterile spikelets. 11. *Lamarckia*
2. Lemmas thin, conspicuously nerved and densely tuberculate; annual, the inflorescence sparsely branched. 12. *Castellia*
- Lemmas not as above. 3
3. Inflorescence a raceme, the spikelets arranged edgeways, alternating on either side of the rachis; lower glume absent (except in terminal spikelet). 13. *Lolium*
- Inflorescence an open or contracted panicle. 4
4. Lemmas laterally compressed and keeled. 5
- Lemmas rounded on the back (or only weakly keeled towards the tip). 7
5. Spikelets 1-flowered (in Africa); palea-keels smooth. 14. *Colpodium*
- Spikelets several-flowered; palea-keels scaberrulous. 6
6. Spikelets borne in dense 1-sided fascicles on the panicle branches; lemmas mucronate, ciliate on the keel. 15. *Dactylis*
- Spikelets borne in an open or contracted panicle; lemmas obtuse to acuminate. 16. *Poa*
7. Perennials; lemmas lanceolate, awned or awnless; stamens 3. 17. *Festuca*
- Annuals; lemmas subulate-lanceolate, with a fine long terminal awn; stamen 1. 18. *Vulpia*

11. LAMARCKIA *Moench* (1794)

Annual. Leaf-blades broadly linear, ligule membranous. Inflorescence a dense secund panicle, the spikelets borne in fascicles composed of one fertile spikelet surrounded by 2–4 sterile spikelets; fascicles falling entire at maturity. Spikelets scarious; glumes equal, slightly shorter than the spikelets. Sterile spikelets several-flowered with the florets reduced to empty lemmas, the lemmas hyaline, imbricate, the central nerve extended as a mucro or short awn from the irregularly-toothed tip. Fertile spikelet 2-flowered, the florets well separated on a filiform rachilla; lower floret fertile, the lemma 5-nerved, chartaceous, rounded on the back, deeply 2-cleft with a long, straight awn arising between the teeth, palea as long as the lemma; upper floret reduced to a vestigial deeply cleft lemma at the base of a long straight awn. Anthers 3. Grain with a small embryo and short linear hilum.



Figure 8. *LAMARCKIA AUREA*: 1 - habit x 3/4; 2 - spikelet cluster x 4; 3 - sterile spikelet x 7; 4 - fertile spikelet x 7. *CASTELLIA TUBERCULOSA*: 5 - habit x 3/4; 6 - lemma x 7. *COLPODIUM HEDBERGII*: 7 - habit x 3/4; 8 - spikelet x 7. 1-4 from Chaudhary 3833; 5 & 6 from Collette 4023; 7 & 8 from Phillips 28. Drawn by Eleanor Catherine.

1 species, Mediterranean and the Middle East.

L. aurea (L.) Moench (1794);

Cynosurus aureus L. (1753). Types from southern Europe.

Slender tufted annual; culms to 40 cm high. Panicle brush-like, oblong, 2–6 cm long, the fascicles of spikelets drooping. Spikelets straw-coloured tinged with purple, shining. Sterile spikelets 5–7-flowered, linear-oblong, 4.5–7 mm long, the lemmas oblong, 2 mm long. Fertile spikelet with the fertile lemma 3 mm long, tipped with a scabrid awn 5–8 mm long. Awn on the sterile floret ± equalling that of the fertile floret.

Fig. 8:1–4.

Dry open places; c 3000 m. EW TU GD; the Mediterranean, extending to Pakistan and Afghanistan; also the Arabian Peninsula and the Red Sea Hills of Sudan. Introduced into North America, South Africa etc. *De Wilde & M.G. Gilbert* 214; *Pappi* 1454, 2015.

12. CASTELLIA Tineo (1846)

Annual; leaf-blades linear, flat, auriculate. Inflorescence racemose, sparsely branched at the base, simple above, the spikelets distichous, appressed to the axis. Spikelets several-flowered, laterally compressed, disarticulating between the florets; glumes unequal, narrow, shorter than the florets, coriaceous; lemmas thinly membranous, prominently 5-nerved, densely tuberculate, rounded on the back, subacute; grain tightly enclosed within the lemma and palea.

One species with a scattered distribution around the Mediterranean, extending eastwards to Pakistan.

C. tuberculosa (Moris) Bor (1948);

Catapodium tuberosum Moris (1841) - type: Sardinia, Moris (TO holo.).

Loosely tufted annual; culms erect or geniculately ascending, 20–75(–100) cm high. Inflorescence stiff, unbranched or with a few spreading branches at the base, the spikelets subsessile, alternating, distant. Spikelets elliptic, 9–15 mm long, 6–12-flowered; lower glume 3-nerved, 2.8–3.5 mm long, upper glume 3–5-nerved, 3.5–5 mm long; lemmas oblong, 4.2–5.7 mm long; anthers 3, 0.3–0.6 mm long. Fig. 8:5, 6.

Among *Juniperus*; 1200–2700 m. EW; Mediterranean, Canary Is., Sudan (Red Sea hills), Djibouti, Arabia, Iran, Pakistan. *Baldrati* 63; *Pappi* 2798, 5729, 8345.

Castella superficially resembles *Lolium* with its stiff, racemose inflorescence of appressed, distichous spikelets, particularly if basal branches are lacking. However, it can be readily separated on close inspection by its conspicuously scabrid-tuberculate lemmas and by the presence of a lower glume.

13. LOLIUM L. (1753)

Terrell in *U.S. Dept. Agric. Tech. Bull.* 1392: 1–65 (1968).

Annuals or perennials; leaf-blades linear, flat or rolled, auriculate. Inflorescence a 2-sided spike, the spikelets arranged edgewise on, alternate and distichous, their inner edges sunk in hollows of the continuous axis. Spikelets several-flowered with the uppermost florets reduced, disarticulating between the florets; lower (adaxial) glume suppressed except in the terminal floret and there similar to the upper; upper glume narrow, persistent, becoming toughened; lemmas rounded on the back, 5–9-nerved, awnless or awned from just below the tip. Grain tightly enclosed by the hardened lemma and palea.

8 species in temperate Eurasia; widely introduced elsewhere.

Lolium is a difficult genus taxonomically as all the species are more or less interfertile and consequently intergrading. Most will also hybridise with *Festuca arundinacea* and its allies.

L. rigidum Gaud. is native from southern Europe and the Mediterranean eastwards to C Asia. It has been reported in the literature from Ethiopia [*Cufodontis, Enum.*: 1212 (1968)], but there is no authenticated record. However, it occurs in Yemen, and may be found in Ethiopia as an introduced weed.

1. Lemmas elliptic to ovate, turgid at maturity; mature fruit not more than 3 times as long as wide; upper glume rigid, as long as or exceeding the florets. 1. *L. temulentum*
- Lemmas oblong, not becoming turgid at maturity; mature fruit more than 3 times as long as wide. 2
2. Perennial with non-flowering shoots at anthesis; spikelets 2–10-flowered, usually awnless; young leaves flat or folded. 2. *L. perenne*
- Annual without non-flowering shoots at anthesis, or if perennial spikelets 11–22-flowered; young leaves rolled. 3
3. Spikelets 11–22-flowered; glume always less than half as long as the spikelet; lemmas usually awned. 3. *L. multiflorum*
- Spikelets 3–11-flowered; glume half as long to longer than the spikelet; rhachis rigid, often thick; lemmas usually awnless.

L. rigidum (see note above)

1. *L. temulentum* L. (1753);

– type: Europe, *Linnaeus* (LINN lecto.).

Tufted annual; culms stiffly erect, slender to moderately robust, 30–90 cm high. Leaf-blades flat, 6–40 cm long and 3–13 mm wide, narrow spreading auricles at the junction with the sheath. Spikes rigid, erect, 10–30 cm long, the spikelets about their own length apart. Spikelets 4–10-flowered, oblong, 12–26 mm long; up-



Figure 9. *LOLIUM* spp.: *L. TEMULENTUM*: 1 - spike x 3/4; 2 - spikelet x 4. *L. MULTIFLORUM*: 3 - spikelet x 4. *L. PERENNE*: 4 - spikelet x 4. 1 & 2 from Meyer 7456; 3 from De Wilde 10939; 4 from Ryding 1267. Drawn by Eleanor Catherine.

per glume conspicuous, linear, rigid, as long as or exceeding the florets, 7-9-nerved, obtuse; lemmas elliptic to ovate, 5-8 mm long, obtuse, becoming swollen and hard at maturity, awnless or with a stiff awn up to 2 cm long. Fig. 9:1, 2.

A weed of arable land, especially wheat fields; 2000-2900 m. EW TU WU SU KF AR HA; a native of the Mediterranean region, now widespread and naturalized in warm temperate countries. Doubtless introduced to Ethiopia with wheat seeds. Darnel (Eng.); Kirrdat; Enkerdat. Friis et al. 1481; Edwards 122; Mooney 8170.

The seeds are often infected by a fungal mycelium (ergot) which produces a strong narcotic, causing poisoning when grazed by cattle, or when present as a contaminant of wheat flour.

Forms lacking awns, or with very short, inconspicuous, weak awns, have been separated as var. *arvense* Liljeblad.

2. *L. perenne* L. (1753);

- type: Europe, *Linnaeus* (LINN lecto.).

Tufted perennial; culms 10-90 cm high, erect or spreading, sometimes prostrate and rooting from the lower nodes. Leaf-blades 5-20 cm long, 2-5 mm wide, with or without auricles up to 3 mm long at the sheath junction. Spikes 3-30 cm long, stiff, slender to moderately stout, the spikelets usually less than their own length apart but occasionally more widely spaced. Spikelets 5-20 mm long, 3-10(-14)-flowered; upper glume 1/3 to as long as the spikelet, rarely exceeding it, 3-9-nerved, acute or obtuse; lemmas oblong or oblong-lanceolate, 3.5-9 mm long, obtuse or subacute, usually awnless but rarely with an awn up to 8 mm long. Fig. 9: 4.

EW; widespread in Europe, temperate Asia and North Africa, and extensively cultivated in temperate regions throughout the world as a lawn and fodder grass. Introduced to Ethiopia and occurring round habitations. Ryding 1267 (ETH). Perennial rye grass.

L. perenne is very variable, and also hybridises freely with other species of *Lolium* and also with some species of *Festuca*.

3. *L. multiflorum* Lam. (1778);

- type: France (P lecto.).

Tufted annual, biennial or short-lived perennial; culms up to 1 m high. Leaf-blades 10-22 cm long, 3-8 mm wide, usually with auricles 1-4 mm long at the sheath junction. Spikes slender to fairly stout, erect or nodding, 10-35 cm long, the spikelets imbricate or up to their own length apart. Spikelets oblong, (5-)11-22-flowered, 8-30 mm long; upper glume much shorter than the spikelet, scarcely exceeding the lowest floret, 3-7-nerved, obtuse, acute or slightly erose; lemmas oblong, 5-8 mm long, with a fine straight awn up to 10 mm long. Fig. 9:3.

EW SU; a native of central and southern Europe and the Mediterranean region, widely grown in temperate zones for pasture and hay. Occurring in Ethiopia as a ruderal around habitations. *De Wilde* 10939; *Sandford* M18 (ETH); *Ryding & Sileshi* 1887 (ETH). Italian rye grass (Eng.).

14. *COLPODIUM* Trin. (1822)

Keniochloa Meld. (1956)

Hedberg & Hedberg in *Nordic J. Bot.* 14: 601–606 (1994).

Small perennials; leaf-blades flat or folded, with navicular tip. Inflorescence an open or contracted panicle. Spikelets 1–4-flowered (1-flowered in Africa), disarticulating above the persistent glumes; glumes equal or unequal, shorter than or equalling to slightly exceeding the floret, firmly membranous with broad hyaline margins and nerveless tip; lemma thin, indistinctly 3–5-nerved below (3-nerved in Africa), nerveless towards the tip, glabrous or appressed-pubescent, awnless; palea-keels smooth; grain with a shortly linear hilum.

About 20 species; Turkey eastwards through the Caucasus to the Himalayas; E Siberia; high mountains of East Africa and Lesotho.

Colpodium is a high mountain segregate from *Poa*, differing mainly in its thinner lemmas with nerveless tips and smooth palea-keels. However, the African species with their long-glumed, single-flowered spikelets and 3-nerved lemmas deviate considerably from the usual pattern in *Poa*.

C. hedbergii (Meld.) Tzvel. (1965);

Keniochloa hedbergii Meld. (1956) - type:

Kenya, Mt Elgon, *Hedberg* 908 (UPS holo., K iso.).

Loosely tufted perennial, basal leaf-sheaths broad and papery; culms prostrate or ascending, up to 40 cm high. Leaf-blades up to 11 cm long, 1–4 mm wide, smooth, glabrous; ligule 1.5–8 mm long, acute. Panicle open, 3.5–20 cm long, branches stiff, the lower reflexed, bearing the spikelets on short pedicels 0.3–0.5 mm long. Spikelets narrowly elliptic, 2.4–3.5(–4) mm long; glumes equal, enclosing the single floret, lower 1-nerved, upper 3-nerved; lemma narrowly ovate, 2.3–3 mm long, rounded on the back, appressed-pubescent with clavate hairs, obtuse; palea equalling the lemma, likewise appressed-pubescent; anthers 1.2–1.5 mm long; grain dorso-ventrally flattened. Fig. 8:7, 8.

Mud along streams and temporary pools; 3500–4000 m. GD BA; Kenya (Mt Elgon, Mt Kenya). *Hedberg & Getachew* 5492, 5361; *Phillips* 28, 43; *Mesfin* T. 7723 (ETH).

C. chionogeiton (Pilg.) Tzvel., known only from Mt Kenya and Mt Kilimanjaro, differs by its narrow, contracted panicle and longer spikelets (3.5–6.5 mm long).

15. *DACTYLIS* L. (1753)

Tufted perennials; leaf-blades linear, flat or folded. Inflorescence a lobed, 1-sided panicle, the spikelets almost sessile and densely clustered in compact fascicles on the panicle branches. Spikelets 2–5-flowered, strongly laterally compressed, disarticulating between the florets; glumes persistent, unequal, strongly keeled; lemmas 5-nerved, strongly laterally compressed and keeled, ciliate on the keel, herbaceous with membranous margins, mucronate.

A temperate genus with 5 species native to Eurasia; widely introduced and naturalized elsewhere.

D. glomerata L. (1753);

- type: Europe (LINN holo.).

Coarse tufted perennial; culms 15–140 cm high, erect or spreading; leaf-blades folded at first, the sheaths strongly compressed and keeled. Panicle oblong to ovate, 2–30 cm long, the fascicles of spikelets densely clustered, or more often with the lower branches distant, spreading and bare at the base. Spikelets oblong to wedge-shaped, 5–9 mm long, the florets closely imbricate; glumes lanceolate to ovate, ciliate on the keel, finely pointed; lemmas lanceolate to oblong in profile, 4–7 mm long, ciliate or scabrid on the keel, tipped with a stout mucro up to 1.5 mm long.

Cultivated at high altitudes; native to Europe, the Mediterranean and Temperate Asia. *Jimma* ATS A47; *Bezabeh* 279 (ETH).

An important pasture and hay grass which has been widely introduced into temperate regions throughout the world. Cocksfoot (Eng.), Orchard grass (Amer.).

16. *POA* L. (1753)

Phillips in *Kew Bull.* 44: 127–137 (1989).

Perennial or rarely annual. Leaf-blades linear, flat or folded, the tip often hooded; ligule membranous. Inflorescence an open or contracted panicle. Spikelets 2-several-flowered, laterally compressed, disarticulating between the florets; glumes 1–3-nerved, keeled, shorter than the lemmas, slightly unequal; lemmas 5–7-nerved, deeply concave, keeled, membranous with hyaline margins and tip, often hairy, awnless; callus often with a tuft of woolly hairs, the hairs long and tangled; palea keels scaberulous to ciliolate; grain with a punctiform hilum.

A cosmopolitan genus of ± 500 species, concentrated in temperate and cold regions of the northern hemisphere; on mountains in the tropics.

Poa is a notoriously difficult genus taxonomically over the whole range of its distribution, due to the uniformity of structure of its spikelets, coupled with great variability in those characters which might be supposed to be important for the delimitation of species. This variability arises largely through extensive introgression, polyploidy and apomixis. These difficulties are

exacerbated in Ethiopia by the fact that most species are known from only a very few collections, as they grow high up in remote mountainous areas, so that it is not yet possible in most cases to properly assess their variability. Indeed, the only Ethiopian species which are at all well known are *P. leptoclada* and *P. schimperiana*, the only two occurring widely at altitudes below 3500 m.

The majority of Ethiopian species are apparently only weakly delimited from each other, and although most collections can be keyed out satisfactorily, problematical specimens will be encountered from time to time. The form of the panicle, which has often been relied on to distinguish species, seems to be a character of very doubtful value. The length of the anthers appears to be a useful character for distinguishing some species, but caution is also required here. In addition, the species are very variable in habit, reacting strongly to environment. Species boundaries are consequently drawn rather widely in this account, and it is very probable that further collecting will result in an increase in the number of species as variation is better understood.

1. Annual; lemmas obtuse with conspicuous broad hyaline margins and tip; leaf-blades soft, to 10 cm long, obtuse or abruptly acute. 1. *P. annua*
- Perennials; lemmas subacute to acuminate with narrow hyaline margins and tip; leaf-blades usually longer than 10 cm, if shorter not soft and obtuse. 2
2. Panicle contracted; lemmas 5-5.3 mm long, glabrous, scabrid; anthers 2.3-2.5 mm long. 8. *P. hedbergii*
- Panicle usually loose and open (if linear and spiciform lemmas < 3 mm long); lemmas 1.5-4.5(-5) mm long, often with some crinkly or woolly hairs; anthers 0.3-2(-2.5) mm long. 3
3. Small cushion-forming perennial 3 cm high; glumes broadly obtuse, sheathing, exposing only the tips of the florets; lemmas smooth, glabrous. 7. *P. pumilio*
- Tufted perennials to 90 cm high; glumes subacute to acuminate, the florets clearly visible; lemmas glabrous or hairy (often only on the nerves below). 4
4. Anthers 0.3-1 mm long. 5
- Anthers 1.3-2.5 mm long. 7
5. Panicle linear, spiciform, the branches ± erect; lemmas 1.5-3(-3.4) mm long. 2. *P. leptoclada*
- Panicle open, ovate to oblong, the branches spreading, often reflexing; lemmas 2.7-4.7 mm long. 6
6. Slender, loosely ascending or straggling perennial to 90 cm high; panicle branches capillary, flexuous. 4. *P. schimperiana*
- Stiffly erect perennial to 40 cm high from a basal tuft of short leaves; panicle branches stiffly spreading. 5. *P. muhavurensis*

7. Lemmas 2.4-3 mm long; panicle branches suberect to spreading, not flexuous. 3. *P. pseudoschimperiana*
- Lemmas 3-5 mm long; panicle branches loosely ascending, flexuous. 8
8. Spikelets 4.5-5.5 mm long, the florets loosely imbricate; lemmas membranous, sharply acute; leaf-blades narrowly linear to filiform, flexuous. 6. *P. simensis*
- Spikelets 6-7 mm long, the florets tightly imbricate; lemmas chartaceous, prominently nerved, subacute; leaf-blades linear, flat or folded. 9. *P. chokensis*

1. *P. annua* L. (1753);

- type from Europe (LINN holo.).

P. bipollicaris Hochst. (1855) - type: Ethiopia, GD, Semien Mts, Mt Bachit, *Schimper* in Herb. Buchinger 101 (STR holo., B iso.).

Tufted annual; culms up to 20 cm high, erect or often straggling and decumbent. Leaf-blades soft, bright green, often crinkled when young, 3-10 cm long, 2-3 mm wide, obtuse or abruptly acute; ligule 1.5-2 mm long. Panicle pyramidal, 3-5 cm long. Spikelets 3-5-flowered, elliptic to ovate, 3.5-6 mm long; glumes with broad hyaline margins, the lower 1(-2)-nerved, elliptic, the upper 3-nerved, broadest at the middle, obtuse; lemmas broadly elliptic, 2.7-3.5 mm long, thinly membranous with conspicuous broad white scarious margins and tip, silky-villous on the keel and marginal nerves below, obtuse or emarginate; palea-keels woolly; anthers 0.7-1 mm long.

A ruderal of pathsides, disturbed ground and overgrazed pasture, in the open and in shade; 2400-4000 m. EW GD GJ WU SU BA HA; a cosmopolitan weed of temperate regions and upland areas in the tropics. *Burger* 3825; *Mooney* 5799; *De Wilde* 5961 (ETH).

P. annua is the most clearly defined of the species of *Poa* occurring in Ethiopia. It can readily be distinguished by its annual habit, relatively short, flat, blunt leaf-blades, and by the conspicuous white margins and blunt tips to the lemmas. The crinkled young leaves are a useful spot character, but are not always present.

2. *P. leptoclada* Hochst. ex A. Rich. (1850);

- types: Ethiopia, TU, Shire [Chiré], Cojeta, *Schimper* 1826 (P syn., TUB K isosyn.) & SU [Choa] *Petit* (P syn.).

Eragrostis puberula Steud. (1854) - type: Ethiopia, without precise locality, *Schimper* s.n. (P holo.)

Poa schimperiana A. Rich. var. *longigluma* Chiov. in *Ann. Ist. Bot. Roma* 8: 377 (1908) - type: Eritrea, Scimazana, Gheleba, *Pappi* 845 (FT holo.).

P. schimperiana A. Rich. var. *micrantha* Chiov., l.c.: 377 (1908) - type: Eritrea, Ocule Cusai, Degga-hen, *Pappi* 1395 (FT holo.).

P. friesiorum Pilg. (1927).

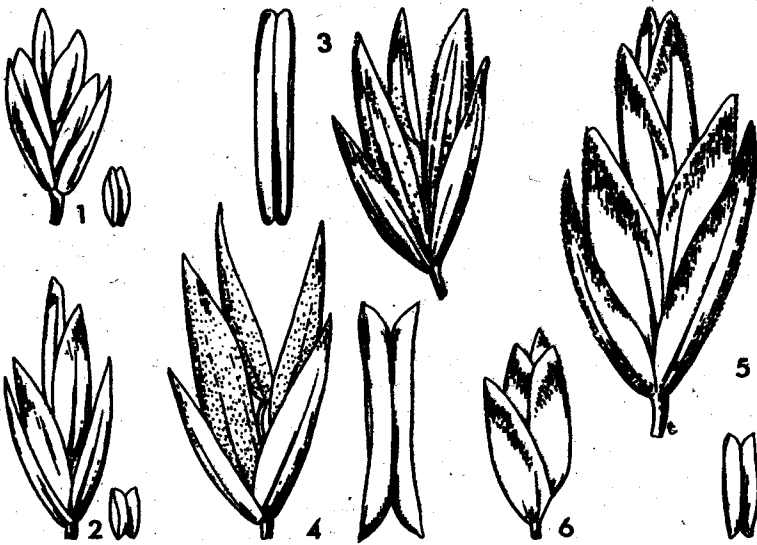


Figure 10. Spikelets and anthers of some *POA* species. Spikelets x 5; anthers x 10. 1 - *P. LEPTOCLADA*; 2 - *P. SCHIMPERIANA*; 3 - *P. SIMENSIS*; 4 - *P. HEDBERGII*; 5 - *P. CHOKENSIS*; 6 - *P. PUMILIO* (without anther). 1 from *Frits et al.* 1099; 2 from *Gilbert* 1931; 3 from *Schimper* 993; 4 from *Hedberg* 5584; 5 from *Evans & Hiller* 565; 6 from *Schimper* 208. Drawn by Eleanor Catherine.

Slender tufted perennial; culms 12–80 cm high, erect or weak and ascending. Leaf-blades narrowly linear, acute; ligule 1–3.5 mm long. Panicle 4–30 cm long, linear, spiciform, the branches erect and \pm appressed to the main axis. Spikelets (2–)3(–4)-flowered, elliptic, 2.1–4.5 mm long; glumes acute, the lower narrowly lanceolate, the upper narrowly oblong; lemmas elliptic to lanceolate in profile, (1.5–)1.7–3.2(–3.4) mm long, glabrous or hairy on the nerves below, sometimes also on the back with or without a tuft of wool at the base of the keel, acute; anthers 0.4–0.7(–1) mm long. Fig. 10:1.

In woodland, on disturbed ground and among rocks on mountains, preferring moist shady situations; 2300–4050 m. EW TU GD SU KF AR BA HA; on mountains southwards through East Africa to Zimbabwe, and in the Sudan (Jebel Marra), Yemen and Cameroon. *Burger* 1469; *Gilbert et al.* 1677; *Mooney* 8316.

P. leptoclada is an extremely variable species and is taken here to include all forms with small anthers (<1 mm) and a spiciform panicle. Its facies varies greatly according to habitat and in particular, plants from the high mountains (over 4000 m) are small and compactly tufted, with erect, dense, purplish panicles, whilst those growing at lower altitudes, especially in woodland, tend to have a much looser straggling growth habit, and a correspondingly longer, usually green inflorescence with the panicle branches only loosely appressed to the main axis. Hairiness of the lemma, and the presence or absence of wool on the callus, is also very variable and quite uncorrelated with differences in habit. *P. leptoclada* also intergrades with *P. schimperiana* (see note under 4. *P. schimperiana*).

3. *P. pseudoschimperiana* *Chiov.* (1908);
- types: Eritrea, *Pappi* 2805, 2890, 5925, 1238, 1327, 1626, 818 (all FT syn.) & *Pappi* 1543, 1950 (FT syn., EA isosyn.).

Loosely tufted perennial, basal sheaths often fibrous; culms slender, erect, 30–45 cm high. Leaf-blades flat, soft, 2–3 mm wide, acute; ligule 1–3.5 mm long, rounded. Panicle linear to elliptic, 10–15 cm long; the branches loosely erect or more spreading and open. Spikelets 3-flowered, elliptic-oblong, 3.2–4.5 mm long, silvery-green; lower glume narrowly elliptic-oblong, acute; upper glume elliptic, obtuse or emarginate; lemmas narrowly elliptic-oblong, 2.3–3.3 mm long, minutely asperulous, glabrous or appressed-pilose on the back below, sometimes with a few woolly hairs at the base of the keel, tip scarious; subacute; anthers 1.3–1.9 mm long.

Dry hillsides; 1800–2600 m. EW; unknown elsewhere. *De Wilde* 4485; *Pappi* 1950; *Baldrati* 4878 (FT).

This species is apparently endemic to the highlands of Eritrea. The spikelets are similar to those of *P. leptoclada*, a resemblance heightened in those forms with a narrow panicle. Where the panicle is more open, there is a strong similarity with some small-spiculate collections of *P. schimperiana* from the Yemen. However, the long anthers of these Eritrean plants preclude their inclusion in the *P. leptoclada-schimperiana* complex where the anthers are always less than 1 mm long (usually 0.5–0.7 mm where the lemmas are shorter than 3 mm).

4. *P. schimperiana* *Hochst. ex A. Rich.* (1850);
- type: Ethiopia, GD, Semien, Demerki, *Schimper* 1386 (K iso.).
P. oligantha *Hochst. ex Steud.* (1854) - type: "Ex collect. Argentor.", Abyssinia, *Schimper* s.n. (P holo.).
P. viridiflora *Hochst.* (1855) - type: Ethiopia, GD, Semien, Demerki, *Schimper* in *Herb. Buchinger* 36 (STR holo., P iso.).

Loosely tufted or shortly rhizomatous perennial; culms slender, 35–90 cm high, erect or often straggling or weakly ascending. Leaf-blades linear, flat; ligule 0.5–2.3(–3.8) mm long. Panicle open, 14–25 cm long, sparsely branched, often flexuous, the branches capillary, widely spreading and usually reflexing at maturity. Spikelets 2–3(–4)-flowered with the florets loosely imbricate, elliptic, 3.7–5.8 mm long; glumes lanceolate, acute; lemmas lanceolate in profile, 2.7–4.7 mm long, pilose on the back or only on the nerves or glabrous, with or without a basal tuft of wool, acute to acuminate; anthers 0.5–1 mm long. Fig. 10:2.

Upland localities and on mountains, favouring damp shady situations, especially along the banks of streams; 1700–4050 m. GD GJ SU KF GG AR SD BA HA; southwards to Malawi; also in Cameroon and Yemen. *Hedberg* 5597; *Mooney* 8517; *Friis* et al. 755.

P. schimperiana is not clearly separable from *P. leptoclada*, and some difficulty will be experienced with intermediate specimens. However, typical *P. schimperiana*, with its lax open panicles of often reflexing branches and longer, more acuminate lemmas, is so different in facies from typical *P. leptoclada*, with its spiciform panicle and smaller, acute lemmas, that it is unacceptable to include them in a single species. Intermediates (e.g. *Mooney* 8269, 5097a) usually have narrow panicles with loosely ascending branches, and lemmas at the lower end of the range for *P. schimperiana*.

Even among those specimens with a typical open "*schimperiana*" panicle there is a large range of variation in lemma length, and also ligule length. Although this variation is completely continuous, there is a tendency for lemmas at the lower end of the range to be pilose, whereas those over 4 mm long are often glabrous, or pilose only on the nerves.

Evans 582 from Mt Talo (GJ) has a panicle and spikelets typical of *P. schimperiana*, but much longer anthers than usual (2.5 mm) and finely pointed leaf-blades.

5. *P. muhavurensis* C. E. Hubb. (1955);

- type: Uganda, Mt Muhavura, *Snowden* 1481 (K. holo.).

Densely tufted perennial; culms stiffly erect, 10–40 cm high. Leaf-blades linear, folded, up to 10 cm long, 2–4 mm wide, forming a basal tuft; ligule 0.3–3.5 mm long. Panicle pyramidal, 4–10 cm long, the branches stiffly spreading or reflexing with the spikelets clustered in the distal half. Spikelets 2–4-flowered with the florets imbricate, elliptic, 4–5.5 mm long, purple-tinged; glumes lanceolate, subacute; lemmas ovate, 3–3.5 mm long, glabrous, subacute; anthers 0.4–1 mm long.

Stony mountainsides, sometimes along water-courses; 4100–4300 m. BA; East Africa and the adjoining mountains of Rwanda and Zaire. *Hedberg* 5577b, 5644.

P. muhavurensis is a high mountain segregate from *P. schimperiana*, distinguished by its compact habit, with a dense tuft of short basal leaves, and stiff panicle with purple, clustered spikelets.

6. *P. simensis* Hochst. ex A. Rich. (1850);

- type: Ethiopia, GD, Semien Mts., Mt Bachit [Bouahit], *Schimper* 993 (P syn., K isosyn.) & SU, *Petit* s.n. (P syn.).

P. psilophylla Hochst. (1855) - type: Ethiopia, GD, Semien, *Schimper* 292 (STR iso.).

Slender, densely tufted perennial, the basal sheaths finally splitting into fibres; culms wiry, 15–50 cm high. Leaf-blades narrowly linear to filiform, mainly basal; ligule 2–4 mm long. Panicle 6–15 cm long, open, flexuous with loosely ascending branches. Spikelets ovate, 4.5–5.5 mm long, loosely 3-flowered, the rhachilla exposed, pale green or purple-tinged; glumes acute to acuminate; lemmas narrowly elliptic-oblong in profile, 3–4.5 mm long, sparsely scaberulous, usually with crinkled hairs on the keel and margins below (sometimes sparse), often also puberulous on the lower back, with or without a basal tuft of wool, acute; anthers 1.6–2.5 mm long. Fig. 10:3.

In the shade of upland forest, in montane grassland and among rocks on mountains; 2400–4000 m. GD BA HA; endemic to Ethiopia. *Chiovenda* 838; *IECAMA* H-23; *Hedberg & Aweke* 5416 (ETH).

A seldom-collected species, known principally from the Semien mountains. It is best recognized by its open, flexuous panicle arising from a dense basal tuft of narrow, often filiform leaves, although plants from forest shade have a looser habit. The spikelets, with their loosely arranged, sharply acute florets on an exposed rhachilla, are also characteristic. Occasionally narrow-leaved forms of the *P. leptoclada-schimperiana* complex have a similar appearance, but these generally have a looser, straggling habit and can also be distinguished by their shorter anthers.

The boundary with *P. hedbergii*, another very imperfectly known species, is unclear at present. However, *P. simensis* has smaller, less scabrid lemmas as well as a more open panicle.

7. *P. pumilio* Hochst. (1855);

- type: Ethiopia, GD, Semien, Mt Bachit, *Schimper* 208 (STR iso.).

Small perennial forming compact cushions 3 cm high; culms scarcely exceeding the leaves. Leaf-blades folded, 0.3 mm wide (when folded), smooth except for the scaberulous margins, obtuse; ligule 0.5 mm long, truncate. Panicle much reduced, subracemose, few-spiculate with the spikelets borne on scaberulous pedicels 1–2 mm long. Spikelets c 3 mm long, 2–3-flowered, narrowly elliptic; glumes subequal, ovate with broadly obtuse tips, 3-nerved, minutely scaberulous-punctate, sheathing so only the floret tips are exposed; lemmas

2.8 mm long, narrowly elliptic in profile, smooth, glabrous, subacute; palea keels scaberulous upwards; anthers not seen. Fig. 10:6.

Rocky mountain tops; 4200 m. GD; unknown elsewhere.

P. pumilio is known only from the type specimen, collected in 1850 on the summit of Mt Bachit. Its claim to specific status is doubtful, but the broad sheathing glumes and subacute lemmas preclude the possibility that it could be a stunted specimen of *P. simensis*.

8. *P. hedbergii* S. M. Phillips (1989);

- type: Ethiopia, BA, Mt Batu, *Hedberg* 5584 (K holo., ETH UPS iso.).

Densely tufted perennial; culms erect or ascending, up to 35 cm high. Leaf-blades narrowly linear, flat or convolute, 0.8–2.3 mm wide, acute; ligule 1.5–8 mm long. Panicle elliptic to narrowly oblong, up to 8 cm long, ± contracted, dense and lobed or looser with the spikelets clustered along the primary branches. Spikelets 5–8 mm long, narrowly elliptic, 3–4-flowered with the florets loosely imbricate; glumes 1–3-nerved, smooth, acuminate, upper glume 1/2–3/4 spikelet length, narrowly elliptic-oblong, lower glume slightly shorter, narrowly lanceolate; lemmas narrowly lanceolate-oblong in profile, 5–5.3 mm long, scabrid, glabrous, purple-tinged with scarious golden margins and acuminate tip; palea keels scabrid; anthers 2.3–2.5 mm long. Fig. 10:4.

Among rocks on mountains; 3700–4300 m. AR BA; endemic to Ethiopia. *Hedberg* 4207, 4209; *Hillman* 401 (ETH).

P. hedbergii is closely related to *P. ruwenzoriensis* from the Ruwenzori mountains in East Africa, but that species has much broader leaf-blades (3–8 mm), broader, papery basal leaf-sheaths, shorter anthers (1.2–1.7 mm) and lemmas woolly-hairy on the keel.

9. *P. chokensis* S. M. Phillips (1986);

- type: Ethiopia, GJ, Mt Birhan, *Evans & Hiller* 565 (K holo.).

Tussocky perennial; culms 30–100 cm high, erect from an ascending base. Leaf-blades linear, flat or folded, 1.7–3.3 mm wide, tips conspicuously hooded and scabrid; ligule 2–6 mm long. Panicle open, 9–20 cm long, the branches flexuous, loosely ascending, scabrid. Spikelets (3–)4–5-flowered, elliptic, 6–7 mm long, the florets tightly imbricate; glumes narrowly elliptic, acute, scabrid on the nerves; lemmas elliptic-oblong, 4–5 mm long, chartaceous, prominently 5–7-nerved, glabrous, subacute; palea keels ciliolate; anthers 1.2–1.5 mm long. Fig. 10:5.

Marshland and streamsides; 4170 m. GJ; unknown elsewhere. *Evans & Hiller* 328.

This species is at present only known from two collections from the vicinity of Mt Birhan in the Choke

mountains, but is distinctive on account of its chartaceous, prominently nerved, completely glabrous lemmas.

The following two collections may well represent two further undescribed species, but more material is required before they can be named with confidence.

Species A. *Dainelli* 1914.

A low tufted grass 10 cm high, from 4100 m in the Semien mountains. It resembles *P. simensis* in its loose panicle, lemmas 3.8 mm long and anthers 1.9 mm long, but differs in its tightly folded, tougher, pilose, obtuse leaf-blades (0.6 mm wide when folded), in its appressed, silky-pubescent, non-fibrous basal leaf-sheaths and glabrous lemmas.

Species B. *Evans* 582.

Collected in Gojam, on cliff screes at 3300 m on Arat Makereke.

The specimen consists only of 3 culms without basal portions, but is described as "tussock forming". Further characteristics are: leaf-blades 2 mm wide, the tips narrowly acuminate with the midrib extended up to 1 mm as a fine hard point; panicle open, flexuous; spikelets with loosely imbricate, acuminate florets; lemmas 4.3 mm long, hairy on the keel, appressed-pilose on the lower back, basal tuft of wool absent; anthers 2.3–2.5 mm. The panicle and spikelets resemble those of *P. schimperiana*, but it differs by its very long anthers and unusually finely pointed leaf-blades.

17. FESTUCA L. (1753)

Alexeev in *Bot. Zhurnal* 71: 1109–1117 (1986) & 72: 1260–1267 (1987).

Tufted perennials. Leaf-blades linear and flat or folded, or inrolled and filiform, setaceous or acicular; ligule membranous. Inflorescence an open or contracted panicle. Spikelets all alike, several-flowered with the uppermost florets reduced, laterally compressed, disarticulating between the florets; glumes shorter than the florets, subequal; lemmas ± lanceolate, rounded on the back, usually 5-nerved, membranous to chartaceous, smooth or scabrid, often with an awn or awn-point arising at or just below the tip; stamens 3; ovary glabrous or the top hairy, styles apical.

A cosmopolitan genus of about 450 species, mainly in temperate and subtropical regions; extending to mountains in the tropics.

Some species of *Festuca* are easily confused with *Bromus* (see note on p. 54).

In the fine-leaved species the position of sclerenchyma tissue, as seen in a cross-section of the leaf-blade, is an important aid to distinguishing the species.

1. Lemmas awnless or with an awn-point up to 5(–8) mm long. 2
- Lemmas awned, awns 7–19 mm long. 6

2. Leaf-blades linear, flat with narrow ciliate auricles. 1. *F. arundinacea*
- Leaf-blades very narrow, filiform to acicular, not auriculate. 3
3. Glumes broad and enveloping, 3/4 as long as the spikelet, \pm equalling the lowest lemma; lower glume usually 3-nerved. 4
- Glumes narrow, not more than 1/2 as long as the spikelet, much shorter than the lowest lemma; lower glume 1-nerved. 5
4. Tufts loose; culms up to 100 cm high; upper culm-blades usually flat; (cross section of leaf-blade showing sclerenchyma on rib tops as well as on underside). 2. *F. abyssinica*
- Tufts compact, dense; culms up to 40 cm high; leaf-blades stiffly acicular; upper culm-blades always rolled or folded; (cross section of leaf-blade showing sclerenchyma strands only on underside). 3. *F. richardii*
5. Culms 50-100 cm high; leaf-blades scaberulous; panicle many-spiculate; spikelets wedge-shaped ovary-top indistinctly hairy. 4. *F. macrophylla*
- Culms 30-35 cm high; leaf-blades smooth; panicle few-spiculate and racemose; spikelets narrowly oblong; ovary-top clearly hairy. 5. *F. gilbertiana*
6. Leaf-blades broadly linear, 7-18 mm wide; culms robust, 1.5-2 m high. 6. *F. mekiste*
- Leaf-blades narrowly linear, 1-4 mm wide; culms slender, up to 1.2 m high. 7
7. Leaf-blades with spreading falcate auricles; lemmas acute with the awn sub-terminal; ovary glabrous. 7. *F. simensis*
- Leaf-blades not auriculate; lemmas acuminate with the awn terminal; ovary-top hairy. 8. *F. chodatiana*

1. *F. arundinacea* Schreb. (1771), *nom. conserv. prop.* in *Taxon* 40: 135-137 (1991) - lectotype: illustration in Scheuchzer, *Agrostographia* (1719).

F. elatior L. (1753); Linder in *Bothalia* 16: 59 (1986).

Tough perennial tussock grass; culms fairly robust, 60-120 cm high. Leaf-blades linear, flat, tough, tapering to a fine point; leaf-sheaths with narrow ciliate auricles. Panicle 10-30 cm long, narrowly oblong, many-spiculate, loose or contracted. Spikelets closely 3-10-flowered, elliptic, 9.5-14 mm long; glumes lanceolate, acute, the lower 1-3-nerved, 3-5.5 mm long, the upper 3-nerved, 4-6.3 mm long; lemmas well exerted from the glumes, lanceolate-oblong, 6-7.6 mm long, firm except for the narrow scarious scaberulous margins, acute, awnless or the midnerve extended into an awn-point up to 4 mm long arising just below the tip; anthers 3-4 mm long.

Ruderal; 2100-2700 m. SU KF HA; Europe, temperate Asia, NW Africa; widely introduced else-

where as a pasture grass. Introduced to Ethiopia and apparently established as a ruderal, particularly around Addis Ababa. *M.G. & S.B. Gilbert* 1198; *Mooney* 4781; *De Wilde* 5889.

The ciliate auricles at the junction of the leaf-blade and sheath are characteristic, but are best seen on young leaves as they often become worn off with age.

2. *F. abyssinica* Hochst. ex A. Rich. (1850);
- type: Ethiopia, TU, Mt Scholoda [Selleuda],
Schimper 410 (P holo., B K LE iso.).

F. schimperiana A. Rich. (1850); *F. restituta* Steud. (1854), *nom. superfl.*; *F. abyssinica* var. *schimperiana* (A. Rich.) St. Yves in *Rev. Bret.* 2: 75 (1927) & in *Notiz. Bot. Gart. Berlin* 9: 1132 (1927)

- type: Ethiopia, GD, Semien [Simen], D merki, *Schimper* 1384 (1684 in protologue) (P lecto., K B isolecto.).

F. rigidula Steud. (1854) - type: Ethiopia, without precise locality, *Schimper* s.n. (P holo.).

F. abyssinica A. Rich. f. *aristulata* St. Yves in *Candollea* 4: 84 (1929) - type: Ethiopia, Tselga, *Schimper* s.n. (B lecto.).

Perennial forming fairly loose tussocks; culms ascending, 40-100 cm high. Basal leaf-blades inrolled, filiform or setaceous, 20-35 cm long, c 0.5 mm wide, smooth, often flexuous, the upper culm-blades usually flat. Panicle contracted, sometimes spiciform, 8-20 cm long, dense with the spikelets appressed to the main axis, or somewhat laxer with the lower branches ascending. Spikelets (2-)3-4(-7)-flowered, narrowly elliptic, 7.8-15 mm long; glumes large and enveloping, \pm 3/4 as long as the spikelet, acute, the lower 1-3-nerved, the upper 3-5-nerved; lemmas narrowly elliptic, 5.6-9.8 mm long, lightly scaberulous to obviously scabrid, tip acute, cuspidate or extended into an awn-point up to 5(-6.6) mm long; anthers 0.5-2.8 mm long; ovary glabrous. Fig. 12.7.

Upland grassland, scrub and alpine moor, often in moist-situations; 2400-4000 m. TU GD GJ SU AR KF GG SD BA HA; on mountains southwards to Zimbabwe and westwards to Cameroon. *Edwards* 19; *Hedberg* 5690; *Mooney* 5683.

The name *F. abyssinica* as applied here covers a highly variable complex characterised by the broad, enveloping glumes, the lower glume being typically 3-nerved (although the lateral nerves may be short and inconspicuous) and the upper glume extending to 3/4 of the spikelet length.

Alexeev (1986 & 1987) has used awn-length to separate *F. abyssinica* [awns 0-1(-1.7) mm] and *F. schimperiana* [awns (1-)1.5-4(-7) mm]. In most Ethiopian specimens the lemma-tip is extended into an awn-point 2-4 mm long, and the panicle is often loosely

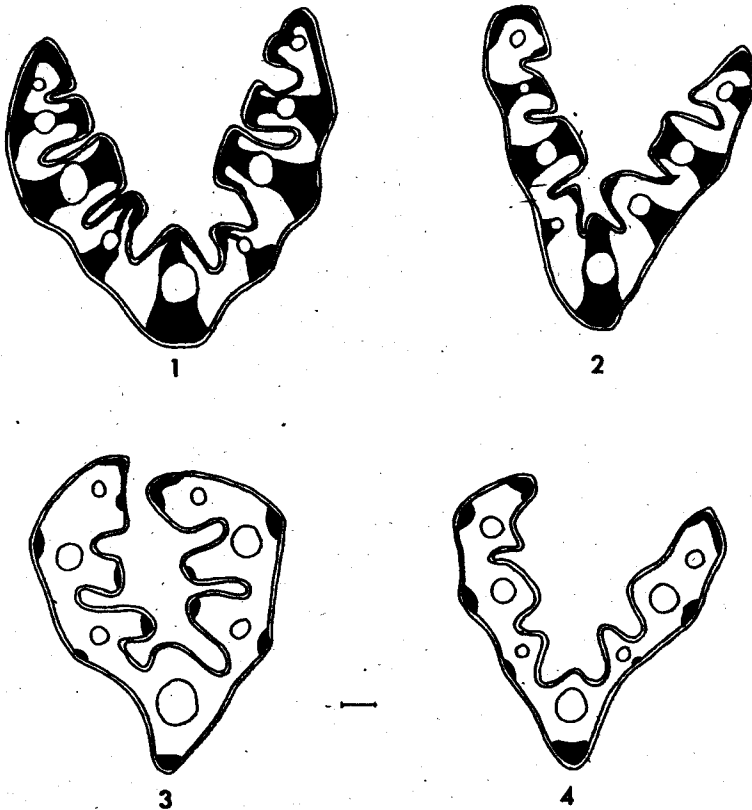


Figure 11. *FESTUCA* spp.: transverse section of leaf-blade to show arrangement of sclerenchyma (shaded black): 1 - *F. MACROPHYLLA*; 2 - *F. GILBERTIANA*; 3 - *F. ABYSSINICA*; 4 - *F. RICHARDII*. 1 from Hedberg & Aweke 5372; 2 from De Wilde & Gilbert 47; 3 from Miehe 46; 4 from Schimper 1560. 3 & 4 provided by H. Scholz (Berlin). Scale bar = 0.1 mm.

linear with the lower branches tending to spread a little from the main axis (*F. schimperiana*). Specimens with the lemmas only acute or cuspidate also tend to have a compact spiciform panicle (*F. abyssinica*). However intergradation with the awned form is complete and the distinction is untenable. Both forms have the same leaf anatomy, with small subepidermal sclerenchyma strands both on the leaf underside and capping the tops of the ribs (Fig. 11:3). The species also exhibits great variation in habit, spikelet size and anther length.

3. *F. richardii* Alexeev (1986);

- type: Ethiopia, GD, Ras Guna, Schimper 1560 (B holo., K iso.).

F. abyssinica f. *perpusilla* St. Yves in Candollea 4: 86 (1929).

F. abyssinica f. *setifolia* St. Yves, l.c.: 86 (1929)

- type: Ethiopia, GD, Demerki, Schimper 120 (B lecto.).

Perennial forming dense tussocks; culms erect, up to 45 cm high, culm-sheaths subinflated. Leaf-blades stiff, acicular, smooth, up to 20 cm long, c 0.5 mm wide. Panicle linear, up to 15 cm long, stiff with few-spiculate, erect, appressed branches, becoming racemose upwards. Spikelets 3-4-flowered, lanceolate, 13-15 mm long (including awn-points), violet-tinged; glumes large and enveloping, $\pm 3/4$ as long as the spikelet, acute, 3-nerved; lemmas narrowly elliptic, 7-9 mm long, scaberulous above the middle, tip extended into an awn-point 2-4(-8) mm long; anthers 1.5-2.8 mm long; ovary glabrous or occasionally sparsely hairy.

Montane grassland and moorland, and on stony mountain tops; 3800-4370 m. GD BA; East Africa. Hedberg 5586; Hedberg & Aweke 5445; Phillips 38.

A high mountain segregate from the *F. abyssinica* complex, whose separate specific status rests mainly on its slightly different leaf-anatomy (Fig. 11:4). Alexeev separated *F. richardii* from *F. abyssinica* by anther length (2-3 mm instead of 0.6-1.8 mm), but further material has shown this division to be untenable. He also stated that the leaf-sheath margins of *F. richardii* are connate to the middle and in *F. abyssinica* almost to the top, but this character cannot be determined reliably from herbarium specimens. The upper culm-blades appear to be always rolled, due to a lack of bulliform cells between the ribs.

4. *F. macrophylla* Hochst. ex A. Rich. (1850);

- type: Ethiopia, GD, Semien, Mt Silke, Schimper 688 (K iso.).

Perennial forming large dense tussocks; culms erect, wiry, 50-100 cm high. Leaf-blades filiform to acicular, stiff, 0.5-1 mm wide, 7-11-ribbed, scaberulous. Panicle 7-25 cm long, narrow, the short branches loosely ascending to suberect. Spikelets 3-5-flowered, wedge-shaped, 12.5-14 mm long; glumes unequal, not more than half as long as the spikelet; lower glume 1-nerved, 3-6 mm long, acuminate-aristate; upper glume 3-nerved, narrowly lanceolate-oblong, 4.5-7 mm long, acute; lemmas narrowly lanceolate-oblong, 6-7 mm long, the tip attenuate and extended into an awn-point



Figure 12. *FESTUCA* spp.: *F. SIMENSIS*: 1 - habit x 3/4; 2 - panicle x 3/4; 3 - base of leaf-blade with auricles x 5; 4 - spikelet x 4. *F. MACROPHYLLA*: 5 - leafy tussock and panicle x 3/4; 6 - spikelet x 4. *F. ABYSSINICA*: 7 - spikelet x 4. 1, 3, 4 from Friis et al. 1295; 2 from Edwards 10; 5 from Leakey & Evans 545; 6 from Hedberg & Aweke 5448; 7 from Ash 2665. Drawn by Eleanor Catherine.

1.5–5 mm long; anthers 2.8–4 mm long; ovary-top scantily and indistinctly hairy. Fig. 12:5, 6.

Montane grassland; 3000–4100 m. GD SU; unknown elsewhere. *Mooney* 6489; *Hedberg & Getachew Aweke* 5341; *Gilbert & Phillips* 9289.

Clearly distinguishable from the *F. abyssinica* complex by its much shorter, narrower glumes. The leaf-blade anatomy is also quite different, with sclerenchyma girders extending on either side of the vascular bundles (Fig. 11:1).

F. macrophylla is closely related to *F. obturbans* St. Yves from Mt Kilimanjaro in E Africa, but this has more florets (5–10) in the spikelet and a glabrous ovary.

5. *F. gilbertiana* *Alexeev ex S. M. Phillips* (1994);

- type: Ethiopia, GD, Semien, Geech, *De Wilde & Gilbert* 47 (K holo.).

Perennial forming large dense tussocks; culms erect, wiry, 30–35 cm high. Leaf-blades filiform, stiff, 0.5–0.8 mm wide, 5–7-ribbed, smooth. Panicle stiff, few-spiculate, reduced to a raceme 6–7.5 cm long with the spikelets borne on pedicels up to 6 mm long directly on the main axis. Spikelets narrowly oblong, 3–4-flowered, 9.5–10.2 mm long; glumes unequal, up to half the length of the spikelet, lanceolate, acute; lower glume 1(–3)-nerved, 2.6–3 mm long; upper glume 3-nerved, 4.2–4.5 mm long; lemmas narrowly lanceolate-oblong, 5.5–6 mm long, acuminate, extended into an awn-point 1.3–2.8 mm long; anthers 2.8 mm long; ovary-top hairy. Fig. 11:2.

Montane grassland; 3240 m. GD; unknown elsewhere.

6. *F. mekiste* *W. D. Clayton* (1969);

- type: Kenya, Mt Elgon, *Bogdan* 5390 (K holo.).

Robust tufted perennial with slender rhizomes; culms stout, 1.5–2 m high, the nodes purple. Leaf-blades broadly linear, flat, 25–45 cm long and 7–18 mm wide. Panicle narrowly ovate, open, 20–43 cm long, the branches flexuous, widely spreading from the main axis. Spikelets linear-oblong, 4–5-flowered with the florets loosely imbricate, 2.5–3 cm long (including awns), green or purplish; glumes much shorter than the lemmas, narrowly lanceolate, acuminate; lower glume 1-nerved, 4–5.7 mm long; upper glume 3-nerved, 5–7.6 mm long; lemmas narrowly elliptic-oblong, 6–9 mm long, membranous, scabrid, awned from just below the acute, hyaline tip; awn 9–15 mm long, fine; palea exceeding the lemma, the keels sometimes extended as 2 awn-points to 1.5 mm long; ovary glabrous.

Upland forest; 2700 m. AR; Kenya, Cameroon Mt, Bioko. *Thulin* 1476.

Festuca engleri Pilg. [syn. *Pseudobromus engleri* (Pilg.) W.D. Clayton], found from Kenya to Malawi, is very similar. Its chief distinguishing characters are the

anastomosing venation in the leaf-blades, obscurely scaberulous lemmas and hairy ovary-top.

7. *F. simensis* *Hochst. ex A. Rich.* (1850);

- type: Ethiopia, GD, Semien [Simen], *Schimper* 684 (K iso.).

Loosely tufted perennial with slender rhizomes; culms rising to 60–120 cm from an ascending or decumbent base. Leaf-blades linear, flat, 2–4 mm wide; leaf-sheaths with spreading falcate auricles 3 mm long. Panicle 15–30 cm long, erect or slightly nodding, narrow, open, the branches few-spiculate, loosely ascending. Spikelets 2–5-flowered, narrowly oblong, 2–2.8 cm long, purple-tinged; glumes acute or acuminate; lower glume 1-nerved, narrowly lanceolate, 2–5 mm long; upper glume 3-nerved, lanceolate-oblong, 4–6.8 mm long; lemmas lanceolate-oblong, 6.5–9 mm long, scaberulous, acute, awned from just below the hyaline tip; awn 9–19 mm long; anthers 3–4 mm long; ovary glabrous. Fig. 12:1–4.

Along streamsides in grass or scrubland; 2600–3900 m. GD GJ SU GG SD BA HA; Cameroon, Sudan (Imatong Mts.), Zaire (Kivu Prov.), Uganda and Kenya. *M.G. & S.B. Gilbert* 1907; *Gillett* 15016; *Gilbert & Phillips* 9222.

8. *F. chodatiana* (*St. Yves*) *Alexeev* (1986);

F. camusiana St. Yves subsp. *chodatiana* St. Yves (1926) in *Bull. Soc. Bot. Genève*, sér. 2, 18: 158 (1926) - type: Tanzania, *Stolz* 1162 (B lecto., K isolecto.).

Slender, loosely tufted perennial; culms weak, ascending, 50–100 cm high. Leaf-blades linear, 1–2 mm wide, flat or folded. Panicle 10–30 cm long, lax and somewhat flexuous, the branches loosely ascending. Spikelets 3–5-flowered, narrowly oblong, 1.4–2.5 cm long, the florets loosely imbricate; glumes narrowly lanceolate, acute, the lower 1-nerved, 2.5–4.5 mm long, the upper 3-nerved, 4–6.5 mm long; lemmas lanceolate, 6–7.5 mm long, smooth, acuminate, the tip extended into a slender awn 7–12 mm long; palea subequalling the lemma; anthers 1.2–2 mm long; ovary-top hairy.

Upland forest; 2800 m. SU; East African Highlands, Cameroon Mt, Sudan (Imatong Mts.). *Mooney* 6348.

A few specimens from Bale (*Miehe* coll. in Herb. Berlin) have spikelets and their scales a little larger than in the description above, but corresponding in size to *F. chodatiana* from Cameroon Mt. They also have a glabrous ovary, and may prove to be a different species when the leaf anatomy is better understood.

F. camusiana St. Yves is a closely related Madagascan endemic differing by its longer lemmas (7.5–8.5 mm) and anthers (3–3.5 mm), and by its shorter awns (1–3 mm).

18. *VULPIA* C.C. Gmel. (1805)Cotton & Stace in *Bot. Not.* 130: 173-187 (1977).

Slender tufted annuals. Leaf-blades linear, flat or rolled; ligule membranous. Inflorescence a narrow, contracted, \pm secund panicle. Spikelets several to many-flowered with the uppermost florets reduced, laterally compressed, the florets widely spaced with the rhachilla clearly visible, disarticulating above the glumes and between the florets; glumes narrow, very unequal, persistent, the lower 0-1-nerved, sometimes minute, the upper 1-3-nerved, much longer than the lower; lemmas faintly 5-nerved, subulate, rounded on the back, the margins inrolled over the palea, membranous, becoming rigid at maturity, narrowed into a long straight awn; stamens 1-3 (often remaining at the tip of the mature grain); grain narrow, tightly enclosed by the lemma and palea.

A temperate genus of 22 species, occurring mainly in the northern hemisphere and extending to upland regions in the tropics.

Closely related to *Festuca*, being distinguished mainly by its annual habit.

1. Panicles long-exserted from the uppermost leaf-sheath, often erect; lower glume $1/2-3/4$ the length of the upper. 1. *V. bromoides*
- Panicles enclosed at the base or only shortly exserted from the uppermost leaf-sheath, usually curved or nodding; lower glume $1/6-1/3$ the length of the upper. 2. *V. myuros*

1. *V. bromoides* (L.) S.F. Gray (1821);

Festuca bromoides L. (1753) - type: Europe, Herb. van Royen (LINN lecto.).

Annual; culms 5-40 cm high, very slender, erect or ascending, solitary or tufted; leaf-blades fine, narrowly linear. Panicle narrowly oblong, 2-12 cm long, contracted to somewhat lax, usually erect, long-exserted from the uppermost leaf-sheath. Spikelets wedge-shaped, 3-10-flowered, 7-14 mm long (excluding awns); glumes linear-lanceolate, the lower 1-nerved, 2-6 mm long, $1/3-3/4$ the length of the upper, the upper 3-nerved, 5-10 mm long; lemmas 6-9 mm long, scaberulous towards the margins and tip, extended into a fine scabrid awn 7-12 mm long; anther usually 1, 0.3-0.6(-1.0) mm long. Fig. 13:1, 2.

Pathsides, among stones, and pasture and arable land, often in light shade; 2400-4300 m. EW TU GD GJ SU GG BA HA; Europe, the Mediterranean region, Sudan and East Africa, Cameroon Mt; widely introduced into most temperate countries. IECAMA J-50; Mooney 5810; Hedberg & Aweke 5330 (ETH).

2. *V. myuros* (L.) C.C. Gmel. (1805);

Festuca myuros L. (1753) - type: Europe, Herb. van Royen (LINN lecto.).

Annual; culms 10-70 cm high, slender, erect or geniculately ascending; leaf-blades narrowly linear.



Figure 13. *VULPIA* spp.: *V. BROMOIDES*: 1 - habit x $3/4$; 2 - spikelet x 4. *V. MYUROS*: 3 - spikelet x 4. 1 & 2 from Gilbert & Phillips 9173; 3 from Kokwaro 3276. Drawn by Eleanor Catherine.

Panicle linear, 5–30 cm long, loose to somewhat dense, mostly curved or nodding, enclosed below by the uppermost sheath or just exerted from it. Spikelets oblong or wedge-shaped, 3–7-flowered, 7–10 mm long (excluding awns); glumes linear-lanceolate, the lower 1–3 mm long, the upper 3–8 mm long; lemmas 5–7 mm long, scaberulous, extended into a scabrid awn up to 15 mm long; anther usually 1, 0.3–1 mm long. Fig. 13:3.

c 1400 m. EW; Europe and the Mediterranean, extending to C Asia and India. *Pappi* 2935; *Ryding & Sileschi* 1883.

MELICEAE Rchb. (1828)

Tufted or rhizomatous perennials. Leaf-blades linear; leaf-sheaths tubular, entire; ligule membranous or absent. Inflorescence an open or contracted panicle. Spikelets all alike, laterally compressed, (1–)several-many-flowered with the upper florets sterile and often clustered to form a clavate knob, usually disarticulating between the florets; glumes persistent, usually shorter than the spikelet, often shorter than the lowest lemma, often with hyaline margins; lemmas rounded on the back, 5–9-nerved, membranous or becoming toughened, entire or 2-toothed, awnless or awned from the tip or back; lodicules 2, small and fleshy, at least partially connate; stamens 3. Grain with a small embryo and linear hilum.

8 genera, mainly in temperate regions.

A small tribe allied to *Poeae*, but differing in the entire tubular leaf-sheaths, the small fleshy lodicules (hyaline in *Poeae*), and in possessing a basic chromosome number of 9 (7 in *Poeae*).

19. STREBLOCHAETE Pilg. (1906)

Perennial. Leaf-blades broadly linear; leaf-sheaths with a longitudinal scarious stripe along the fused margins, this extended at the top into a sheathing scarious ligule. Panicle narrow, secund. Spikelets narrow, composed of 2–3 fertile florets widely spaced on a filiform rhachilla and topped by a group of 2–3 reduced sterile florets; glumes shorter than the lemmas, thinly membranous with broad scarious margins, the lower 1–5-nerved, the upper 5–7-nerved; lemmas firmly membranous, prominently 7-nerved, awned from below the bidentate tip; awn fine and flexuous, becoming coiled and entangled with the awns from other lemmas; lodicules free; callus pubescent, pungent.

A single species on the African mountains and in southeast Asia.

S. longiarista (A. Rich.) Pilg. (1926);

Trisetum longiaristum A. Rich. (1850); *Danthonia streblochaeta* Steud. (1854); *D. "longiaristata"* Engl. (1892); *Streblochaete nutans* Hochst. ex Pilg. (1906), nom. illegit. - type: Ethiopia, GD, Simen, Mt Silke, *Schimper* 683 (P holo., K iso.).



Figure 14. *STREBLOCHAETE LONGIARISTA*: 1 - habit x 3/4; 2 - inflorescence x 3/4; 3 - spikelet x 4; 4 - base of fertile florets with callus x 4. 1 from *Mooney* 8371; 2–4 from *IECAMA* J48. Drawn by Eleanor Catherine.

Bromus trichopodus A. Rich. (1850) - type: Ethiopia, TU Shire, near Kouaieta, *Quartin Dillon & Petit* (P holo.).

Tufted perennial; culms up to 1 m high, slender, erect or loosely ascending. Leaf-blades up to 20 cm long, 8–12 mm wide, thin and flat, sharply acute; ligule 3–8 mm long, longest on the side away from the blade, soon splitting here, the split continuing down the sheath. Panicle 12–25 cm long, nodding, the spikelets hanging together in groups by their tangled awns. Spikelets linear, 1.8–2.5 cm long, green; glumes acute, the lower linear, 6–11 mm long, the upper narrowly lanceolate, 9–14 mm long; lemmas linear-lanceolate in profile, 12–14 mm long, glabrous, scaberulous between the nerves, tapering to a narrow bidentate tip; awn arising below the narrow tip, c 3 cm long; callus 2 mm long, densely hispid with conspicuous shining hairs. Fig. 14.

In the shade of upland forest or *Erica* thicket, sometimes forming extensive patches on the forest floor; 2000–3200 m. TU GD SU AR KF SD BA HA; on mountains southwards to Natal and in Cameroon; across the Indian Ocean to Indonesia and the Philippines. *Friis* et al. 1219; *Mooney* 8371; *De Wilde* 8686.

The disarticulated florets hang together in bunches at maturity, held by the hygroscopic coiling of their awns. The barbed calluses are thus exposed and readily adhere to passing animals, hence effecting dispersal.

AVENEAE Dumort. (1824)

Agrostideae Dumort. (1824)

Annuals or perennials. Leaf-blades narrow, linear to setaceous, flat or rolled; ligule membranous. Inflorescence an open to contracted or sometimes spiciform panicle. Spikelets all alike (sterile spikelets in *Phalaris paradoxa*), laterally compressed, 1- to several-flowered with the florets all similar and usually disarticulating below each lemma, rarely 2–3-flowered with only the upper floret fertile and the lower 1–2 florets male or reduced to sterile lemmas of different appearance, then disarticulating above the glumes, the fertile and sterile lemmas falling together. Glumes usually large and as long as the spikelet with broad, hyaline, shining margins, persistent; lemmas (3–)5–11-nerved, hyaline to cartilaginous or coriaceous, entire or denticulate, awned from the back, rarely awnless; awn usually geniculate with twisted column; palea hyaline, subequalling or much shorter than the lemma; stamens 1–3; stigmas 1–2. Grain with a small embryo and round or oval hilum.

57 genera in temperate and cold regions, extending to mountains in the tropics.

Most members of the tribe *Aveneae* can be recognized by the shining appearance of their long, scarious glumes, coupled with a dorsal geniculate awn.

1. Spikelets several-flowered (sometimes only one floret fertile). 2
- Spikelets strictly 1-flowered. 9
2. Lemmas all alike or the uppermost reduced. 3

- Spikelets 3-flowered with the 2 lower florets reduced to sterile lemmas; the uppermost floret fertile, hard and shining (if sterile lemmas obscure, the spikelets falling in clusters). 8
- 3. Lemmas rounded on the back with a dorsal geniculate awn. 4
- Lemmas keeled, awnless or mucronate; panicle densely spiciform. 7
- 4. Perennials. 5
- Annuals. 6
- 5. Awn arising near or above middle of the lemma; lemmas firm, chartaceous to cartilaginous.

20. Helictotrichon

- Awn subbasal; lemmas delicate, thinly membranous. 21. *Deschampsia*

- 6. Spikelets large, pendulous, 2–6-flowered. 22. *Avena*
- Spikelets small, 2-flowered. 23. *Aira*

- 7. Perennial. 24. *Koeleria*
- Annual. 25. *Rostraria*

- 8. Sterile lemmas exceeding the fertile floret, awned. 26. *Anthoxanthum*

- Sterile lemmas obsolete or reduced to small unawned scales up to half as long as the fertile floret. 27. *Phalaris*

- 9. Panicle open, or if contracted lobed and interrupted. 10

- Panicle densely spiciform, cylindrical to ovoid. 14
- 10. Glumes swollen at the base around the floret; small annual; panicle densely spiciform.

28. *Gastridium*

- Glumes not swollen at the base. 11

- 11. Spikelets shed together with the pedicel (or part of it). 29. *Polypogon*

- Spikelets disarticulating above the persistent glumes. 12

- 12. Glumes mucronate. × *Agropogon* (p. 46)
- Glumes acute to acuminate. 13

- 13. Callus of the floret glabrous or only shortly bearded. 30. *Agrostis*

- Callus bearded with long silky hairs exceeding the floret. 31. *Calamagrostis*

- 14. Spikelets falling entire; glumes connate at the base; lemma awned, the margins connate below, palea absent. 32. *Alopecurus*

- Spikelets disarticulating above the persistent glumes; glumes free; lemma awnless, the margins free; palea subequalling lemma. 33. *Phleum*

20. HELICTOTRICHON Schult. (1827)

Tufted perennials, sometimes with short rhizomes. Leaf-blades linear, flat, folded or rolled; ligule membranous. Inflorescence a narrow panicle, the primary branches often verticillate. Spikelets 2–6-flowered, the florets alike or the uppermost reduced, laterally compressed, the rhachilla internodes slender, often hairy, disarticulating between the florets; glumes unequal, keeled with hyaline margins, acute, the lower 1–3-nerved, the upper 3–5-nerved; lemmas narrowly

lanceolate in profile, 7–11-nerved, rounded on the back, chartaceous to cartilaginous, the tip hyaline, shortly bifid with acute lobes, the nerves often extended as one or more fine bristles from the tip of each lobe; awn geniculate with a twisted column, arising from the lemma back; callus bearded; stamens 3; ovary hairy in the upper half, stigmas 2.

About 100 species, mainly in temperate Eurasia, but extending across the tropical mountains to temperate regions throughout the world.

Helictotrichon is a homogenous genus, and in Ethiopia the species differ little from each other and tend to intergrade. Detailed cytotaxonomical investigations are required before variation within the genus can be properly understood.

1. Rhachilla internodes bearded with conspicuous silky hairs 3–4 mm long; florets exerted from the glumes. 1. *H. lachnanthum*
- Rhachilla internodes hispid, the hairs up to 2 mm long, not conspicuously protruding between the florets. 2
2. Glumes enveloping, only the tips of the florets exerted, the lower 3-nerved, the upper 3–5-nerved; panicle linear-oblong. 2. *H. elongatum*
- Glumes not enveloping, usually clearly shorter than the florets, the lower 1-nerved, the upper 3-nerved; panicle linear. 3
3. Awn clearly geniculate with a strongly twisted column, arising from the middle of the lemma. 3. *H. umbrosum*
- Awn flexuous, only weakly geniculate and twisted, arising from the upper third of the lemma; florets well-spaced and long-exserted on elongate rhachilla-internodes. 4. *H. milanjanum*

1. *H. lachnanthum* (Hochst. ex A. Rich.) C.E. Hubb. (1936);

Trisetum lachnanthum Hochst. ex A. Rich. (1850); *Avena lachnantha* (Hochst. ex A. Rich.) Hook.f. (1864); *Avena rothii* Stapf (1897) nom. superfl.; *Avenastrum lachnanthum* (Hochst. ex A. Rich.) Vierh. (1914); *Arrhenatherum lachnanthum* (Hochst. ex A. Rich.) Potztl (1951) - type: Ethiopia, GD, Semien, Mt Aber, Schimper 859 (K iso.).

Weak-stemmed tufted perennial; culms slender, 80–120 cm high, erect and arching, or straggling. Leaf-blades flat, 3–6 mm wide, glabrous. Panicle narrowly oblong, 15–30 cm long, loose with fine, flexuous branches, nodding. Spikelets laxly 2–4-flowered, the florets well exerted from the glumes, 7–11 mm long, pale green or the lemma tips often purple-tinged; rhachilla-internodes c 1.5 mm long, copiously bearded with soft silky hairs 3–4 mm long; glumes delicate, hyaline; lower glume 1(–sub-3)-nerved, narrowly lanceolate-oblong, 4–5 mm long; upper glume 3-nerved, narrowly elliptic-oblong, 5–6 mm long; lemmas 6–8 mm long, herbaceous,

hyaline above the awn, geniculate, 8.5–13 mm long, arising from the upper third of the lemma. Fig. 15:1.

Upland scrubland; 1200–2500 m. TU GD WU SU; East Africa. *De Wilde* 8242; *Smeds* 1155; *Mesfin* T. 6615 (ETH).

The most clearly distinct of the Ethiopian species of *Helictotrichon*, being readily distinguished by the long, silky rhachilla-hairs which obscure the lower part of the lemma.

2. *H. elongatum* (Hochst. ex A. Rich.) C.E. Hubb. (1936);

Danthonia elongata Hochst. ex A. Rich. (1850); *Trisetum neesii* Steud. (1854), non *T. elongatum* (Kunth) Kunth (1829); *Avena neesii* (Hochst. ex Steud.) Hook.f. (1864); *Avena muriculata* Stapf (1897), nom. superfl.; *Avenastrum elongatum* (Hochst. ex A. Rich.) Pilg. (1926); *Arrhenatherum elongatum* (Hochst. ex A. Rich.) Potztl (1951) - type: Ethiopia, TU, Mt Scholoda, Schimper 402 (K iso.).

Avena festuciformis Hochst. (1855) - type: Ethiopia, GD, Semien [Simen], Mt Bachit, Schimper 107 (K fragment).

Tufted perennial; culms slender, 35–140 cm high, erect or ascending. Leaf-blades flat, 2–6 mm wide, glabrous; basal leaf-sheaths often orange-brown. Panicle 10–38 cm long, narrowly oblong with the branches loosely ascending or sublinear, pendulous. Spikelets narrowly oblong, 2–3(–4)-flowered, 8–14 mm long, only the tips of the florets exerted, pale green usually purple-tinged; rhachilla-internodes 2 mm long, densely hispid; glumes herbaceous with broad hyaline margins, enveloping, acute to acuminate, lower glume 3-nerved, lanceolate, 6–9 mm long; upper glume 3–5-nerved, elliptic-oblong, 7.5–11 mm long, equalling or only slightly shorter than the lowest lemma; lemmas 7.8–10 mm long, chartaceous with a hyaline tip, minutely puberulous or granular, awn geniculate, 1–2 cm long, arising from the middle of the lemma. Figs. 15:2, 16:1.

Upland grassland and scrub; 2000–4500 m. EW TU GD GJ SU AR KF GG SD BA HA; Cameroon, Sudan, and southwards through East Africa to Zimbabwe; also in Madagascar. *De Wilde* 6040; *Mooney* 5884; *Thulin* 1473.

Three collections from Gonder (*Chiovenda* 1359, 1528, 1818) have markedly larger spikelets (13–14 mm) than is usual in Ethiopian *H. elongatum*, with very long glumes and long cartilaginous lemmas (11–11.7 mm). Such large-spiculate forms also occur in East Africa, and have been separated as *H. cartilagineum* C.E. Hubb. However, according to Clayton [*Fl. Trop. East Afr.*: 91 (1970)] such forms intergrade with smaller-spiculate *H. elongatum*, and it is impracticable to maintain 2 distinct species.

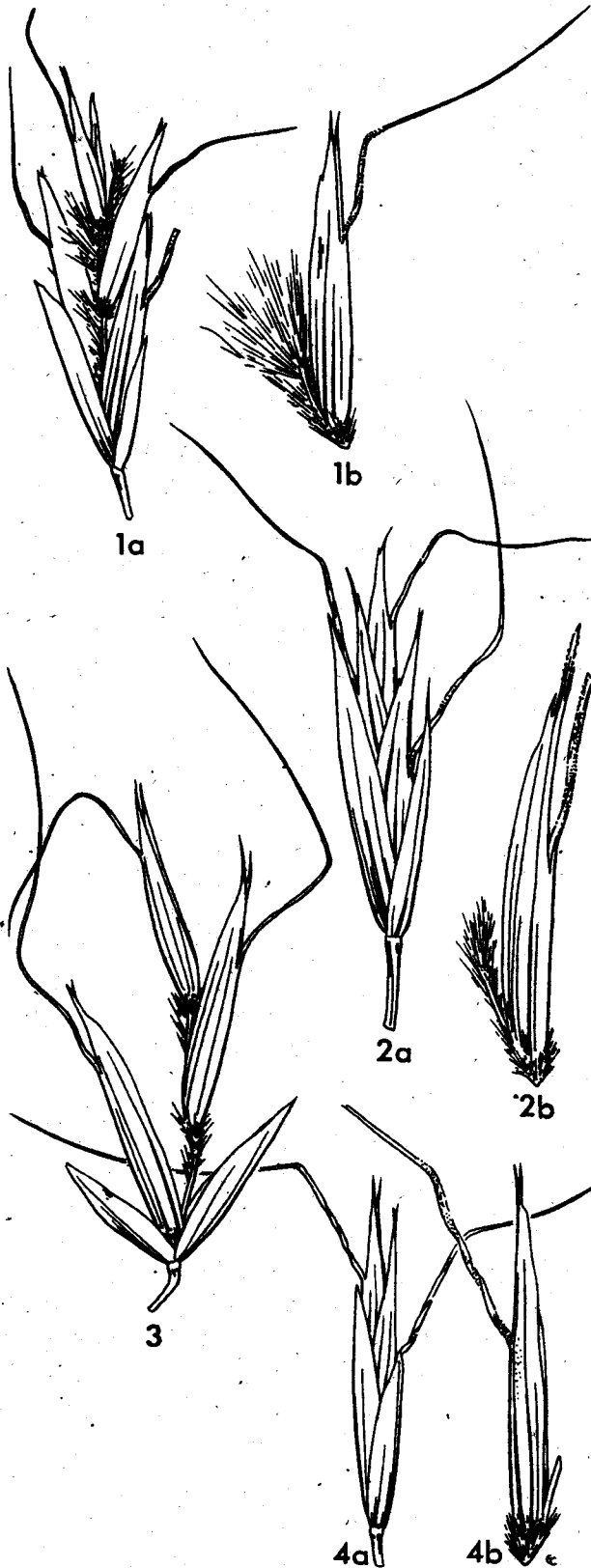


Figure 15. *HELICTOTRICHON* spp., spikelets (a) $\times 4$, and lemmas (b) $\times 5$: 1 - *H. LACHNANTHUM*; 2 - *H. ELONGATUM*; 3 - *H. MILANJIANUM* (spikelet only); 4 - *H. UMBROSUM*. 1 from Gilbert & Phillips 9280; 2 from Leakey & Lythgoe 634; 3 from Chiovenda 3126; 4 from Chiovenda 2494. Drawn by Eleanor Catherine.

3. *H. umbrosum* (Hochst. ex Steud.) C.E. Hubb. (1936);

Trisetum umbrosum Hochst. ex Steud. (1854); *Avenastrum umbrosum* (Hochst. ex Steud.) Pilg. (1926); *Arrhenatherum umbrosum* (Hochst. ex Steud.) Potztl (1951) - type: Ethiopia, without precise locality, Schimper s.n. (P holo.).

Trisetum biflorum Hochst. (1855) - type: Ethiopia, without precise locality, Schimper 960 (STR holo., B iso.).

Tufted perennial. Culms slender, 40–80 cm high, suberect or geniculately ascending. Leaf-blades flat, c 2 mm wide, scattered-pilose on the upper surface. Panicle linear, stiff, or looser and slightly flexuous, the short branches lying close to the main axis, 10–20 cm long. Spikelets narrowly oblong, 10–16 mm long, 2–4-flowered with the florets exserted; rhachilla-internodes 2–2.8 mm long, hispid above or almost glabrous; glumes herbaceous with broad, hyaline margins, acute; lower glume 1-nerved, narrowly lanceolate, 5.8–8 mm long; upper glume 3-nerved, narrowly oblong, 7.6–9 mm long; lemmas 7.2–8.5 mm long, firm, smooth, glabrous or minutely puberulous; awn geniculate, 12–16 mm long, arising from the middle of the lemma. Fig. 15:4.

Upland grassland up to 4000 m. GD GJ; Sudan and East Africa. Chiovenda 2494; Flenley & Leakey 603.

H. umbrosum occupies an intermediate position between *H. milanjanum* and *H. elongatum*, and is easily confused with both species. The glumes are relatively longer, and the spikelets not so loosely arranged and long-exserted as in *H. milanjanum*. It can also be distinguished from that species by its well-twisted geniculate awn inserted lower down the lemma back.

The boundary with *H. elongatum* is less well-defined in Ethiopia, and the two species probably intergrade. The panicle in *H. umbrosum* is generally narrower than in *H. elongatum*, and the florets are usually clearly exserted from the glumes. However, the glumes may sometimes be almost as long as in *H. elongatum*, but are narrower, with the lower glume only 1-nerved and the upper glume 3-nerved.

4. *H. milanjanum* (Rendle) C.E. Hubb. (1936);

Bromus milanjanus Rendle (1894); *Arrhenatherum milanjanum* (Rendle) Potztl (1951) - type: Malawi, A. Whyte 9 (K iso.).

Loosely tufted perennial with thin wiry rhizomes; culms slender, 40–80 cm high, ascending from a suberect or decumbent base. Leaf-blades flat, 3–4.5 mm wide, scattered-pilose above; leaf-sheaths glabrous or softly pilose. Panicle linear, 12–20 cm long, the short branches lying close to the main axis. Spikelets narrowly oblong, 9.5–15 mm long, loosely 2–3-flowered with the florets long-exserted; lowest rhachilla-internode 2.5–3 mm long, stiffly hispid in the upper half; glumes membranous with broad, hyaline margins, acute; lower glume 1(-sub 3)-nerved, lanceolate, 3.6–4.5 mm long; upper glume 3-nerved, elliptic to narrowly oblong, 5–6.5 mm

long; lemmas 6.5–8 mm long, firm with a hyaline tip, smooth or minutely granular; awn flexuous, only weakly geniculate and the column scarcely twisted, 10.5–14.5 mm long, arising from the upper third of the lemma. Fig. 15:3.

Grassland and clearings in upland forest, often in moist situations; 2600–3500 m. GD SU KF BA; southwards through East Africa to Malawi. *Chioyenda* 3126; *de Wilde* 8523; *Friis et al.* 1641.

H. milanjanum is readily distinguishable from *H. elongatum* by its much smaller glumes and long-exserted florets loosely arranged on elongate, filiform rhachilla-internodes, and by the flexuous, scarcely geniculate awn inserted nearer the lemma tip. Specimens from Ethiopia tend to be less robust, with narrower leaf-blades, than those from East Africa.

Helictotrichon angustum C.E. Hubb. from Kenya and Yemen is to be expected in Ethiopia. It is best recognized by its very narrow, often filiform leaf-blades coupled with a linear panicle. The florets are well exserted from the glumes, and the geniculate awn arises from the upper third of the scabrid lemma.

21. DESCHAMPSIA P. Beauv. (1812)

Tufted perennials. Leaf-blades linear to setaceous, flat, folded or rolled; ligule often elongate. Inflorescence paniculate, the spikelets shining and loosely arranged on the fine filiform branches. Spikelets 2(–3)-flowered with the florets all bisexual, laterally compressed, disarticulating below each floret, the rhachilla internodes usually bearded; glumes subequal, keeled, hyaline and shining, ± as long as the spikelet, the lower 1–3-nerved; the upper 3 (rarely 1)-nerved; lemmas thinly membranous, lanceolate to oblong, rounded on the back, the tip broad, denticulate or 4-lacerate, finely 4-nerved with the 5th central nerve extended into an awn arising on the back or subbasally; awn twisted below, geniculate (sometimes scarcely so); palea slightly shorter than the lemma, 2-keeled; callus minute, bearded; stamens 3; stigmas 2.

About 40 species, mainly in the temperate and cold regions of both hemispheres.

1. Plant robust; leaf-blades linear, tough and scabrid; awns ± straight, only the tips exserted from the glumes. 1. *D. caespitosa*
- Plant slender; leaf-blades setaceous, smooth; awns geniculate, clearly exserted from the glumes. 2. *D. flexuosa*

1. *D. caespitosa* (L.) P. Beauv. (1812);

– type: Europe, *Linnaeus* (LINN holo.).

D. latifolia Hochst. ex A. Rich. (1850); *Aira latifolia* (A. Rich.) Steud. (1854) non Hook. (1840), nom. illegit.; *D. caespitosa* (L.) P. Beauv. var. *latifolia* (A. Rich.) Hook. f. (1864) – type: Ethiopia, Semien, Demerki, *Schimper* 555 (K isolecto.).

Robust perennial tussock grass; culms erect, 35–110 cm high. Leaf-blades tough, flat or folded, 12–32 cm long and 2.5–5 mm wide, strongly ribbed and harshly scabrid above, smooth below; leaf-sheaths smooth, striate; ligule pointed, 8–13 mm long. Panicle flexuous, nodding, 15–30 cm long, narrowly oblong at first, the branches spreading at maturity, many-spiculate. Spikelets narrowly oblong, 2 (rarely 3)-flowered, 4.4–6.2 mm long, green or purplish with a golden sheen, the tips of the florets and awns protruding from the glumes; glumes acute or subacute, the lower 1-nerved, narrowly oblong, the upper 3-nerved, narrowly elliptic-oblong; lemmas elliptic-oblong, 3–4.7 mm long, truncate and irregularly 4-denticulate or lacerate; awn subbasal, 3.6–5 mm long, fine, obscurely twisted below but not geniculate. Fig. 16:6, 7.

An upland grass of marshy, waterlogged ground alongside streams; 3100–4300 m. GD GJ AR BA; widespread in temperate regions of both hemispheres; Cameroon Mountain and the East African mountains. *Ash* 2911; *Hedberg* 4143; *Mooney* 8326.

2. *D. flexuosa* (L.) Trin. (1836)

var. *afromontana* C.E. Hubb. in *Fl. Trop. Afr.* 10: 93 (1937) – type: Tanzania, Kilimanjaro, *Volkens* 1130 (K iso.).

Densely tufted perennial, sometimes with wiry rhizomes; culms erect, 20–75 cm high, slender, much exceeding the leaves. Leaf-blades mainly basal, inrolled, setaceous, 0.5 mm wide, rather stiff; ligule 1 mm long on the basal leaves, 2.5–4.5 mm long on the culm leaves. Panicle loose and flexuous, 10–20 cm long, oblong to ovate. Spikelets ovate-oblong, 2–3-flowered with the awns clearly exserted, 4.5–6.2 mm long, glistening silvery with a purple or brownish tinge; glumes 1-nerved, acute, the lower lanceolate, the upper narrowly ovate; lemmas elliptic-oblong, 4–5.3 mm long, scaberulous or minutely pubescent in the upper half, the tip broad, bidenticulate, irregularly lacerate or almost entire; awn subbasal, 5–6.7 mm long, geniculate with a dark brown twisted column. Fig. 16:2–5.

Open stony situations, frequently in *Erica* scrub, especially after burning; 2800–4300 m. SU AR GG BA, East Africa. *Gilbert* 504; *Mooney* 8372; *Thulin* 1670.

Var. *flexuosa* occurs in northern temperate regions, and tends to have asperulous rather than pubescent lemmas, and shorter spikelets and ligules than var. *afromontana*.

22. AVENA L. (1753)

Malzew in *Trudy Prikl. Bot. Gen. Selek.*, *Suppl.* 38: 1–522 (1930); Rajhathy & Thomas in *Misc. Publ. Gen. Soc. Canada*, no. 2 (1974); Ladizinsky in *Econ. Bot.* 29: 238–241 (1975); Baum, *Monogr.* no. 14, *Biosyst. Res. Inst.*, Dept. Agric., Ottawa, Canada (1977).



Figure 16. *HELICTOTRICHON ELONGATUM*: 1 - habit and panicle x 3/4. *DESCHAMPSIA FLEXUOSA*: 2 - habit x 3/4; 3 - panicle x 3/4; 4 - spikelet x 9; 5 - florets x 9. *DESCHAMPSIA CAESPITOSA*: 6 - spikelet x 9; 7 - florets x 9. 1 from Leakey & Lythgoe 634; 2-5 from Mooney 8372; 6 & 7 from Ash 2911. Drawn by Eleanor Catherine.

Annuals; culms fairly robust; leaf-blades linear, flat. Inflorescence a large panicle, open or rarely contracted. Spikelets large, pendulous, oblong to gaping, 2-6-flowered with the uppermost florets reduced, disarticulating above the glumes, often also between the florets, or non-shattering (in cultivated species); glumes large, usually subequal, lanceolate to elliptic, 3-11-nerved, rounded on the back, equalling the spikelet and exceeding the florets, herbaceous with scarious margins; lemmas 5-9-nerved, lanceolate-oblong, rounded on the back, chartaceous, becoming firm at maturity, bidentulate to bifid, the lobes sometimes extended into fine bristles; awn geniculate, arising from the lemma back (often reduced or absent in cultivated species); callus bearded; grain hairy, with a small embryo and linear hilum.

20-30 species, centred on the Mediterranean and extending eastwards to Iran and Nepal. Several species have become widely distributed in temperate regions as weedy adventives. *Avena sativa* (Common Oats) is extensively cultivated in north temperate regions as a cereal crop, and a few other species are cultivated as minor crops locally in Europe.

The genus comprises a polyploid series of diploids, tetraploids and hexaploids, with wild and cultivated forms at all ploidy levels. A tetraploid form, probably introduced from the Mediterranean in ancient times with other crop plants, has adapted and diversified as a weed of arable land on the high Ethiopian plateau. Diploid oats are unknown in Ethiopia, but two hexaploid species occur sporadically as adventives.

1. Lemma tip bifid, each lobe with a fine apical bristle 1-3 mm long. 2
- Lemma tip bidentate to bifid, but lacking apical bristles. 3
2. Rhachilla fragile, disarticulating between the florets; lemma often hairy; awn perfect.
 1. *A. vaviloviana*
 - Rhachilla tough, the spikelets not disarticulating; lemmas ± glabrous; awn sometimes reduced. 2. *A. abyssinica*
3. Rhachilla tough, the spikelets not disarticulating; lemmas ± glabrous. 3. *A. sativa*
- Rhachilla disarticulating between all the florets, or at least below the lowest; lemmas hairy. 4
4. Rhachilla disarticulating between each floret, every lemma with a basal callus. 4. *A. fatua*
- Rhachilla disarticulating only below the lowest floret, only the lowest lemma with a basal callus. 5. *A. sterilis*

1. *A. vaviloviana* (Malz.) Mordv. (1936);

A. strigosa Schreb. subsp. *vaviloviana* Malz. (1929); *A. barbata* Pott ex Link subsp. *vaviloviana* (Malz.) Tab. Mor. (1939) - type: Ethiopia, EW, Asmara, *Vavilov* 52286 (WIR lecto.).

A. strigosa Schreb. subsp. *abyssinica* var. *pilosiuscula* Thell. (1912); *A. strigosa* Schreb. subsp.

vaviloviana var. *pilosiuscula* (Thell.) Malz. (1930); *A. vaviloviana* var. *pilosiuscula* (Thell.) Hubb. (1937); *A. barbata* Pott ex Link subsp. *vaviloviana* var. *pilosiuscula* (Thell.) Tab. Mor. (1939) - type: Ethiopia, TU, Adoa, *Schimper* 950 (K iso.).

Annual. Culms simple, erect, 70-110 cm high. Panicle 20-30 cm long, loose and open, the branches scaberulous. Spikelets 2-3-flowered with the third floret reduced or vestigial, 2.0-2.5 cm long, disarticulating above the glumes and between the florets, each floret provided with a basal bearded callus; rhachilla-internode bearded with hairs to 4 mm long; callus scar ovate to elliptic; glumes narrowly elliptic, sharply acuminate; lemmas 1.5-2 cm long, smooth, golden-brown and densely hispid with spreading brown hairs in the lower half, varying to glabrous or nearly so with only a few long setae around the awn insertion and margins, green and scaberulous towards the narrowly bifid tip, each lobe with one nerve extended into a fine apical bristle 1-3 mm long, usually also minutely toothed at the base of the bristle; awn slender, strongly geniculate, 2.5-3.2 cm long, inserted at or a little below the middle of the lemma back. $2n=28$. Fig. 17.

A serious weed of arable land, particularly in fields of barley, wheat and tef, 1650-2800 m. EW TU GD WU SU KF HA; not known elsewhere. *De Wilde* 10945; *De Wilde & Gilbert* 194; *Mogk* 85.

A. vaviloviana is very similar to the Mediterranean weedy tetraploid *A. barbata* Pott ex Link, from which it is probably derived. The two taxa are fully interfertile and on this account Ladizinsky (1975) regards *A. vaviloviana* as conspecific with *A. barbata*. However, the long isolation of the former on the Ethiopian plateau has led to divergent evolution from the main body of *A. barbata* in the Mediterranean. Ethiopian plants tend to have a smaller, more compact habit, and spikelets with a higher frequency of glabrous lemmas and shorter bristles at the lemma tip. In addition, the development of a non-shattering form (*A. abyssinica*) is a purely Ethiopian phenomenon, with no parallel in the Mediterranean.

Although *A. vaviloviana* and *A. barbata* are undoubtedly very closely related, and are distinguished only by minor morphological differences, the changes that have evolved in the spatially separated Ethiopian population are recognized here by the retention of *A. vaviloviana* as a distinct species.

2. *A. abyssinica* Hochst. (1844);

A. sativa L. var. *abyssinica* (Hochst.) Körn. & Werner (1885); *A. strigosa* Schreb. var. *abyssinica* (Hochst.) Hausskn. (1894); *A. strigosa* subsp. *abyssinica* (Hochst.) Thell. (1912); *A. alba* Vahl subsp. *abyssinica* (Hochst.) Löve & Löve (1961) - type: Ethiopia, without locality, *Schimper* 1877 (K iso.).



Figure 17. *AVENA VAVILOVIANA*: 1 - habit x 3/4; 2 - spikelet x 2; 3 - lemma x 3. All from Scott 245. Drawn by Eleanor Catherine.

Many other subspecies and varieties have been described. A complete synonymy is listed in the monograph by Baum (1977).

Annual. Culms simple, erect, 50–110 cm high. Panicle 20–35 cm long, loose and open, the branches scaberulous. Spikelets 2–3-flowered with the third floret reduced or vestigial, 2–2.5 cm long, non-disarticulating, the florets remaining within the glumes at maturity or tardily deciduous with the rhachilla fracturing irregularly, florets glabrous or shortly pilose at the base but lacking a callus; rhachilla internode glabrous or partially or completely pilose with dense hairs to 1 mm long; glumes narrowly elliptic, sharply acuminate; lemmas 1.5–2 cm long, smooth and glabrous, or with a very few setae near the awn insertion or margin, narrowly bifid, each lobe with one nerve extended into an apical bristle 1–2.5 mm long, usually also minutely toothed at the base of the bristle; awn slender, 2.5–3.2 cm long, inserted at or a little below the middle of the lemma back, usually both awns perfect, occasionally the upper reduced. $2n=28$.

Cultivated for grain in northern Ethiopia; also a weed of arable land, particularly barley fields, often tolerated and harvested with the crop; 1700–2800 m. EW TU GD GJ SU AR HA; Yemen. Meyer 7505; Parker E607; Westphal & Westphal-Stevens 1961.

A. abyssinica is fully interfertile with the more common *A. vaviloviana*, and they represent two different facies of a single species complex. The main difference between them lies in the non-shattering nature of the spikelets of *A. abyssinica*, which are also more frequently glabrous than in *A. vaviloviana*. Ladizinsky (1975) has demonstrated that the non-shattering and glabrous lemma characters are both simply controlled genetically by recessive genes.

A. abyssinica x *vaviloviana*

A. wiestii Steud. var. *glabra* Hausskn. (1899); *A. strigosa* Schreb. subsp. *wiestii* var. *glabra* (Hausskn.) Thell. (1912); *A. strigosa* subsp. *vaviloviana* var. *glabra* (Hausskn.) Malz. (1930); *A. vaviloviana* (Malz.) Mordv. var. *glabra* (Hausskn.) Hubb. (1937); *A. barbata* Pott ex Link subsp. *vaviloviana* var. *glabra* (Hausskn.) Tab. Mor. (1939) - type: Eritrea, Schweinfurth (JE holo.).

A. strigosa Schreb. subsp. *wiestii* var. *intercedens* Thell. (1912); *A. strigosa* subsp. *vaviloviana* var. *intercedens* (Thell.) Malz. (1930); *A. vaviloviana* (Malz.) Mordv. var. *intercedens* (Thell.) Hubb. (1937); *A. barbata* Pott ex Link subsp. *vaviloviana* var. *intercedens* (Thell.) Tab. Mor. - type: cult. in Algeria, Trabut [whereabouts unknown, cf. Baum, Monogr.: 263 (1977)].

The hybrid occurs where both parents grow together. It is best recognized by the presence of an imperfect disarticulation scar, coupled with \pm glabrous lemmas or with only a few large setae around the awn insertion. Stewart 84.

3. *A. sativa* L. (1753)

Annual. Culms simple, erect, 40–180 cm high. Panicle up to 25 cm long, loose and open or contracted. Spikelets 2–3-flowered with the uppermost florets reduced, 1.7–3 cm long, non-shattering, the florets lacking a basal bearded callus. Glumes narrowly elliptic-oblong, sharply acute; lemmas usually tough, 1.2–2.5 cm long, glabrous or sparsely hairy around the awn insertion, ± truncate or minutely and irregularly 2–4-denticulate; awn inserted near or above the middle of the lemma back, perfect, rudimentary or absent. $2n=42$.

The "Common Oat", extensively cultivated as a cereal crop in north-temperate regions of the Old and New World. It is usually grown in Ethiopia at altitudes of 2700–3000 m, especially in areas of decreasing soil fertility in preference to barley. The crop residue is used for forage. It may occur occasionally as a contaminant of wheat or as an escape near cultivations. Also cultivated in the highlands of Uganda and Kenya. *Gilbert & Getachew* 3063.

Two species of oat with non-shattering spikelets occur in Ethiopia, the hexaploid *A. sativa* and the tetraploid *A. abyssinica*. *A. sativa* is much less frequent in Ethiopia than *A. abyssinica*, and can readily be separated from it by the lack of bristles at the lemma tip.

4. *A. fatua* L. (1753);

- type: Sweden, *Linnaeus* (LINN holo.).

Annual. Culms simple, erect or geniculate at the base, 30–150 cm high. Panicle 10–40 cm long and up to 20 cm wide, nodding, narrowly to broadly pyramidal. Spikelets 2–3-flowered, 1.8–2.8 cm long, disarticulating above the glumes and between the florets, each floret provided with a bearded basal callus, the hairs up to 4 mm long; callus scar horseshoe-shaped; glumes lanceolate, finely acute; lemmas 1.4–2 cm long, brown and densely hispid in the lower two-thirds, green and scaberulous towards the shortly 2–4-toothed tip; awn 2.5–4 cm long, geniculate.

Arable weed, especially in barley fields; 2700–3200 m. EW SU AR; native to the Mediterranean and W and C Asia, widely introduced elsewhere. *Tadesse* T. s.n.; *Slavtsov* s.n.

5. *A. sterilis* L. (1762);

- type: Spain, *Alstroemer* (LINN holo.).

Annual. Culms simple, erect or ascending, 50–120 cm high. Panicle loose and open, pyramidal, 13–30 cm long, the branches coarsely scabrid. Spikelets 2–5-flowered with the uppermost florets reduced and awnless, 2–5 cm long, disarticulating only above the glumes, the florets falling together at maturity, only the lowest lemma provided with a bearded callus; first rhachilla-internode bearded with hairs up to 7 mm long; callus scar narrowly ovate; glumes narrowly elliptic-oblong, finely acuminate; lemmas 1.8–3.5 cm long, granular, often golden-brown and loosely to densely hispid in the lower half, green towards the finely bifid tip; awn in-

serted at about the lower third of the lemma back, 3–9 cm long, strongly geniculate with a dark brown, pubescent column. $2n = 42$.

A noxious weed of arable land, especially fields of cereals, and in disturbed open situations along roadsides and the edges of cultivations; 2100–2400 m EW TU SU AR; a widespread weed native to the Mediterranean region and Middle East, where it often infests cereal crops, especially on deep fertile soils; introduced in warm temperate regions elsewhere.

Two subspecies are recognized on the basis of spikelet size; both occur over the whole range of the species.

subsp. *sterilis*

Spikelets 3–5 cm long, 3–5-flowered; glumes 9–11-nerved; lowest lemma 2.5–3.3 cm long; awns 6–9 cm long, stout. *Baldrati* s.n.; *Mercier* 1527.

subsp. *ludoviciana* (Dur.) Nyman, *Consp.*: 810 (1882).

A. abyssinica Hochst. var. *granulata* Chiov. in *Ann. Ist. Bot. Roma* 8: 343 (1908) - type: Eritrea, Amasen, Mt Lesa, *Pappi* 4901 (FT holo.).

Spikelets 2–3 cm long, 2–3-flowered; glumes 7–9-nerved; lowest lemma 1.8–2.5 cm long; awns 3–6 cm long, fairly slender. *Parker* E519.

23. *AIRA* L. (1753)

Small annuals. Inflorescence an open or contracted panicle. Spikelets small, 2-flowered, laterally compressed, the florets both alike and separated only by a very short rhachilla segment, enclosed within the glumes, disarticulating below each floret; glumes equal, 1–3-nerved, thinly membranous and shining; lemmas indistinctly 5-nerved, lanceolate in profile, rounded on the back, membranous, becoming firm at maturity, scaberulous, bidentate, dorsally awned or awnless; awn geniculate with a twisted column; stamens 3; stigmas 2.

8 species, centred on the Mediterranean but extending from Scandinavia to South Africa and eastwards to Iran. Introduced in temperate regions elsewhere.

A. caryophyllea L. (1753);

- type: Europe (LINN holo.).

A. latigluma Steud. (1854); *A. caryophyllea* L. var. *latigluma* (Steud.) C.E. Hubb. (1937) - type: Ethiopia, GD, Semien, Demerki, *Schimper* 546 (K iso.).

Delicate annual; culms very slender, solitary or tufted, up to 40 cm high, erect or spreading. Leaf-blades narrowly linear to filiform; ligule up to 3 mm long, triangular, soon becoming lacerate. Panicle open, ovate, up to 10 cm long, the spikelets clustered towards the tips of the filiform branches. Spikelets oblong, 1.8–2.8 mm long, shining silvery and purple-tinged, seated on a pear-shaped swelling of the pedicel tip; glumes as long as the spikelet, ovate, obtuse to subacute; lemmas 1.8–

2.1 mm long, scabrid above, acuminate bidentate, awned from below the middle; awn 2.5–3.2 mm long; callus minute, the lower glabrous, the upper very shortly bearded laterally. Fig. 18:3–5.

An upland grass of bare disturbed situations, in grassland on thin soils or among rocks, in the open or in moderate shade; 2400–4500 m. GD GJ SU AR GG BA; N Europe and W Asia southwards through the African highlands to South Africa; widely introduced elsewhere. *De Wilde* 8184; *Mooney* 8352; *Thulin* 1361.

European *Aira caryophyllea* L. differs from Ethiopian material in possessing generally larger spikelets (2.5–3.5 mm) with acute glumes and a bearded callus. In the size and shape of the glumes and the ± glabrous callus, Ethiopian *Aira* approaches more closely the Mediterranean species *A. cupaniana* Guss. However, in that species the florets are proportionally smaller (1.1–1.3 mm), with the lower lemma awnless, acute and barely denticulate. Also the swelling of the pedicel tip is annular rather than pear-shaped. These two species probably intergrade, and until their status is fully understood it is best to retain the familiar name for Ethiopian *Aira*.

24. KOELERIA Pers. (1805)

Domin in *Bibl. Bot.* 14: 1–354 (1907).

Tufted perennials, sometimes with a rhizome. Leaf-blades mainly basal, narrow, usually filiform or setaceous. Panicle dense, spiciform, shining. Spikelets all alike, (1–)2–several-flowered, laterally compressed, disarticulating between the florets; glumes subequal or unequal, strongly keeled, narrow, ± equalling or somewhat shorter than the florets, herbaceous with broad hyaline margins, persistent; lemmas obscurely 3–5-nerved, keeled, membranous with hyaline margins, obtuse to acuminate, sometimes with a subapical mucro; palea gaping; callus obscure, glabrous or almost so.

About 35 species in temperate regions of the world, extending to mountains in the tropics.

The relatively short glumes and lack of a geniculate awn may lead to confusion with members of the tribe *Poeae*. The thin, shining texture of the spikelets of *Koeleria* provides the best means of distinguishing it.

K. capensis (Steud.) Nees (1832);

Aira capensis Steud. (1829) - type: South Africa, *Ecklon* 945 (K iso.).

K. convoluta Steud. (1854); *K. cristata* (L.) Pers. var. *convoluta* (Steud.) C.E. Hubb. in *Kew Bull.* 1936: 500 (1936); *K. gracilis* Pers. var. *convoluta* (Steud.) Hedb., *Afroalp. Vasc. Pl.*: 42 (1957); *K. pyramidata* (Lam.) Domin var. *convoluta* (Steud.) Cuf., *Enum.*: 1227 (1968) - type: Ethiopia, GD, Semien, Mt Silke, *Schimper* 689 (K iso.).

Airochloa uniflora Hochst. (1855); *Koeleria uniflora* (Hochst.) Schweinf. & Asch. (1867) - type:

Ethiopia, GD, Semien, Mt Silke, *Schimper* 671 (TUB holo.).

K. convoluta Steud. var. *densiflora* Domin in *Bibl. Bot.* 14:111 (1907) - type: Ethiopia, GD, Mt Guna, *Schimper* s.n. (K iso.).

K. pyramidata (Lam.) Domin var. *brevifolia* (Nees) Cuf., *Enum.*: 1227 (1968); *K. cristata* (L.) Pers. var. *brevifolia* (Nees) C. E. Hubb. (1937).

Densely tufted perennial; culms simple, stiffly erect, 15–80 cm high, lanate, especially below the inflorescence. Basal leaf-blades filiform and somewhat flexuous to acicular, convolute or folded, often villous on the underside; culm-blades flat and broader; leaf-sheaths villous to almost glabrous, the old sheaths splitting into brown segments and persisting around the base of the culm. Panicle linear, 3–18 cm long, compactly spiciform or somewhat lobed and interrupted towards the base, pale green with a silvery sheen, often purple-tinged, the rachis and pedicels lanate. Spikelets narrowly oblong, 1–2(–3)-flowered, 3.8–5.8 mm long; glumes slightly unequal, ± as long as the spikelet, scaberulous in the upper half and scabrid to ciliolate on the keel; lower glume 1-nerved, linear-oblong in profile, 3.5–4.8 mm long; upper glume 3-nerved, narrowly oblanceolate in profile, 3.5–5.6 mm long; lemma narrowly elliptic-oblong in profile, 3.8–5.0 mm long, acute, cuspidate or mucronate. Fig. 18:6, 7.

Open situations in upland grass- or scrubland and in high alpine moorland; 2500–4350 m. GD GJ SU AR GG SD BA HA; Cameroon Republic and southwards to the Cape. *De Wilde* 8422; *IECAMA* J-52; *Mooney* 5274.

This is a polymorphic species showing much variation both in spikelet size and vegetatively in the compactness of the plant, and stiffness and pubescence of the leaf-blades. A chromosome number of $2n=14$ has been recorded, but further cytotaxonomic studies are essential for a proper understanding of variation in the species.

K. capensis is very closely related to the equally variable temperate European species *K. macrantha* (Ledeb.) Schult. [*K. cristata* (L.) Pers.; *K. gracilis* Pers.], for which chromosome numbers of 28 and 30 have been recorded. The only distinguishing feature between the two species appears to be the mode of decay of the old leaf-sheaths, those of *K. macrantha* not splitting into segments, but remaining soft and papery.

25. ROSTRARIA Trin. (1822)

Lophochloa Rchb. (1830)

Annuals; leaf-blades flat. Inflorescence a spike-like panicle. Spikelets (1–)several-flowered, laterally compressed, disarticulating between the florets; glumes subequal or unequal, keeled with hyaline margins; lemmas slightly exceeding the glumes, membranous, keeled, narrowly oblong in profile, 5-nerved, obtuse to



Figure 18. *ROSTRARIA CRISTATA*: 1 - habit x 3/4; 2 - spikelet x 9. *AIRA CARYOPHYLLEA*: 3 - habit x 3/4; 4 - spikelet x 9; 5 - floret x 17. *KOELERIA CAPENSIS*: 6 - habit and panicle x 3/4; 7 - spikelet x 9. 1 & 2 from *Wickens* 2794; 3-5 from *Thulin* 1361; 6 & 7 from *Mooney* 8373. Drawn by Eleanor Catherine.

acute with a straight subapical awnlet; callus obscure, glabrous or shortly hairy; stamens 3; stigmas 2.

About 10 species in the Mediterranean and Middle East, extending eastwards to NW India.

Rostraria is an annual derivative of *Koeleria*, in which it is sometimes included.

R. cristata (L.) Tzvelev (1971);

Festuca cristata L. (1753); *Lophochloa cristata* (L.) Hyl. (1953). Type from Portugal.

Festuca gerardii Vill. (1786); *Koeleria gerardii* (Vill.) Shinnery (1956), non *K. gerardi* Munro ex Benth. & Hook. (1847).

Festuca phleoides Vill. (1787), nom. superfl. based on *F. gerardii*; *Koeleria phleoides* (Vill.) Pers. (1805); *Lophochloa phleoides* (Vill.) Rchb. (1830).

Tufted annual; culms erect or geniculately ascending, 5–60 cm high. Panicle 1–12 cm long, dense and cylindrical or laxer and lobed. Spikelets 3–7 mm long, 3–10-flowered, rhachilla not produced; glumes unequal, glabrous or thinly hairy, the lower 1-nerved, narrowly lanceolate, 2–3 mm long, the upper 3-nerved, elliptic, 2.5–3.5 mm long; lemmas elliptic, 2.5–3.5 mm long, glabrous or sparsely hairy, smooth or minutely tuberculate, acute; awn 1–3 mm long. Fig. 18:1, 2.

A variable annual weed; 1000–2000 m. EW; Sudan (Red Sea hills), Mediterranean, Arabian Peninsula and eastwards to Pakistan and NW India; introduced elsewhere. *Pappi* 1348, 3123 (both FT); *Ryding & Sileschi* 1882 (ETH).

26. ANTHOXANTHUM L. (1753)

Hedberg, I. in *Bot. Not.* 129: 85–90 (1976).

Annuals or perennials. Inflorescence a contracted panicle. Spikelets laterally compressed, lanceolate, with the 2 lower florets sterile and reduced to empty lemmas, the uppermost floret fertile, the 3 florets falling together at maturity; glumes unequal with the upper as long as the spikelet, persistent, thinly membranous with broad hyaline margins, the lower 1-nerved, the upper 3-nerved with the nerves close together; lemmas rounded on the back, obscurely 5-nerved; sterile lemmas narrowly oblong, brown, hirsute, often bilobed, the lower with a fine awn from near the middle of the back, the upper with a stouter awn arising above the base; fertile lemma cartilaginous, smooth and shining, rotund, entire, enclosed within the sterile lemmas; palea hyaline, 1-nerved; lodicules absent; stamens 2; stigmas 2, long and filiform.

About 18 species in temperate Europe and Asia, the African and Asian highlands, South Africa and Central America.

All species are scented with coumarin. The flowers are protogynous, and the long protruding stigmas are a feature of the *Anthoxanthum* panicle.

A. aethiopicum I. Hedberg (1976);

- type: Ethiopia, AR, Galama Mts, Hedberg 4239 (UPS holo.).

Tufted perennial arising from thin wiry rhizomes; culms slender, erect, ascending or sometimes straggling, 20–50 cm high. Leaf-blades 9–17 cm long and 2–4 mm wide, flat, glabrous, acute, bright green; basal leaf-sheaths not loose and spongy. Panicle slender, 3.5–7 cm long, open or loosely contracted. Spikelets narrowly oblong, 7–8.4 mm long, the awns inconspicuous and barely protruding; glumes narrow, acute, slightly unequal, the lower linear in profile, at least 3/4 as long as the upper, the upper narrowly lanceolate in profile, as long as the spikelet; sterile lemmas narrowly oblong, 3.3–4.3 mm long, the tip broad, emarginate or irregularly lacerate, the lower with a fine straight awn 2.6–4.4 mm long, the upper with a geniculate awn 6.7–8.5 mm long; fertile lemma shorter than or ± equalling the sterile lemmas, 2.5(–3.6) mm long. Fig. 19:1–4.

Moist situations on mountains, often in light shade; 2700–4500 m. AR GG SD BA; confined to Ethiopia. *De Wilde* 9139; *Ouren* 20907; *Smeds* 1154.

A. aethiopicum is replaced on the East African mountains by *A. nivale* K. Schum., a much stouter, more robust species with conspicuously spongy papery white leaf-sheaths, broader usually hairy leaves, and a dense, stiff, cylindrical panicle. The glumes are also broader and more unequal, the lower being ovate and usually about half as long as the lanceolate upper glume. However, some variants of *A. nivale* are more slender and wiry than normal, and 2 chromosome numbers are known to occur in East Africa.

Gillett 14908 from Mt Delo (SD) has the slender straggling habit of *A. aethiopicum*, but approaches *A. nivale* in its denser panicle and broader, unequal glumes.

27. PHALARIS L. (1753)

Typhoides Moench (1794)

Anderson in *Iowa State Journ. Sci.* 36: 1–96 (1961).

Tufted or rhizomatous annuals or perennials. Leaf-blades linear, flat; ligule membranous. Inflorescence a contracted, spike-like panicle. Spikelets all alike, or rarely fertile and sterile spikelets mixed together, ovate, strongly laterally compressed, 3-flowered with the 2 lower florets reduced to sterile lemmas, the uppermost floret fertile, disarticulating above the glumes, or rarely the spikelets falling in clusters; glumes subequal, as long as the spikelet and enclosing the florets, strongly keeled, boat-shaped, chartaceous, prominently nerved, often winged on the keel; sterile lemmas up to half as long as the fertile lemma, narrow and often hairy, or one or both reduced to a vestigial fleshy scale at the base of the fertile floret; fertile lemma lanceolate to ovate, rounded on the back, faintly 5-nerved, often becoming cartilaginous and shiny, awnless; palea 2-



Figure 19. *ANTHOXANTHUM AETHIOPICUM*: 1 - habit x 3/4; 2 - panicle x 3/4; 3 - spikelet x 5; 4 - sterile lemmas and fertile floret x 5. *PHALARIS ARUNDINACEA*: 5 - base of plant x 3/4; 6 - panicle x 3/4; 7 - spikelet x 5; 8 - sterile lemmas with fertile floret x 5. 1 from *Fritis et al.* 3605; 2-4 from *Edwards* 64; 5, 7, 8 from *Phillips* 1; 6 from *Gillet* 5356. Drawn by Eleanor Catherine.

nerved, resembling the lemma; stamens 3; stigmas 2; grain with a small embryo and linear hilum.

15 species, mainly in the Mediterranean region and warm temperate parts of the New World; one species circumboreal; several species widely distributed as adventives.

The genus *Phalaris* has sometimes been treated as a separate monotypic tribe, *Phalarideae* Kunth. However, it shows clear links with other genera in *Aveneae*, such as *Anthoxanthum* L., which also has 2 sterile florets below the single fertile floret.

Phalaris aquatica L. is widely cultivated as a forage crop in many parts of the world. It is best suited to upland areas of high rainfall, and has been grown on an experimental basis in Ethiopia.

1. Spikelets falling in clusters of 7 with a single fertile spikelet encircled by 6 ± reduced sterile spikelets; tufted annual. 1. *P. paradoxa*
- Spikelets all alike, not in clusters, disarticulating above the persistent glumes; perennials. 2
2. Glumes not winged; sterile florets 2, equal, subulate; panicle lobed and interrupted. 2. *P. arundinacea*
- Glumes winged; sterile floret 1, subulate (the other suppressed or very short); panicle cylindrical. 3
3. Glume wing toothed; annual. 3. *P. minor*
- Glume wing usually entire; perennial, the culm bases sometimes tuberos.

P. aquatica (see note above)

1. *P. paradoxa* L. (1763);
– type: “in Oriente”, *P. Forsskål* (LINN holo.).
P. praemorsa Lam. (1778).
P. appendiculata Roem. & Schult. (1824).

Tufted annual; culms slender, 15–100 cm high, erect or geniculately ascending. Panicle dense, narrowly oblong, 2.5–6 cm long, the base often enclosed in the inflated uppermost leaf-sheath. Spikelets arranged in clusters composed of one fertile spikelet encircled by 6 sterile spikelets, the clusters falling entire, 4 sterile spikelets on the abaxial side of the fertile spikelet reduced to clavate knobs composed only of abortive glumes, the 2 remaining adaxial sterile spikelets larger with well-developed, winged glumes. Glumes of the fertile spikelet 4.4–5.7 mm long, prominently 7–9-nerved, acuminate, narrowly winged, the wing expanded near the middle into a large tooth, pale green or straw coloured with a dark green stripe above the tooth; sterile florets abortive, represented by 2 minute fleshy scales at the base of the fertile floret; fertile floret elliptic, 2.8–3.2 mm long, cartilaginous, shiny, sparsely pilose above.

A weed of cultivated and disturbed land, especially in fields of tef and other grain crops. 1800–2400 m. EW TU SU KF AR HA; a native of the Mediterranean region, which has become widely distributed as a weed throughout the world. *IECAMA* RS119; *Mooney* 5074.

2. *P. arundinacea* L. (1753);
Typhoides arundinacea (L.) Moench (1794); – type: Sweden (LINN lecto.).
Phalaris arundinacea L. subsp. *oehlerii* Pilger (1909).
P. caesia Nees (1841).

Robust perennial from extensive creeping rhizomes; culms erect, leafy, up to 2 m high. Leaf-blades flat, 20–30 cm long and 10–15 mm wide, tapering to a fine point. Panicle linear-oblong, 7–20 cm long, lobed and interrupted, the spikelets densely clustered on short lateral branches. Spikelets oblong, 5–6 mm long, pale green streaked with darker green or purple tinged, disarticulating above the glumes; glumes 3-nerved, narrowly lanceolate in profile, the keel scaberulous, wingless or very narrowly and inconspicuously winged above the middle, sharply acute; sterile lemmas equal, subulate, villous, 1.5–1.8 mm long; fertile lemma lanceolate, 3–4 mm long, becoming cartilaginous and shiny, scattered-pilose above. Fig. 19:5–8.

A colonizing grass of streamsides and marshy ground; 2400–3100 m. SU AR BA HA; north temperate regions, widely introduced elsewhere. *Mooney* 7013; *Thulin* 1474.

P. arundinacea s.lat. comprises 3 cytotypes. The widespread form is tetraploid (2n=28), whilst African material appears to be hexaploid (2n=42). Hexaploid forms also occur in S Europe, and a diploid (2n=14) is restricted to Corsica (Baldini & Jarvis in *Taxon* 40: 475–485, 1991).

3. *P. minor* Retz. (1783);
– type: probably from India (LD holo.).

Annual; culms 20–100 cm high; upper leaf-sheaths not inflated. Panicle dense, ovate-oblong, 1–6 cm long. Spikelets 4.5–5.5 mm long; glumes conspicuously winged on the keel, the wing margin erose-denticulate; sterile lemma 1, c 1 mm long; fertile lemma 2.7–4 mm long, lanceolate-ovate, pubescent, becoming cartilaginous and shiny.

Sandy and stony places; 1300–2400 m. EW; Mediterranean eastwards to N India; throughout the Arabian peninsula. *Baldrati* 3804; *Chiovenda* 137; *Pappi* 4327 (all FT).

28. *GASTRIDIMUM* P. Beauv. (1812)

Slender annuals. Leaf-blades linear, flat; ligule membranous. Panicle narrow, dense and spiciform, glistening. Spikelets 1-flowered with the rhachilla extended or not, linear-oblong, laterally compressed, disarticulating above the glumes; glumes persistent, 1-nerved, linear-lanceolate, far exceeding the floret, the lower longer than the upper, cartilaginous and slightly swollen at the base around the floret, herbaceous and keeled above with hyaline margins, scabrid on the keel; lemma elliptic-oblong, rounded on the back, thin, pilose or ± glabrous, truncate and irregularly denticulate, 5-nerved

with the midnerve usually extended into an awn from the upper third; awn fine, weakly geniculate with a twisted column; palea equalling the lemma, hyaline.

3 species, centred on the Mediterranean and extending into adjacent regions. Introduced elsewhere.

G. phleoides (Nees & Meyen) C.E. Hubb. (1954);

Lachnagrostis phleoides Nees & Meyen (1843) - type: Chile, Meyen (B hol., destr.).

G. lendigerum (L.) Desv. var. *longearistatum* Schweinf. in *Bull. Herb. Boiss.* 2, App. 2: 30 (1894) - types: Eritrea, Aidereso, Schweinfurth 1651 (K isosyn.) & Geleb, Schweinfurth 1199, 1539 & Bizen, Schweinfurth 2012.

Annual; culms tufted or solitary, 10–40 cm high. Leaf-blades scaberulous, especially on the upper surface; ligule 2–5 mm long. Panicle linear or linear-elliptic, 3–12 cm long, pale green and glistening. Spikelets linear, 4.5–6.5 mm long, the rachilla extended as a short, hairy bristle; glumes narrowly acuminate, the upper about 3/4 as long as the lower; lemma 1.2 mm long, pilose; awn much longer than the lemma with a brown twisted column, 4.5–6.5 mm long. Fig. 20.

Open and disturbed situations; 1300–2900 m. EW TU GD SU; Sudan, Kenya and in the Mediterranean region, extending to Iraq and the Arabian Peninsula. M.G. & S.B. Gilbert 1927; Mooney 6287; Ryding & Sileshi 1891 (ETH).

G. ventricosum (Gouan) Schinz & Thell., a closely related species from southern Europe, may occur in Ethiopia as an adventive. It can be distinguished by its somewhat smaller spikelets (3–5 mm long), minute or absent rachilla-extension, sparingly pubescent or glabrous lemmas, and by its shorter awns (3–4 mm) which may occasionally be completely absent.

29. POLYPOGON Desf. (1798)

Annuals or perennials. Leaf-blades linear, flat; ligule membranous. Panicle dense and spiciform (rarely merely loosely contracted), often bristly, with numerous, small, deciduous spikelets. Spikelets 1-flowered, laterally compressed, falling entire with the pedicel, or only the upper part of it remaining attached to the spikelet as a stipe, finally disarticulating below the floret, the rachilla not extended; glumes equal, as long as the spikelet, 1-nerved, scabrid, awned from the entire, emarginate or 2-lobed tip, or less often awnless; lemma about half as long as the glumes, obscurely 5-nerved, broad, rounded, thin, smooth and shiny, truncate, the midnerve usually extended as a very fine, fragile awn; palea equalling or shorter than the lemma.

18 species in warm temperate and subtropical regions, favouring damp locations.

Polypogon is closely related to the larger genus



Figure 20. *GASTRIDIMUM PHLEOIDES*: 1 - habit x 1/2; 2 - spikelet x 17; 3 - floret x 17. All from Mooney 6287. Drawn by Eleanor Catherine.

Agrostis, and the boundary between the two is not clear-cut, a few intermediate species exhibiting characters from both genera, especially *P. schimperiana* which lies

on the boundary. The possession of deciduous spikelets with an attached basal stipe is the definitive characteristic for *Polypogon*.

1. Glumes awned. 2
- Glumes awnless. 3
2. Awns of the glumes 2.5–3.5 times as long as the glume body. 1. *P. monspeliensis*
- Awns of the glumes shorter than to 1.5 times as long as the glume body. 2. *P. fugax*
3. Panicle contracted, lobed, the spikelets densely crowded; spikelets 1.5–2 mm; glumes obtuse. 3. *P. viridis*
- Panicle narrow, slightly flexuous; spikelets 2–3 mm; glumes acute. 4. *P. schimperianus*

1. *P. monspeliensis* (L.) Desf. (1798);

Alopecurus monspeliensis L. (1753) - type: Europe, cultivated at Uppsala, Sweden, originating from Montpellier, France, *Linnaeus* (LINN holo.).

Tufted annual; culms up to 80 cm high, slender to moderately stout, erect or geniculately ascending. Leaf-blades flat, scaberulous, often slightly glaucous; leaf-sheaths somewhat inflated, smooth. Panicle linear-oblong, 3–15 cm long, densely cylindrical or slightly lobed on big plants, pale green and thickly clothed in yellow bristles. Spikelets narrowly oblong, 1.5–2.5 mm long, disarticulating from the pedicel a little below its tip, the swollen distal portion remaining attached to the spikelet; glumes narrowly elliptic-oblong, firmly membranous, puberulous, scabrid-aculeate on the nerve and ciliate on the margins, especially in the lower half, a fine, scabrid awn 2.5–3.5 times as long as the glume body (4–7 mm long) arising from the emarginate tip; lemma obovate, *c* 1 mm long, the mid-nerve extended into a fine, straight, readily deciduous awn 1.5–2 mm long, the lateral nerves also sometimes minutely extended. Fig. 21:1–4.

River banks and as a weed of cultivations, favouring damp situations; 1600–2500 m. EW TU GD SU AR; Europe, the Mediterranean and eastwards through Asia to China, widely introduced to other warm temperate countries. *IECAMA* J46; *Mooney* 6375.

2. *P. fugax* Nees ex Steud. (1854);

- type: Nepal, *Royle* (K fragment).

Annual or short-lived perennial. Leaf-blades broadly linear, up to 15 cm long and 10 mm wide. Culms 15–60 cm high, tufted, ascending or trailing and rooting at the lower nodes. Panicle 5–15 cm long, pale green, dense, cylindrical and slightly lobed or more open, narrowly ovate with the spikelets densely clustered on the ascending branches. Spikelets narrowly oblong, 2–2.5 mm long; glumes narrowly elliptic-oblong, puberulous, scabrid-aculeate on the nerve, shortly ciliate on the margins in the lower half, awned from the emarginate tip, the awn shorter than, or up to 1.5 times as long as the glume body; lemma elliptic, 1.2 mm long, awnless or the mid-nerve extended into a fine, straight awn up

to 2 mm long, the lateral nerves also minutely excurrent. Fig. 21:5.

Damp places; 1900–2900 m. GD SU; the Himalayan region from Iran eastwards to Burma; also occurring as a rarity further west in Iraq and Somalia. *Schimper* 594 (P); *Mooney* 6407 (ETH).

P. fugax is distinguishable at a glance from the much commoner *P. monspeliensis*, the shorter awns on the glumes giving the panicle a much less bristly appearance.

3. *P. viridis* (Gouan) Breistr. (1966);

Agrostis viridis Gouan (1762) - type: France, *Gouan* (K holo.).

Phalaris semiverticillata Forssk. (1775); *Agrostis semiverticillata* (Forssk.) C. Christ. (1922); *Polypogon semiverticillatus* (Forssk.) Hyl. (1945).

Agrostis stolonifera L. var. *densiflora* (Gussone) Chiov. in *Malpighia* 35 (1939).

Loosely tufted perennial with slender, spreading stolons rooting at the nodes. Culms smooth, geniculately ascending to 50 cm. Leaf-blades flat, up to 8 mm wide, scaberulous, acute. Panicle contracted, lanceolate to oblong, 5–10 cm long, lobed and often interrupted, the numerous, tiny spikelets densely crowded on the semiverticillate branches, the pedicels articulated on the branches. Spikelets narrowly oblong, 1.5–2 mm long, falling entire with the pedicel attached; glumes equal, 1-nerved, elliptic-oblong, membranous, lightly keeled above, scabrid, obtuse; lemma broadly elliptic, thin and shining, awnless, truncate and minutely denticulate; palea equalling the lemma; anthers 0.5 mm. Fig. 21:6, 7.

An aquatic grass, rooting in the sand or mud of streams, and in marshy grassland; 1000–3000 m. EW TU SU HA; the Mediterranean, Arabian Peninsula and eastwards to NW India and southern USSR. Introduced into Australia, South Africa and N and S America. *Gilbert & Getachew* 2796; *Burger* 1593; *Baldrati* 45.

P. viridis approaches *Agrostis* quite closely, lacking the awned glumes typically found in *Polypogon*. However, the spikelets with their attached pedicels are readily and obviously deciduous.

4. *P. schimperianus* (Hochst. ex Steud.) Cope (1995);

Agrostis schimperiana Hochst. ex Steud. (1854); *Agrostis alba* var. *schimperiana* (Hochst. ex Steud.) Engl. in *Abh. Preuss. Akad. Wiss.* (Berlin) 2:128 (1891) - types: Ethiopia, TU, Adua, *Schimper* 746 & without locality, *Schimper* 973 (both K, isosyn.).

A. simensis Hochst. ex Steud. (1854); *A. alba* var. *simensis* (Hochst. ex Steud.) Engl., l.c. (1891) - type: Ethiopia, GD, Semien [Simen], Demerki, *Schimper* 562 (K iso.).

A. hirtella Hochst. ex Steud. (1854) - type: Ethiopia, GD, Semien [Simen], *Schimper* 1345 (K iso.).



Figure 21. *POLYPOGON* spp.: *P. MONSPELIENSIS*: 1 - habit x 3/4; 2 - panicle x 3/4; 3 - glumes x 14; 4 - lemma x 14. *P. FUGAX*: 5 - spikelet x 14. *P. VIRIDIS*: 6 - panicle x 3/4; 7 - spikelet x 14. *P. SCHIMPERIANUS*: 8 - habit x 3/4; 9 - spikelet x 14. 1-4 from Thulin 1589; 5 from McKinnon S240; 6 & 7 from Burger 1593; 8 from Gillett 5312; 9 from Gilbert & Tewolde 3293. Drawn by Eleanor Catherine.

A. fissa Stapf (1897) - type: Ethiopia, TU, Gajeh Merki, *Schimper* 1093 (K. holo.).

Tufted perennial. Culms slender, weak, often prostrate and rooting at the lower nodes or shortly stoloniferous, geniculately ascending to 85 cm. Leaf-blades flat, glabrous, scaberulous. Panicle narrow with ascending branches, 5–23 cm long, slightly flexuous, somewhat contracted with the spikelets clustered along the primary branches, purplish. Spikelets gaping, 2–3 mm long, disarticulating above the glumes, and also the whole spikelet tardily falling with the scabrid pedicel still attached, rhachilla not extended; glumes 1-nerved, lanceolate-oblong, scaberulous on the body and scabrid on the keel, finely acute; lemma elliptic-oblong, 1.3–1.9 mm long, 5-nerved, glabrous, truncate-denticulate with the nerves excurrent as mucros, awnless or occasionally the midnerve extended below the tip into an awnlet up to 0.75(–2) mm long; palea almost equalling the lemma; anthers 0.75 mm long. Fig. 21:8, 9.

Streamsides and moist places in upland grassland; 2800–3750 m. TU GD GJ SU SD BA HA; southwards through East Africa to Zambia. *Gilbert & Tewolde* 3293; *Gillett* 5312; *Phillips* 8.

This grass is placed in *Polypogon* on account of its articulated pedicels. However, the gaping spikelets with pointed glumes and deciduous florets are much more typical of *Agrostis* and it clearly lies on the boundary between the two genera. It will often be keyed out to *Agrostis* as the pedicels disarticulate only tardily, but close inspection will reveal the disarticulation points even in younger panicles.

The central nerve of the lemma may be extended at the tip as a mucro like the other 4 nerves, or may stop a little below the tip, at which point it is occasionally extended as a mucro or short awn. The plasticity of this character is illustrated by the fact that awned and awnless lemmas may occur in the same panicle, and even in adjacent spikelets. *Agrostis simensis* and *A. hirtella* are both based on specimens showing an extreme form of this variation, with the awnlet attaining a length of 1.5 mm. *A. fissa* is also based on an awned form, in which additionally the lemma-tip is bifid, the fissure often extending to the point of origin of the awn.

× **AGROPOGON** P. Fourn. (1934)
(*Agrostis* L. × *Polypogon* Desf.)

× *A. lutosus* (Poir.) P. Fourn. (1935);

Agrostis littoralis Sm. (1800), non Lam. (1791);
A. lutosus Poir. (1810); *Polypogon littoralis* Sm.
(1816); × *Agropogon littoralis* (Sm.) C.E. Hubb.
(1946) - type from British Isles.

Agrostis subaristata Aitch. & Hemsl. (1881);
Cufodontis Enum.: 1230 (1968).

Loosely tufted perennial; culms up to 60 cm high, geniculately ascending or creeping and rooting at the lower nodes. Leaf-blades flat, 3–20 cm long, 2–11 mm wide, scabrid especially towards the tip. Panicle dense,

lanceolate to narrowly ovate or oblong, lobed, 2–18 cm long. Spikelets 2–3 mm long, disarticulating above the persistent glumes; glumes acute to emarginate, tipped with a mucro 0.2–3 mm long, scabrid; lemma c 1.5 mm long, truncate-denticulate, awnless or with a subapical awn 0.2–3 mm long; palea 3/4 the length of the lemma; anthers 0.5–1 mm long.

Damp and saline places. EW; W and S Europe, temperate Asia from Pakistan and Afghanistan to NW India. *Pappi* 1509.

× *A. lutosus* is the name given to hybrids between *Agrostis stolonifera* L. and *Polypogon monspeliensis* (L.) Desf. *Pappi* 1509 is probably a chance introduction referable to this taxon. It is similar to *P. schimperianus*, but has smoother emarginate glumes tipped by a mucro 0.3 mm long. The mode of spikelet disarticulation is unclear.

30. AGROSTIS L. (1753)

Annuals or perennials. Leaf-blades linear to filiform or setaceous, flat, folded or inrolled. Inflorescence an open or contracted panicle. Spikelets small, 1-flowered, often gaping, disarticulating above the persistent glumes, rhachilla not usually extended; glumes exceeding the floret, equal or the lower a little longer than the upper, 1–3-nerved, membranous and shiny, usually acute to acuminate; lemma (3–)5-nerved, oblong to elliptic, thinly membranous, rounded on the back, glabrous or pilose, awnless or awned from the back, truncate-denticulate; awn usually geniculate; palea usually shorter than the lemma, often very small; callus glabrous or shortly pubescent.

About 220 species, mainly in temperate and cold regions of the northern hemisphere; extending to mountains in the tropics.

Variation in several African species of *Agrostis* is still incompletely understood, especially in those species from the upper parts of the high mountains. Collections of these species from Ethiopia are often scanty. Further material is needed to clarify variation in those species already known from Ethiopia, and might also reveal the presence of species at present only known from the East African mountains.

1. Lemma awnless, or the midnerve extended into a mucro up to 1(–2) mm long. 2
- Lemma awned from the back; awn geniculate, usually exceeding 3 mm. 4
2. Glumes scabrid; pedicels articulated, the glumes finally falling with the pedicel attached. *Polypogon schimperianus* p. 44
- Glumes smooth (except along the keel); pedicels not articulated, glumes and pedicels persistent. 3
3. Loosely tufted perennial up to 85 cm high; lemma 3-nerved, pilose. 1. *A. lachnantha*
- Compact, cushion-forming perennial up to 5 cm high; lemma 5-nerved, glabrous. 2. *A. sclerophylla*

4. Leaf-blades linear, flat. 5
 - Leaf-blades very narrow, filiform, usually folded or involute. 8
5. Panicle linear, spiciform; spikelets linear-oblong. 3. *A. quinqueseta*
 - Panicle open or only loosely contracted; spikelets oblong or gaping. 6
6. Awn arising from the lower third of the lemma back; panicle narrow with ascending branches. 4. *A. keniensis*
 - Awn arising from the lower quarter of the lemma back or below; panicle elliptic to ovate with spreading branches. 7
7. Glumes unequal, the lower longer than the upper, acuminate; palea 1/2-3/4 as long as the lemma; awn 4-6 mm long. 5. *A. diffusa*
 - Glumes subequal, acute; palea subequalling the lemma; awn c 3.5 mm long. 6. *A. mannii*
8. Leaf-blades scaberulous; panicle-branches flexuous; the 4 outer lemma nerves excurrent into awnlets to 1 mm long. 7. *A. volkensii*
 - Leaf-blades smooth on the under (outer) side; panicle-branches stiff; the 2 outermost lemma-nerves excurrent as short mucros. 8. *A. gracilifolia*

1. *A. lachnantha* Nees (1836);

- type: South Africa, *Drège* s.n. (K iso.).

A. vestita Hochst. ex A. Rich. (1850) - type: Ethiopia, TU, Urahit, *Schimper* 1788 (K iso.).

Loosely tufted perennial. Culms erect or ascending, 65-85 cm high, the nodes and lower leaf-sheaths purplish; leaf-blades linear, flat, glabrous, scaberulous. Panicle linear with the spikelets clustered along the ascending primary branches, 20-35 cm long, arching, light green sometimes purple-tinged. Spikelets gaping, 2-2.5 mm long, disarticulating above the glumes, rhachilla not extended; glumes 1-nerved, lanceolate-oblong, smooth except for the scabrid keel, finely acute; lemma lanceolate-oblong, 1.7-2.2 mm long, 3-nerved, silky-villous, obtuse, awnless or the midnerve excurrent just below the tip into a mucro or awnlet up to 0.8 mm long; palea almost equalling the lemma; anthers 0.5-0.6 mm long; callus bearded. Fig. 22:1-3.

Streamsides, pond margins and damp grassland; 2000-3000 m. EW TU GD SU AR; Sudan, Uganda and Tanzania to South Africa; also in Yemen. *De Wilde* 9005; *Mooney* 4787.

A. lachnantha is unusual in *Agrostis* in possessing a 3-nerved lemma, the majority of species having a 5-nerved lemma.

2. *A. sclerophylla* C. E. Hubb. (1936);

Sporobolus alpicola Hochst. ex A. Rich. (1850), non *Agrostis alpicola* Hochst. (1855); *Vilfa alpicola* (Hochst. ex A. Rich.) Steud. (1854) - type: Ethiopia, Semien [Simen], Mt Silke, *Schimper* 669 (K iso.).

Compact perennial forming dense, low cushions 3-5 cm high. Leaf-blades stiff and tough, distichous, 1-2 cm

long, subulate, smooth; leaf-sheaths papery, closely imbricate, the old sheaths accumulating at the base. Panicle stiffly erect, 1-1.5 cm long, few-spiculate, scarcely exerted from the leaves. Spikelets 2.1-2.5 mm long, gaping, disarticulating above the glumes, green tinged with purple, rhachilla not extended; glumes lanceolate-oblong, smooth and cartilaginous with scarious margins, the lower 1-nerved, the upper a little shorter, 3-nerved; lemma elliptic-oblong, 2 mm long, cartilaginous, smooth and shiny, obscurely 5-nerved, the outer nerves becoming prominent towards the membranous, scaberulous, denticulate tip, the midnerve terminating at about the middle, sometimes extended into a short mucro; palea subequalling the lemma; callus minutely hairy. Fig. 22:6, 7.

Dry, barren slopes and among rocks on mountain summits above 4000 m. GD AR BA; Kenya (Mt Kenya). *Mooney* 8333; *Aweke* 1063 (ETH).

3. *A. quinqueseta* (Hochst. ex Steud.) Hochst. (1855);

Anomalotis quinqueseta Hochst. ex Steud. (1854); *Trisetaria quinqueseta* (Hochst. ex Steud.) Hochst. (1855) - type: Ethiopia, GD, Semien, Mt Bachit, *Schimper* 116 (P holo., B iso.).

A. alpicola Hochst. (1855) - type: Ethiopia, GD, Semien, Mt Bachit, *Schimper* (B iso.).

A. mildbraedii Pilger (1910).

Tufted perennial with short, slender rhizomes. Culms slender, sometimes wiry, ascending, 20-80 cm high. Leaf-blades linear, flat, 1-3 mm wide, striate. Panicle linear, erect, contracted to spiciform, the branches and pedicels smooth or scabrid. Spikelets narrowly oblong, 3-4.5 mm long, green or purple-tinged, rhachilla-extension 0-0.5 mm, hairy; glumes lanceolate-oblong, enclosing and clearly exceeding the floret, sub-3-nerved, scabrid on the keel upwards, acuminate, the upper usually a little shorter and narrower than the lower; lemma lanceolate-oblong, 1.7-3 mm long, thinly membranous, pilose or glabrous, 5-nerved with the 2 outer nerves excurrent as mucros at the truncate tip, awned from near the base; awn weakly geniculate, 3-5 mm long; palea 2/3-3/4 as long as the lemma; callus bearded laterally. Fig. 22:8-10.

Scrubland in the uplands, often between *Erica* bushes, in the open or in light shade; 2500-4300 m. GD GJ SU KF AR GG BA; Kenya, Uganda, Zaire (Kivu Province), Cameroon Mt Friis et al. 1500; *Hedberg* 4251; *Mooney* 8355.

A. quinqueseta is a rather variable grass vegetatively, ranging from loosely tufted, sprawling plants with long, narrow leaf-blades, to more erect, compact forms with shorter, stiffer leaf-blades. There is also considerable variation in the culms, which may be thin, stiff and wiry, slender or moderately stout, and in the thickness and density of the panicle. However, these forms all intergrade, and may be at least partially environmentally induced.



Figure 22. *AGROSTIS* spp.: *A. LACHNANTHA*: 1 - habit x 3/4; 2 - panicle x 3/4; 3 - spikelet x 9. *A. KENIENSIS*: 4 - spikelet x 9; 5 - floret x 17. *A. SCLEROPHYLLA*: 6 - habit x 3/4; 7 - spikelet x 9. *A. QUINQUESETA*: 8 - habit x 3/4; 9 - spikelet x 9; 10 - floret x 17. 1 & 2 from Persson & Fröman 1723; 3 from De Wilde 9602; 4 & 5 from Mooney 7275; 6 & 7 from Mooney 8333; 8-10 from Edwards 21. Drawn by Eleanor Catherine.

A. quinqueseta can be distinguished from all other Ethiopian species of *Agrostis* by its dense, linear, spiciform panicle coupled with the narrow, nongaping spikelets.

Three specimens from near Debra Berhan, Shoa Province [Mooney 6470; West 5704; Weinert 429 (ETH)] have a more slender, linear panicle and smaller spikelets (2.5 mm) than is normal in *A. quinqueseta*. In addition, the lemmas are proportionately large, more or less equalling the glumes, and the palea equals or slightly exceeds the lemma. However, more material is required to establish whether these 3 specimens represent a distinct taxon, or simply a local form of this variable species.

4. *A. keniensis* Pilger (1926);

- type: Mt Kenya, Fries 1465 (UPS holo.).

Tufted perennial. Culms erect, 65–130 cm high. Leaf-blades linear, flat, smooth or scaberulous. Panicle linear to narrowly oblong, 20–50 cm long, loose, the slender, scaberulous branches ascending and somewhat flexuous. Spikelets gaping, 3–4 mm long, pale green tinged with purple, shining; rhachilla-extension 0–0.3 mm, hairy; glumes narrowly lanceolate-oblong, smooth except for the scabrid keel, acute, the lower 1-nerved, a little longer than the upper, the upper sub-3-nerved; lemma lanceolate, 2.5–3 mm long, loosely pilose except towards the tip, clearly 5-nerved with the 2 outer nerves excurrent as short mucros at the denticulate tip, the midnerve extended as an awn from one-third the way up the back; awn fine, weakly geniculate, 3.5–5 mm long; palea a little shorter than the lemma. Fig. 22:4, 5.

Streamsides in the uplands; 3000–3200 m. BA; East Africa. Edwards 57 (ETH); Mesfin T. 5819 (ETH); Mooney 7275.

5. *A. diffusa* S.M. Phillips (1986);

- type: Ethiopia, SD, Amaro Mts., Mt Delo, Gillett 14923 (K holo.).

A. kilimandscharica sensu Cufodontis in Enum.: 1228 (1968), non Mez. (1922).

Loosely tufted perennial with straggling, slender, ascending culms 40–100 cm high; leaf-blades linear, flat. Panicle large and open, elliptic to ovate, up to 30 cm long and 17 cm wide, the branches loosely ascending to divaricate, filiform, somewhat flexuous, the spikelets distant. Spikelets oblong or gaping, 3.3–4.8 mm long; rhachilla-extension 0.2–2 mm long, hairy; glumes slightly unequal, lightly keeled, sub-3-nerved, scabrid on the keel upwards, smooth or infrequently granular; lower glume lanceolate, 3.4–4.8 mm long, acuminate; upper glume narrowly elliptic-oblong, 2.8–4.0 mm long, acute; lemma lanceolate-oblong, 2.6–3.5 mm long, pilose, awned from near the base, truncate-denticulate, the outer nerves extended into mucros 0.3–0.6 mm long; awn geniculate, 4.2–6 mm long; palea 1/2–3/4 lemma length; callus hairy. Fig. 23.

Bamboo forest and montane scrubland, often in moist situations; 1500–3500 m. GD GJ GG SD; unknown elsewhere. Chioventa 3117; Evans 584; Mulvany 91.

A. diffusa is very closely related to the large-spiculate variety *sororia* (C. E. Hubb.) Hedberg of the East African species *A. kilimandscharica* Mez. *A. kilimandscharica* usually has a narrower oblong panicle with ascending branches bearing clustered spikelets; typical *A. kilimandscharica* also has shorter spikelets up to 3 mm long, although they can extend to 4 mm in var. *sororia*. The palea is also a little longer, subequalling the lemma in *A. kilimandscharica*.

6. *A. mannii* (Hook.f.) Stapf (1899);

Deyeuxia mannii Hook. f. (1864) - types: Bioko, Mann 1469 & Cameroon Mt, Mann 1350, 2096 (all K syn.)

subsp. *aethiopica* S.M. Phillips in *Kew Bull.* 41: 134 (1986) - type: Ethiopia, KF, Dekano, Mooney 6178 (K holo.).

Loosely tufted perennial; culms slender, erect or ascending, 45–80 cm high; leaf-blades linear, flat. Panicle loose and open, 15–35 cm long, the spikelets clustered on the slender, flexuous, ascending or spreading branches. Spikelets oblong to gaping, 4–4.4 mm long; rhachilla-extension 0–0.4 mm long; glumes subequal, 3-nerved, the lower as long as the spikelet, the upper slightly shorter, smooth or minutely granular, acute; lemma subequalling the glumes, 3.3–3.9 mm long, pilose, awned from near the base, the lateral nerves barely extended at the truncate tip; awn geniculate, barely exerted from the spikelet, c 3.5 mm long, the portion above the genicula 1–1.3 mm long; palea as long as the lemma; callus hairy.

Grassland on wet soils; 2900 m. KF; unknown elsewhere. Stewart C-14.

Subsp. *mannii* occurs in West Africa (Cameroon and Bioko), and differs in its shorter lemmas (2.2–2.8 mm) and longer, well-exserted awns (4–7 mm long).

Agrostis mannii is very closely related to the East African species *A. producta* Pilg., which also has subequal glumes and a hairy, sub-basally awned lemma. Further distinguishing characters for *A. producta* are given under no. 7. *A. volkensii*.

7. *A. volkensii* Stapf (1897);

- type: Tanzania, Mt Kilimanjaro, Volkens 1856 (K holo.).

Densely tufted perennial; culms slender, erect, up to 60 cm high. Leaf-blades very narrow, folded or involute, filiform, rarely opened out and 1 mm wide, scaberulous, striate on the underside. Panicle open, lanceolate to narrowly oblong, 3–15 cm long, the ascending branches smooth or slightly scaberulous, flexuous. Spikelets oblong to gaping, 2–4.5 mm long, purplish; rhachilla-extension usually short, hairy; glumes equal, lanceolate,



Figure 23. *AGROSTIS* spp.: *A. DIFFUSA*: A - habit x 2/3; B - spikelet x 17; C - lemma x 5; D palea x 5. *A. MANNII* subsp. *AETHIOPICA*: E - spikelet x 17; F - floret x 5. A-D from Evans 584; E & F from Mooney 6178. Drawn by Eleanor Catherine. (Reproduced from *Kew Bull.* Vol. 41 with permission of the Editors).

3-nerved, often glandular along the nerves, smooth or asperulous, acute; lemma lanceolate-oblong, 2-3 mm long, almost glabrous or sparsely to densely pilose, 5-nerved, dentate-laciniate with the 4 lateral nerves (and the palea keels) excurrent into conspicuous awnlets to 1 mm long; awn sub-basal, geniculate, 3-5.7 mm long; palea as long as the lemma.

Upland grassland and moor; 3700 m. AR; the high mountains of Uganda, Kenya and N Tanzania. *Hedberg* 4242.

A. volkensis may sometimes be confused with *A. producta*, a species occurring in upland grassland in

East Africa and the Imatong mountains of Sudan, but at present unknown from Ethiopia. In *A. producta* the old basal leaf-sheaths split into fine fibres, whereas in *A. volkensis* they remain papery, and the leaf-blades are usually linear, not filiform. In addition, the spikelets are on average a little larger (*c* 4 mm), the glumes are always densely granular-asperulous (particularly near the base), and the lemmas are always hairy.

Hedberg 4242 is best placed under *A. volkensis* at present, but differs by its non-scaberulous leaf-blades and glabrous lemmas; it also possesses a long, bristle-like rhachilla extension (2 mm) as in *A. producta* but no fibrous basal sheaths.

8. *A. gracilifolia* C. E. Hubb. (1936);

- type: Uganda, Mt Elgon, Liebenberg 1689 (K holo.).

Loosely to densely tufted perennial. Culms slender, erect, up to 60 cm high. Leaf-blades filiform to setaceous, tightly folded or opened out and then 0.8–2 mm wide, smooth or striate on the outer (under) surface, not scaberulous. Panicle lanceolate to narrowly oblong, open, 2–20 cm long, the branches stiffly spreading, smooth or sometimes scaberulous below the spikelets. Spikelets lanceolate to oblong, 2–4 mm long, green or purple; rachilla-extension 0.2–0.8 mm long, hairy; glumes subequal, lanceolate, (1–)3-nerved, scaberulous and often glandular along the keel, acute; lemma elliptic-oblong, 1.4–3 mm long, scaberulous upwards, glabrous or thinly scattered-pilose, 5-nerved, truncate-denticulate with the two outer nerves excurrent as mucros 0.1–0.5 mm long, awned from 1/4 the way up the back; awn geniculate, (1.4–)1.8–5.3 mm long; palea 1/2 as long to equalling the lemma; callus shortly hairy.

Montane grassland among *Erica* and on the rocky summits of high mountains, in moist places; 3600–4300 m.

A. gracilifolia is primarily a grass of the high mountains of Uganda and Kenya, where it occurs in montane grass and moorland above 2800 m, usually in boggy places where it is often abundant. It is a variable species, showing a wide range both in culm height and spikelet size, and additionally small morphological differences exist between the populations on different mountains, which were at one time assigned to different species, but are better accommodated at subspecific level. Variation in Ethiopian populations is still very incompletely understood, but is at present accommodated in 2 subspecies:

subsp. *parviflora* S.M. Phillips in *Opera Botanica* 121: 55 (1993);

- type: Ethiopia, AR, Mt Cacca, Mooney 5275 (K holo.).

Loosely tufted; leaf-blades soft, very narrowly linear, flat or loosely folded, 1–1.6 mm wide, striate; ligule 3–5 mm long, acute; spikelets 2–3(–3.4) mm long; lemma thinly pilose on the back; awn 1.4–2.5(–3.3) mm long, clearly geniculate; palea 1/3–2/3 as long as the lemma.

AR, BA; confined to S Ethiopia. G. & S. Miehe 1506; Phillips 39; Gilbert & Jones 209.

This subspecies has somewhat smaller spikelet parts than the others, but is especially distinguished by its remarkably long pointed ligule and shorter palea which is usually only about half the length of the lemma.

subsp. *gracilifolia*

A. volkensii Stapf var. *deminuta* Pilg. in *Not. Bot. Gart. Berlin* 9: 512 (1926) - type: Mt Kenya, Fries 1374 (UPS holo., K iso.).

A. dissitiflora C. E. Hubb. (1936) - type: Mt Kenya, Fries 1284 (K holo.).

A. leptophylla C. E. Hubb. (1936) - type: Uganda, Mt Elgon, H.B. Johnston 876 (K holo.).

A. bryophila C. E. Hubb. var. *elgonensis* C. E. Hubb. in *Kew Bull.* 1937: 63 (1937) - type: Kenya, Mt Elgon, Taylor 3703 (K holo.).

Densely tufted; leaf-blades stiffly filiform, tightly involute, 0.3–0.6 mm wide (rolled), smooth or striate; ligule < 3 mm long; lemma glabrous or loosely pilose near the margins; awn 2.5–4 mm long, clearly geniculate; palea subequalling the lemma.

Uganda and Kenya: Mt Elgon, Mt Kenya, Cherangani Hills.

Two specimens from the Semien mountains of northern Ethiopia (Hedberg & Aweke 5441, 5449) have the spikelet measurements of this subspecies and match the type of *A. bryophila* var. *elgonensis* in habit. Further collections from northern Ethiopia are highly desirable.

A third subspecies, subsp. *bryophila* (C. E. Hubb.) S.M. Phillips, occurs in *Carex runssoroensis* bog in the Ruwenzori mountains of Uganda and Zaire. It is distinguished by a very loose habit and large spikelets (2.5–3.7 mm) with glabrous lemma and weakly geniculate awn.

31. *CALAMAGROSTIS* Adans. (1763)

Deyeuxia P. Beauv. (1812)

Tufted perennials, often with creeping rhizomes. Leaf-blades linear, flat or convolute; ligule membranous. Panicle usually narrow and contracted, many-spiculate. Spikelets 1-flowered, linear to lanceolate, laterally compressed, the floret densely surrounded by long, silky hairs from the callus, disarticulating above the glumes, the rachilla sometimes extended as a short bristle; glumes subequal, exceeding the floret, acute to acuminate, herbaceous, narrow, persistent, the lower 1-nerved, the upper 1–3-nerved; lemma 3–5-nerved, lanceolate to oblong, usually firmer than the glumes, truncate-denticulate or ± 2-toothed, awned from the back or from between the lobes or from the tip; awn inconspicuous, fine, straight or geniculate; palea hyaline, equalling or shorter than the lemma.

About 270 species in temperate regions throughout the world, and on tropical mountains.

C. epigejos (L.) Roth (1788);

Arundo epigejos L. (1753) - type: Europe (LINN holo.).

var. *capensis* Stapf in Dyer, *Fl. Cap.* 7: 551 (1899);

- type: South Africa, Drège s.n. (K holo.).

Robust tufted perennial with creeping rhizomes; culms fairly stout, 60–150 cm high, leafy. Leaf-blades tough, flat or loosely convolute, tapering to a fine tip, scaberulous on the margins; ligule 3–10 mm long. Panicle erect, linear-oblong, 10–25 cm long, dense; spikelets linear-oblong or slightly gaping, 6–8 mm long; glumes

subulate, rounded at the base around the floret, keeled above and narrowly tapering to an acuminate tip, scabrid on the keel; lemma 3-nerved, oblong, 3–4 mm long, bidenticulate; awn arising $1/4$ – $1/3$ the way up the lemma back, 3–4 mm long; palea half as long as the lemma; callus hairs 5 mm long. Fig. 24.

Wet upland grassland and clearings in upland forest; 2900–3100 m. SU BA; East African mountains and in South Africa. *Gilbert & Tewolde 3232; Edwards 35; Phillips 2.*

Var. *epigejos* occurs throughout temperate Europe and Asia. It is distinguished by its smaller spikelets (4.5–7 mm) and shorter awn (1–2 mm), which arises from the upper half of the lemma back, usually from the sinus of the bilobed tip.

32. ALOPECURUS L. (1753)

Annuals or perennials; leaf-blades linear. Inflorescence a contracted, spiciform panicle of numerous, densely crowded spikelets. Spikelets 1-flowered, strongly laterally compressed, falling entire from the cupuliform tips of the short pedicels. Glumes equal, as long as the spikelet, membranous, 3-nerved, strongly keeled, the keel winged or ciliate, the margins almost free or connate for up to half their length; lemma enclosed within the glumes, thinly membranous, elliptic, smooth, glabrous, truncate, usually awned from the back, the margins often connate below; awn fine, straight; palea and lodicules usually absent.

36 species, mainly in north temperate regions; also in South America.

A. baptarrhenius S.M. Phillips (1986);

- type: Ethiopia, BA, near Dinsho, M.G. & S.B. Gilbert 1818 (K holo.).

Tufted annual or short-lived perennial; culms erect or ascending, 10–30 cm high. Leaf-blades narrowly linear, flat or folded, up to 10 cm long and 1–3 mm wide, finely acute; leaf-sheaths loose, the upper slightly inflated; ligule 3–6 mm long with a tapering acute tip. Panicle cylindrical, linear-oblong, 2.5–4.5 cm long. Spikelets elliptic, 3–4.5 mm long; glumes narrowly oblong, connate at the base, ciliate on the keel with hairs c 0.5 mm long, appressed-hispid around the marginal nerves, the tips hyaline, slightly recurved, obtuse; lemma subequalling the glumes, the midnerve extended into an awn $1/3$ – $1/2$ way up the back, the margins connate for $1/3$ – $1/2$ of their length; awn c 3 mm long, exerted from the glumes by 1–1.6 mm; anthers 1.3–2 mm long, pale yellow at first, soon becoming bright orange-brown. Fig. 25.

Growing in the shallow water or wet mud of streams and small afroalpine lakes, locally abundant; 2700–4000 m. SU BA; unknown elsewhere. *Ash 3558; Mooney 7276; Friis et al. 5721 (ETH).*

A. baptarrhenius is very closely related to *A. aequa-*



Figure 24. *CALAMAGROSTIS EPIGEJOS* var. *CAPENSIS*: 1 - habit x $1/2$; 2 - spikelet x 7; 3 - floret x 14; 4 - lemma x 14. Drawn by D. Erasmus. (Modified from *Fl. Trop. E. Afr. Gramineae 1*: Fig. 35, with permission of the Editors).

lis Sobol., a widespread semi-aquatic species of north temperate regions, which has smaller spikelets (1.8–2.7 mm), shorter anthers (0.7–1.3 mm), and an awn included within or only very shortly exerted from the glumes.

The species of *Alopecurus* are protogynous, the stigmas being exerted and withering before the anthers appear. The bright orange-brown anthers clothing the panicle and persisting at maturity are a conspicuous feature of *A. baptarrhenius*.

***A. arundinaceus* Poir. x *pratensis* L.**

A single specimen of this hybrid between two European species has been found on marshy ground at 3000 m in Bale (*Phillips* 48). It was presumably carried by migratory birds from the Baltic region where it occurs frequently. It is readily distinguished from *A. baptarrhenius* by its more robust, tufted habit (c 100 cm high), larger spikelets (5 mm) and acute glumes.

33. PHLEUM L. (1753)

Annuals or perennials; leaf-blades linear, flat. Inflorescence a cylindrical spiciform panicle, elongate or ovoid to capitate, the spikelets densely crowded on the short branches, these sometimes adnate to the axis. Spikelets strongly laterally compressed, 1-flowered, disarticulating below the floret, the rachilla not usually extended. Glumes persistent, equal, as long as the spikelet and enclosing the floret, firm, 3-nerved, often pectinate-ciliate along the keel, truncate with a stout awnlet or more gradually acute, the margins overlapping but not connate; lemma shorter than the glumes, 3–7-nerved, membranous, keeled, truncate to subacute, awnless; palea subequalling the lemma, 2-nerved; lodicules 2; stamens 3.

15 species in north temperate and cold regions, extending southwards along the American mountain chain into Chile.

The bi-horned, pectinate spikelets of *Phleum* are very characteristic, and serve to distinguish it at a glance from *Alopecurus*, which has a similar spiciform inflorescence.

A species of *Phleum* is known to occur in the Bale mountains, but no specimen is available to confirm its identity.

BROMEAE Dumort. (1824)

Annuals or perennials; leaf-sheaths usually tubular, the margins connate; leaf-blades linear; ligule membranous. Inflorescence paniculate, large and open or contracted. Spikelets all alike, several to many-flowered with the uppermost florets reduced, laterally compressed, disarticulating above the glumes and between the florets; glumes shorter than the lemmas, persistent; lemmas herbaceous to coriaceous, 5–13-nerved, rounded or keeled, usually a straight or recurved awn arising

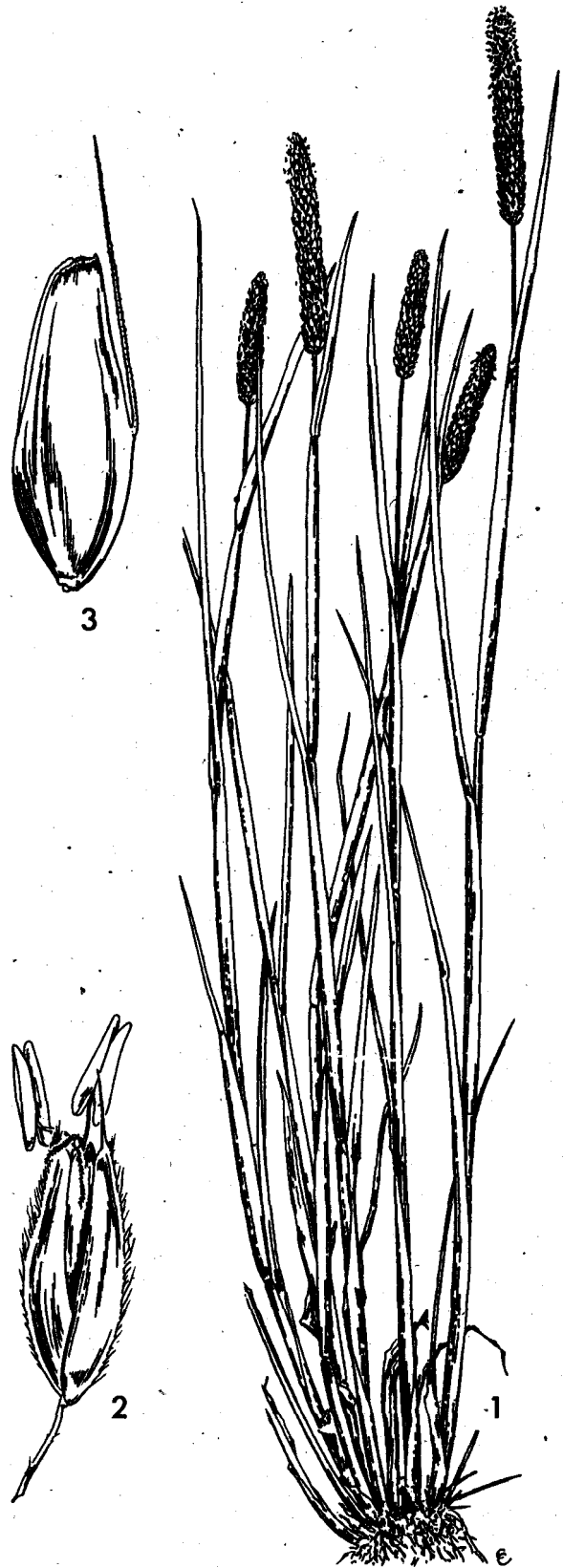


Figure 25. *ALOPECURUS BAPTARRHENIUS*: 1 - habit x 3/4; 2 - spikelet x 11; 3 - lemma x 17. All from M.G. & S.B. Gilbert 1818. Drawn by Eleanor Catherine.

just below the bidentate tip; lodicules glabrous; stamens 2-3; ovary tipped with a conspicuous hairy appendage, the 2 plumose stigmas borne laterally. Grain with a small embryo and linear hilum.

3 genera, mainly in north temperate regions.

The *Bromeae* resemble the *Poeae*, but are characterized by the distinctive hairy apical appendage on the ovary, which persists at the tip of the mature grain. The simple rounded starch grains in the endosperm are another unusual feature, linking *Bromeae* to *Triticeae*.

34. BROMUS L. (1753)

Annuals or perennials. Leaf-blades linear, flat; leaf-sheaths often hairy, tubular, soon splitting. Panicle large, effuse and nodding or contracted and erect with crowded spikelets. Spikelets large, lanceolate or wedge-shaped; glumes unequal, narrow, herbaceous, the lower 1-3-nerved, the upper 3-7-nerved; lemmas 5-11-nerved, herbaceous with scarios margins and tip, back keeled or rounded, tip often bidentate, usually with a straight or recurving subapical awn, rarely only mucous or awn-pointed; palea hyaline, ciliate with spaced hairs on the keels.

About 150 species, mainly temperate but extending to upland areas in the tropics.

The larger, long-awned species of *Festuca* are easily confused with *Bromus*, especially as the main distinguishing feature of *Bromus*, the hairy ovary appendage, is not apparent without a detailed inspection. However, *Bromus* can also be separated by its hairy tubular leaf-sheaths and ciliate palea-keels, the *Festuca* species having glabrous leaf-sheaths and smooth or scaberulous palea-keels.

1. Spikelets lanceolate, tapering towards the top; lemmas strongly laterally compressed and keeled, acuminate. **1. *B. catharticus***
- Spikelets parallel-sided or wider at the top; lemmas rounded on the back, awned. **2**
2. Perennial; palea-keels ciliate. **2. *B. leptoclados***
- Annuals. **3**
3. Panicle loose and open; lower glume 3-nerved; upper glume 5-7-nerved; anthers 3.
- 3. *B. pectinatus***
- Panicle contracted; lower glume 1-nerved; upper glume 3-nerved; anthers 2. **4. *B. madritensis***

1. *B. catharticus* Vahl (1791);
- type from South America.
B. unioloides Kunth (1815).
B. willdenowii Kunth (1829).

Laxly tufted short-lived perennial; culms erect or ascending, 20-100 cm high; leaf-sheaths glabrous or the lower shortly hairy. Panicle 5-30 cm long, loose, the branches spreading or nodding, often longer than the spikelets. Spikelets lanceolate to ovate, 2-4 cm long, very strongly compressed, smooth or scabrid, 5-12-flowered with the florets tightly imbricate; glumes

slightly-unequal, lanceolate, acuminate, sharply keeled; lower glume c 6 mm long, 3-nerved; upper glume c 8 mm long, 9-nerved; lemmas broadly lanceolate, 10-18 mm long, sharply keeled, acuminate or produced into a short mucro up to 1 mm long; anthers 3, up to 4 mm long.

A weed of irrigated cultivations; 2400 m. EW; native to South America, but occasionally cultivated for fodder or occurring as an introduced weed elsewhere. Ryding & Ermias 1141.

2. *B. leptoclados* Nees (1841);

- type: South Africa, Drège s.n. (whereabouts uncertain).

B. petitianus A. Rich. (1851) - type: Ethiopia, TU; Uoggerat [Ouodgerate], Petit s.n. (P holo., K iso.).

B. cognatus Steud. (1854) - type: Ethiopia, GD, Simen, Mt Silke, Schimper 678 (K iso.).

Tufted perennial; culms slender, 1-2 m high, erect from an ascending base or scrambling; leaf-sheaths retrorsely hispid (sometimes sparsely). Panicle large, diffuse and open, 20-30 cm long, erect or nodding, the branches filiform, widely spreading. Spikelets narrowly oblong to wedge-shaped, loosely 4-9-flowered, 2.5-4.3 cm long, green or purple-tinged; glumes finely acuminate and often shortly awned, the lower 1-nerved, linear-lanceolate, 8.5-15 mm long, the upper 3-nerved, lanceolate, 10-17 mm long; lemmas 5(-7)-nerved, narrowly elliptic-oblong, rounded on the back, 10-16 mm long, strigillose to pilose especially on the outer nerves, narrowed to an entire or emarginate tip; awn slightly shorter than the lemma body, 8-12 mm long, straight, arising at or just below the lemma tip; palea-keels ciliate, the hairs c 0.3 mm long; anthers 3, (2-)3-5 mm long. Fig. 26:4, 5.

Shady sheltered situations among rocks, woodland margins or in scrubland, often growing among *Erica* bushes; 1800-2300 m. EW GD GJ WU SU AR GG SD BA HA; throughout the African highlands. De Wilde 8700; Gillett 15038; Mooney 8309.

B. leptoclados is a variable species, exhibiting a wide range of spikelet and lemma length, anther length and lemma pubescence, but the variation appears to be continuous. A form from Mt Boraluco in the Galama Mts (AR) has large hairy lemmas with proportionally shorter awns than usual and unusually short anthers 1.8 mm long (Hedberg 4235; De Wilde 9151).

3. *B. pectinatus* Thunb. (1794);

B. adoënsis Steud. (1854) - type: Ethiopia, TU, Adua, Schimper 58 (K iso.).

Danthonia anomala Steud. (1854) - type: Ethiopia, without precise locality, Schimper s.n. (P holo.).

Annual; culms 10–85 cm high, erect, solitary or tufted; leaf-sheaths softly hairy. Panicle 10–25 cm long, loose and nodding, the branches filiform, flexuous, simple or sparsely branched. Spikelets narrowly oblong becoming wedge-shaped, 5–13-flowered, 3.2–4.7 cm long, green with the glumes sometimes purple-tinged; rhachilla-segments clavate; lower glume narrowly lanceolate, 3-nerved, 6.8–9.7 mm long, acuminate; upper glume narrowly elliptic-oblong, 5–7-nerved, 9.6–12 mm long, acute; lemmas oblong, 11–17 mm long, rounded on the back, 7-nerved, the midnerve and marginal pair prominent, scaberulous to puberulous, less often pilose, tip hyaline, acutely bidentate; awn slightly longer than the lemma body, 12–23 mm long, straight, arising 1/6–1/4 way down the lemma back; palea-keels conspicuously pectinate, the hairs 0.5 mm long; anthers 3, 0.8–1.3 mm long. Fig. 26:1–3.

Open situations, pathsides, field margins, among rocks and as an arable weed, especially in fields of barley and tef, 2000–3500 m. EW TU GD GJ WU SU KF AR GG BA; East Africa, Sudan, Egypt and Sinai; Yemen; South Africa. *Aweke & Gilbert* 794; *De Wilde* 9197; *Stewart* 85.

4. *B. madritensis* L. (1755);

- type: Spain, *Loefling* (LINN holo.).

Annual; culms erect or ascending, 10–35 cm high, glabrous below the panicle. Leaf-blades up to 20 cm long, 2–4 mm wide, glabrous or pubescent. Panicle 3–12 cm long, contracted, ± erect, the branches 1–3 cm long, usually not exceeding the spikelets, simple or the lower 2–3-spiculate. Spikelets wedge-shaped, 2.5–4(–5) cm long, 5–10-flowered; rhachilla-internodes linear; glumes narrow, the lower 1-nerved, 5–9 mm long, the upper 3-nerved, 9–15 mm long; lemmas glabrous to pubescent, 12–18 mm long, (2–)3 mm wide, bidentate; awn 12–20 mm long, straight or weakly divaricate; anthers 2, 0.5–1 mm long.

Dry grassy places and as a weed of cultivation. EW; Europe, N Africa, Arabian peninsula, Middle East eastwards to Iran and Afghanistan; widely naturalised elsewhere. *Pappi* 4898 (FT).

BRACHYPODIEAE Harz (1880)

Perennials or rarely annual; leaf-sheaths open, the margins free; leaf-blades linear; ligule membranous. Inflorescence a raceme of shortly pedicelled spikelets alternating on opposite sides of, and lying broadside on to the axis; rhachis tough. Spikelets several to many-flowered, terete or lightly laterally compressed, disarticulating between the florets. Glumes persistent, shorter than the lemmas, unequal, several-nerved; lemmas 7–9-nerved, firmly membranous to chartaceous or sometimes coriaceous at maturity, rounded on the back, awned from the entire tip; lodicules ciliate; stamens 3; ovary with a hairy apical appendage. Grain with a small embryo and linear hilum.

1 genus; mainly in temperate regions of the Old World; also in C America.

Brachypodieae occupies a rather isolated position between *Bromeae* and *Triticeae*. All three tribes are united by the possession of unusual simple rounded starch-grains in the endosperm and by the hairy ovary-appendage. *Brachypodium* differs from members of the *Bromeae* by its racemose inflorescence, entire lemma-tip with apical awn, ciliate lodicules, and also by its much smaller chromosomes. It is sometimes placed as a peripheral member of *Triticeae*, but differs by its small chromosomes and characteristics of the seed anatomy. Furthermore, it is isolated from both *Bromeae* and *Triticeae* by seedling structure and serology.

35. **BRACHYPODIUM** P. Beauv. (1812)

Tufted or rhizomatous perennials, rarely annual; leaf-blades usually flat. Inflorescence an erect or nodding loose raceme of relatively few, divergent spikelets overlapping towards the top of the culm. Spikelets elongate; glumes prominently nerved; lemmas narrow, often scaberulous or pilose, the nerves prominent in the upper half, midnerve extended at the tip into a fine straight awn; awns increasing in length slightly up the spikelet.

16 species; mainly Europe and temperate Asia; extending to mountains in Africa and in America from Mexico to Bolivia.

Brachypodium is a very uniform genus, the species differing little from one another and often intergrading. Due to the similarity of the spikelets, reliance must often be placed on vegetative characters for separating the species.

1. Annual; anthers 0.5–1 mm long; spikelets laterally compressed. 1. *B. distachyon*
- Perennials; anthers 3–5 mm long; spikelets terete or nearly so. 2
2. Awn much shorter than the lemma; plant with extensive creeping rhizomes. 3
- Awn as long as or longer than the lemma; plant tufted, not obviously rhizomatous. 4
3. Leaf-blades obviously distichous, glaucous, often inrolled, up to 10 cm long and 1–3 mm wide; rhizome much branched. 2. *B. retusum*
- Leaf-blades not obviously distichous, usually flat and flaccid, more than 10 cm long and 2–7 mm wide; rhizome sparingly branched. 3. *B. pinnatum*
4. Leaf-sheaths and culms retrorsely scabrid; culms straggling, branching at the nodes. 4. *B. flexum*
- Leaf-sheaths and culms smooth; culms compactly tufted, unbranched. 5. *B. sylvaticum*

1. *B. distachyon* (L.) P. Beauv. (1812);

Bromus distachyos L. (1759); *Trachynia distachya* (L.) Link (1827) - types from S Europe and Orient (LINN).



Figure 26. *BROMUS* spp.: *B. PECTINATUS*: 1 - habit x 3/4; 2 - lemma x 4½; 3 - palea x 4½. *B. LEPTOCLADOS*: 4 - lemma x 4½; 5 - palea x 4½. *BRACHYPODIUM FLEXUM*: 6 - habit x 3/4; 7 - spikelet x 3. 1-3 from Lythgoe & Evans 593; 4 & 5 from Edwards 11; 6 & 7 from Thulin 1606. Drawn by Eleanor Catherine.

Triticum schimperii Hochst. ex A. Rich. (1850); *Festuca schimperii* (Hochst. ex A. Rich.) Steud. (1854); *Brachypodium schimperii* (Hochst. ex A. Rich.) Schweinf. & Asch. (1867) - type: Ethiopia, TU, Adua, Mt Scholoda, *Schimper* 59 (K iso.).

Loosely tufted, bright green or somewhat glaucous annual; culms slender, stiff, 12–30 cm high, erect or geniculately ascending. Leaf-blades linear, flat, acute with firm scabrid margins, blades and sheaths pilose (sometimes sparsely). Raceme composed of up to 7 spikelets clustered together at the top of the culm, or often reduced to a single terminal spikelet. Spikelets narrowly oblong or elliptic-oblong, 2.5–5 cm long (including awns), 5–17-flowered, laterally compressed; glumes lanceolate, prominently 5–7-nerved, the lower 3–5.2 mm long, the upper 4.8–7 mm long; lemmas narrowly elliptic-oblong, 7–10 mm long, firm, smooth, scaberulous or shortly pilose, acuminate, lowest lemma often only apiculate, the rest provided with an awn 8–17 mm long; palea pectinate-ciliate on the keels above; anthers 0.5–1 mm long.

Dry upland scrubland, favouring calcareous soils; 1200–2700 m. EW TU GD SD HA; the Mediterranean, extending eastwards to C Asia and NW India; Arabian peninsula and Sudan (Red Sea hills). Introduced elsewhere. *M.G. & S.B. Gilbert* 1431; *Schimper* 316; *Pappi* 499 (FT).

The annual habit, relatively large, long-awned, laterally compressed spikelets, and especially the very small anthers render this species easily separable from the other members of the genus.

2. *B. retusum* (Pers.) P. Beauv. (1812);

Bromus retusa Pers. (1805) - type from France.

Slender perennial from much-branched, superficial rhizomes; culms 30–70 cm high, geniculately ascending, rooting at the lower nodes, smooth and glabrous. Leaf-blades usually stiffly convolute, pale green or glaucous, distichous, patent, glabrous or softly hairy; leaf-sheaths smooth and glabrous. Raceme composed of 2–5 pale green spikelets, or occasionally reduced to a single spikelet. Spikelets linear or linear-oblong, 8–15-flowered, 2.3–4.3 cm long; glumes acute, the lower 3–5-nerved, lanceolate, 3.5–6.2 mm long, the upper 7-nerved, broadly lanceolate, 5.2–9 mm long; lemmas narrowly oblong, 6.3–9.8 mm long, scaberulous especially in the upper half, or almost smooth, acutely extended into an awn 1/3–1/2(–3/4) as long as the lemma body; palea scabrid on the keels above; anthers 4–5 mm long.

Dry rocky places, especially on limestone; 2500–3300 m. TU SU HA; the Mediterranean, Yemen and upland parts of Saudi Arabia. *Gillett* 5302; *Pavlov & Petelin* 90 (ETH).

The pale green colour of this grass, coupled with the short-awned spikelets, gives it a different facies from that of *B. flexum*, from which it can also be distinguished by its perfectly smooth culms and leaf-sheaths.

3. *B. pinnatum* (L.) P. Beauv. (1812);

Bromus pinnatus L. (1753) - type from Europe.

Slender perennial with sparingly branched rhizomes; culms 30–100 cm high, smooth, the nodes pubescent. Leaf-blades flat or lightly rolled, flaccid, 10–40 cm long, 2–7 mm wide, smooth or scabrid, sometimes thinly pilose. Raceme 5–20 cm long, ± erect with up to c 20 spikelets. Spikelets terete, 7–20-flowered, 1.5–4 cm long; glumes sharply acute to mucronate, the lower 3–5-nerved, lanceolate, 3–6 mm long, the upper 9-nerved, broadly lanceolate, 5–8 mm long; lemmas lanceolate-oblong, 6–10 mm long, scaberulous; awn 1–7 mm long; palea scabrid on the keels above; anthers 3.5–5.5 mm long.

Grassy hillsides, favouring calcareous soils; 2700–3000 m. EW; Eurasia, Middle East; also in Sri Lanka. *Pappi* 1159, 2886 (both FT).

4. *B. flexum* Nees (1841);

Triticum flexum (Nees) A. Rich. (1850); *Festuca flexa* (Nees) Steud. (1854) - types from South Africa.

B. flexum var. *abyssinicum* Hochst. in sched., *Schimper Iter. Abyss.* 2, (1842) & Hochst. ex A. Rich., *Tent. Fl. Abyss.* 2: 441 (1850); *Festuca diaphana* Steud. (1854), nom. superfl. [*T. flexum* in syn.]; *B. sylvaticum* P. Beauv. var. *abyssinicum* (Hochst.) Chiov. in *Ann. Ist. Bot. Roma* 8: 379 (1908); *Brachypodium diaphanum* (Steud.) Cuf. (1968) - type: Ethiopia, GD, Semien, Mt Silke, *Schimper* 674 (K iso.).

Festuca quartiniana A. Rich. (1850) - type: Ethiopia, TU, Shire [Chiré], Maigouagoua, *Quartin Dillon & Petit* (P hol.).

B. sylvaticum P. Beauv. var. *pseudopinnatum* Chiov. in *Ann. Ist. Bot. Roma* 8: 379 (1908) - types: Eritrea, EW, Ocule Cusai, Mt Saiac-Arà, *Pappi* 1997 & Mt Metaten, *Pappi* 1573, 1593 & Mt Mahot, *Pappi* 1239 (all FT hol.).

Diffuse tufted perennial; culms slender, weak and straggling, 90–150 cm long, branching at the nodes, usually scaberulous. Leaf-blades flat, 5–17 cm long, 2–6 mm wide, thin, scabrid below, scattered-pilose above; leaf-sheaths strongly retrorsely scabrid. Raceme 6–15 cm long with 4–10 green spikelets, ± pendulous. Spikelets 6–12-flowered, terete or opening to become linear-oblong, 2.5–4 cm long (including awns); glumes lanceolate, acute, the lower 4.2–6.5 mm long, 7-nerved, the upper 6.3–8.8 mm long, 9–11-nerved, often mucronate; lemmas narrowly oblong, 8.8–10.8 mm long, pubescent especially in the upper half and near the margins, acute; awn 7–11 mm long; palea scabrid on the keels above; anthers 3–3.8 mm long. Fig. 26:6, 7.

Margins of clearings in upland forest, bamboo thicket and sometimes upland ericaceous bushland, often scrambling through shrubs; 2300–3000 m. EW GD SU AR BA HA; Sudan and southwards to South Africa

and Madagascar. *De Wilde* 9489; *Friis et al.* 1237; *Thulin* 1606.

B. flexum largely replaces the widespread Old World species *B. sylvaticum* in tropical Africa. The spikelets of the two species are virtually identical and they are separated on rather small vegetative differences. The easiest distinguishing character is the retrorsely scabrid leaf-sheaths and culms of *B. flexum*, whereas those of *B. sylvaticum* are smooth. Typical specimens of *B. flexum* do feel very rough to the touch, but sometimes the sheaths are merely scaberulous and the difference is not so obvious. Typical *B. flexum* also has a rather different habit, the long wiry culms often straggling through vegetation and frequently branching at the nodes, whereas *B. sylvaticum* is more compactly tufted with unbranched culms. The type specimen of *Festuca quartiniana* and also *Schimper* 1785 (from Urahit) both have the straggling habit of *B. flexum*, but smooth leaf-sheaths and culms as in *B. sylvaticum*.

5. *B. sylvaticum* (Huds.) P. Beauv. (1812);

Festuca sylvatica Huds. (1762) - type from England.

Tufted perennial without rhizomes; culms erect or ascending, 50–100 cm high, smooth, the nodes pubescent. Leaf-blades flaccid, drooping, 10–35 cm long, 6–12 mm wide, scabrous, loosely pilose; leaf-sheaths smooth, usually loosely hairy. Raceme up to 20 cm long, suberect or pendulous, with 6–12 spikelets. Spikelets 8–16-flowered, terete, 1.5–4 cm long, narrowly oblong or lanceolate; glumes lanceolate, acute, the lower 6–9 mm long, 5–7-nerved, the upper 8–11 mm long, 7–9-nerved; lemmas lanceolate, 7–11 mm long, shortly pubescent or infrequently glabrous or scabrous, acuminate; awn 7–14 mm long; anthers 3.5–5 mm long.

Shady places; EW; Europe, temperate Asia and the mountains of tropical Asia; Saudi Arabia. *Baldrati* 481 (FT).

See note under 4. *B. flexum*.

TRITICEAE Dumort. (1824)

Körnigke & Werner, *Handbuch des Getreidebaues*. Berlin (1885); Schiemann, E. *Weizen, Roggen, Gerste*. Jena (1948); Bowden, W.M. *Can. J. Bot.* 37: 657–684 (1959); Löve, A. *Feddes Rep.* 95: 425–521 (1984); Baum et al. *Amer. J. Bot.* 74: 1388–1395 (1987).

Annuals or perennials; leaf-blades linear, often auriculate; ligule membranous. Inflorescence spicate, bilateral, the spikelets single or in clusters of 2–3 in 2 opposite rows, broadside to the rachis. Spikelets 1–many-flowered, laterally compressed (or dorsally if 1-flowered), all alike and sessile, or the 2 laterals of a cluster shortly pedicelled, reduced and male or barren; disarticulating between the florets if rachis tough, sometimes rachis fragile and the spikelet falling with the internode below, rachis, and rachilla tough in cultivated cereals; glumes persistent, usually coriaceous, shorter or narrower than the lemma, sometimes awn-

like; lemmas mostly coriaceous, 5–11-nerved, awnless or with a straight or recurving awn from the tip; lodicules ciliate; ovary with a hairy apical appendage. Grain with a small embryo and linear hilum.

About 18 genera in temperate regions, mainly in the northern hemisphere; a number of annual genera are centred on the Mediterranean region. The tribe includes the major temperate cereals, some of which are cultivated in the Ethiopian highlands, and also a number of widespread weeds of cultivation.

The tribe is generally easy to recognize by its bilateral spicate inflorescence and coriaceous spikelet texture; the ciliate lodicules and hairy ovary-top are good supporting characters. The endosperm of the grain contains unusual, simple, rounded, starch grains like those of the *Bromeae*, suggesting a close relationship between these 2 tribes.

Secale cereale L. (rye) is cultivated as a minor cereal in the East African highlands. There is an old literature record from Ethiopia [Schweinf., *Beitr. Fl. Aeth.*: 302 (1867)], and it has been tried experimentally in recent times in Arsi, but is not in general cultivation in Ethiopia. The seeds have occasionally been confused with those of some primitive wheats.

The hybrid cereal *Triticale*, derived from crossing *Triticum* with *Secale*, has proved promising when grown experimentally in Ethiopia [Fröman & Persson, *Ill. Guide Grasses Eth.*: 134 (1974)]. It is now grown locally in GG (Chencha), where farmers have found it to be suitable for the local acidic soil conditions.

1. Spikelets in triads, 1-flowered (cultivated cereal).
36. *Hordeum*
- Spikelets borne singly, 2- to several-flowered. 2
2. Inflorescence loose, of spaced spikelets (wild).
37. *Elymus*
- Inflorescence compactly spiciform (cultivated cereals). 3
3. Glumes subulate, 1-nerved; spikelets 2-flowered; lemmas pectinate-spinulose on the keel, tapering to an awn. *Secale* (see note above)
- Glumes ovate to oblong, 5–11-nerved; spikelets 3–9-flowered; lemmas not pectinate, truncate-dentate, awned or not. 38. *Triticum*

36. *HORDEUM* L. (1753)

Von Bothmer et al. *Systematic and Ecogeographic Studies in Crop Genepools* 7. *Hordeum*. IPBGR, Rome (1991); Jacobsen & Von Bothmer. *Hereditas* 116: 25–28 (1992).

Annual or perennial. Inflorescence linear to oblong, densely spiciform, the spikelets in alternating triads of one central sessile bisexual spikelet and 2 male or barren pedicellate laterals (laterals sometimes also fertile

in cultivated species); rhachis fragile, the triad deciduous with the rhachis segment below (tough in cultivated species). Spikelets 1-flowered, the central at least with a rhachilla extension; glumes lanceolate to subulate or awn-like, placed abaxially side by side; lemma rounded on the back, glabrous or hairy, acuminate into a long awn. Lateral spikelets usually smaller, often reduced to a group of 3 awns.

About 32 species in temperate regions; the genus includes several widespread weedy annuals, but none have been recorded to date from Ethiopia.

The temperate cereal barley has been cultivated in the Ethiopian highlands since ancient times at altitudes above 1000 m, and is used both for food and for the production of various beverages. There are many forms of cultivated barley, usually grouped nowadays under the single species *H. vulgare* s. lat.

H. vulgare L. (1753)

H. distichon L. (1753).

H. deficiens Steud. ex A. Braun (1848) & Steud. (1854); *H. vulgare* L. subsp. *deficiens* (Steud. ex A. Braun) A. Löve in *Feddes Rep.* 95: 435 (1984) - type: Ethiopia, TU, cultivated near Adoa, *Schimper* 589 (K iso.).

Cultivated barley may be either 2-rowed with only the central spikelet of the triad fertile as in wild forms (*H. distichon*, *H. deficiens*); 4-rowed in which the central spikelet is sterile and the laterals fertile; or 6-rowed where all 3 spikelets of a triad produce a grain. Irregular-rowed forms may also arise where 2-rowed and 6-rowed forms are grown together. Other variables include degree of exposure of the grain (hulled or naked) and grain colour.

Ethiopia is a centre of diversity for barley, with a multiplicity of land races, including many endemic forms. These are discussed in detail by Zemedu Asfaw [*The barley of Ethiopia: A Focus on the Intraspecific Taxa. Acta Univ. Ups. Summaries Upps. Dissert. Fac. Sci.* 226 (1989)].

37. *ELYMUS* L. (1753)

Anthosachne Steud. (1854)

Tufted or rarely rhizomatous perennials; leaf-blades flat or convolute. Inflorescence a dense or occasionally loose spike, the spikelets usually sessile, solitary or 2-3 at each node of the tough rhachis (fragile in *E. farctus*). Spikelets laterally compressed, 3-9-flowered, disarticulating above the glumes and between the florets or falling entire at maturity; glumes subequal or unequal, opposite or side by side, shorter than the lemmas, narrowly oblong to lanceolate, firmly membranous to coriaceous, prominently 3-9-nerved, obtuse to shortly awned; lemmas lanceolate, coriaceous, 5-nerved, dorsally rounded or keeled upwards, obtuse, acute or bidentate, awned or not.

About 150 species in temperate regions of both hemispheres, especially in Asia.

A literature record for *Elymus farctus* (Viv.) Melderis (syn. *Agropyron junceum* (L.) P. Beauv.), a species of maritime sands in Europe, the Mediterranean and SW Asia, has not been confirmed. (Dur. & Schinz, *Consp. Fl. Afr.* 5: 935 (1895)).

1. Rhachis tough, scabrid on the angles. *E. africanus* - Rhachis fragile, disarticulating at maturity just above each spikelet, smooth on the angles.
E. farctus (see note above)

E. africanus A. Löve (1984); nom. nov.

Triticum elymoides Hochst. ex A. Rich. (1850) non Hornem. (1813) & non *Elymus elymoides* Swezey (1891); *Anthosachne elymoides* (Hochst. ex A. Rich.) Nevski (1934); *Agropyron elymoides* (Hochst. ex A. Rich.) Candargy (1901) - type: Ethiopia, TU, Urahit, *Schimper* 1764 (P holo., K iso.).

Tufted perennial; culms slender, 60-90 cm high. Leaf-blades narrowly linear, 2.5 mm wide, glabrous, scaberulous on the upper surface, acute; ligule truncate, c 1 mm long. Spike 13 cm long, slender, flexuous, loose, the spikelets inserted singly about their own length apart on a brief pubescent pedicel; rhachis tough, scabrid on the angles. Spikelets loosely 5-6-flowered, readily disarticulating above the glumes and between the florets, rhachilla segments pubescent; glumes subequal, side by side, 9.5-12.5 mm long (slightly shorter than lowest floret), oblong; prominently 7-nerved, dorsally flattened, obtuse and apiculate; lemmas narrowly lanceolate-oblong, 9-10.5 mm long, lightly keeled, strigillose, 5-nerved, the 3 inner nerves extending into the flattened awn-base, obtuse; callus 0.5 mm long, rounded, shortly bearded; awn 2.5-3 cm long, stout, strongly recurving; palea exceeding the lemma body; anthers 3.2 mm long. Fig. 27.

TU; endemic to Ethiopia.

E. africanus is known only from the type specimen. It is related to *E. longiaristatus* (Boiss.) Tzvelev, a species found from Turkey to Pakistan and the Himalayas, but this has unequal, shorter, 3-5-nerved, opposite glumes and a shorter palea ± equalling the lemma body.

38. *TRITICUM* L. (1753)

Percival, J. *The Wheat Plant*. London (1921); Vavilov, N.I. (Ed.) *The wheats of Abyssinia, and their place in the general system of wheats. Bull. Appl. Bot., Suppl.* 51 (in Russian) (1931); Flaksberger et al. *Key to the True Cereals. People's Comm. Agric. USSR. Lenin Mem. All-Union Acad. Sci., Inst. Plant Culture*, 416 pp. (in Russian) (1939); Mac Key, *Hereditas*, Suppl. 2: 237-276 (1966).

Annuals. Inflorescence linear, a dense distichous spike with the spikelets borne singly, rhachis fragile, or tough or only tardily fragile in cultivated species. Spikelets 2-

9-flowered with the uppermost florets sterile (rarely only 1 floret fertile); glumes subequal, oblong to ovate, usually chartaceous to coriaceous, 5–11-nerved, 1–2-keeled, obtusely truncate to bidentate, the lateral nerves diverging into the teeth, mucronate or awned; lemmas coriaceous, the back gibbous, keeled towards the tip, sometimes awned.

10–20 species from the eastern Mediterranean to Iran; more than half the species cultivated.

Triticum (wheat) is the principal cereal of temperate regions, providing the staple food for millions of people. It arose in prehistoric times in the Middle East from wild diploid wheat, and is now grown worldwide in temperate regions and in cool uplands in the tropics. The various types of cultivated wheat have evolved from the ancestral form by hybridisation and polyploidy to form a series of diploids, tetraploids and hexaploids. The diploids ($2n=14$) have one *Triticum* genome; the tetraploids ($2n=28$) have this genome and another probably derived from *Aegilops speltoides* Tausch; the hexaploids ($2n=42$) acquired a further genome from *Aegilops tauschii* Cosson. Within each level selection has proceeded from wild species to primitive cultivated hulled species (grain enclosed by lemma and palea), and then to more advanced free-threshing naked species (grain exposed). There are no naked diploids or wild hexaploids.

The classification of wheats has been the subject of much debate for over a century, and there is still no consensus of opinion as to the best system of nomenclature. Some authors (e.g. Bowden, 1959; Mac Key, 1966) take the view that cultivated forms with the same genome should be regarded as a single species, hence each ploidy level is represented by only one species as follows: *T. monococcum* (diploid); *T. turgidum* (tetraploid); *T. aestivum* (hexaploid). The different types of wheat are then relegated to subspecific rank or treated as cultivars. A more extreme view is followed by Löve (1984), who assigns each ploidy level to a separate genus: *Crithodium* Link (diploid); *Gigachilon* Seidl (tetraploid); *Triticum* (hexaploid). Other authors still prefer to uphold the traditional species for the time being, until a stable system has been worked out, and that view is followed here.

Modern agriculture is based almost exclusively on *Triticum aestivum* (bread wheat) and *T. durum* (macaroni wheat), which have replaced the other cultivated species in most areas. However, these other species still persist in less developed areas where there is a tradition for their cultivation. The species enumerated here are recorded as being cultivated in the past in Ethiopia [Cufodontis, *Enum.*: 1220 (1968)], and it is likely that the cultivation of some at least persists in more remote parts of the country.

Ethiopia is a centre of diversity for the tetraploid wheats, and numerous forms have been accorded taxonomic status by Vavilov (1931). Only a small selection



Figure 27. *ELYMUS AFRICANUS*: 1 - inflorescence x 1; 2 - spikelet x 5; 3 - floret x 6. All from Schimper 1764. Drawn by Eleanor Catherine.

of these have been recorded in the synonymy here, accounting for old names first published elsewhere.

1. Glumes 2.5–3 cm long, equalling or longer than and concealing the lemmas, membranous or herbaceous. **1. T. polonicum**
- Glumes 1.5 cm long or less, not concealing the lemmas, firmly chartaceous to coriaceous. **2**
2. Rhachis fragile, disarticulating at maturity (sometimes only under pressure); hulled wheats, the grain tightly enclosed by lemma and palea, not easily separable on threshing. **3**
- Rhachis tough, not disarticulating at maturity, naked wheats, the grain easily separable from lemma and palea on threshing. **5**
3. Spikelets 2-flowered, 1-grained; glumes 2-keeled. **2. T. monococcum**
- Spikelets usually 3–5-flowered, 2-grained. **4**
4. Rhachis disarticulating above the spikelet; spikelet falling with the rhachis segment below; glumes 1-keeled. **3. T. dicoccon**
- Rhachis disarticulating below the spikelet; spikelet falling with the rhachis segment above. **7. T. spelta**
5. Glumes keeled in the upper half only; endosperm mealy. **8. T. aestivum**
- Glumes strongly keeled throughout. **6**
6. Spikes dorsally compressed or almost square in section; glume-keel slenderly acute to awned at the tip; endosperm flinty. **4. T. aethiopicum**
- Spikes laterally compressed or square in section; glume-keel acutely toothed at the tip, not extended into an awn. **7**
7. Spike stout, nearly square in section; glumes 2/3 length of lowest floret; endosperm mealy. **5. T. turgidum**
- Spike slender, laterally compressed; glumes subequalling lowest floret; endosperm flinty. **6. T. durum**

1. T. polonicum L. (1762)

“Polish wheat”

T. polonicum var. *abessinicum* Körn. in Körn. & Werner: 103 (1885) - type: Ethiopia, TU, Adoa, Schimper (B holo.).

T. abyssinicum Steud. (1854); *T. polonicum* subsp. *abyssinicum* (Steud.) Vav.: 159 (1931) - type: cultivated in Abyssinia Schimper s.n. (P holo.).

Culms thick-walled, solid. Spikes 7–16 cm long, square or oblong in section; rhachis tough, thinly hairy at the nodes. Spikelets 2.5–3 cm long, 4–5-flowered; glumes as long as the spikelet, lanceolate, membranous, with a prominent veined keel, hairy or almost glabrous; lemma awned or not. Grain with a flinty endosperm. Tetraploid (2n=28). Vern. name “Fellasito” (Tigrinia).

A minor crop in SW Europe (Spain, Italy), Algeria, Iraq, Iran, Afghanistan, Pakistan, Argentina and a few other scattered localities. The flour is suitable for macaroni, but not for bread.

Körnigke based his variety on a Schimper collection with very dense spikes; glabrous glumes 2.5–2.8 cm long tipped with an awn-point up to 18 mm long; and a white, somewhat short and broad grain 7 mm long (unripe).

2. T. monococcum L. (1753)

“Einkorn wheat; Small spelt”

Culms tufted, rarely solitary, slender, solid or thick-walled, nodes retrorsely pubescent. Spikes 3–4 cm long, laterally compressed; rhachis disarticulating only under pressure at maturity, subglabrous. Spikelets 2–3-flowered, usually only the lowest fertile; glumes 6–9 mm long with 2 dentate keels, one prominent; fertile lemma with an awn up to 8 cm long; palea splitting to base at maturity. Diploid (2n=14).

A minor crop in SE Europe (Balkans, Romania), Middle East and N Africa.

GD (Simien). *Scott* 246. Vern. name “Aija” (but see also *T. dicoccon*).

One of the oldest wheats, cultivated since neolithic times in Europe, but not in the archeological record for Africa.

3. T. dicoccon Schrank (1789);

Vavilov, *The Wheats of Abyssinia*: 164 (1931).

“Emmer wheat”

T. farrum Bayle-Bar. (1809).

T. arras Hochst. (1848); *T. dicoccon* var. *ajar* Percival: 193 (1921) - type: Ethiopia, without precise locality, Schimper 953 (Percival: “grain pale red, endosperm flinty”).

Culms solid or thick-walled. Spikes 3–10 cm long, laterally compressed; rhachis glabrous or shortly ciliate at the nodes, fragile, disarticulating above the spikelet insertion, spikelet falling attached to the internode below. Spikelets 3(–4)-flowered; glumes 7–10 mm long, coriaceous with a single prominent keel; lemma usually with an awn up to 15 cm long. Tetraploid (2n=28). Vern. name “Ajar or Agga” (Amharic); “Arras” (Tigrinia).

A minor crop still cultivated locally in SE Europe and in scattered localities eastwards to Iran and S Russia; also in Arabia and N Africa.

An ancient wheat, remains of which have been found in prehistoric excavations in Europe, Asia Minor and in Egyptian tombs. It can withstand poor, water-logged soils.

4. T. aethiopicum Jakubz. (1947);

in *Selekts. i Semen*. 5: 46 (1947) & 1st Int. Wheat Genetics Symposium, Winnipeg, Manitoba (1958), as “*aethiopicum*”, nom. nov.; *T. durum* L. subsp. *abyssinicum* Vav.: 26 (1931) & Schiemann (1948); *T. abyssinicum* (Vav.) Flaksb., Key to the True Cereals, 4th Ed.: 92 (1939) non *T. abyssinicum* Steud. (1854); *Gigachilon aethiopicum* (Jakubz.) A. Löve (1984).

T. diversiflorum Steud. (1854) - types: 4 different forms cultivated in Ethiopia, *Schimper* s.n. (3 specimens) & *Schimper* 1967 (all P syn.).

T. recognitum Steud. (1854); Vavilov, *The wheats of Abyssinia*: 62 (1931); *T. compactum* Host var. *recognitum* (Steud.) Körn. in Körn. & Werner, *Handb. d. Getr.* 1: 55 (1885) - types: Ethiopia, TU, Adoa, *Schimper* 607 & without precise locality, *Schimper* 1968 (both P syn.; K isosyn.). "Qualai, Chochen artgi, Acho Mai" (Tigrinia); "Gorisch" (Amharic). Grain red.

T. compactum Host var. *compressum* Körn., l.c.: 55 (1885) - type: Ethiopia, Dawoski, *Schimper* (B holo.). Grain red.

T. compactum Host var. *copticum* Körn., l.c.: 55 (1885) - type: Ethiopia, without precise locality, *Schimper* (B holo.). Grain white.

T. durum L. var. *arraseita* Hochst. ex Körn. in Körn. & Werner, *Handb. d. Getr.* 1: 70 (1885); *T. dicoccum* L. var. *arraseita* (Hochst. ex Körn.) Percival, *The Wheat Plant*: 195 (1921) - type: Hochstetter's plants were grown from a sample of violet coloured grains sent from Ethiopia by *Schimper* (whereabouts unknown). "Tukur Sinde" "Arraseita".

T. durum var. *schimperi* Körn., l.c.: 71 (1885); *T. dicoccum* L. var. *schimperi* (Körn.) Percival, l.c.: 196 (1921) - type: seed from this violet-grained variety sent by *Schimper* to Berlin, mixed with those of var. *arraseita*.

T. dicoccum L. var. *uncinatum* Percival, l.c.: 194 (1921). "Nach Sinde". Grain red, flinty.

T. dicoccum L. var. *pseudo-uncinatum* Percival, l.c.: 195 (1921). Grain red, flinty.

T. dicoccum L. var. *tomentosum* Percival, l.c.: 195 (1921). Grain white or amber, flinty.

T. dicoccum L. var. *rufescens* Percival, l.c.: 196 (1921). Grain red, flinty.

T. durum L. *acutodenticulatum* Flaksb. (1929).

T. turgidum L. subsp. *abyssinicum* Vav. (1931).

T. turgidum L. group *aethiopicum* Bowden (1959).

Culms short; spikes loose to very dense, rhachis tough; glumes clearly keeled and winged with a narrowly acute or awned keel-tooth; lemmas with slender delicate awns; grains usually violet. Tetraploid ($2n=28$).

A group of very variable, early ripening, free-threshing emmer wheats, endemic to the Ethiopian highlands. They are morphologically very similar to *T. aestivum*, and according to Schiemann (1948) are the main wheats in Ethiopia, being cultivated up to 3000 m.

These wheats have had a chequered nomenclatural history, having been assigned, under many varietal names, to either *T. dicoccon*, *T. durum*, *T. turgidum* or *T. pyramidale* (sometimes regarded in earlier literature as distinct from *T. durum*), before being recognized as a species in their own right. The races listed above in the synonymy, to which formal varietal names have been given, are based on differences in the colour of the

glumes, awns and grains. These names are a small selection of the named varieties of this Ethiopian wheat; very many more are given in Vavilov (1931). All Percival's varieties are based on plants grown at Reading from Ethiopian seed; his vouchers are now at Kew (K).

Vavilov (1931) splits them between *T. durum* subsp. *abyssinicum* and *T. turgidum* subsp. *abyssinicum*. Mac Key (1966) regards them as a morphological group with some common characteristics, superimposed on either a *T. durum* or a *T. turgidum* genotype. He includes them, together with *T. durum* sensu strictu, in *T. turgidum* sensu lato, and does not regard the Ethiopian wheats as even meriting subspecific rank. In complete contrast, they are maintained at specific level by Löve (1984).

5. *T. turgidum* L. (1753)

"Rivet wheat; Cone wheat; Pollard wheat"

Culms thick-walled, \pm solid. Spikes 7–12 cm long, densely cylindrical, sometimes compound below and then ovate; rhachis tough, nodes and margins densely ciliate with hairs 1–2 mm long. Spikelets 5–7-flowered, 2–5 fertile; glumes 8–10 mm long, coriaceous, broadly ovate, glabrous to villous with a prominent, 1-nerved keel terminating in an acute, curved apical tooth; lemma with an awn 8–16 cm long. Grain with a mealy endosperm. Tetraploid ($2n=28$).

Cultivated locally in much of Europe but concentrated in the south; also Turkey eastwards to Pakistan and C Asia and elsewhere.

6. *T. durum* Desf. (1798)

"Macaroni wheat; Durum wheat"

T. pyramidale Percival, *The Wheat Plant*: 262 (1921).

Culms solid or thick-walled. Spike 4–11 cm long, laterally compressed; rhachis tough, nodes and margins ciliate. Spikelets 4–7-flowered, longer than broad; glumes 8–12 mm long, coriaceous, sometimes pubescent near the tip, 2-keeled with one keel prominent, nerved, ciliate-scabrid, and crested, terminating in a tooth, the second keel weaker; lemma with a very long stout awn up to 20 cm long. Grain very hard, the endosperm flinty.

Widely cultivated in the Mediterranean region, Middle East and elsewhere, mainly for pasta products such as macaroni and spaghetti, and also for semolina and porridge.

The naked tetraploid wheats are sometimes considered conspecific, with *T. durum* reduced to a subspecies of *T. turgidum*. *T. pyramidale*, based on Egyptian plants, is placed with the Ethiopian wheats (*T. aethiopicum*) by Schiemann (1948, p. 41).

7. *T. spelta* L. (1753)

"Spelt wheat; Dinkel wheat"

Culms thin-walled, hollow. Spike 10–15 cm long, slender, lax, laterally compressed, with 1–4 vestigial basal spikelets; rhachis glabrous to sparsely ciliate at the

nodes, fragile, disarticulating below the spikelet insertion, spikelet falling with the internode lying alongside. Spikelets (2-)3-5-flowered; glumes 7-10 mm, truncate, 2-keeled with one keel prominent, nerved and dentate, the second keel weaker; lemma with a stout divergent awn up to 10 cm. Hexaploid ($2n=42$).

Cultivated in C and NW Europe, mainly in hill country.

8. *T. aestivum* L. (1753)

"Bread wheat; Common wheat"

Culms thin-walled, hollow (rarely partly pithy). Spike 4-18 cm long, lax to dense, square in section; rachis tough, glabrous. Spikelets 3-6(-9)-flowered, as wide as long or wider; glumes c 10 mm long, coriaceous, glabrous or pubescent, sharply keeled in the upper half, indistinctly so below, truncate, keel acutely crested at the tip or extended into a short awn up to 1 cm long; lemma awnless, or with an awn up to 16 cm long. Grain with a mealy or flinty endosperm. Hexaploid ($2n=42$).

T. aestivum is the most widespread wheat, extensively grown throughout the world in temperate climates. Intensive breeding work has led to the development of many modern cultivars.

CENTOTHECEAE Ridley (1907)

Annuals or perennials; leaf-blades broad, flat, cross-nerved, sometimes falsely petiolate; ligule a scarious rim. Inflorescence a panicle or composed of racemes. Spikelets 1-many-flowered with the upper florets reduced, laterally compressed, disarticulating below each floret or falling entire; glumes persistent, shorter than the lemmas, herbaceous, 3-7-nerved; lemmas similar to the glumes, 5-9-nerved, awnless or shortly awned from the tip; palea 2-nerved; stamens 2-3. Grain ellipsoid or trigonous, with an embryo 1/4-1/3 its length and an oval hilum.

10 genera; throughout the tropics, in forests.

39. MEGASTACHYA P. Beauv. (1812)

Annual; leaf-blades narrowly lanceolate, amplexicaul. Inflorescence a panicle or the primary branches reduced to racemes. Spikelets several-flowered, disarticulating below each floret at maturity; lemmas 5-7-nerved, glabrous, mucronate; stamens 3.

1 species in Africa and Madagascar.

M. mucronata (Poir) P. Beauv. (1812);

Poa mucronata Poir. (1804); *Centotheca mucronata* (Poir.) Kuntze (1891) - type: ? Africa, specimen in Herb. Jussieu s.n. (P holo.).

Tufted annual; culms 40-90 cm high. Leaf-blades 10-15 cm long, 1-2 cm wide, glabrous, scaberulous, cross-nerved, acuminate; ligule 0.5 mm long. Panicle oblong, 15-20 cm long, the branches at first ascending, later spreading, the spikelets borne on slender pedicels.

Spikelets narrowly oblong, 8-10-flowered, 7-14 mm long (sometimes shorter and only 2-3-flowered in poorly developed panicles); glumes 1.5-2 mm long; lemmas broadly elliptic, 2-2.5 mm long, with broad hyaline margins, obtuse or emarginate with a mucro up to 0.3 mm long; palea ciliolate on the keels.

Lowland forest; throughout tropical Africa southwards to Natal, and in Madagascar.

Not yet recorded from Ethiopia, but expected in the western forests.

ARUNDINEAE Dumort. (1824)

Danthonieae Zotov (1963)

Tussocky perennials, or infrequently annuals or tall reeds. Leaf-blades linear or often inrolled, filiform to setaceous; ligule ciliate (membranous in *Arundo*). Inflorescence an open or contracted panicle, rarely reduced to a few-spiculate raceme. Spikelets usually several-flowered, bisexual with the uppermost florets reduced (lowermost floret male or barren in *Phragmites*), sometimes strictly 2-flowered or rarely 1-flowered, laterally compressed, disarticulating between the florets; floret callus truncate to pungent, usually bearded, sometimes with long, silky or woolly hairs; glumes 1 to many-nerved, hyaline to chartaceous, sometimes glistening, shorter than or as long as the spikelet, persistent; lemmas 3- to many-nerved, membranous to coriaceous, rounded on the back, often pilose, entire or 2-lobed, awnless or awned from the tip or sinus, the lobes sometimes also mucronate; awn straight or geniculate with a twisted column; palea usually \pm equalling the lemma; stamens 2-3. Grain with a medium-sized embryo and linear hilum.

40 genera; cosmopolitan, but best developed in the southern hemisphere.

The tribe *Arundineae* is a rather heterogenous assemblage of loosely related genera, held together mainly on anatomical and embryo characters. The diffuse chlorenchyma, slender microhairs and arundinoid embryo are the chief distinguishing features.

1. Robust reeds with stout leafy culms 2-8 m high; panicle large, plumose. 2
- Slender annuals or perennials to 1.5 m high. 3
2. Spikelet-hairs arising from the floret callus; ligule ciliate. 40. *Phragmites*
- Spikelet-hairs arising from the lemma back; ligule membranous. 41. *Arundo*
3. Spikelets in dense globose clusters, spaced or confluent along an elongate axis; erect annual. 42. *Elytrophorus*
- Spikelets in loose or contracted panicles or a raceme. 4
4. Lemmas 3-nerved, awnless or with a fine, straight awn. 5
- Lemmas 7-9-nerved, awned from the bifid tip; awn geniculate with a twisted column (*Schismus* awnless). 7

5. Lemmas glabrous, acute; culm-bases swollen, club-shaped; basal leaf-blades deciduous. 43. *Molinia*
 - Lemmas hairy, mucronate to awned. 6
6. Spikelet 1-flowered; callus with woolly hairs surrounding the lower half of the lemma; awn 1–1.7 mm long. 44. *Leptagrostis*
 - Spikelet 2–7-flowered; callus shortly bearded, the hairs not surrounding the lemma; awn 3–14 mm long. 45. *Crinipes*
7. Lemma pilose on the back or flanks, the hairs not tufted. 8
 - Lemma with marginal tufts of hairs or a transverse fringe below the apical lobes. 9
8. Lemma awnless; glumes deciduous with the spikelet. 46. *Schismus*
 - Lemma with a geniculate awn; glumes persistent on the panicle branches. 47. *Pentaschistis*
9. Lemmas with a transverse line of tufted hairs across the base of the apical lobes; panicle many-spiculate, contracted; tough glaucous perennials with pungent leaf-blades. 48. *Centropodia*
 - Lemmas with 1–3 tufts of hairs along the margins; panicle few-spiculate, often simply racemose. 10
10. Glumes shorter than the lowest lemma; trailing, stoloniferous perennial; leaf-blades short, the sheaths imbricate. 49. *Phaenanthoecium*
 - Glumes longer than the lowest lemma, often exceeding the florets; tufted perennials with erect culms; leaf-blades mainly basal, filiform. 50. *Rytidosperma*

40. **PHRAGMITES** *Adans.* (1763)

Clayton in *Kew Bull.* 21: 113–117 (1967) & in *Taxon* 17: 168–169 (1968).

Tall perennial reeds with robust, erect, leafy culms from a branching rhizome. Leaf-blades cauline, broadly linear, flat, rounded at the junction with the sheath, deciduous; ligule ciliate. Panicle large, plumose, copiously branched with numerous, crowded, silky-hairy spikelets. Spikelets several-flowered; the florets loose and enveloped by abundant long silky spreading hairs from each linear floret callus, lowermost floret male or barren, succeeding florets bisexual, disarticulating below each fertile floret, lowermost floret persistent; glumes shorter than the lemmas, unequal with the upper glume longer than the lower, 3–5-nerved, membranous; sterile lemma similar to, but longer than the glumes; fertile lemmas 1–3-nerved, hyaline, glabrous, very narrow and long-caudate; palea short, hyaline; stamens 2 in the sterile floret, 3 in the fertile florets.

3–4 species; a cosmopolitan genus of tall aquatic or semi-aquatic reeds.

The species of *Phragmites* are extremely closely related, being separated only by minor vegetative and spikelet differences which are far from clear cut. *P. australis* has a generally temperate distribution, whereas *P.*

karka is confined to the Old World tropics. Where their distributions overlap, as is the case in Ethiopia, identification becomes very difficult. It is often necessary to be content with an approximation to the species with which the specimen shows the greatest similarity.

The scabridity on the underside of the leaf-blades, a frequently used key character in *Phragmites*, is not easily seen except under high magnification, when it appears as strings of tiny beads along the nerves. However, it is apparent to the touch when the leaf is stroked from the tip downwards.

1. Upper glume (5–)6–9 mm long; rhachilla-hairs 7–10 mm long; panicle spiculate to its base; leaf-blades smooth below. 1. *P. australis*
 - Upper glume 3–6 mm long; rhachilla-hairs 4–8 mm long; panicle branches often bare around the lowermost node; leaf-blades scabrid below. 2. *P. karka*

1. *P. australis* (*Cav.*) *Steud.* (1841);

Arundo australis *Cav.* (1799) - type: Australia, *Née?* (MA holo.).

Arundo phragmites *L.* (1753) - *Phragmites communis* *Trin.* (1820) - type: Europe (LINN holo.).

subsp. *altissimus* (*Benth.*) *W.D. Clayton* in *Taxon* 17: 169 (1968);

Arundo altissima *Benth.* (1826) - type: Spain, collector uncertain (K holo.).

Robust perennial from an extensive creeping rhizome; culms 3–6 m high. Leaf-blades 30–60 cm long and 1–3 cm wide, smooth on both surfaces, tapering to a fine, filiform tip. Panicle silvery, 30–50 cm long. Spikelets 12–18 mm long, the rhachilla-hairs 9–16 mm long, copious; glumes asperulous, the lower lanceolate, 3–4.8 mm long, sharply acute, the upper narrowly oblong, 5–9 mm long, obtuse or tridenticulate; lowest lemma linear-lanceolate, 8–15 mm long; fertile lemmas very narrowly lanceolate and long-attenuate, 9–16 mm long.

The swampy margins of lakes and rivers, or on adjoining seasonally flooded alluvial flats, forming extensive pure stands; 200–400 m. AF (Lake Hertalle) EW BA–HA (Wabe Shebele R.) KF–GG (lower reaches of the Omo R.); shores of the Mediterranean, eastwards to Iran, and southwards to the southern edge of the Sahara, Kenya and the Arabian Peninsula. *Ash* 1778; *Carr* 447; *Sandford* A.11 (ETH).

P. australis var. *australis* is the cosmopolitan common reed widespread in all temperate parts of both hemispheres. It is somewhat shorter than var. *altissimus* (1.5–3 m high), and has a lanceolate, sharply acute upper glume.

P. australis is best distinguished from *P. karka* by the combination of spikelet characters listed in the key. Whilst the leaf-blades are typically smooth on the underside with filiform flexuous tips, in contrast to the typically scabrid leaves with stiff tips of *P. karka*, this

character is much less reliable than the spikelet characters. The blades in *P. australis* are often also somewhat scabrid, especially towards the tips, which may be stiff and acicular as in *P. karka*. Likewise, the leaf-tips in *P. karka* may also occasionally be filiform and flexuous. However, if the blades are notably rough on the underside, the plant is more likely to be *P. karka*.

2. *P. karka* (Retz.) Steud. (1841);

Arundo karka Retz. (1786) - type: India, König (LD holo.).

P. laxiflorus Steud. (1854) - type: Ethiopia, TU, Shire [Schire], Schimper 1697 (P holo., K iso.).

Robust perennial from an extensive creeping rhizome; culms 2–8 m high, very stout, often woody and bamboo-like. Leaf-blades up to 80 cm long and 1–4 cm wide, scabrid beneath (at least towards the tips), tips attenuate, stiff. Panicle 30–50 cm long, the lowest node bearing a whorl of many branches bare of spikelets towards the base. Spikelets 7–16 mm long, rhachilla-hairs 4–8 mm long; glumes similar, lanceolate-oblong to ovate, sharply acute, the upper 3–6 mm long and sometimes not much exceeding the lower; lowest lemma narrowly elliptic, 7–12 mm long; fertile lemmas narrowly lanceolate, 8–11 mm long. Fig. 28.

A tall reed growing in marshy or seasonally flooded alluvial soils along river banks; 500–2100 m. EE EW TU SU (Awash R.) IL KF GG SD (Daua R.) HA; westwards to W Africa and southwards through tropical Africa to Madagascar; N Yemen, tropical Asia, Polynesia, N Australia. M.G. & S.B. Gilbert 1561, 1298; Burger 1429; Getachew Aweke 2865 (ETH).

P. karka is best separated from *P. australis* by its spikelets with an acute upper glume and rather shorter, less dense rhachilla-hairs, and by its rough, stiffly pointed leaves. Plants from tropical Africa with a broad, lanceolate to ovate, sharply pointed upper glume which is often not much longer than the lower, have been separated as *P. mauritanus* Kunth. However, in Ethiopia at least, this small glume character is unworkable, variation being completely continuous. Hence, all *Phragmites* collections with acute glumes, rhachilla-hairs under 8 mm, and scabrid leaves are referred here to *P. karka*.

41. ARUNDO L. (1753)

Robust rhizomatous reeds with tall, stout, erect culms clothed with distichous leaves. Leaf-blades broadly linear; tough, flat, rounded or cordate at the junction with the sheath; ligule a narrow membrane. Inflorescence a large, copiously branched, plumose panicle of numerous crowded spikelets. Spikelets laterally compressed, wedge-shaped, few-flowered, the florets bisexual or the uppermost reduced, scarcely exceeding the glumes, densely silky-hairy, disarticulating between the florets; glumes 3–5-nerved, narrow, membranous, persistent; lemmas 5–7-nerved, hyaline, narrow, tapering to a bifid tip, the midnerve and 2 laterals excurrent, the other



Figure 28. *PHRAGMITES KARKA*: 1 - panicle x 1/2; 2 - leaf and section of culm x 1/2; 3 - glumes and lowest lemma x 7; 4 - fertile floret x 7. 1, 3, 4 from M.G. & S.B. Gilbert 1582; 2 from M.G. & S.B. Gilbert 1561. Drawn by Eleanor Catherine.

nerves short, plumose on the back below the middle; palea short, densely ciliate on the keels; stamens 3.

3 species from the Mediterranean to China; widely introduced elsewhere.

A. donax L. (1753);

- types from Spain and France (LINN).

Robust reed from a thick, knotty rhizome; culms very stout, up to 6 m high. Leaf-blades cauline, 30–60 cm long and 2–5 cm wide, smooth except along the margins, tapering to a slender, filiform tip; ligule 0.7–1 mm long, membranous with a ciliolate margin. Panicle dense, 30–65 cm long. Spikelets 3–4-flowered, 10–15 mm long; glumes subequal, 10–12 mm long, linear-lanceolate, the lower acute, the upper sharply acuminate; lemmas linear-lanceolate, 9–13 mm long, the hairs 3/4 as long as the lemma, the midnerve extended at the tip into an awn 2 mm long, 2 lateral nerves also shortly extended.

On wet soils by rivers, along ditches etc.; native from the Mediterranean basin eastwards to Burma, now widely introduced elsewhere. In Ethiopia it is often planted for shelter and screening, and is also used for construction, basketwork, matting and other purposes. *Pichi-Sermolli* 1946; *Ryding* 1270; *Wilson* 640 (ETH).

Arundo is said not to flower in Ethiopia, but in the vegetative state can be readily distinguished from the other tall reeds (*Phragmites* spp.) by its membranous ligule, and by the generally broader leaf-blades which are cordate at the junction with the sheath.

42. *ELYTROPHORUS* P. Beauv. (1812)

Annuals; leaf-blades linear, flat; ligule membranous. Inflorescence of dense globular clusters of spikelets spaced or confluent along a central axis; outer spikelets of each cluster with an enlarged lower glume and the lower or all lemmas empty, forming a chaffy involucre of linear-acuminate scales. Spikelets 3–6-flowered, ovate, strongly laterally compressed; glumes slightly shorter than the lemmas, subequal, narrow, membranous, 1-nerved, acuminate to a short awn-point; lemmas 3-nerved, keeled, membranous, shortly ciliate on the keel and margins, keel acuminately extended into an awn-point; palea winged; lodicules 1–2; stamens 1–3. Grain with embryo 1/2 its length and free pericarp.

2 species; tropical Africa, Asia and Australia, in wet places.

E. spicatus (Willd.) A. Camus (1923);

Dactylis spicata Willd. (1801) - type: India, Klein (B holo., K iso.).

Glabrous annual; culms erect, up to 50 cm high; leaf-blades basal, linear, up to 25 cm long and 4 mm wide, often as long as the inflorescence. Inflorescence 2–30 cm long, the globular spikelet-clusters 3–7 mm in diameter, discrete or confluent into a narrow cylinder. Spikelets ovate; lower glume 1.5–2 mm long, the upper

1.5–2.5 mm long; lemma 2–2.5(–3) mm long (including awn), extended into an awn of variable length but commonly about as long as the lemma body; palea-wings very variable in size and shape, often conspicuous; anthers 1–3, 0.3 mm long. Fig. 29.

Seasonally swampy places in grassland; up to 1500 m. Eritrea/TU (Mareb Valley); tropical Africa, India, Indo-China and Australia, often in rice fields. *Quartin Dillon & Petit* s.n. (P).

43. *MOLINIA* Schrank (1789)

Tufted perennials; leaf-blades linear, flat, deciduous from the sheath; ligule ciliate. Inflorescence paniculate. Spikelets 1–several-flowered with the florets well spaced on the rachilla and clearly exerted from the glumes, laterally compressed, disarticulating beneath each floret, rachilla extended above the uppermost floret; glumes subequal, membranous, persistent, the lower nerveless or 1-nerved, the upper 1–3-nerved; lemmas 3(–5)-nerved, firmly membranous, rounded on the back, smooth, glabrous, unawned; palea equalling and similar to the lemma; stamens 3; grain with a linear hilum.

2–4 species in Europe, SW and N Asia and in China and Japan; introduced into N America.

Molinia superficially resembles an awnless species of *Festuca*, from which genus it can readily be distinguished by the ciliate ligule. It is also easily confused with *Eragrostis*, and unfortunately there are no readily apparent morphological differences between the two genera, although anatomically they are distinct enough, *Molinia* possessing the diffuse chlorenchyma of *Arundineae* in its leaf-blades and *Eragrostis* the radiate chlorenchyma of *Eragrostideae*.

M. caerulea (L.) Moench (1794);

- type from Europe (LINN).

Tough tussocky perennial; culms stiffly erect, 15–150 cm high, the basal internode becoming swollen and club-shaped. Leaf-blades basal, narrowly linear, smooth or sparsely hairy, gradually tapering to a fine point, finally disarticulating from the sheaths; leaf-sheaths persistent, inrolled and spiky around the base of the culms; ligule a dense ciliate rim 0.5 mm long. Panicle loose and flexuous, to 40 cm long, narrow with erect branches or more open and spreading. Spikelets 1–4-flowered, 4–9 mm long; glumes subequal or the upper longer, subacute, the lower oblong, 1.5–3 mm long, the upper narrowly ovate, 2.5–4 mm long; lemmas narrowly lanceolate-oblong in profile, 4–6 mm long, obtuse to acute; anthers 1.5–3.5 mm long, purple; callus truncate, glabrous.

On mountains in TU; a very variable grass, widespread throughout Europe and N Asia, usually on damp moorland; reported from Mt Kenya. *Figari* s.n.

The swollen club-shaped culm bases, providing a food-storage organ, coupled with the cushion of spiky sheaths from which the leaf-blades have disarticulated around the base of the plant, are very characteristic of this grass and provide the best means of distinguishing it from species of the genus *Eragrostis*.

44. LEPTAGROSTIS C.E. Hubb. (1937)

Perennial. Leaf-blades linear, ligule ciliate. Inflorescence a panicle with short ascending branches. Spikelets 1-flowered, narrow, disarticulating above the persistent glumes, rhachilla shortly extended; glumes unequal, membranous, the lower 1-nerved, about half as long as the floret, the upper 3-nerved, \pm equalling the floret; lemma 3-nerved, membranous, rounded on the back except towards the tip, the midnerve extended at the entire or bidenticulate tip into a short straight awn; palea as long as the lemma; callus with long woolly hairs.

A single species, endemic to Ethiopia.

Leptagrostis was at first placed in the *Agrostideae*, from which it is clearly excluded by its ciliate ligule. It is now placed in the *Arundineae* on account of its anatomy (diffuse chlorenchyma, double bundle sheath, slender microhairs), but its generic affinities remain obscure.

L. schimperiana (Hochst.) C.E. Hubb. (1937);

Calamagrostis schimperiana Hochst. (1855) -
-type: Ethiopia, Dschadscha (Agau), Schimper in
Herb. Buchinger 1330 (STR holo., P K iso.).

Tufted perennial; culms erect, to 25 cm high. Leaf-blades linear, flat, 15–20 cm long, 3–4 mm wide, softly pilose above, glabrous below, finely acuminate; sheaths bearded at the mouth; ligule a ciliate rim 0.5 mm long. Panicle narrowly elliptic-oblong, 6–8 cm long, somewhat contracted, branches and pedicels smooth. Spikelets narrowly lanceolate, 4.8–5.2 mm long, purplish; glumes keeled towards the acute tips, scabrid on the keel, the lower narrowly elliptic-oblong, the upper lanceolate-oblong; lemma narrowly elliptic-oblong, 2.6–3.3 mm long, smooth and glabrous; awn 1–1.7 mm long, the lateral nerves sometimes also shortly excurrent; callus hairs extending to the middle of the floret or above.

This strange little grass does not appear to have been collected again since Schimper found it in the Agau region (probably TU) in 1853.

45. CRINIPES Hochst. (1855)

C. E. Hubbard in *Kew Bull.* 12: 54–58 (1957).

Perennial tussock grasses; leaf-blades linear, flat or in-rolled when dry, tough; ligule a ciliate rim. Inflorescence a many-spicate panicle, glistening golden-



Figure 29. *ELYTROPHORUS SPICATUS*: 1 - habit $\times \frac{1}{2}$; 2 - spikelet $\times 17$; 3 - palea $\times 17$. All from Polhill & Paulo 2113. Drawn by D. Erasmus. (Modified from *Fl. Trop. E. Afr. Gramineae 1*: Fig. 45, with permission of the Editors).

brown at maturity. Spikelets oblong, 2(–3)-flowered, the rhachilla extended above the uppermost floret, often as a scabrid bristle, disarticulating above the glumes and

between the florets; glumes narrow, shorter than the spikelet, thinly membranous or scarious, 1-nerved, acuminate or awn-pointed, upper glume longer than the lower; floret callus obtuse, short or the upper elongated, laterally bearded; lemmas lanceolate, 3-nerved, scarious-membranous, rounded on the back, densely pilose near the margins, awned from the narrowed, acute or minutely bidentate tip; awn fine, flexuous; palea shorter than the lemma; stamens 3.

2 species in east and northeast tropical Africa.

The two species of *Crinipes* are very closely related, being similar in general appearance, and also occupying the same habitat. Careful inspection of the spikelet is therefore necessary before making a determination. *C. abyssinicus* has a more northerly distribution within Ethiopia than *C. longifolius*.

1. Awns (7-)9-14 mm long; florets separated by a slender rhachilla-internode 0.8-1.5 mm long; callus of both florets short (c 0.5 mm long).

1. *C. abyssinicus*

- Awns 3-7 mm long; rhachilla-internode obsolete, the florets separated by the elongate callus of the upper floret (0.8-1.5 mm long).

2. *C. longifolius*

1. *C. abyssinicus* (Hochst. ex A. Rich.) Hochst. (1855); *Danthonia abyssinica* Hochst. ex A. Rich. (1850); *D. tenuiglumis* Steud. nom. superfl. (1854); *Triraphis abyssinica* (Hochst. ex A. Rich.) Nees ex Engl. (1892) - type: Ethiopia, TU, Mt Scholoda [Selleuda], Schimper 114 (P holo., K B iso.).

Tough perennial forming large dense tussocks up to 1 m. across; culms 55-100 cm high, pendulous. Leaf-blades 4-9 mm wide, pilose on the upper surface, glabrous below, strongly scabrid on the margins and towards the setaceous tip. Panicle narrowly oblong, 17-35 cm long. Spikelets 2-flowered or with a third reduced floret, the florets separated by a slender rhachilla-internode 0.8-1.5 mm long; glumes linear-lanceolate, lower glume 3.5-6.6 mm long, upper glume 4.0-7.3 mm long; callus of both florets c 0.5 mm long; lemmas 4.5-5.5 mm long, the marginal hairs 1-1.8 mm long; awn (7-)9-14 mm long; palea glabrous or sparsely pilose on the flanks.

Rocky slopes on mountains and in upland river gorges; 2000-3200 m. TU GD GJ SU; unknown elsewhere. *De Wilde & Gilbert* 206; *Ash* 2688; *Chiovenda* 2211.

2. *C. longifolius* C.E. Hubb. (1935);

- type: Uganda, *Thomas* 296 (K holo.).

Coarse perennial forming large tussocks; culms 50-115 cm high, pendulous. Leaf-blades 5-12 mm wide, glabrous below, pilose above especially near the ligule, glabrescent towards the scabrid, setaceous tip. Panicle

elliptic-oblong to ovate, 15-30 cm long. Spikelets 2-flowered, the florets separated by the elongate callus of the upper floret, rhachilla-internode obsolete, the disarticulation scar of the upper floret lying at the base of the palea of the lower floret; glumes lanceolate, thinly membranous, lower glume 2-3 mm long, upper glume 2.8-4 mm long; lower floret callus short, upper floret callus (0.7-)1.0-1.5 mm long; lemmas lanceolate-oblong, 4-6 mm long, scaberulous towards the tip, the marginal hairs c 1 mm long; awn 3-7 mm long; palea pilose on the flanks. Fig. 30.

Hanging from moist crevices on rocky slopes and cliffs; 2000-3000 m. SU AR; Uganda, S Sudan. *Gilbert & Thulin* 1009; *Thulin* 1542.

C. longifolius tends to have a somewhat broader, more open panicle than *C. abyssinicus*, with smaller, shorter-awned spikelets.

46. SCHISMUS P. Beauv. (1812)

Conert in *Abh. Senck. Nat. Ges.* 532: 1-81 (1974).

Annuals or short-lived perennials; leaf-blades narrow, flat or inrolled; ligule ciliate. Inflorescence a contracted or spiciform panicle. Spikelets laterally compressed, 4-10-flowered, falling entire or the upper florets disarticulating separately and then the pedicel, glumes and lower florets falling tardily together; glumes subequal, ± as long as the spikelet, membranous with hyaline margins, prominently 5-7-nerved; floret callus short; lemmas membranous, 7-9-nerved, pilose on the back or margins, emarginate to bilobed, mucronate or not. Grain with a hilum 1/5 its length.

5 species; Mediterranean and Middle East, South Africa.

S. arabicus Nees (1841);

- type: Egypt, Sinai, *Schimper* 391 (B holo.).

[*S. barbatus* sensu Cuf., *Enum.*: 1233 (1968), non (L.) Thell. (1907)].

Small tufted annual; culms 10-25 cm high; leaf-blades inrolled, to 10 cm long, often pilose on the upper surface, acuminate. Panicle compact, to 4 cm long. Spikelets 5-8-flowered, 5-7 mm long; glumes ovate-lanceolate, the lower 5-nerved, 4.7-5 mm long, the upper 3-5-nerved, 5.5-6 mm long; callus bearded; lemmas elliptic-ovate, 9-nerved, 2.5-3.2 mm long, pilose below the middle, the apical lobes (of lowest lemma) acuminate, clearly longer than wide, with or without a mucro from the sinus; palea reaching only slightly beyond the base of the lemma sinus, never exceeding the middle of the lobes; anthers 0.3 mm long.

Deserts; EE (Dahlak Is.); E Mediterranean eastwards to C Asia and in Arabia; naturalized in America and Australia. *Quartin Dillon* s.n. in Herb. Drake (P).

D.E.



Figure 30. *CRINIPES LONGIFOLIUS*. 1 - habit x 3/4; 2 - panicle x 3/4; 3 - spikelet x 5; 4 - lower glume x 12; 5 - upper glume x 12; 6 - callus of florets x 12; 7 - lemma x 14; 8 - palea x 12. All from A.S. Thomas 296. Drawn by D. Erasmus. (Reproduced from *Fl. Trop. E. Afr. Gramineae 1: Fig. 42*, with permission of the Editors).

S. barbatus (L.) Thell. is a closely related species occurring over the same area and also in South Africa. It is distinguished by its shorter, broader lemma-lobes which are scarcely longer than wide, the palea extending at least to the middle of the lobes and often as long as or longer than the lemma.

47. PENTASCHISTIS Stapf (1898)

Linder & Ellis, *Contrib. Bolus Herb.* 12 (1990). Phillips in *Proc. 13th AETFAT meeting, Zomba, 1991*: 359–372 (1994).

Annuals or perennials; leaf-blades linear to filiform; ligule ciliate. Inflorescence an open or contracted panicle, the branches sometimes glandular. Spikelets 2-flowered with the rhachilla extended above the uppermost floret, lanceolate to oblong, glistening, laterally compressed, disarticulating below each floret; glumes subequal, exceeding and enclosing the florets, 1-nerved (or sub-3-nerved at the base), keeled, hyaline to scarious, acute or acuminate; lemmas 7–9-nerved, lanceolate-oblong, membranous, rounded on the back, pilose (in Ethiopian species), emarginate to bifid, awned from the sinus, each lobe extended into a fine scabrid bristle; awn geniculate with a strongly twisted column; palea as long as the lemma, hyaline; anthers 3; callus shortly bearded laterally.

About 70 species, mainly in South Africa, but extending northwards through the African mountains to Ethiopia and Cameroon; also in Madagascar and Australia.

Pentaschistis is a difficult genus taxonomically as the species are both variable and intergrading. There are very few definitive characters available for specific delimitation, with spikelet structure remarkably uniform throughout. More collections are required from the Ethiopian mountains and some experimental work, especially chromosome counts, is needed before the variation can be properly understood. New collections should be accompanied by good habitat notes, as it seems likely that ecological preference plays an important role.

1. Annual; panicle open or loosely contracted, branches and pedicels glandular; anthers 0.3–0.6 mm long. 1. *P. trisetoides*
- Tussocky perennials. 2
2. Anthers 0.4–0.8 mm long; awn 2.3–6.7 mm long; panicle contracted to spiciform, < 3 cm wide. 2. *P. pictigluma*
- Anthers 1.5–2.7 mm long; awn 6.8–14 mm long; panicle open to loosely contracted, up to 12 cm wide. 3
3. Branches of panicle glandular; spikelets 4.0–6.5 mm long. 3. *P. borussica*
- Branches of panicle not glandular; spikelets 8.2–9.5 mm long. 4. *P. dolichochoaeta*

1. *P. trisetoides* (Hochst. ex Steud.) Pilg. (1926);

Danthonia trisetoides Hochst. ex Steud. (1854) - type: Ethiopia, GD, Semien, Debra Eski, *Schimper* 109 (P holo.).

Danthonia segetalis Hochst. (1855); *Pentaschistis segetalis* (Hochst.) Pilg. (1926) - type: Ethiopia, GD, Semien, Debra Eski, *Schimper* 24 (TUB holo.).

Danthonia trisetoides Hochst. ex Steud. var. *tenuis* Engl., *Hochgebirgsfl.*: 131 (1892); *P. trisetoides* (Hochst. ex Steud.) Pilg. var. *tenuis* (Engl.) Pilg. in *Notisbl. Bot. Gt. Berlin* 9:517 (1926) p.p. - type: Ethiopia, TU, Urahut, Mt Erareta, *Schimper* 766 (B destr., K fragment), excl. *Schimper* 621 (*P. pictigluma*).

Slender tufted annual; culms ascending, 10–35 cm high. Leaf-blades shortly linear, 2–8 cm long and 1–2 mm wide, flat or loosely folded, softly pilose (sometimes sparsely). Panicle narrowly elliptic to ovate, open or loosely contracted, 2.5–6 cm long, branches and pedicels usually conspicuously glandular. Spikelets narrowly lanceolate-oblong, 3.5–5.5 mm long; glumes narrowly lanceolate with sharply acuminate, slightly recurving tips, thinly scarious, silvery, often purpletinged, scaberulous and sometimes also glandular along the keel; lemmas narrowly elliptic-oblong, 1.5–2 mm long, the rounded tip extended into 2 fine bristles 1.2–2.5 mm long arising at the awn base; awn 5.5–6.5 mm long; anthers 0.3–0.6 mm long. Fig. 31:4, 5.

Upland grassland and as a weed of cultivation, favouring damp soils; 2500–3900 m. TU GD SU AR BA; unknown elsewhere. *Hedberg* 5343; *Thulin* 1604.

The most distinct of the Ethiopian species of *Pentaschistis* on account of its annual habit. The open, conspicuously glandular panicle resembles that of *P. borussica*, but this is a larger perennial grass with much longer anthers (1.5–2.5 mm).

2. *P. pictigluma* (Steud.) Pilg. (1926);

Aira pictigluma Steud. (1854); *Danthonia anthoxanthiformis* Hochst. (1855) nom. superfl. - type: Ethiopia, without precise locality, *Schimper* s.n. (P holo.).

Danthonia thunbergii sensu A. Rich. (1850) non Kunth (1829); based on *Quartin Dillon & Petit* s.n. (P).

Danthonia uberior Hochst. (1855); *D. anthoxanthiformis* Hochst. var. *uberior* (Hochst.) Engl., *Hochgebirgsfl.*: 131 (1892) - types: Ethiopia, GD, Semien, Mt Bachit, *Schimper* 112 in *Herb. Buchinger* (P isosyn.) & 541 (STR syn., K isosyn.).

Danthonia depressa Hochst. (1855) - type: *Schimper* 209b (STR holo.).

Danthonia nana Engl. (1892) - type: Ethiopia, GD, Mt Guna, *Schimper* 1561 (B holo., BM K iso.).

Danthonia trisetoides Hochst. var. *schimperi* Engl., *Hochgebirgsfl.*: 130 (1892); *Pentaschistis trisetoides* var. *schimperi* (Engl.) Pilg. in *Not. Bot.*

Gart. Berlin 9: 517 (1926) - type: Ethiopia, TU, Amba Hedecha, *Schimper* 1005 (B holo., K. iso.).

Pentaschistis mannii C.E. Hubb. (1936).

P. imatongensis C.E. Hubb. (1936).

Densely tufted perennial; culms erect or ascending, up to 50(-85) cm high, usually glandular at the base of the panicle, often scarcely exceeding the leaves. Leaf-blades filiform and inrolled or less often linear and flat, glabrous or pilose, scabrid especially towards the tip; basal leaf-sheaths whitish and papery, culm sheaths somewhat inflated. Panicle contracted to spiciform, elliptic to narrowly oblong, up to 13 cm long, sometimes lobed, the spikelets glistening, greyish, silvery or golden-brown; rhachis branches sometimes glandular. Spikelets narrowly lanceolate, 3.6-7.7 mm long; glumes hyaline, acute to acuminate; lemmas 2-2.5 mm long, bifid, each lobe with an apical bristle 1-3 mm long; awn 2.3-6.7 mm long, only slightly exerted from the glumes; anthers 0.4-0.8 mm long. Fig. 31:1-3.

Open situations in montane grassland, low scrubland, and among rocks at high altitudes, usually where the soil is damp; 2400-4300 m. TU GD GJ SU AR KF BA; East African mountains; Sudan (Jebel Marra, Imatong Mts.), Cameroon Mt; Yemen.

The classification of the perennial, compact-panicled forms of *Pentaschistis* from the high mountains of tropical Africa presents much difficulty. There are small shifts in variation between the populations on the different mountains, which have often been accorded separate specific status in the past. The situation is complicated by the existence of an altitudinal cline of widely but continuously varying forms on the Ethiopian plateau and extending up to the highest peaks in Ethiopia. It is now generally accepted that most forms with larger spikelets (>5.5 mm) are best included within *P. pictigluma* (Wickens in *Kew Bull.* 26: 41-44, 1971; Clayton in *Fl. W. Trop. Afr.* 3: 374, 1972). The name *P. minor* has been applied to smaller-spiculate forms from the highest peaks. Parts of the Ethiopian cline match both *P. pictigluma* and *P. minor* from the high East African mountains. Additionally there are taller, small-spiculate forms from lower altitudes in Ethiopia (*P. gracilis*). Due to the continuous variation between these forms in Ethiopia, they are now all included at infraspecific level within *P. pictigluma* (Phillips, 1994). A detailed study of the Ethiopian cline would do much to improve our understanding of this difficult genus, and it must be emphasised that it is not possible to assign every specimen to varietal rank.

var. *pictigluma*

Culms (7-)10-40 cm high; leaf-blades inrolled, often scabrid; panicles golden-brown; leaf-blades and panicle glandular or not; spikelets 5.5-7.7 mm long; awns 4-6.7 mm long.

Ericaceous bushland or afroalpine moorland, usually in moist places above 3500 m; TU GD GJ SU AR BA;

endemic to Ethiopia. *Hedberg & Aweke* 5374; *Hiller & Evans* 340; *Mooney* 5282.

The very attractive golden-brown panicles are unique to this variety, and seem to be associated with a preference for moist situations. However, morphologically identical grey-panicled forms also occur which match specimens from Sudan (Jebel Marra) and elsewhere, where they grow on dry stony mountain sides.

var. *minor* (*Ballard & C.E. Hubb.*) *S.M. Phillips* in *Proc. 13th AETFAT meeting*: 371 (1994);

P. borussica (K. Schum.) Pilg. var. *minor* Ballard & C.E. Hubb. in *Kew Bull.* 1930: 121 (1930); *P. minor* (Ballard & C.E. Hubb.) Ballard & C.E. Hubb. (1937) - type: Tanzania, Mt Kilimanjaro, *Cotton & Hitchcock* 64 (K. holo.).

Culms 1-40 cm high; leaf-blades inrolled; panicles grey; leaf-blades and panicle eglandular; spikelets 3.6-5.2 mm long; awns 2.3-5.4 mm long.

Dry stony mountain summits, mostly above 4000 m. TU AR BA; East Africa (where it occurs down to 3200 m). *Mooney* 8323; *Phillips* 37; *Mesfin T.* 7714 (ETH).

var. *gracilis* (*S.M. Phillips*) *S.M. Phillips* in *Proc. 13th AETFAT meeting*: 372 (1994);

P. gracilis *S.M. Phillips* (1986) - type: Ethiopia, SU, Entoto Hill, *Friis et al.* 1303 (K. holo.).

Culms 20-60(-85) cm high; leaf-blades usually flat and pilose; panicles grey or silvery; panicle usually eglandular but glands frequently present on leaf-margins; spikelets 3.8-5 mm long; awns 3.3-5 mm long.

Upland grassland, field margins and extending into ericaceous bushland, often in moist or lightly shaded places; 2500-3000 m. SU KF BA; Kenya (Mt Elgon). *Gilbert* 9300; *De Wilde* 5972; *Mooney* 8353.

3. *P. borussica* (K. Schum.) Pilg. (1926);

- type: Tanzania, Mt Kilimanjaro, *Volkens* 1368 (B holo., BM K. iso.).

Tufted perennial from a short rhizome; culms erect, 20-75 cm high. Leaf-blades narrowly linear to setaceous, often curving or flexuous, pilose on the upper surface, scabrid on the nerves below; basal leaf-sheaths becoming whitish and papery. Panicle loose and open, elliptic to ovate, 8-16 cm long, the branches capillary with blackish circular glands. Spikelets purplish-grey with a silvery sheen, 4.0-6.5 mm long; glumes scarious, lanceolate-oblong, glandular on the lower part of the keel, acute; lemma clearly 9-nerved, 2-3 mm long, bifid, the acute hyaline lobes each extended into a fine bristle 1.5-2.5 mm long; awn 6.8-9 mm long; anthers 1.5-2.5 mm long.

Open situations in upland grassland; 2800-3700 m. SU AR BA; East Africa. *De Wilde* 9110; *Gilbert & Te-wolde* 3294; *Mesfin T.* 7696 (ETH).



Figure 31. *PENTASCHISTIS* spp.: *P. PICTIGLUMA*: 1 - habit x 3/4; 2 - detail of leaf x 35; 3 - glumes and florets x 9. *P. TRISETOIDES*: 4 - habit x 3/4; 5 - group of spikelets x 4. 1-3 from Hedberg 5604; 4 & 5 from Thulin 1604. Drawn by Eleanor Catherine.

The open panicle of large, greyish, long-awned spikelets on capillary glandular branches is characteristic of this species.

4. *P. dolichochoeta* S.M. Phillips (ined.);

- type: Ethiopia, SU, Ankober [Ancobere],

Lemna Selassie 887 (ETH holo.).

Perennial, base unknown, whole plant eglandular, culms fairly robust, erect, c 1 m high. Leaf-blades 40–60 cm long, narrow, inrolled, tough, scabrid on the margins, pilose on the upper surface, tapering to a long filiform tip. Panicle loosely contracted, elliptic, 15–20 cm long, pale glistening yellow, much-branched and many-spiculate. Spikelets 8.2–9.5 mm long; glumes scarious, linear-lanceolate, glabrous or thinly pilose on the flanks, setaceously acuminate; lemmas faintly 7-nerved, pilose, 3–3.5 mm long to the awn, 2-toothed, a fine bristle 5.5–6.5 mm long arising from the inner margin of each hyaline lobe; awn 2–15 mm long, its column proportionally very short, 1.5–2 mm long, tightly twisted; anthers 2.7 mm long.

Upland forest; c 3000 m. SU; unknown elsewhere. *Demel Teketay* 1421A.

Related to the robust species *P. chrysurus* (K. Schum.) Peter from the mountains of N Tanzania, which has awns with a similarly very short but almost untwisted column. The absence of conspicuous black glands on the panicle branches easily distinguishes *P. dolichochoeta* from *P. borussica*, the only other species in Ethiopia with long anthers which more or less fill the florets.

48. *CENTROPODIA* Rchb. (1828)

Asthenatherum Nevski (1934)

Perennial from a woody rootstock; leaf-blades short, stiff, flat or rolled, pungent. Inflorescence a contracted panicle. Spikelets laterally compressed, 2- to several-flowered, lanceolate; glumes as long as the spikelet, chartaceous, strongly 7–11-nerved, acute; floret callus pungent; lemmas coriaceous, 9-nerved, rounded on the back, deeply bifid, lines of short hairs between the nerves, each line terminating in a longer tuft forming a transverse fringe below the hyaline apical lobes, a straight or geniculate awn arising from the sinus; palea shorter than the lemma.

4 species of desert grasses; N Africa through the Middle East to N India and in southern Africa.

Centropodia is unique in *Arundineae* in possessing Kranz leaf anatomy and C4 photosynthesis.

C. forskalii (Vahl) Cope (1992);

Avena pensylvanica Forssk. (1775) non L. (1753); *A. forskalii* Vahl (1791) nom. nov.; *Trisetum forskalii* (Vahl) P. Beauv. (1812); *Danthonia forskalii* (Vahl) R. Br. (1826); *As-*

thenatherum forskalii (Vahl) Nevski (1934) - type: "In desertis Kahirinis" (C holo.).

Loosely tufted perennial or facultatively annual, the roots thickly clothed in sand; culms erect or shortly decumbent, 20(–45) cm high; leaf-blades glaucous, usually pilose, pungent. Panicle dense, the base included within the broad uppermost leaf-sheath, 2–10 cm long. Spikelets 2–3-flowered, yellow or purple-tinged; glumes subequal, 5.5–9 mm long, prominently 7–9-nerved; lemmas 3.7–5.2 mm long, 9-nerved, a straight awn projecting 1–2 mm beyond the acuminate lobes, these shorter than the lemma body; anthers 0.7–1.2 mm long.

Sandy and stony desert soils. Sudan, Yemen; N Africa through Arabia to C Asia. Expected in Eritrea.

Centropodia glauca (Nees) Cope is a related species from southern Africa with an outlying population in N Kenya (Turkana District). It differs by its very deeply bifid lemma with the lobes clearly longer than the lemma body, and by its longer anthers (2–3 mm long).

49. *PHAENANTHOECIUM* C. E. Hubb. (1936)

Slender stoloniferous perennial. Leaf-blades short, distichous with imbricate sheaths; ligule ciliate. Inflorescence a single raceme of shortly-pedicelled spikelets. Spikelets several-flowered, narrow with divaricate awns, lightly laterally compressed, disarticulating below each floret; glumes persistent, subequal, a little shorter than the lowermost lemma, chartaceous with broad white margins, the lower 3-nerved, the upper 5-nerved, obtuse to emarginate; floret callus short, laterally bearded; lemmas 9-nerved, membranous, glabrous on the back, 1–2 penicillate tufts on each margin, deeply bifid, the lobes extended into long awns; geniculate awned from the sinus; palea equalling the lemma; lodicules ciliate; grain with a hilum 4/5 its length.

1 species; northeast tropical Africa and Yemen.

A segregate from *Rytidosperma* with short glumes and a long hilum.

P. koestlinii (Hochst. ex A. Rich.) C. E. Hubb. (1936);

Danthonia koestlinii Hochst. ex A. Rich. (1850)

- type: Ethiopia, TU, Mt Scholoda [Selleuda], *Schimper* 412 (P holo., K B iso.).

Streblochaete koestlinii Hochst. ex A. Rich. (1850) as syn. of *D. koestlinii*, based on *Schimper* 683.

Slender tufted perennial with thin, trailing, many-noded, branching culms to 30 cm long. Leaf-blades acicular, flat or folded, 1–3 cm long, 0.8–1.2 mm wide, striate on the outer (under) surface, shortly pilose above. Raceme 3 cm long, scarcely exerted from the uppermost leaf-sheath, composed of 3–5 erect crowded spikelets. Spikelets 5–6-flowered with the uppermost floret reduced, linear-lanceolate, 8–12 mm long (excluding the spreading awns); glumes oblong, 3–4.5 mm long with the lower a little shorter and narrower than the upper, irregularly truncate; lemmas green, narrowly

elliptic, 3–3.5 mm long, smooth in the lower half, prominently nerved and scabrid above, the 2 lateral awns 9–11 mm long, fine and weakly twisted; central awn 11–17 mm long with a short, brown, strongly twisted column, and a long, fine, weakly twisted, purple bristle. Fig. 32:4–6.

Among rocks and trailing down cliffs in damp, shady places, often near the spray from waterfalls; 1700–3000 m. EW TU KF; N Yemen, Sudan (Jebel Marra). *Friis et al.* 2189.

50. RYTIDOSPERMA *Steud.* (1854)

Tufted perennials; leaf-blades often convolute and filiform; ligule ciliate. Inflorescence a contracted panicle (reduced and few-spiculate in Ethiopia), or simply racemose. Spikelets 2–6-flowered with the uppermost floret reduced, disarticulating between the florets; glumes subequal, chartaceous, equalling or exceeding the florets, 1–13-nerved, persistent; floret callus obtuse, laterally bearded; lemmas 5–9-nerved, rounded on the back, membranous to coriaceous, bearing tufts of hairs arranged in 2 transverse series or only on the margins, bifid, awned from the sinus, the lobes acuminate, sometimes with 1–2 nerves excurrent as awns; central awn flat, usually geniculate; palea equalling the lemma; lodicules ciliate; grain with a hilum 1/4–1/3 its length.

About 90 species; mountain grassland mainly in Australia, New Zealand and southern Africa; also in Asia, tropical Africa and Argentina.

Both *Rytidosperma* and *Phaenanthoecium* (together with some other genera) are included in *Danthonia* when a wide view is taken of that genus. Generic concepts are still undecided in this group of Arundinoid grasses, but *Danthonia sensu stricto* differs from these two genera by its lemma indumentum and glabrous lodicules.

1. Glumes 5–12(–16) mm long; lemma-lobes entire, setaceous-acuminate. 1. *R. subulata*
- Glumes 30–40 mm long; lemma-lobes biaristate. 2. *R. grandiflora*

1. *R. subulata* (*A. Rich.*) *Cope* (1984);

Danthonia subulata *A. Rich.* (1850) - type: Ethiopia, TU, Ouodgerate, *Petit* s.n. (P holo.).

Danthonia albida *Hochst. ex Steud.* (1854) - type: Ethiopia, without precise locality, *Schimper* s.n. (P holo.).

D. candida *Hochst. ex Steud.* (1854) - type: Ethiopia, without precise locality, *Schimper* s.n. (P holo.).

Tussocky perennial; culms erect, 15–35(–50) cm high, often scarcely exceeding the leaves. Leaf-blades filiform to stiff and pungent, convolute, densely papillose on the inner (upper) surface, smooth and striate below; leaf-sheaths bearded at the mouth. Inflorescence a reduced panicle, the lowest branch often 2-spiculate, the 2–5 remaining spikelets borne directly on the main axis on

villous pedicels, or the whole inflorescence racemose. Spikelets 12–18 mm long, elliptic-oblong, 3–6-flowered; glumes narrowly lanceolate-oblong, 3–5-nerved, chartaceous, (5–)7–12(–16) mm long, enclosing the lower florets and often subequalling the spikelet, acute to obtuse or bidentate; lemmas 7–9-nerved, narrowly elliptic-oblong, 7–9 mm long, 1–3 tufts of hairs on the margins, deeply bifid in the upper third, the lobes scaberulous, finely setaceous-acuminate or short-awned, central awn often with a tuft of hairs at its insertion, 7.5–15 mm long. Fig. 32:1–3.

Moist places in montane grassland; 3000–4300 m. TU GD GJ SU BA; N Yemen. *Chiovenda* 3014; *Hedberg* 5602; *Hedberg & Aweke* 5375 (ETH).

The number of bearded tufts of hairs along the lemma margins is very variable, being usually 2, but sometimes 1 or 3, with the lower florets in a spikelet often bearing more than the upper florets. The presence or absence of a bearded tuft at the awn insertion is likewise of no taxonomic significance, as both conditions may occur within the same spikelet. The basal, strongly twisted portion of the awn often assumes a vivid green colour at maturity.

2. *R. grandiflora* (*Hochst. ex A. Rich.*) *S.M. Phillips*, comb. nov.;

Danthonia grandiflora *Hochst. ex A. Rich.*, *Tent. Fl. Abyss.*: 418 (1850) - type: Ethiopia, GD, Mt Silke [Selki], *Schimper* 690 (P holo., K iso.).

Compactly tufted perennial; culms erect, 30–50 cm high, shorter than the leaf-blades. Leaf-blades filiform, folded or convolute, smooth and striate on the outer (lower) surface, scabrid on the keel towards the fine flexuous tip. Inflorescence a 3–5-spiculate raceme scarcely exerted from the subtending leaf-sheath. Spikelets large, laterally compressed, 3–5-flowered; glumes linear-lanceolate, 3–4 cm long, much exceeding the florets, hyaline, acuminate, the lower 5–7-nerved, the upper 5-nerved; lemmas 9-nerved, oblong, sparsely scattered-pilose on the back, a tuft of hairs near the base on each margin, deeply bifid, each apical lobe itself bifid and the nerves extended into 2 awns, sometimes with a small additional lobe; central awn with a tuft of hairs at its insertion, 1.7–3 cm long.

Among rocks on mountains. GD; unknown elsewhere.

This distinctive, very long-glumed species is still known only from the type collection.

ARISTIDEAE *C. E. Hubb.* (1960)

Henrard in *Med. Rijks Herb. Leiden* 54 (1926), 54a (1927), 54b (1928), 54c (1933), 58 (1929) & 58a (1932); *de Winter* in *Bothalia* 8: 201–404 (1965).

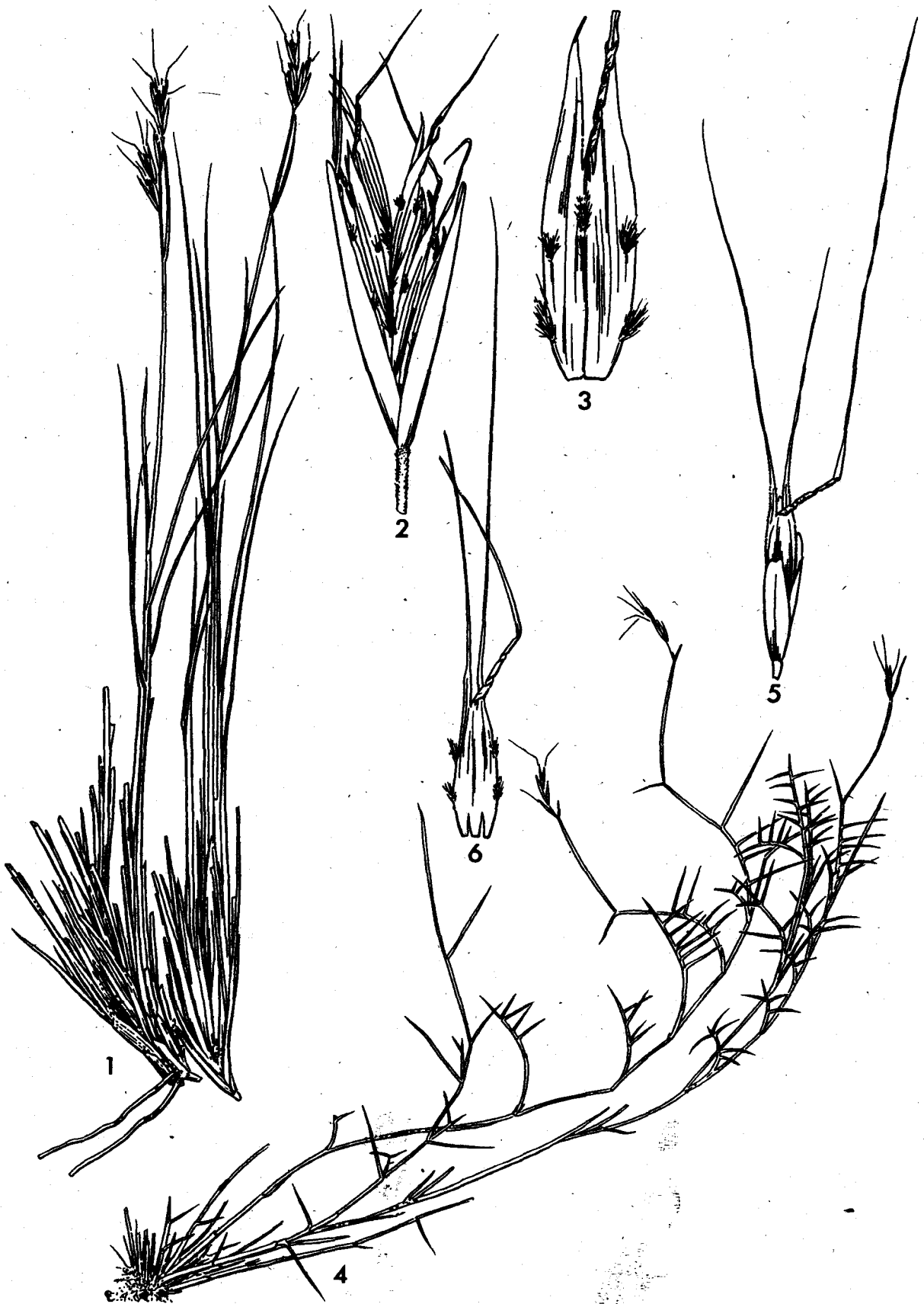


Figure 32. *RYTIDOSPERMA SUBULATA*: 1 - habit x 3/4; 2 - spikelet x 3; 3 - lemma x 7. *PHAENANTHOECIUM KOESTLINII*: 4 - habit x 3/4; 5 - spikelet x 7; 6 - lemma x 7. 1-3 from *Hedberg & Aweke* 5451; 4-6 from *Schimper* 323. Drawn by Eleanor Catherine.

Tufted perennials, or occasionally annual or suffruticose. Leaf-blades narrow, often convolute and stiff or wiry; ligule ciliate. Inflorescence paniculate. Spikelets all alike, bisexual, 1-flowered without a rhachilla-extension, disarticulating above the persistent glumes; glumes long, scarios, usually exceeding the floret; lemma narrowly cylindrical, cartilaginous, becoming indurated at maturity, the margins tightly convolute or involute over the palea and grain, 1-3-nerved, the nerves converging at the tip and extended into a 3-branched awn arising either directly from the lemma tip or more usually from the summit of a twisted column (rarely the two lateral awn-branches obsolete); awn-branches glabrous or all or only the central branch plumose; palea much shorter than the lemma; stamens 3 or 1; grain with a large embryo and linear hilum.

Tribe with 3 genera, distributed throughout the tropics and subtropics, especially on the poor stony soils of dry plains and desert areas.

Aristideae is most closely related to the *Arundineae*, but most species have C4 photosynthesis and *Aristida* possesses unusual bundle-sheaths, in which chloroplasts are not confined to the outer layer. The tribe is in most cases instantly recognizable on account of the 1-flowered spikelets with a distinctive triple awn. There is a superficial resemblance to *Stipeae*, with which it was once thought to be related, but stipoid grasses have a quite different pooid anatomy, and can also be distinguished morphologically by their membranous ligule.

Key to genera

1. Branches of the awn glabrous. **51. *Aristida***
- Branches of the awn (or at least the central branch) plumose. **52. *Stipagrostis***

51. ARISTIDA L. (1753)

Tufted perennials, less often annuals or suffruticose; leaf-blades narrow, usually basal. Panicle effuse, contracted or spike-like. Spikelets 1-flowered with long, scarios glumes; glumes usually exceeding the floret, unequal with the upper usually longer than the lower; lemmas narrowly cylindrical or laterally-compressed, indurated, glabrous or sparsely hairy, margins convolute or involute, extended at the tip into a 3-branched awn (rarely the lateral branches absent); awn glabrous, the three branches arising directly from the lemma tip, or more commonly from the summit of a usually strongly twisted column, persistent or disarticulating either at the base or apex of the column; callus bearded, obtuse to pungent or bidentate; grain tightly enclosed within the toughened lemma.

About 250 species throughout the tropics and subtropics, especially along the Tropics of Cancer and Capricorn. Typical of poor, dry soils in areas of low rainfall, but unlike *Stipagrostis*, not penetrating into true desert.

This large genus can be conveniently divided into sections on the basis of awn characteristics.

1. Awn not articulated, persistent at maturity. **Sect. I. *Aristida***
- Awn articulated and breaking at maturity, either at the lemma-tip or top of the column. **2**
2. Column absent, the awn-branches disarticulating directly from the lemma-tip. **Sect. II. *Pseudochaetaria***
- Column present, bearing the 3 awn-branches at its summit. **3**
3. Articulation at the lemma-tip, the column and branches falling together. **Sect. III. *Arthratherum***
- Articulation at the top of the column (the position marked by a swelling just below the 3 awn-branches). **Sect. IV. *Pseudarthratherum***

Sect. I. *Aristida*

Sect. *Chaetaria* Trin.

1. Lemma convolute and enclosing the grain below, the upper half gaping and tomentose within; lateral awns vestigial; small annual. **1. *A. abnormis***
- Lemma not divided into fertile and sterile portions; lateral awns well developed. **2**
2. Awns arising directly from the lemma-tip. **3**
- Awns separated from the lemma-tip by a twisted column. **2. *A. somalensis***
3. Lemma equalling or exceeding the glumes. **4**
- Lemma shorter than the glumes (at least clearly shorter than the upper glume). **6**
4. Glumes oblong, papery, mucronate; lemma linear-lanceolate, involute, ventrally furrowed; whole plant scabrid. **3. *A. rhiniochloa***
- Glumes narrow, linear to linear-oblong; lemma linear, parallel-sided, convolute; plant ± smooth. **5**
5. Panicle contracted, or if open the spikelets not in bunches; lemma often exceeding the glumes; glumes usually unequal, the upper obtuse. **4. *A. adscensionis***
- Panicle open, the spikelets in bunches at the branch tips; lemma and glumes all equal in length; both glumes acute. **5. *A. kenyensis***
6. Delicate annual; lemma 1.5–1.7 mm long. **6. *A. cumingiana***
- Perennials; lemma over 6 mm long. **7**
7. Culms 10–25 cm high, 1-noded, rising above the leaves; lemma involute, densely scabrid, awns flattened, 0.5 mm wide at base. **7. *A. pennelii***
- Culms 25–100 cm high, 2–3-noded, leafy; lemma convolute, smooth or scabrid only near the tip; awns slender, < 0.3 mm wide. **8**
8. Panicle linear, spiciform with numerous crowded spikelets; lemma keeled and scabrid above; awns subequal. **8. *A. adoensis***
- Panicle few-spiculate, the primary branches subracemose, often spreading; lemma ± smooth; awns unequal. **9. *A. ferrilateris***

Sect. II. *Pseudochaetaria* *Henr.*

Annual; panicle oblong, spiciform; lemma striate-asperulous. 10. *A. hordeacea*

Sect. III. *Arthratherum* (*P. Beauv.*) *Rchb.*

1. Lower glume longer than the upper; annual. 11. *A. funiculata*
- Lower glume shorter than the upper; usually perennial. 2
2. Awn-branches unequal, the central branch clearly exceeding the laterals. 3
- Awn-branches subequal, the central branch only slightly longer than the laterals. 5
3. Panicle loose and open with capillary branches; lateral awn-branches 8–12 mm long. 12. *A. anisochaeta*
- Panicle contracted to spiciform; lateral awn-branches 17–40 mm long. 4
4. Glumes both bifid, short-awned from the sinus; lemma 2.5–2.8 mm long, smooth, narrowed upwards. 13. *A. kelleri*
- Lower glume acute, upper glume bidentate and mucronate; lemma 3.3–4.7 mm long, ± cylindrical, papillose above. 14. *A. triticoides*
5. Low, mat-forming perennial; leaf-blades basal, short and stiff; the panicle of long-awned spikelets forming most of the height of the plant. 15. *A. migiurtina*
- Tufted perennials with ascending, leafy culms. 6
6. Glumes usually ± entire; lemma cylindrical, smooth. 16. *A. stenophylla*
- Glumes usually both bidentate and mucronate; lemma narrowed and scabrid upwards. 17. *A. paoliana*

Sect. IV. *Pseudarthratherum* *Henr.*

1. Panicle densely spiciform; tufted perennial. 18. *A. congesta*
 - Panicle open or loosely contracted, the spikelets clustered at the tips of the branches. 2
 2. Densely tufted perennial to 90 cm high. 19. *A. barbicollis*
 - Loosely tufted annual to 50 cm high. 20. *A. mutabilis*
1. *A. abnormis* *Chiov.* (1903);
- types: Eritrea, EE, Assaorta, *Pappi* 2666 (2227 in protologue in error) & *Terracciano* 2668; Saati in Samhar, *Schweinfurth & Riva* 378 p.p.; Dahlak Is., *Terracciano* 2667 (all FT syn.).

Slender tufted annual; culms wiry, erect or spreading, branching, to 30 cm high. Leaf-blades up to 10 cm long, convolute, striate, sharply acute; leaf-sheaths bearded at the mouth. Panicle delicate, open, ovate to narrowly elliptic, 6–10 cm long. Spikelets purple-tinged; glumes equal, keeled, linear-lanceolate, 4.5–6 mm long (as long as the fertile portion of the lemma), acute and often mucronate, the lower caducous, the upper persistent; lemma linear, convolute, densely to sparsely scaberulous, 8–11 mm long, the lower half

terete, glabrous within, enclosing the grain, the upper half inflated, tomentose within, angled at the tip and extended into a twisted column 4.5–8 mm long; central awn-branch stout, divaricate, 7–17 mm long, the laterals vestigial or present as fine, erect bristles up to 15 mm long; callus 1 mm long, narrowly oblong, acute.

Dry sandy and stony soils; EE; Djibouti, Somalia and in the Arabian Peninsula. *Robertson* 1101 (ETH).

This is a very curious species, most closely related to *A. redacta* *Stapf* from India, with which it shares the otherwise unique character of a lemma differentiated into fertile and sterile portions. This character, together with the abbreviated lateral awns, provides an instantly recognizable means of identification.

2. *A. somalensis* *Stapf* (1907);

- type: N Somalia, *Drake-Brockman* 10, 124, 127 & *Lort Phillips* s.n. (all K syn.).

Tufted perennial; culms erect, glabrous, 40–80 cm high. Leaf-blades convolute-setaceous, tough, scabrid towards the fine, filiform tip; leaf-sheaths pilose on the auricles. Panicle ovate, effuse, 20–35 cm long, the branches spiculate only in the distal half. Glumes unequal, finely acuminate, the lower 8–12 mm long, linear-lanceolate, straight, the upper (11–)13–18 mm long, linear, slightly falcately curved; lemma linear-lanceolate, terete, convolute, 6–9.5 mm long, scaberulous upwards, the tip gradually extended without articulation into a twisted column 6–8 mm long; central awn-branch 3–4 cm long, the laterals a little shorter; callus linear, pungent, 1–1.5 mm long.

Dry bushland; up to 1500 m. SD BA; Somalia (N), Kenya. *Rippstein* 1822; *Gilbert & Ensermu* 7869.

A. somalensis has the general facies of species belonging to the section *Arthratherum*, but it cannot be included in that section due to the absence of an articulation at the base of the column.

3. *A. rhiniochloa* *Hochst.* (1855);

- type: Ethiopia, TU, Gageros, *Schimper* 1229 (K iso.).

A. serrulata *Chiov.* (1924) - type: Eritrea, Um Ager, *Corni, Calciati & Braccioni* (FT holo.).

Tufted annual; culms scabrid, 20–75 cm high. Leaf-blades linear, flat, 2–4 mm wide, scabrid below with a prominent midrib and marginal nerves, scabrid-pubescent above; leaf-sheaths bearded at the collar. Panicle 10–20 cm long, usually loosely contracted, the branches scabrid, rather stiff. Spikelets with conspicuous reddish-brown glumes, these oblong, papery, scaberulous, subequal or the lower exceeding the upper, both tipped with a micro 1 mm long, the lower 9–16 mm long, acute, the upper 8–14 mm long, obtuse to emarginate; lemma ± equalling the glumes, linear-lanceolate, 7–10 mm long, striate-scabrid, involute, furrowed on the ventral side; awn-branches arising from the lemma tip

without column or articulation, stiffly ascending, harshly scabrid, central branch 2–3 cm long, the laterals slightly shorter; callus oblong, 1 mm long, broadly obtuse.

Deciduous bushland; c 1000 m. EW TU; westwards to Mauritania, and from Tanzania to Namibia and the Transvaal. *Pappi* 308; *Schimper* 118.

A coarse, scabrid annual, well marked by its broad, papery glumes, conspicuously scabrid lemma and stiff, narrowly ascending awns.

4. *A. adscensionis* L. (1753);

- type: Ascension I., *Osbeck* (LINN holo.).

A. caerulescens Desf. (1798).

A. ehrenbergii Trin & Rupr. (1842); *A. adscensionis* var. *ehrenbergii* (Trin. & Rupr.) Henr. in *Med. Rijks Herb. Leiden* 54: 158 (1926) - type: Arabia, *Ehrenberg* (LE holo.).

A. vulgaris Trin. & Rupr. var. *abyssinica* Trin. & Rupr., *Sp. Gram. Stipac.*: 134 (1842); *A. adscensionis* var. *abyssinica* (Trin. & Rupr.) Engl. (1904) - type: Ethiopia, TU, near Adoa, *Schimper* 319 (K iso.).

A. vulgaris Trin. & Rupr. var. *aethiopica* Trin. & Rupr., l.c.: 134 (1842); *A. aethiopica* (Trin. & Rupr.) Schweinf. & Aschers. (1867); *A. adscensionis* var. *aethiopica* (Trin. & Rupr.) Dur. & Schinz, *Consp. Fl. Afr.* 5: 799 (1895) - types: Sudan, Senar, *Kotschy* 248, 226 (both K isosyn.).

A. curvata (Nees) Trin. & Rupr. var. *abyssinica* A. Rich., *Tent. Fl. Abyss.* 2: 392 (1850) - type: Ethiopia, TU, Shire, *Schimper* 1796 (K iso.).

A. macrochloa Hochst. (1855) - type: Ethiopia, without precise locality, *Schimper* in Herb. *Buchinger* 32 (K iso.).

A. mauritiana Hochst. ex A. Rich. (1851), non Kunth (1829), nom. illegit.; *A. modatica* Steud. (1854) - type: Eritrea, Modat, Ailet, *Schimper* 1047 (K iso.).

Tufted annual or short-lived perennial; culms slender, erect or geniculately ascending, to 60 cm high. Leaf-blades linear, tapering to a fine tip, flaccid or stiff, convolute or opening out to 2.5 mm wide; leaf-sheaths glabrous. Panicle usually narrowly oblong, loosely contracted with short ascending branches, sometimes more open with spreading branches or contracted and linear (but never densely spiciform). Spikelets green or purplish; glumes unequal, the lower usually about 3/4 as long as the upper, occasionally subequal; lower glume lanceolate-oblong to linear-oblong, acute; upper glume linear, (5.5–)6–9.5(–10.8) mm long, obtuse or emarginate to apiculate; lemma linear, 5–14.5 mm long, laterally compressed, convolute, equalling to much exceeding the upper glume, usually scabrid on the keel above, sometimes generally scabrid in the upper half or almost to the base; awn-branches arising from the lemma-tip without column or articulation, central

branch (0.8–)1.2–2.5 cm long, the laterals subequal or up to a third shorter; callus 0.5 mm long, obtuse. Fig. 33:6.

Poor, dry, sandy or stony soils, often among rocks; sea level–2500 m. EE AF EW TU GD SU GG SD HA; a pantropical pioneer of dry, open situations. *Friis* et al. 788; *Gilbert & Thulin* 997; *Sandford* in *Mooney* 7447.

A. adscensionis is a very variable annual pioneer of dry, open places, recognized by its laterally compressed, long, parallel-sided lemma, equalling or more usually exerted from the awnless glumes.

A number of varieties have been described [see *Henrard*, l.c., p.322 (1932)], based on the relative lengths of the lemma and glumes, degree of scabridity of the lemma, and form of the panicle. However, variation is continuous in all these characters, and none are sufficiently distinct to be worthy of retention.

Perennial forms, especially common around the Mediterranean region and penetrating southwards into Eritrea, have long been separated as *A. caerulescens* Desf., but here also the distinction is unworkable in practice. It is often very difficult to distinguish annuals from short-lived perennials, and it is not uncommon for plants, otherwise inseparable from *A. adscensionis*, to have a few sterile vegetative shoots at the base and to persist for a few seasons.

5. *A. kenyensis* *Henr.* (1933);

- type: Kenya, *Hitchcock* 24829 (L holo.).

Loosely tufted annual; culms slender, smooth, 25–60 cm high. Leaf-blades linear, flat or convolute; leaf-sheaths glabrous. Panicle open, lanceolate-oblong, 15–25 cm long, the primary branches flexuous, naked in their lower half, the spikelets clustered in fascicles at their tips. Spikelets purple; glumes subequal, either the upper or lower slightly longer, linear-oblong, 5–8.5 mm long, sharply acute, the lower scabrid on the keel and often also on the flanks, the upper ± smooth; lemma linear, ± equalling the glumes, convolute, laterally compressed, scabrid except near the base, the awn-branches arising from the tip without column or articulation; central awn 1.2–2 cm long, laterals a little shorter; callus 0.2–0.4 mm long, broadly obtuse. Fig. 33:3, 4.

Dry, open situations on eroded soils, limestone, overgrazed grassland and in cleared forest; 1600–2200 m. EW TU GD SU AR SD HA; East Africa. *M. G. & S. B. Gilbert* 1419; *Thulin* 1317.

A. kenyensis intergrades with *A. adscensionis*, and represents a discrete element distinguishable from the main body of variation within that species. The open panicle, with little bunches of purple spikelets at the tips of the flexuous branches, gives it a recognizable facies, reinforced by the pointed glumes and scabrid lemma, equalling the glumes in length.



Figure 33. *ARISTIDA* spp.: *A. ADOENSIS*: 1 - habit x 3/4; 2 - spikelet x 4. *A. KENYENSIS*: 3 - habit x 3/4; 4 - spikelet x 4. *A. FERRILATERIS*: 5 - spikelet x 4. *A. ADSCENSIONIS*: 6 - spikelet x 4. 1 & 2 from Ash 2676; 3 & 4 from Mooney 6292; 5 from Wood 2552; 6 from Gilbert 1218. Drawn by Eleanor Catherine.

6. *A. cumingiana* Trin. & Rupr. (1842);- type: Philippine Is., *Cuming* 671 (K iso.).*A. delicatula* A. Rich. (1851) - types: TU, Shire, *Schimper* 1830 (P syn., K isosyn.) & *Quartin Dillon* (P syn.).

Delicate annual; culms solitary or tufted, 8–30 cm high; leaf-blades narrow, 2–7 cm long. Panicle loose and open, oblong to ovate, 3–8 cm long, the spikelets distant on capillary branches. Spikelets very small, reddish or purplish; glumes unequal, cuspidate or mucronate, lower glume lanceolate, 1.5–2 mm long, scabrid on the keel, upper glume narrowly lanceolate-oblong, smooth on the keel, 2–2.6 mm long; lemma lanceolate, terete, 1.5–1.7 mm long, scabrid towards the tip; awn-branches unequal, arising directly from the lemma-tip without column or articulation, central branch 4.5–6 mm long, the laterals 2.5–4 mm long; callus very short, broadly obtuse.

Damp soils. TU; an infrequently collected grass of scattered localities from the Guinée Republic to Ethiopia and southwards to Zimbabwe; also in India and eastwards to the Philippines.

A. cumingiana is very unusual within the genus *Aristida* in growing in damp situations.

7. *A. pennei* Chiov. (1905);- type: Eritrea, Oculé Cusai, Halai, *Pappi* 1976 (FT holo.).*A. jemensis* Henr. (1939).

Short, densely tufted perennial; culms 10–25 cm high, smooth, 1-noded, rising above the leaves. Leaf-blades all basal, 1–6 cm long, convolute, rather stiff and glaucous, smooth; leaf-sheaths bearded at the collar. Panicle contracted, oblong-cuneate, 5–9 cm long. Spikelets purplish; glumes unequal, linear to linear-lanceolate, acuminate and extended into a mucro 1–1.5 mm long, the lower 6.5–8 mm long, the upper 9.5–10.5 mm long; lemma linear, 7–8.5 mm long (as long as the lower glume), lightly keeled, ventrally furrowed, strongly scabrid except towards the base, the awn-branches arising from the tip without column or articulation; branches subequal, 1.5–2.5 cm long, scabrid, flattened and 0.5 mm wide near the base; callus linear, 1.2–1.5 mm long, narrowly obtuse.

Dry, stony and sandy soils; 2600 m. EW; Saudi Arabia, Yemen.

A. pennei is a much smaller plant than *A. adoensis*, with a compact tuft of basal leaves and a shorter, broader panicle. It also has a more conspicuously scabrid lemma, not enclosed within both glumes but equalling the lower glume, stouter broader awns, and a longer callus.

8. *A. adoensis* Hochst. (1844);- type: Ethiopia, TU, Shire, *Schimper* 1806 (K iso.).

A. abyssinica (Trin. & Rupr.) Chiov. (1907) non *A. vulgaris* var. *abyssinica* Trin. & Rupr., based on an element of *Schimper* 390 [a mixture of *A. adscensionis* & *A. adoensis*; see Henrard p. 3 (1926)].

Tussocky perennial; culms erect, smooth, 30–100 cm high. Leaf-blades pale green, filiform, flat or convolute, up to 25 cm long and 3 mm wide, scabrid on the midnerve and margins towards the tip. Panicle linear, spiciform, 10–30 cm long and 1 cm wide (excluding awns), interrupted below, the spikelets densely crowded on the short, erect branches, these bearded at the junction with the main axis. Glumes subequal or either the lower or upper a little longer, enclosing the lemma, 7–13 mm long, linear-lanceolate, acuminate and mucronate, the lower scabrid on the nerve, the upper narrower, smooth; lemma linear, 6–8 mm long, convolute, lightly keeled towards the tip, scabrid on the keel and surrounding flanks; awn-branches subequal, 1.5–2.5 cm long, scabrid, rigidly ascending from the lemma-tip without column or articulation; callus oblong, 0.5–0.8 mm long, narrowly obtuse. Fig. 33:1, 2.

Well-drained grassland, dry grassy clearings in woodland, and along roadsides; 1400–2300 m. EW TU GJ WU SU WG KF GG SD HA; Sudan, East Africa. *Friis* et al. 1593; *Gilbert & Getachew* 2776; *Mooney* 5510.

The linear, spiciform panicle, with a dense tuft of hairs at the axils of the primary branches, is characteristic, but occasionally the tuft is reduced to just a few hairs in some of the axils only.

9. *A. ferrilateris* S.M. Phillips (1986);- type: Yemen, *Wood* 1142 (K holo.).

Densely tufted perennial; culms erect, smooth, 25–70 cm high. Leaf-blades linear, pale green, flat or loosely folded, up to 30 cm long and 2–2.5 mm wide, tapering to a fine, filiform tip. Panicle 9–23 cm long, few-spiculate, the primary branches linear, subracemose, erect, forming a sparse, narrow panicle, or the lower branches often widely spreading. Spikelets pale green tinged with purple; glumes subequal, enclosing the lemma, linear-lanceolate, obtuse to acuminate, mucronate, the lower scabrid on the nerve, often also minutely pubescent, the upper slightly longer, smooth and glabrous; lemma linear-lanceolate, 6.5–8.5 mm long, terete, convolute, smooth or minutely scabrous upwards; awn-branches arising from the lemma-tip without column or articulation, unequal, slender, the central branch 1.3–2 cm long, the laterals 2/3–3/4 as long; callus oblong, 0.5 mm long, obtuse. Fig. 33:5.

Rocky slopes on limestone with evergreen bushland; 1800–2000 m. HA; Yemen and adjoining parts of Saudi Arabia. *Gilbert* 4017, *Friis* et al. 6152.

A. ferrilateris is closely related to *A. adoensis*, both species having narrow, mucronate glumes enclosing the convolute lemma, slender awns, and a short, obtuse

callus. However, *A. ferrilateris* is immediately distinguishable by its much sparser, open panicle, the smooth lemma and unequal awn-branches providing additional confirmatory characters. It is primarily an Arabian species, but penetrates westwards into eastern Ethiopia.

10. *A. hordeacea* Kunth (1831);

- type: Senegal, Leprieur (P iso.).

A. steudeliana Trin. & Rupr. (1842) - types: Sudan, Kotschy 33 & Ethiopia, Gapdia, Schimper 804 (both K isosyn.).

Tufted annual; culms pubescent, erect or ascending, to 80 cm high. Leaf-blades linear, flat or folded, keeled, 2–5 mm wide, scaberulous, abruptly acute; leaf-sheaths keeled. Panicle densely spiciform, oblong, 5–15 cm long, the spikelets clustered in fascicles along the rachis, the lower fascicles sometimes slightly spaced, rachis and branches pubescent. Spikelets with purple glumes and green awns; glumes slightly unequal, awn-tipped, the lower linear-lanceolate, 4–7 mm long, hispid, acute or emarginate, the upper linear-oblong, 5–9 mm long, hispidulous above, bifid; lemma terete, furrowed ventrally, 4–7 mm long, striate-asperulous except near the base with rows of upwardly-directed prickles; awn-branches subequal, 1.5–3.5 cm long, articulated at the lemma-tip just below the branching point, column absent; callus narrowly oblong, obtuse.

Dry situations; 400–1500 m. AF EW TU SU; throughout tropical Africa. Schimper 1021, 2277; Hemming 1240; Pappi 601.

11. *A. funiculata* Trin. & Rupr. (1842);

- type: Senegal, Leprieur (P holo.).

A. macrathera A. Rich. (1851) - type: Ethiopia, TU, Shire, Quartin Dillon & Petit (P holo., K iso.).

Slender, densely tufted annual; culms wiry, 15–50 cm high. Leaf-blades narrowly linear, 1–1.5 mm wide, smooth below, scabrid above, often scattered-pilose near the ligule. Panicle linear, 6–20 cm long, few-flowered, loosely contracted with erect branches and overlapping spikelets; spikelets green tinged with brown; glumes linear, keeled, finely attenuate into a short-awned tip, the lower 2–3 cm long, often with a strigose stripe along one flank, the upper shorter and narrower; lemma terete, convolute, 4–5.8 mm long, densely papillose towards the tip; awn-column articulated at the lemma-tip, 2.5–4.5 cm long, cylindrical and as broad as the lemma at the base, thereafter strongly twisted, awn-branches subequal, 5–9 cm long; callus pungent, 1.5–2 mm long.

Dry sandy or stony soils, often in *Acacia* bushland; 250–1100 m. EE AF EW TU WU SD HA; N Kenya, westwards to Senegambia and eastwards through Arabia to Pakistan and India. Burger 3528; Hemming 1007; Pappi 6497.

Easily recognized by its annual habit and inverse glumes, with the lower glume clearly exceeding the upper.

Specimens with a shorter awn-column than usual (1.2–2 cm long) and much shorter awn-branches (3–4 cm long) are common in Pakistan (syn. *A. funiculata* var. *mallica* (Edgew.) Henr.; *A. royleana* Trin. & Rupr.). Occasional specimens with these dimensions also occur further west and frequently have almost subequal glumes, the key inverse glume character of *A. funiculata* being much less obvious (e.g. Kahurananga 2472 from Chiffra, AF).

12. *A. anisochaeta* Clayton (1969);

- type: Ethiopia, HA, southeast of Uardere, Ellis 38 (K holo.).

Short-lived tufted perennial or sometimes annual; culms much-branched, wiry, 40–60 cm high. Leaf-blades flat or convolute, 1–1.5 mm wide, smooth & glabrous below, pubescent above. Panicle delicate, open, narrowly ovate, 10–20 cm long, the spikelets clustered towards the tips of the slender, capillary branches. Glumes very unequal, sharply acute to minutely emarginate and mucronate, the lower linear-lanceolate, 5–7 mm long, the upper linear-caudate, 10–12.5 mm long; lemma narrowly fusiform, convolute, 2.5–3 mm long, blackish at maturity, scaberulous around the top of the lateral nerves, otherwise smooth; awn articulated at the lemma-tip, column 5–6.5 mm long, the branches conspicuously unequal, the central branch 5–6 cm long, stout, the laterals 8–12 mm long, very fine; callus pungent, 1 mm long.

Red sandy soils in open *Acacia-Commiphora* bushland; 300–700 m. EE HA; Somalia. M.G. & S.B. Gilbert 2083; Hemming 1468; Robertson 1101.

A. anisochaeta is a locally common grass of the sandy plains of the Ogaden region. It can be recognized by its delicate open panicle, coupled with an awn with very abbreviated, slender lateral branches.

13. *A. kelleri* Hack. (1900);

- type: Ogaden, Keller 163 (Z holo.).

Tussocky perennial from a branching rootstock; culms wiry, 20–45 cm high, often branching, scabrid. Leaf-blades convolute-setaceous, glabrous; bearded at the sheath mouth. Panicle ovate-oblong, 8–10 cm long, spiciform with densely crowded spikelets, subtended by the inflated uppermost leaf-sheath. Glumes unequal, linear, keeled, scabrid; lower glume 5.2–8 mm long, bidentate, mucronate from between the acute lobes; upper glume 10–12 mm long, bifid with an awn 3–5 mm long from between the acuminate lobes; lemma terete, 2.5–2.8 mm long, lanceolate, convolute, smooth and glabrous, narrowed towards the tip; awn articulated at the lemma-tip, column weakly twisted, 1–2 cm long, the central branch curving outwards, 4–5.5 cm long, the lateral branches erect, weaker, about half as long; callus recurved, pungent, 0.7–1.5 mm long. Fig. 34:1–3.

Sandy soils on open plains in *Acacia* bushland, sometimes dominant; 500–1200 m. HA; Somalia, NE

Kenya. Bally 9617; M.G. & S.B. Gilbert 2068; IECAMA BH-20.

A distinctive species, dominant over large areas of the Ogaden. It can be readily recognized by its compact panicle, subtended by the inflated uppermost leaf-sheath, bidentate awned glumes, and awns with a weakly twisted column and unequal branches.

14. *A. triticoides* Henr. (1933);

- type: Somalia, Appleton 104 (K holo.).

Tussocky perennial from a branching rhizome; culms erect, 45–65 cm high. Leaf-blades setaceous, convolute, smooth and glabrous; basal leaf-sheaths persistent, becoming coriaceous and golden-brown; ligule conspicuously villous, 2–3 mm long. Panicle 15–20 cm long, dense with erect branches. Spikelets pale green; glumes very unequal, scaberulous; lower glume linear-lanceolate, 5.5–8 mm long, finely acute or awn-pointed; upper glume linear, 12–16 mm long, emarginate to bifid with an awn-point to 2 mm long from the sinus; lemma terete, convolute, 3.3–4.7 mm long, papillose above; awn articulated at the lemma-tip, column twisted, 1.7–2.7 cm long, central branch longer and stouter than the laterals, recurved outwards at the base, 4–6 cm long, lateral branches erect, 3–4 cm long; callus recurved, pungent, *c* 1 mm long. Fig. 34:4, 5.

Stony or gravelly soils in open situations in dry scrubland; 300–400 m. SD HA; Somalia, Arabia, Pakistan. De Wilde 5952; M.G. & S.B. Gilbert 2119.

A. triticoides is closely related to *A. kelleri*, but is a rather more robust grass with taller culms, a longer panicle exerted from the uppermost leaf-sheath, and much tougher basal leaf-sheaths. The lemma is also longer than in *A. kelleri*, with a broader, papillose tip, and the awn-column is proportionally longer and much more tightly twisted.

15. *A. migiurtina* Chiov. (1928);

- type: Somalia, Puccioni & Stefanini 8 (FT holo.).

Low mat-forming perennial from a tough, much-branched base. Leaf-blades short, stiff, often falcately curving; leaf-sheaths imbricate, topped by a woolly ring of hairs. Panicle loosely contracted, few-spiculate, *c* 10 cm long, the spikelets with their long, stiffly-diverging awns rising above the basal leaves and forming most of the height of the plant. Glumes linear, long-acuminate, awn-tipped, the lower 8–14 mm long, entire, the upper 14–23 mm long, bifid; lemma linear, terete, 3–4 mm long, smooth; awn articulated at the lemma-tip, column 1–1.7 cm long, tightly twisted, awn-branches subequal, the central branch 6–7.5 cm long, the laterals slightly shorter and thinner; callus 0.8–1.2 mm long, pungent with a recurved tip.

A. migiurtina occurs in open situations in the northern part of Somalia and in southern parts of the Arabian Peninsula. Although it grows near the Ethiopian border,

it has not yet been found in Ethiopia, but is to be expected on limestone in Harerge.

16. *A. stenophylla* Henr. (1928);

- type: Somalia, Robecchi-Bricchetti (RO, holo.).

Tussocky perennial; culms wiry, branching, 40–45 cm high. Leaf-blades convolute-setaceous, *c* 1 mm wide, glabrous. Panicle linear-oblong, loosely contracted, 10–12 cm long, the branches erect, few-flowered. Spikelets with long purple awns; glumes very unequal, linear; lower glume 7–9 mm long, acute; upper glume 13–20 mm long, shortly acute, or obtuse or emarginate and minutely mucronate; lemma linear, terete, 4–5 mm long, smooth (or at most minutely granular towards the tip), blotched with purple; awn articulated at the lemma-tip, the column 1–2 cm long, the branches subequal, central branch 4.0–5.6 cm long, the laterals slightly shorter; callus pungent with a recurved tip, 1.4–1.8 mm long. Fig. 34:8, 9.

Dry sandy and stony soils in open bushland; 700–1100 m. HA; Somalia. Hemming 1451; IECAMA BH-12, Ellis 209.

A. stenophylla is closely allied to *A. sieberiana* Trin., a species with a more widespread distribution from Senegambia to Somalia and Kenya, and northwards to N Africa and Israel. It is generally a more robust grass than *A. stenophylla*, with woody, glaucous, suffrutescent culms up to 1 m high, long-acuminate, awn-tipped glumes, and a longer lemma (7–10 mm).

17. *A. paoliana* (Chiov.) Henr. (1927);

Aristida stipiformis Poir. var. *paoliana* Chiov. in *Ann. di Bot.* 13: 371 (1915) - type: Somalia, Paoli 116 (FT holo.).

Aristida hemmingii Clayton (1969).

Profusely branched, laxly tufted perennial; culms slender, 30–45 (–75) cm high. Leaf-blades narrowly linear, 1–2.5 mm wide, flat or convolute, smooth and glabrous below, shortly pubescent above. Panicle loose and open, ovate, 10–20 cm long. Spikelets with purplish awns; glumes very unequal; lower glume linear-lanceolate, 4–5.3 mm long, usually emarginate with a mucro up to 1 mm long from the sinus, rarely shortly acute; upper glume linear, 10–13 mm long, emarginate to bifid with an awnlet to 2 mm long; lemma linear-lanceolate, terete, 3–5 mm long, narrowed and scabrid in the upper half; awn articulated at the lemma-tip, the column 1–1.5 cm long, the branches subequal, central branch 4–5 cm long, the laterals slightly shorter; callus 1 mm long, pungent with a recurved tip. Fig. 34:6, 7.

Red sandy soil in open bushland; *c* 400 m. HA; Somalia, N Kenya. Hudleston 6; Simmons 221 (both K).

A. paoliana is closely related to *A. stenophylla*, the easiest distinguishing characters being its scabrid, narrowed lemma-tip and generally bidentate, mucronate glumes. It also has a slightly different facies, forming a looser, much-branched, sprawling tuft with usually more open panicles.

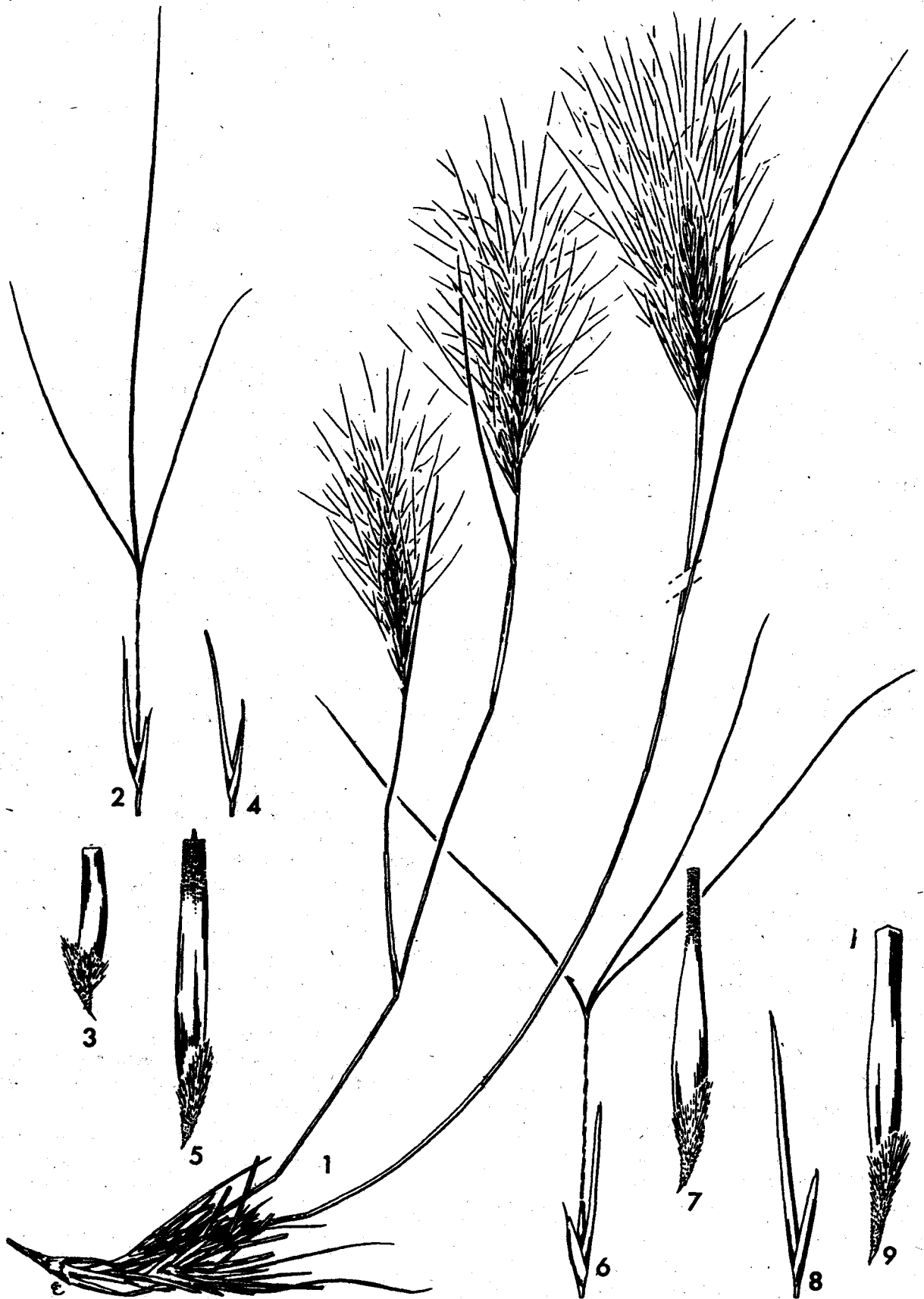


Figure 34. *ARISTIDA* spp.: *A. KELLERI*: 1 - habit x 3/4; 2 - spikelet x 2; 3 - lemma x 9. *A. TRITICOIDES*: 4 - glumes x 2; 5 - lemma x 9. *A. PAOLIANA*: 6 - spikelet x 2; 7 - lemma x 9. *A. STENOPHYLLA*: 8 - glumes x 2; 9 - lemma x 9. 1-3 from *Ellis* 39; 4 & 5 from *Gilbert* 2119; 6 & 7 from *Hemming* 1469; 8 & 9 from *Hemming* 1451. Drawn by Eleanor Catherine.

18. *A. congesta* Roem. & Schult. (1817);

- type: South Africa, *Lichstenstein* (B holo., destr.).

A. congesta var. *pilifera* Chiov. in *Ann. Ist. Bot. Roma* 8: 333 (1908); *A. elyptrophoroides* Chiov. (1924) - type: Eritrea, Oculai Cusai, Decamere, Pappi 1709 (FT holo.).

Densely tufted perennial; culms erect or ascending, up to 75 cm high. Leaf-blades linear, folded or convolute, to 20 cm long; leaf-sheaths prominently silky-hairy on the auricles with spreading hairs 2–3 mm long. Panicle linear-oblong, densely contracted, spiciform or interrupted at the base, 3–20 cm long. Glumes unequal, both with an awn-point up to 2 mm long; lower glume lanceolate, 4–5 mm long, acute; upper glume linear, 6.5–10 mm long, emarginate to bifid; lemma terete, linear-elliptic, 3–5 mm long, asperulous upwards, passing into a twisted awn-column 2–4 mm long; awn-branches articulated at the top of the column, equal, 1.2–3 cm long; callus narrowly oblong, finely obtuse, ± 1 mm long. Fig. 35:6.

Dry sandy soils in open scrubland; 800–2200 m. EW AF TU; eastern Africa from the Mediterranean to the Cape, also Saudi Arabia and Yemen. *Gilbert & Getachew* 2779; *Mooney* 8015.

The spikelets of *A. congesta* are indistinguishable from those of *A. barbicollis*, but the two species are well separated by panicle shape in Ethiopia, although there is some intergradation in other parts of their geographical range.

19. *A. barbicollis* Trin. & Rupr. (1842);

- types: South Africa, *Drège* s.n. (lecto. whereabouts uncertain).

Densely tufted perennial; culms usually erect, up to 90 cm high. Leaf-blades linear, flat or convolute, to 20 cm long; leaf-sheaths prominently silky-hairy on the auricles with spreading hairs 2–3 mm long. Panicle ovate, open, 7–20 cm long, the spikelets clustered at the tips of the main branches. Glumes unequal, both with an awn-point up to 2 mm long; lower glume lanceolate, 3–7 mm long, acute; upper glume linear, 6.5–11 mm long, emarginate to bifid; lemma terete, linear-elliptic, 3–5 mm long, asperulous upwards, passing into a twisted awn-column 2–4 mm long; awn-branches articulated at the tip of column, equal, divaricate, 1.2–2.8 cm long; callus narrowly oblong, finely obtuse, 1–1.5 mm long.

Acacia scrubland; 900–1200 m. AF SD; from East Africa southwards to the Cape. *Sandford* in *Mooney* 7444; *Friis* et al. 3029; *Mooney* 9631.

A. barbicollis is very closely related to the annual *A. mutabilis*, and the two species are sometimes difficult to distinguish in eastern Africa, where their distributions overlap. In particular, some specimens of *A. mutabilis* from Ethiopia tend towards a perennial habit, with perennating shoots at the base. In most cases, however, the habit differences are distinct enough. *A. barbicollis*

is typically a densely tufted perennial with taller, erect culms and longer leaf-blades, whilst *A. mutabilis* is typically a loose or sprawling annual with much-branched, wiry culms and short leaf-blades.

20. *A. mutabilis* Trin. & Rupr. (1842);

- type: Sudan, Kordofan, *Kotschy* 103 (K isolecto.).

A. meccana Trin. & Rupr. (1842) - type: Saudi Arabia, near Mecca, *Schimper* (LE holo.).

A. tenuis Hochst. (1855) non Kunth (1829), nom. illegit. - based on: Ethiopia, TU, Gurrarfa, *Schimper* 1271 (P iso.).

A. cassanellii Terr. (1892) - type: Eritrea, Ras Morah, *Terracciano* 1523 (FT holo.).

A. astroclada Chiov. (1912) - type: Eritrea, Beni Amer, Ducambia, *Pappi* 8793 (FT holo.).

A. mutabilis Trin. & Rupr. var. *laeviglumis* Henr. in *Med. Rijks Herb. Leiden* 54c (1933) - types: Ethiopia, TU, Goelleb, *Schimper* 2132 & Gurrarfa, *Schimper* 2198 (both K isosyn.) & Eritrea, Assaorta, *Pappi* 5814 (L syn.).

Slender, loosely tufted annual; culms wiry, usually geniculately ascending, branching at the nodes, less often erect, up to 50 cm high. Leaf-blades 2–10 cm long and 0.8–1.5 mm wide, flat or convolute, usually somewhat rigid; leaf-sheaths with a conspicuous circlet of silky spreading hairs 2–3 mm long on the auricles. Panicle open, narrowly ovate, 5–15 cm long, the spikelets densely clustered at the tips of the main branches. Lower glume lanceolate, 3–4.5 mm long, acuminate, apiculate or the scabrid keel extended into a mucro to 1 mm long; upper glume linear, 6–7.5 mm long, bidentate with a mucro 0.5–1.5 mm long from the sinus; lemma narrowly elliptic, 2–4 mm long, asperulous upwards, the tip extended into a twisted awn-column 3–5(–6.8) mm long; awn-branches equal, 1.5–3 cm long, articulated at the top of the column; callus narrowly oblong, obtuse, 0.8 mm long. Fig. 35:1–5.

Shallow stony or sandy soils of hot dry plains and semi-desert *Acacia* scrubland, and in eroded situations; sea level–1700 m. EE AF TU WU SU AR GG HA; Mauritania eastwards to Sudan, Arabia and Pakistan; also in East Africa. *Bally* 6785; *M.G. & S.B. Gilbert* 2350; *IECAMA* 1-56.

A. mutabilis is a rather variable annual, and several varieties have been described over its geographical range in Africa, based mainly on small differences in the relative length and scabridity of the glumes, and in the relative proportions of the lemma and awn-column. A key to these varieties is available in *Henrard* [*Med. Rijks Herb. Leiden* 58:136 (1929)].

A. mutabilis is much the most common species of section *Pseudarthatherum* in Ethiopia. The awn-branches do not always disarticulate at maturity, but the disarticulation line can clearly be seen as a slight swelling at the top of the column, often marked by a change in colour.



Figure 35. *ARISTIDA* spp.: *A. MUTABILIS*: 1 - habit x 3/4; 2 - spikelet x 9; 3 - lemma x 11; 4 - awn x 2; 5 - disarticulation point of awn x 18. *A. CONGESTA*: 6 - habit x 3/4. 1-5 from M.G. & S.B. Gilbert 2350; 6 from Mooney 8015. Drawn by Eleanor Catherine.

52. *STIPAGROSTIS* Nees (1832)*Aristida* sect. *Stipagrostis* Trin. & Rupr. (1842)

Densely tufted perennials, sometimes suffrutescent, rarely annual. Leaf-blades mostly convolute, tough, the blades sometimes deciduous leaving the green sheaths and culms as the photosynthetic organs. Panicle open or contracted. Spikelets 1-flowered; glumes scarious, 1-11-nerved; lemma indurated, narrowly cylindrical, produced into a 3-branched awn; awn articulated at the lemma tip (or rarely near the middle of the lemma), a twisted column present or not, at least the central awn branch plumose, lateral branches shorter, often capillary; callus pungent, usually bearded.

About 50 species in arid and desert regions of Africa, the Middle East, Central Asia and Pakistan.

1. Callus hairs in two groups, a short basal tuft and a longer fringe at the lemma base; glumes usually hairy. 1. *S. hirtigluma*
- Callus hairs continuous; glumes usually glabrous. 2
2. A tuft of conspicuous spreading hairs at awn branching-point. 2. *S. uniplumis*
- Awn branching-point glabrous. 3
3. Lower glume slightly shorter than the upper; leaves hairy on the lower (outer) surface. 3. *S. foëxiana*
- Lower glume slightly longer than the upper; leaves glabrous on the lower (outer) surface. 4. *S. obtusa*

1. *S. hirtigluma* (Trin. & Rupr.) de Winter (1963);
Aristida hirtigluma Trin. & Rupr. (1842) - type: Arabia, Schimper 165 (K iso).

Densely tufted annual or short-lived perennial; culms 30-40(-75) cm high. Leaf-blades filiform, 0.5 mm wide, acute. Panicle 10-25 cm long, usually loosely contracted. Glumes unequal, 3-nerved, softly pilose (very occasionally glabrous), lower 6.8-10 mm long, upper 9.5-12 mm long; lemma 2.5-3.2 mm long, coarsely tuberculate, the tip broad, passing without constriction into the stout awn base; column of awn 7-16(-22) mm long, usually plumose in the upper half, occasionally the hairs extending lower or glabrous; central branch 4-6 cm long, plumose in the upper half with an excurrent naked tip, lower half plumose (sometimes thinly) or glabrous; lateral branches 9-13 mm long, glabrous; callus bearded with a short tuft near its base and a longer fringe at the lemma base. Fig. 36:1-3.

Poor, dry, often sandy soils in thin *Acacia* bushland and semi-desert grassland; sea-level-1500 m. EE AF EW TU GG SD BA, HA; westwards to Mali and southwards to South Africa; Arabian Peninsula; India. *Burger* 2164; *M. G. & S. B. Gilbert* 2377; *Hemming* 1031.

The two distinct sets of hairs on the callus, often separated by a short internode, are the best distinguishing character for *S. hirtigluma* as this arrangement is

unique in the genus. The presence of hairy glumes is a useful, but less reliable character.

S. hirtigluma is very variable in the degree of hairiness of its awn. The upper half of the central awn is always plumose, but the lower part and upper part of the column vary from fully plumose through thinly plumose to glabrous.

2. *S. uniplumis* (Licht.) de Winter (1963);
Aristida uniplumis Licht. (1817) - type: South Africa, Lichtenstein (B holo.).
Aristida papposa Trin. & Rupr. (1842). *Stipagrostis papposa* (Trin. & Rupr.) de Winter (1963).

Densely tufted perennial from a knotty rootstock; culms 30-75 cm high. Leaf-blades setaceous, 0.3-0.5 mm wide, finely acuminate. Panicle 10-18 cm long, loosely contracted. Glumes unequal, 3-nerved, glabrous or sparsely hairy near the margins, lower 6-7.5 mm long, upper 7.5-8.5 mm long; lemma 1.5-1.9 mm long, finely tuberculate in the upper half, narrowed to the tip, passing abruptly into the slender awn base; column of awn 5.5-9.5 mm long, glabrous except for a conspicuous tuft of spreading hairs at the branching point; central branch 2-3 cm long, glabrous or sometimes sparsely pilose in the lower 1/4-1/3, plumose above to the tip; lateral branches 7-12 mm long, glabrous; callus bearded with one set of hairs increasing uniformly in length upward. Fig. 36:4-6.

Acacia bushland in arid areas; 350-1200 m. EE EW TU SD HA; tropical and South Africa; Arabia; Pakistan and India. *M. G. & S. B. Gilbert* 2053; *Gilbert, Ensermu & Vollesen* 7598; *Pappi* 6858.

The conspicuous tuft of hairs at the awn branching-point and the rounded top of the feather without an excurrent naked tip are the most easily observed differences from *S. hirtigluma*. The continuously arranged callus hairs and more finely tuberculate lemma with a narrower tip are good confirmatory characters.

3. *S. foëxiana* (Maire & Wilczek) de Winter (1963);
Aristida foëxiana Maire & Wilczek (1934) - types: Morocco, Maire & Wilczek & Maire, Weiller & Wilczek; Algeria, Maire (MPU syn.).
Aristida corradii Chiov. (1951) - type: Ethiopia, GG, Seghido, *Corradi* 917 (FT holo.).

Slender, densely tufted perennial, with dense basal clusters of coriaceous sheaths lacking blades; culms wiry, to 40 cm high, glabrous. Leaf-blades convolute, curling, pilose with fine spreading hairs; leaf-sheaths conspicuously woolly near the mouth. Panicle 5-12 cm long, loosely contracted. Glumes 3-nerved, glabrous, the lower 10 mm long, scaberulous, the upper 10.5-12 mm long, smooth; lemma 2.3-2.5 mm long, smooth and shiny; column of awn 6.5-13 mm long, glabrous; central branch 3-4.5 cm long, glabrous below the middle, plumose above to the tip; lateral branches 7-18 mm long, glabrous; callus bearded with one set of hairs



Figure 36. *STIPAGROSTIS* spp.: *S. HIRTIGLUMA*: 1 - floret x 2; 2 - glumes x 4; 3 - lemma and callus x 17. *S. UNIPLUMIS*: 4 - floret x 2; 5 - glumes x 4; 6 - lemma and callus x 17. *S. FOEXIANA*: 7 - floret x 2; 8 - glumes x 4; 9 - lemma and callus x 17. 1-3 from *Hudleston* 13; 4-6 from *Pappi* 7560; 7-9 from *Corradi* 917. Drawn by Eleanor Catherine.

increasing uniformly in length upward, the tip minutely bifid. Fig. 36:7-9.

In rock fissures. GG (type collection only); North Africa; southwestern Africa; Saudi Arabia and Yemen.

4. *S. obtusa* (Del.) Nees (1832);

Aristida obtusa Del. (1813) - type: Egypt, *Delile* (MPU holc.).

Tufted perennial forming tight cushions, the basal sheaths persistent and finally fibrous; culms wiry, up to 35(-60) cm high. Leaf-blades basal, stiff, curling, glabrous, tightly inrolled. Panicle 6-20 cm long, narrow, contracted, looser and interrupted at the base. Glumes 3-nerved, narrowly lanceolate, 8.5-12 mm long with the lower slightly longer, scaberulous, acuminate; lemma 2.5-4 mm long, smooth, abruptly contracted into

the awn; column of awn 5-9 mm long, glabrous; central branch 2-3 cm long, glabrous below the middle, plumose above to the tip; lateral branches 10-15 mm long, glabrous; callus bearded with one set of hairs of increasing length.

Stony and sandy soils in semi-desert; 1000 m. HA (near N Somali border); N Africa, Sinai and eastwards to Pakistan, Arabian peninsula, Namibia, South Africa. *Gillett* 4664.

PAPPOPHOREAE *Kunth* (1829)

Annuals or perennials. Leaf-blades linear, often convolute; ligule ciliate. Inflorescence a contracted, rather narrow panicle. Spikelets all alike, 2- to several-flowered, the lower florets bisexual, the upper progressively reduced, disarticulating above the glumes but not be-

tween the florets; glumes persistent, membranous, (1-) 3-11-nerved, usually enclosing the florets; lemmas broad, rounded on the back, 9-11-nerved, the nerves extended into awns or hyaline lobes; palea broad, sub-equalling the lemma, the keels ciliate; stamens 3; stigmas 2. Grain with large embryo and punctiform hilum.

5 genera in the tropics and subtropics, usually in dry places.

Pappophoreae is related anatomically to *Eragrostideae*, but its stalked microhairs, with bulbous glandular tips, are unique. It can be recognized morphologically by the multi-nerved, many awned lemmas on a tough rhachilla.

1. Lemmas 9-awned without alternating lobes; awns usually ciliate. 53. *Enneapogon*
- Lemmas 5-awned, the awns alternating with 6 hyaline lobes; awns scaberulous. 54. *Schmidtia*

53. ENNEAPOGON *P. Beauv.* (1812)

Renvoize in *Kew Bull.* 22: 393 (1968).

Tufted perennials, or sometimes annual, pilose with swollen gland-tipped hairs. Leaf-blades linear and flat or inrolled and filiform. Inflorescence paniculate, usually contracted or spiciform. Spikelets 3-6-flowered, the lowermost floret bisexual, the second floret smaller, usually male, the third (and any subsequent florets) reduced to a sterile lemma forming a brush-like appendage; glumes lanceolate, enclosing the florets, unequal, the upper longer than the lower, 3-9-nerved, persistent; lemmas many-nerved, rounded on the back, tough, hairy, 9 nerves extended into awns forming a circlet around the top of the lemma; awns usually stout and ciliate for much of their length, slender and scaberulous towards the tips, rarely scaberulous throughout; palea usually equalling the body of the lemma.

28 species in dry parts of the Old World tropics and subtropics, mainly in Australia and Africa but extending eastwards to China; one species in America.

1. Awns scaberulous throughout. 1. *E. scaber*
- Awns ciliate for most of their length, scaberulous only at the tips. 2
2. Third lemma vestigial, 0.5-2 mm long. 3
- Third lemma sterile but well developed, 3-5 mm long. 5
3. Small perennial to 40 cm high; old leaf-sheaths forming fibrous tufts; anthers 0.3-0.7 mm long. 2. *E. desvauxii*
- Annuals or perennials 30-80 cm high; old leaf-sheaths not fibrous; anthers 1-2.2 mm long. 4
4. Coarse annual; culms not bulbous at base; leaf-blades linear, usually flat, 2.5-7.5 mm wide. 3. *E. cenchroides*
- Slender perennial, culms bulbous and knotty at base; leaf-blades setaceous, 1-3 mm wide. 4. *E. scoparius*

5. Lemma shortly and uniformly hairy; awns ciliate for 2/3-3/4 of their length; anthers (0.5-)0.8-1.1 mm long. 5. *E. persicus*
- Lemma bearded with 3 tufts of long hairs; awns ciliate for up to half their length; anthers 0.5 mm long. 6. *E. lophotrichus*

1. *E. scaber* *Lehm.* (1831);

- type: South Africa, Cape of Good Hope (S).

Pappophorum laxum *Chiov.* (1912) - type: Eritrea, Habab, Magber, *Pappi* 8089 (FT hol., K iso.).

Slender tufted perennial; culms branching, ascending to 35 cm high. Leaf-blades linear, flat or involute, 5-15 cm long, 2-4 mm wide, acuminate. Panicle lanceolate to oblong, 4-11 cm long, rather loose, the spikelets contracted around the primary branches. Spikelets 3-flowered, 4.8-6 mm long; glumes sparsely pilose, subacute to minutely denticulate, the lower 7(-9)-nerved, 3.7-5.3 mm long, the upper 5(-7)-nerved, 4-6 mm long; lowest lemma 1.5-1.7 mm long, hirsute with long spreading hairs, its awns 2.8-3.5 mm long, scaberulous, flattened and narrowly winged below the middle; third lemma vestigial, 0.5 mm long; palea much exceeding the lemma; anthers 1.5-2 mm long.

Eritrea; N Africa from Mauretania to Algeria; N Somalia; southern Africa from Angola southwards to the Cape.

A seldom collected grass, known in the Flora area only from the *Pappi* collection cited above. It is immediately distinguishable from all the other species of *Enneapogon* by its non-ciliate awns.

2. *E. desvauxii* *P. Beauv.* (1812);

- type from America.

Pappophorum brachystachyum *Jaub. & Spach* (1851); *Enneapogon brachystachyus* (*Jaub. & Spach*) *Stapf* (1900) - type: Saudi Arabia, *Botta* (P hol.).

Slender, densely tufted perennial; culms wiry, erect or geniculately ascending, 5-40 cm high, often with bunches of old fibrous sheaths at the base. Leaf-blades filiform, finely tapering; basal leaf-sheaths leathery, enclosing cleistogenous spikelets. Panicle spiciform, 2-8 cm long, linear or shorter and ovate. Spikelets 3-flowered, 5.5-7 mm long, silvery-grey; glumes 3-9-nerved, sparsely pilose, the lower 2.5-5 mm long, the upper 2.8-5.5 mm long; lowest lemma 1.5-2 mm long, densely villous, its awns 2.5-5 mm long, ciliate in the lower 2/3; third lemma reduced to a small tuft of awns 0.5-2 mm long; anthers 0.3-0.7 mm long.

Sandy or stony soils in dry, open situations; 400-700 m. EW AR GG HA; throughout Africa, extending eastwards through Arabia to India and China; also in southern U.S.A. and Mexico. *Hudleston* 4; *Sandford* AT.63 (ETH); *Corradi* 1112, 1134 (FT).

A widespread species, though seldom collected in Ethiopia, usually recognisable by its small stature, very fine leaf-blades and fibrous clumps of old leaf-sheaths.

It is occasionally confused with *E. lophotrichus*, but is easily distinguished from that species by its uniformly hairy lemma and vestigial third floret.

It appears to be the only species of *Enneapogon* with cleistogenous spikelets, and mature grains can often be found within the whitish basal leaf-sheaths.

3. *E. cenchroides* (Roem. & Schult.) C. E. Hubb. (1934);

Pappophorum cenchroides Roem. & Schult. (1817) - type: South Africa, *Lichtenstein* (B holo.).

Pappophorum abyssinicum Hochst. (1855); *Enneapogon abyssinicus* (Hochst.) Rendle (1899) - type: Ethiopia, TU/GD, Tacazze valley, *Schimper* in Herb. Buchinger 1451 (STR holo., P iso.).

Pappophorum cenchroides Roem. & Schult. var. *albescens* Schweinf. in *Bull. Herb. Boiss.* 2, App. 2: 99 (1894) - type: Eritrea, Mahio, Haddas valley, *Schweinfurth* 87.

Coarse tufted annual, occasionally with a few perennating shoots at the base; culms 30–80 cm high. Leaf-blades linear, usually flat, 2.5–7.5 mm wide, tapering to a long setaceous tip. Panicle 6–16 cm long, contracted, linear-oblong, often lobed. Spikelets 3-flowered, 4–7 mm long, greyish; glumes scattered-pilose, the lower ovate, 3–7-nerved, 2.5–4.5 mm long, the upper narrowly elliptic-oblong, 3-nerved, 3.2–6 mm long; lowest lemma 1.5–2.5 mm long, villous, its awns 2.5–6 mm long, ciliate for most of their length; third lemma reduced to a brush of awns 0.5–2 mm long; anthers 1–1.6 mm long. Fig. 37:1–3.

Dry sandy or stony soils in *Acacia* bushland; 1000–1500 m. EW TU-GD SU GG HA; Sudan southwards to the Cape, through Arabia to India; also on Ascension Island. *Burger* 906; *M. G. & S. B. Gilbert* 2060; *Gilbert & Thulin* 327.

A variable annual, showing a wide range in both leaf width and spikelet size. The glumes are noticeably fewer-nerved than in other Ethiopian species (except the rare *E. scoparius*), the upper glume generally having only 3 long nerves.

Plants which are not clearly annual may approach longer-leaved, more robust forms of *E. persicus* in appearance. However, the leaf-blades are generally longer and softer than in *E. persicus*, and do not diverge widely from the stem. The smaller spikelets, abortive third lemma, and 3-nerved upper glume provide additional distinguishing characters.

4. *E. scoparius* Stapf (1900);

Pappophorum scoparium (Stapf) Chiov. (1908) - types: South Africa (6 syntypes) & Ethiopia, TU?, Awarra near Mawen, *Schimper* 2235 (K, syn.).

Pappophorum setifolium Hochst. (1871), nom. nud. based on *Schimper* 2235.

Slender, densely tufted perennial; culms wiry, 30–80 cm high, arising from a bulbous, knotty base, unbranched near the base, then profusely branching. Leaf-

blades involute, setaceous, up to 20 cm long, 1–3 mm wide. Panicle spiciform, narrowly oblong, 2.5–11 cm long. Spikelets 3-flowered, 4.5–7 mm long, greyish; glumes pilose, the lower ovate, 3–7-nerved, 2.5–5 mm long, the upper lanceolate-oblong, 3(–5)-nerved, 3.3–7 mm long; lowest lemma 2–2.3 mm long, villous, its awns 2.3–4.5 mm long, ciliate for 2/3 of their length; third lemma reduced to a brush of awns 0.5–1.5 mm long; anthers 1.2–2.2 mm long.

Dry situations; 1000–1700 m. EW TU; Somalia, Zambia southwards to the Cape, and in N Yemen. Absent from East Africa. *Mooney* 9392 (ETH).

E. scoparius has a primarily southern African distribution, with a few outlying populations in northern Ethiopia and Yemen. In spikelet characters it approaches *E. cenchroides* most closely, but is set apart from that species by its distinctive habit with swollen knotty culm-bases, wiry profusely branched culms, and long setaceous leaf-blades.

5. *E. persicus* Boiss. (1844);

Pappophorum persicum (Boiss.) Steud. (1854) - type: Iran, *Aucher-Eloy* (P holo., K iso.).

Pappophorum schimperianum Hochst. ex A. Rich. (1850); *Enneapogon schimperianus* (Hochst. ex A. Rich.) Renv. (1968) - type: Ethiopia, TU, Adoa, *Schimper* 323 (K iso.).

Pappophorum elegans Steud. (1854); *Enneapogon elegans* (Steud.) Stapf (1907).

Pappophorum glumosum Hochst. (1855); *Enneapogon glumosus* (Hochst.) Maire & Weiller (1953) - type: Ethiopia, TU, *Schimper* 1297 (STR holo., P iso.).

Compactly tufted perennial with slender, wiry culms 15–45(–70) cm high. Leaf-blades usually inrolled, filiform, 1–8(–17) cm long, sometimes flat and then 2–3 mm wide, often diverging at a wide angle from the culm. Panicle narrowly oblong, contracted to spiciform, 4–10 cm long. Spikelets 4-flowered, narrowly oblong, 6.5–9 mm long, tinged olive-grey or purplish; glumes (5–)7–9-nerved, sparsely hairy, the lower 3.6–7 mm long, the upper 4.6–8 mm long; lowest lemma 1.2–2.2 mm long, shortly and uniformly villous, its awns 4.5–7 mm long, usually ciliate 2/3–3/4 of their length, third lemma sterile but well developed, 3–5 mm long (including awns), fourth lemma vestigial; anthers 0.5–1.3 mm long. Fig. 37:4–6.

Dry, stony or sandy soils in open grassland and *Acacia-Commiphora* bushland, often on limestone; 400–2400 m. EW TU WU SU GG SD HA; East Africa and eastwards through Arabia to India and Burma. *Gilbert & Getachew* 2668; *M. G. & S. B. Gilbert* 1220; *Hudleston* 10.

The relatively short, inrolled leaf-blades frequently (but not invariably) diverge widely, sometimes horizontally, from the stem, providing an easy spot character for this species, when coupled with its low stature and slender wiry culms.



Figure 37. *ENNEAPOGON* spp.: *E. CENCHROIDES*: 1 - habit x 3/4; 2 - spikelet x 7; 3 - florets x 7. *E. PERSICUS*: 4 - habit x 3/4; 5 - spikelet x 7; 6 - florets x 7. *E. LOPHOTRICHUS*: 7 - lemma x 7. 1-3 from Ash 1244; 4-6 from Gilbert et al. 1864; 7 from Gilbert et al. 1269. Drawn by Eleanor Catherine.

6. *E. lophotrichus* *Chiov. ex Scholz & König* (1983);
- type: Ethiopia, GG, Dande, *Corradi* 860 (FT
holo.).

Tufted perennial; culms slender, 10–30 cm high. Leaf-blades linear, 2–7 cm long, 1.5–3 mm wide or inrolled and filiform, ascending (not widely diverging). Panicle oblong, spiciform, 2–5.5 cm long. Spikelets 6-flowered, 6.8–7 mm long, pale green often tinged reddish-purple; glumes scattered-pilose, the lower 9-nerved, 4.2–4.8 mm long; lowest lemma 1.5–2 mm long, bearded with 3 basal tufts, one central and one on each margin, the hairs long, silky and partially obscuring the prominent nerves, its awns 5–5.3 mm long, ciliate for not more than half their length; third lemma 4–4.5 mm long (including awns), forming a spreading brush of awns together with the remaining reduced sterile lemmas; anthers 0.5 mm long. Fig. 37:7.

Dry stony soils and among rocks in open shrubland and semi-desert; 350–1000 m. AF EW SU (Awash valley) GG SD HA; N Kenya, N Somalia, Djibouti, Sudan, Chad (Tibesti), and in the Arabian peninsula. *Burger* 3529; *M. G. & S. B. Gilbert* 1269; *Hemming* 1044.

E. lophotrichus is a small grass of dry lowland localities, very similar in habit to both *E. persicus* and *E. desvauxii*, with which it is often confused. It can generally be distinguished from the former by its shorter panicle and lack of diverging leaf-blades, and from the latter by the absence of cleistogenes in the basal leaf-sheaths. However, the 3 conspicuous tufts of hair on the lemma (immediately visible when the glumes are opened out), which are unique in the genus, provide a sure means of identification for this species.

54. *SCHMIDTIA* *Steud.* in *Schmidt* (1852) *nom. conserv.*

Launert in *Bol. Soc. Brot., sér. 2*, 39: 303 (1965).

Annual or perennial. Leaf-blades linear, flat or convolute, the blades and sheaths pilose with swollen, gland-tipped hairs. Inflorescence an open or contracted panicle. Spikelets several-flowered with the uppermost florets reduced; glumes clearly (7–)9–11(–14)-nerved, rounded on the back, exceeding the lower florets, persistent; lemmas 9-nerved, rounded on the back, entire, tough and hairy below, divided into 6 hyaline lobes alternating with 5 straight scaberulous awns; palea slightly exceeding the body of the lemma, shortly ciliate on the keels with some of the hairs gland-tipped.

2 species in tropical and South Africa; also in Pakistan.

S. pappophoroides *J. A. Schmidt* (1852);
- type: Cape Verde Is., *J. A. Schmidt* s.n. (P iso.).

Tussocky perennial, often with arching stolons; culms slightly swollen basally, 30–90 cm high, erect or geniculately ascending, sometimes suffrutescent, leafy and

with fascicles of shoots at the nodes. Leaf-blades linear, 2–7 mm wide, the blades and sheaths softly pilose, many of the hairs with swollen, glandular tips. Panicle loosely contracted, elliptic, 6–12 cm long. Spikelets 4–10-flowered, elliptic to obovate, up to 15 mm long, pallid, conspicuously hairy; glumes unequal, elliptic to narrowly ovate, glabrous or sparsely pilose, acute to obtuse-denticulate, the lower 4.5–7.5 mm long, the upper 6–9 mm long; lemmas 8.5–14 mm long, the lower 2/3 chartaceous, densely silky-villous, the upper 1/3 divided into 6 hyaline, acute lobes alternating with 5 awns, the nerves extending into the lobes and awns alternately; awns 4.5–8 mm long; palea villous.

Dry stony and sandy soils in open deciduous bushland; 700–800 m. GG HA; southwards to South Africa and westwards to Senegal and Mauretania; occasional sporadic occurrences eastwards to Pakistan. *Ellis* 208; *Sebsebe D.* 260 (ETH).

ERAGROSTIDEAE *Stapf* (1898)

Phillips in *Kew Bull.* 37: 133–162 (1982).

Annuals or perennials. Leaf-blades usually linear to filiform; ligule ciliate or infrequently membranous. Inflorescence an open or contracted panicle, or composed of tough 1-sided racemes or spikes (2-sided in *Oropetium*, bottlebrush in *Harpachne*) of biseriate spikelets, these digitate or spread along a central rhachis or sometimes solitary, persistent or deciduous. Spikelets 1-many-flowered with the uppermost florets reduced, usually laterally compressed, disarticulating between the florets, or less often the paleas persistent or the spikelet falling entire; glumes usually 1-nerved, persistent or not, mostly shorter than the lowest lemma but sometimes as long as the spikelet; floret callus sometimes bearded; lemmas 1–3-nerved (except *Aeluropus*, *Drake-Brockmania*), membranous to cartilaginous or infrequently coriaceous, glabrous or hairy especially along the nerves, sometimes also on the back, entire or 2–(3)-toothed, mucronate or awned from the tip or sinus, lateral nerves sometimes also excurrent; stamens 2–3. Grain occasionally ornamented or enclosed in a free pericarp.

77 genera; tropics and subtropics, often as pioneers of arid or disturbed situations.

Many species have simple, several-flowered spikelets disarticulating between the florets and bear a superficial resemblance to *Poeae*, especially when the inflorescence is paniculate. Eragrostoid grasses can generally be distinguished by their 3-nerved lemmas and ciliate ligule, in contrast to the 5- or more-nerved lemmas and membranous ligule of *Poeae*; there is often also a rather more cartilaginous spikelet texture. Anatomically the two tribes are quite different, and they are unrelated. *Eragrostideae* has Kranz anatomy and C4 physiology.

1. Lemmas 9-11-nerved. (subtribe *Monanthochloinae*) 55. *Acliaropus*
 - Lemmas 1-3(-5)-nerved, occasionally with subsidiary nerves in the keel. 2
2. Spikelets 2-several-flowered, or if 1-flowered the inflorescence clearly composed of 1 or more spikes or racemes (subtribe *Eleusininae*). KEY 1 3
 - Spikelets strictly 1-flowered; inflorescence an open or contracted panicle (subtribe *Sporobolinae*). KEY 3 26
- KEY 1**
3. Spikelets sunk in the rhachis of a solitary terminal spike; upper glume elongate, covering the single floret, lower glume small or suppressed. 59. *Oropetium*
 - Spikelets exposed (if inflorescence a solitary spike, spikelets not sunk in the rhachis); both glumes well developed. 4
4. Lemmas bearded from the callus with encircling hairs c 1/2 spikelet length; robust tussocky glaucous perennial. 57. *Halopyrum*
 - Lemmas not or only shortly bearded from the callus. 5
5. Lemma-tip emarginate or 2-toothed, or if entire the marginal nerves or flanks hairy (if paleas persistent on a tough rhachilla, see 74. *Acrachne*). 6
 - Lemma-tip entire, the marginal nerves glabrous (at most ciliolate on the margins). KEY 2 17
6. Glumes shorter than the spikelet, usually shorter than the lowermost lemma. 7
 - Glumes as long as the spikelet, or at least the lower clearly longer than the lowest lemma. 14
7. Inflorescence a solitary spike; small tufted perennials. 58. *Tripogon*
 - Inflorescence paniculate, or composed of spikes or racemes. 8
8. Inflorescence digitate, the spikes deciduous. 65. *Ochthochloa*
 - Inflorescence paniculate, or of persistent spikes or racemes. 9
9. Grain rugose, enclosed within a free pericarp, dorsally flattened, concavo-convex; lemmas flattened across the back. 72. *Coelachyrum*
 - Grain not rugose and enclosed within a free pericarp; lemmas keeled or rounded. 10
10. Leaf-blades short, distichous and pungent; inflorescence a short dense ovoid head. 60. *Odyssea*
 - Leaf-blades not conspicuously distichous and pungent. 11
11. Lemmas 3-awned; inflorescence paniculate. 56. *Triraphis*
 - Lemmas 1-awned or awnless; inflorescence of distinct spike-like racemes. 12
12. Spikelets disarticulating above the glumes but not between the florets. see *Cynodontes* (p. 157)
- Spikelets disarticulating between the florets. 13
13. Inflorescence open, composed of scattered racemes; lemma with lateral nerves shortly pilose. 61. *Leptochloa*
 - Inflorescence a dense feathery head of crowded racemes; lemma with lateral nerves conspicuously ciliate. 62. *Leptocarydion*
14. Lateral nerves of lemma conspicuously ciliate. 63. *Trichoneura*
 - Lateral nerves of lemma appressed pubescent or the lower flanks hairy. 15
15. Inflorescence of persistent racemes; spikelets 1-flowered. 61. *Leptochloa*
 - Inflorescence of deciduous spikes, or secondary branchlets deciduous. 16
16. Glumes subequal, as long as the spikelet, enclosing the florets, 1-nerved. 64. *Dinebra*
 - Upper glume much longer than the lower with divergent tip, conspicuously many-nerved. 66. *Drake-Brockmania*
- KEY 2**
17. Grain dorsally flattened, concavo-convex, enclosed within a free pericarp; lemmas flattened, asperulous or clavate pubescent. 72. *Coelachyrum*
 - Grain globose to ellipsoid, not strongly flattened; lemmas keeled or rounded. 18
18. Inflorescence a panicle. 19
 - Inflorescence of 1 or more spikes or racemes. 20
19. Lowermost culm-internode clavately swollen and persistent as a storage organ. 43. *Molinia* (p. 66)
 - Lowermost culm-internode not expanded as a storage organ. 67. *Eragrostis*
20. Inflorescence a solitary raceme or spike (if lemmas awned, see 58 *Tripogon*). 21
 - Inflorescence of 2 or more subsecund spikes. 22
21. Spikelets erect, the lemmas disarticulating leaving persistent paleas. 68. *Eragrostiella*
 - Spikelets deflexed, falling entire with pedicel attached. 69. *Harpachne*
22. Spikes dispersed singly along an elongate central axis; grain smooth. 23
 - Spikes digitate or ± whorled; grain ornamented with a free pericarp. 24
23. Spikes deciduous; spikelets breaking up at maturity; rhachilla-internodes tipped with short stiff hairs (if glumes longer than florets, see 64 *Dinebra*). 70. *Pogonarthria*
 - Spikes persistent; spikelets falling entire; rhachilla-internodes glabrous. 71. *Desmostachya*
24. Spikes terminating in a point. 73. *Dactyloctenium*
 - Spikes terminating in a fertile or abortive spikelet. 25
25. Spikes terminating in an abortive spikelet; rhachilla tough, paleas persistent. 74. *Acrachne*
 - Spikes terminating in a fertile spikelet; rhachilla fragile, disarticulating between the florets. 75. *Eleusine*

KEY 3

26. Inflorescence a short dense ovoid or ellipsoid head, subtended by an inflated leaf-sheath with rudimentary blade. 76. *Crypsis*
 - Inflorescence an open or contracted panicle, or elongate and spiciform, exerted from the uppermost leaf-sheath. 27
27. Spikelets fusiform, glumes and lemma rounded on the back; grain not beaked. 77. *Sporobolus*
 - Spikelets strongly laterally compressed, glumes and lemmas keeled; grain beaked. 78. *Urochondra*

55. *AELUROPUS* Trin. (1822)

Glaucous stoloniferous perennials; leaf-blades short and stiff, pungent, often markedly distichous; ligule a narrow ciliate membrane. Inflorescence capitate to spiciform, composed of short, congested racemes of subsessile spikelets appressed to one side of the central axis, or sometimes the spikelets borne directly on the axis. Spikelets several- to many-flowered, laterally compressed, disarticulating above the glumes and between the florets; glumes shorter than the lemmas, keeled, 1- to several-nerved; lemmas ovate, chartaceous with broad scarious margins, strongly 9-11-nerved, rounded on the back, glabrous or pilose along the margins, or sometimes also on the back, entire or emarginate, apiculate; palea equalling the lemma; stamens 3. Grain broadly elliptic, dorso-ventrally flattened.

3-4 species; Mediterranean eastwards to central Asia, India and Sri Lanka, Arabia and NE tropical Africa.

A genus of grasses adapted to saline conditions along the coasts and in desert regions inland; especially useful as desert pasturage.

A. lagopoides (L.) Thwaites (1864);

Dactylis lagopoides L. (1767); *Dactylis brevifolia* Willd. (1797) nom. superfl.; *Aeluropus brevifolius* (Willd.) Steud. (1840) - type: India, *Burmann* (LINN holo.).

Dactylis repens Desf. (1798); *Aeluropus repens* (Desf.) Parl. (1848).

Poa massauensis Fresen. (1837) - type: Eritrea, shore by Massaua, *Rüppel* (FR holo.).

A. brevifolius (Willd.) Steud. var. *longifolius* Chiov. in *Ann. Ist. Bot. Roma* 8: 70 (1903) - types: Eritrea, Dahlak Is., *Terracciano* 418, 762 & Samhar, Seek Said Is., *Terracciano & Pappi* 2776, 2777 (all FT syn.).

A. brevifolius (Willd.) Steud. var. *pygmaeus* Terracc. ex Chiov., l.c. 70 (1903) - types: Eritrea, Dahlak Is., *Terracciano* 424, 447, 481 (all FT syn.).

A. mucronatus (Forsk.) Aschers. var. *erythraeus* Terracc. in *Ann. Ist. Bot. Roma* 5: 96 (1893); *Aeluropus erythraeus* (Terracc.) Mattei (1910) - type: Eritrea, Ras Madir to Haressan, *Terracciano* (PAL holo.).

A. erythraeus (Terracc.) Mattei var. *scandens* Terracc. ex Mattei in *Bol. Ort. Bot. Palermo* 9: 63 (1910) - type: Eritrea, Assab, *Terracciano* (PAL holo.).

Perennial with scaly rhizomes and also elongate surface stolons; culms much branched, sometimes suffrutescent, up to 40 cm high. Leaf-blades tough, flat or inrolled, 0.5-4 cm long (rarely more), 1.5-2.5 mm wide, pungent, usually stiffly distichous and horizontally spreading with imbricate sheaths, occasionally looser and ascending, glabrous or pilose. Inflorescence capitate, subglobose to ovoid, 0.5-2 cm long, the congested spikelets borne directly on the main axis or the lower on short racemes. Spikelets ovate-oblong, often curling, 4-7 mm long, 4-18-flowered, the florets closely imbricate; glumes loosely pilose, subacute, the lower narrowly oblong-lanceolate, 1-4-nerved, the upper oblong to ovate, 7-9-nerved; lemmas 2.3-3 mm long, variably hairy, pilose only near the margins in the lower 2/3 or also on the back, or sometimes densely villous; palea pilose below, its broad tip often exposed. Fig. 38.

Sandy seashores down to high water mark, salt flats and around saline pools inland; sea level-500 m (higher by the Blue Nile). EE GJ/SU (Blue Nile) BA/HA (near Somali border); Mediterranean; Red Sea coast of Sudan, Somalia; Arabia and eastwards to C Asia, India and Sri Lanka. *IECAMA* BH-31; *Hemming* 1109; *Moo-ney* 8955.

A variable grass vegetatively, especially in the length, stiffness and degree of distichous spread of the leaf-blades. It is extremely salt tolerant, sometimes forming almost pure swards where little else will grow.

56. *TRIRAPHIS* R. Br. (1810)

Annuals or perennials. Leaf-blades linear; ligule membranous or ciliate. Inflorescence an open or contracted, rarely spiciform panicle. Spikelets several-flowered with the uppermost florets reduced, laterally compressed, disarticulating between the florets, these well-spaced on the slender, filiform rhachilla; glumes subequal, hyaline, 1-nerved, persistent, shorter than the spikelet, usually mucronate; lemmas narrow, keeled, 3-nerved, pilose especially near the margins, 3-toothed and 3-awned, the central tooth bifid, the awns arising from the 2 lateral teeth and from the sinus of the central tooth; awns straight, scabrid, the central awn exceeding the 2 laterals; palea hyaline, a little shorter than the lemma; stamens 3.

7 species, mainly in southern tropical Africa and South Africa; one species in N Africa from Mauretania to Sudan and Arabia, and one species in Australia.

T. compacta Cope (1980);

- type: Ethiopia, SD, between Neghelle and Filtu, *Friis et al.* 969 (K holo., C iso.).

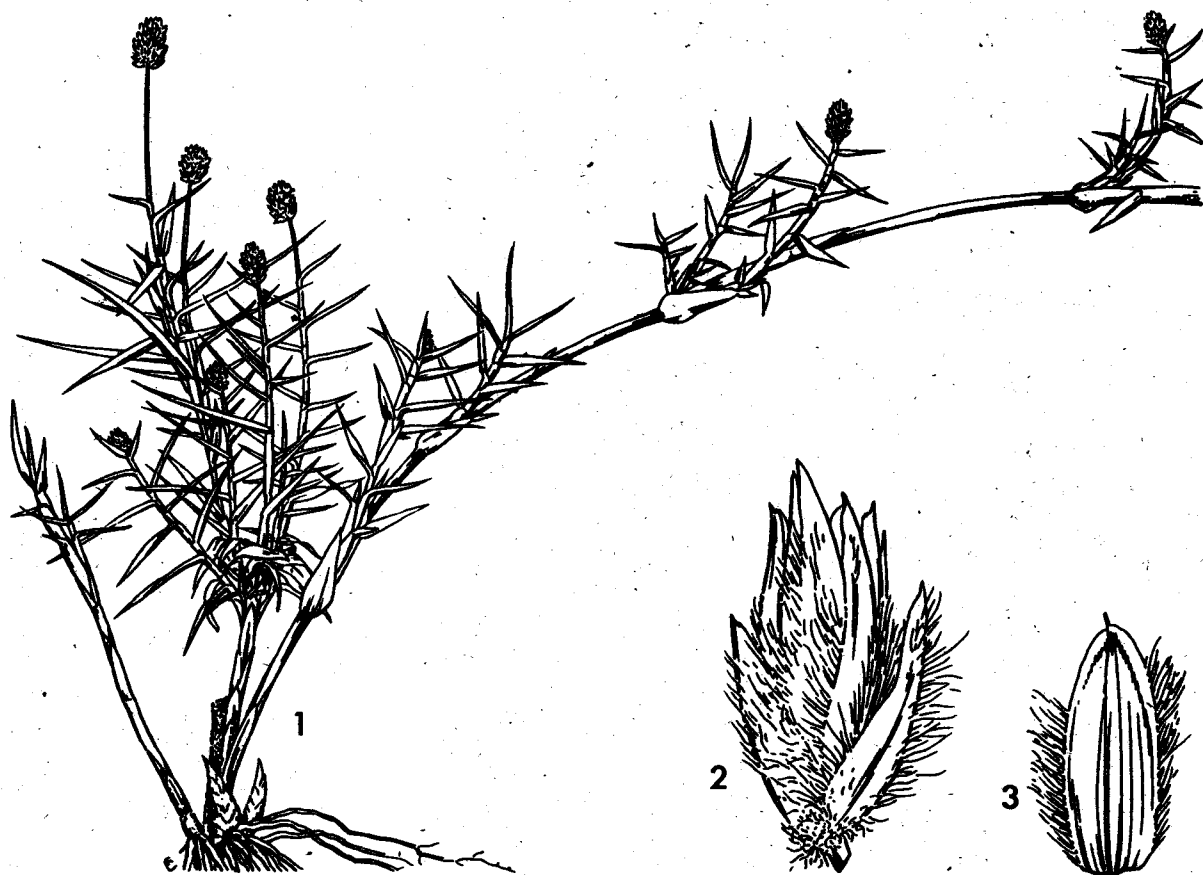


Figure 38. *AELUROPUS LAGOPOIDES*: 1 - habit x 3/4; 2 - spikelet x 11; 3 - lemma x 11. All from *Musselman 6202*. Drawn by Eleanor Catherine.

Slender, tufted perennial; culms erect, 70 cm high, 3-4-noded, the nodes purplish. Leaf-blades linear, flat, pilose with lax spreading hairs near the ligule, otherwise glabrous, setaceously acuminate; leaf-sheaths hispid, purplish. Panicle linear, compact, lobed or interrupted below, 15-23 cm long, the spikelets densely crowded on the short erect branches; spikelets 6-8-flowered, 5.5-6 mm long (excluding awns), glistening, green with purple awns; glumes irregularly denticulate and mucronate, the lower linear-lanceolate, 2.5-3.5 mm long, the upper linear-oblong, 4-6 mm long; lemmas linear-oblong, 3-3.5 mm long, pilose with longer hairs near the upper margins; central awn 6-8 mm long; anthers 0.3 mm long; callus and the base of the rhachilla-internodes bearded. Fig. 39.

Grassland; 1300 m. SD HA; unknown elsewhere. *Michel Corrà JBK-12 (ILCA)*.

57. *HALOPYRUM* Stapf (1896)

Perennial; leaf-blades narrow, ligule a ciliate rim. Inflorescence composed of short racemes of loosely arranged, shortly pedicellate spikelets scattered along a central axis. Spikelets large, many-flowered with very short rhachilla internodes, laterally compressed, disarticulating between the florets; glumes shorter than the

lemmas, 3-7-nerved; lemmas coriaceous, rounded on the back or lightly keeled towards the tip, entire or emarginate, mucronate, bearded at the base with long silky hairs, the hairs arising on the callus and rhachilla tip. Grain elliptic, concavo-convex.

1 species along the shores of the Indian Ocean from Mozambique to Sri Lanka.

H. mucronatum (L.) Stapf (1896);

Uniola mucronata L. (1762); *Brizopyrum mucronatum* (L.) Wight (1837); *Eragrostis mucronata* (L.) Defl. (1887); *Desmazeria uniolooides* Defl. (1889), nom. superfl. - type: India, *Burmann* (missing from LINN).

Tough, tussocky perennial with spreading stolons, the roots thick, tomentose and coated in sand; culms hard, rigid, up to 2 m high, fasciculately branching at the nodes. Leaf-blades narrowly linear to setaceous, up to 45 cm long, inrolled, glaucous with pungent tip. Inflorescence narrowly lanceolate, 10-40 cm long, composed of a number of ascending racemes 3-8 cm long. Spikelets 8-25-flowered, elliptic to oblong, 12-26 mm long; glumes narrowly ovate, the lower 3-5-nerved, the upper 5-7-nerved; lemmas lanceolate, 7-9 mm long, asperulous, acute and shortly mucronate, the basal tuft of hairs half as long as the lemma. Fig. 40.

Coastal sand dunes, a sand binder; sea level. EE; the east coast of Africa from Egypt to Mozambique, Arabian peninsula, Iran, Pakistan, India and Sri Lanka. *Ash* 708A; *Hemming* 1110.

58. **TRIPOGON** Roem. & Schult. (1817)

Phillips & Launert in *Kew Bull.* 25: 301-322 (1971).

Slender tufted perennials, the persistent basal sheaths often fibrous; culms erect, unbranched. Leaf-blades basal, usually filiform; ligule a narrow ciliate membrane. Inflorescence a solitary terminal subsecund spike of biseriate spikelets on a slender triquetrous rhachis. Spikelets 2- to several-flowered, linear to elliptic, laterally compressed, disarticulating above the glumes and between the florets; glumes unequal, narrow, the lower 1-nerved, usually broadened into an additional basal lobe on one side, the upper 1-3-nerved, sometimes exceeding the lower lemmas; floret callus bearded, a tuft of hairs sometimes also present at the base of the rhachilla-internode; lemmas membranous, 3-nerved, lanceolate to elliptic, lightly keeled or rounded, glabrous, bidentate (subentire in *T. major*), mucronate or awned from the sinus, the lateral nerves often also excurrent; palea-keels usually winged; stamens 2-3. Grain narrow, subterete.

About 30 species; tropics and subtropics, especially Africa and India; one species in tropical America.

Tripogon is an easily recognizable genus, with its solitary terminal spike of 2-ranked, awned spikelets. However, its species are often separated by rather small characters, which impart an individual facies, but are not readily expressed in keys. Anther number and length, although awkward to use, is one of the most helpful characters in species recognition.

1. Lemmas 1-2.4 mm long; anthers 0.2-0.7 mm long 2
- Lemmas 2.2-8.4 mm long; anthers 0.8-2.4 mm long 3
2. Anthers 3; lemma-tip emarginate, with a mucro up to 1 mm long; lateral nerves not excurrent.
 1. *T. minimus*
 - Anthers 2; lemma-tip 2-toothed, often with additional lobes between the teeth, awn 0.8-2.5 mm long; lateral nerves excurrent.
 2. *T. subtilissimus*
3. Anthers 2; lemmas 4.5-8.4 mm long; palea-keels clearly winged. 3. *T. major*
- Anthers 3; lemmas 2.2-4.5 mm long (or if longer, palea-keels not winged). 4
4. Spikelets 3-5-flowered, blackish or purple; palea-keels not winged, scaberulous; awns 4-10 mm long, flexuous; rhachilla-internodes bearded at base. 4. *T. montanus*
- Spikelets 4-19-flowered, pale green to grey; palea-keels winged, ciliate; awns up to 4 mm long, usually straight; rhachilla-internodes glabrous (callus shortly bearded). 5



Figure 39. *TRIRAPHIS COMPACTA*: 1 - habit x 3/4; 2 - inflorescence x 3/4; 3 - spikelet x 7; 4 - lemma x 11. All from *Friis et al.* 969. Drawn by Eleanor Catherine.



Figure 40. *HALOPYRUM MUCRONATUM*: 1 - habit and inflorescence x 3/4; 2 - spikelet x 3; 3 - lemma x 5. 1 from Sampson 65 & Hemming 1110; 2 & 3 from Hemming 1110. Drawn by Eleanor Catherine.

5. Spike slender, flexuous, the spikelets imbricate <math>< 1/2</math> their length; leaf-blades pilose; basal sheaths splitting into fine fibres. 5. *T. leptophyllus*
 - Spike linear-oblong, the spikelets clustered, imbricate >math>> 1/2</math> their length; leaf-blades glabrous; basal sheaths not fibrous. 6. *T. multiflorus*

1. *T. minimus* (A. Rich.) Hochst. ex Steud. (1854);
Festuca minima A. Rich. (1850) - types: Ethiopia, TU, near Djeladjeranne [Tchéla-tchékanné], Schimper 1652 (P syn., BM FT K isosyn.) & Shire [Chiré], *Quartin Dillon* (P syn.).

Small perennial; basal sheaths persistent, finally coarsely fibrous; culms 5–15(–25) cm high. Leaf-blades narrowly linear, 1–9 cm long, 0.5 mm wide, usually folded, scattered-pilose on the upper surface, subacute. Spikes 2–8 cm long, straight, slender, erect, the spikelets imbricate by up to 1/2 their length. Spikelets narrowly elliptic-oblong, 2.6–4(–8) mm long, 4–10-flowered with tightly imbricate florets, tinged grey or purplish; glumes 1-nerved, acute to acuminate; lower glume lanceolate-oblong, 0.8–2(–2.7) mm long; upper glume narrowly oblong, 1.8–3(–4) mm long; floret callus bearded, also a conspicuous tuft of hairs at the base of the rachilla-internode; lemmas 1.5–2.3(–2.8) mm long, lanceolate-oblong, emarginate to obtusely bidentate, lateral nerves not excurrent; mucro 0.1–0.3(–1.2) mm long; palea-keels narrowly winged; anthers 3, 0.2–0.5 mm long. Fig. 41:8, 9.

Open places in woodland or bushland, often on sand or shallow soil overlying rock; 1000–2000 m. TU GD SU; tropical Africa southwards to Natal, excluding the Congo basin; also in Madagascar. *M. G. & S. B. Gilbert* 2176; *Gilbert & Getachew* 2769.

This is the commonest species of *Tripogon*, and can be distinguished from all other Ethiopian species except *T. subtilissimus* by its small size. Specimens from East Africa southwards tend to have larger spikelets with more florets (bracketed measurements in the description) than those from western and northeastern tropical Africa.

2. *T. subtilissimus* Chiov. (1906);
 - type: Somalia, *Baudi & Candeo* 42 (FT holo.).

Slender perennial; basal sheaths persistent, finally coarsely fibrous; culms up to 25(–37) cm high. Leaf-blades filiform, rarely flat, 1–11 cm long, up to 2 mm wide, glabrous or scattered-pilose on the upper surface. Spikes 2–10(–20) cm long, sometimes feathery, the spikelets slightly to densely imbricate. Spikelets linear-oblong, 4.2–11 mm long, 7–19-flowered, the florets thinly membranous, usually tightly imbricate, pale green or purple-tinged with green nerves; glumes 1-nerved or the upper 3-nerved, very variable in shape; lower glume 0.8–2.6 mm long, acute to acuminate or mucronate; upper glume 1.7–3.8 mm long, usually narrowly oblong, subacute to tridentate, rarely narrowly acuminate and exceeding the lower lemmas; lemma body ovate-oblong, rounded on the back, 1.1–2.4 mm

long, bidentate to deeply bifid with additional lobes between the teeth, lateral nerves excurrent 0.1–2.5 mm; awn 0.8–3.6 mm long; palea-keels winged, ciliate along the wing margins; anthers 2, 0.2–0.7 mm long. Fig. 41:7.

Deciduous bushland on gypsum or limestone; 450–1700 m. SU (Blue Nile Gorge) SD BA HA; Kenya, Somalia, S Yemen and Oman. Friis et al. 3315; Gilbert et al. 7660; Gilbert & Thulin 989.

A local species, with precise habitat requirements, restricted to calcareous soils in the lower parts of the country. There is much variation in spikelet characteristics, sometimes leading to striking differences in facies. The core of the species is characterized as follows: short acute lower glume; oblong 1-nerved upper glume with acute or minutely tridentate tip; shortly bilobed lemma-tip, the lateral nerves excurrent c 0.5 mm; anthers < 0.5 mm long. Most specimens from southern Ethiopia deviate from this pattern by the possession of a 3-nerved tridentate upper glume, anthers 0.5–0.7 mm long, and also relatively tall culms and sometimes flat leaf-blades. However, specimens with 3-nerved upper glumes also occur sporadically throughout the range of the species. Occasional specimens from scattered localities with a narrow, acuminate, 1-nerved upper glume exceeding the lower lemmas (e.g. Gilbert & Thulin 989) coupled with narrow lemmas, appear to be no more than extreme variants.

The lemma-tip varies from shortly bidentate to deeply bifid, with additional filiform lobes simulating awns and lateral nerves excurrent up to 2.5 mm, imparting a quite different feathery appearance to the spike. However, these feathery forms sometimes grow together with normal shortly bidentate forms (e.g. Rippstein 1089), and may not be as significant as their different facies suggests.

3. *T. major* Hook.f. (1864);

- type: Cameroon Mt, Mann 2098 (K holo.).

Tussocky perennial from a tough rootstock; culms slightly swollen at the base and enclosed by the persistent, non-fibrous leaf-sheaths, stiffly erect, 20–65 cm high. Leaf-blades 5–25 cm long, 0.5–2(–4) mm wide, narrowly linear to filiform, glabrous or thinly pilose. Spikes 8–25 cm long, stiffly erect, the spikelets distant to slightly imbricate, or infrequently clustered. Spikelets oblong, 13–25 mm long, 6–18-flowered, the florets loosely imbricate with the rachilla often exposed, olive-grey; glumes acute to acuminate; lower glume linear-lanceolate, 4–6.6(–8.4) mm long; upper glume narrowly lanceolate, often exceeding the following lemma; floret callus loosely bearded with conspicuous spreading hairs; lemmas 4.5–7(–8.5) mm long, lanceolate, tapering to a very narrow emarginate to subentire tip, lateral nerves not usually excurrent; awn (0.5–)1–5 mm long; palea-keels distinctly winged, scaberulous along the wing margins; anthers 2, 1.4–2.4 mm long.

Rock crevices and in thin soil on mountains; WG; Sierra Leone, Cameroon, Sudan, Kenya, Uganda, Tanzania, Malawi. *Benedetto* 513 (FT).

T. major occurs in scattered upland locations across tropical Africa, the different populations showing slight morphological differences. Surprisingly, it has been collected only once in Ethiopia, but is to be expected in the southern mountains above 1200 m. It is more robust in habit than the other Ethiopian species except *T. multiflorus*, and is easily distinguished from this by its well spaced, broader spikelets with looser florets clearly exposing the spreading callus hairs.

4. *T. montanus* Chiov. (1908);

- type: Eritrea, Scimezana, Guna Guna, Pappi 614 (FT lecto., K isolecto.).

Perennial forming compact tussocks; basal sheaths pale, not fibrous; culms 6–35 cm high, wiry. Leaf-blades filiform, 2.5–15 cm long, 0.5–0.8 mm wide, sparsely pilose on the upper surface. Spikes 3–15 cm long, very slender, clearly extending above the leaves, the spikelets distant or only slightly imbricate. Spikelets narrowly obcuneate, 8.5–15 mm long, 3–5-flowered, dark olive-green to blackish or purplish; glumes very unequal, 1-nerved, linear-lanceolate; lower glume 1.3–4.3 mm long, acute to acuminate; upper glume 4.6–8.4 mm long, almost as long as the spikelet, acuminate to caudate; floret callus bearded, also with a conspicuous tuft of long hairs at the base of the rachilla-internode; lemmas 3.5–5.2 mm long, firm with prominent nerves, minutely scaberulous, abruptly narrowed above the middle, lateral nerves extended into fine awnlets 0.5–1.5 mm long at the base of the awn; awn 4–10 mm long, flexuous; palea-keels not winged, scaberulous; anthers 3, 1.4–2 mm long. Fig. 41:4–6.

Rock crevices and among boulders in exposed places in upland grassland; 2200–3000 m. EW TU GD GJ SU; Uganda, Sudan (Jebel Marra), N Yemen, Saudi Arabia. *De Wilde & Gilbert* 187; *Gilbert & Getachew* 2648; *Mooney* 6291.

T. montanus can be recognized by its dark coloured, firm textured, few-flowered spikelets with long, flexuous awns. Besides the key characters, the non-fibrous base, ± distant spikelets and proportionately shorter lower glume also serve to distinguish it from *T. leptophyllus*, which has a similar geographical distribution but generally occurs at lower altitudes.

5. *T. leptophyllus* (A. Rich.) Cuf. (1968);

Danthonia leptophylla A. Rich. (1850) - type: Ethiopia, TU, near Adoa, *Schimper* 324 (P holo., BM FT K M iso.).

Leptochloa setacea Hochst. (1841), nom. nud. based on *Schimper* 324.

Tripogon abyssinicus Nees ex Steud. (1854), nom. superfl. - type: Ethiopia, TU/GD, towards R. Tacazze, *Schimper* 1732 (P holo., BM FT K M iso.).

Delicate perennial; basal sheaths splitting into dense cushions of fine regular fibres; culms 10–55 cm high, very slender. Leaf-blades filiform, 3–28 cm long, 0.5–2 mm wide, pilose. Spikes 3–18 cm long, flexuous, scarcely exceeding the leaves, the spikelets imbricate by c 1/2 their length. Spikelets narrowly elliptic, 6.5–11 mm long, 4–10-flowered, the florets loosely imbricate, the rhachilla often exposed, greenish-grey or purple tinged; glumes 1-nerved, unequal to subequal, linear-lanceolate; lower glume 2–4.7 mm long, subacute to acuminate; upper glume 2.3–5 mm long, $>$ 1/2 spikelet length, acuminate; floret callus shortly bearded, glabrous at base of rhachilla-internode; lemmas thinly membranous, elliptic-oblong, 2.2–4 mm long, gradually narrowed to a bilobed tip, lateral nerves usually extended as mucros up to 0.7 mm long from the obtuse lobes; awn 1.8–4 mm long; palea-keels very narrowly winged, ciliolate along the wing margins; anthers 3, 0.8–1.3 mm long.

Moist situations among rocks on grassy hillsides; 1500–2300 m. EW GD TU; Sudan (Jebel Marra), N Yemen, Oman (Dhofar). *De Wilde & Gilbert* 252; *Gilbert & Getachew* 3011; *Mooney* 8066.

T. leptophyllus is at present known in Ethiopia only from the north of the country. It is sometimes confused with *T. montanus* (see note under that species). The boundary with *T. multiflorus* is not clear-cut. *Gilbert et al.* 1927 (BA) and *Gilbert & Getachew* 2686B (TU) have the fibrous basal sheaths, hairy leaves and slender spike of *T. leptophyllus*, but narrow spikelets with tightly imbricate florets similar to those of *T. multiflorus*.

6. *T. multiflorus* *Miré & Gillet* (1956);
- type: Niger, Air, *Gillet* 1051 (PAT holo.).

Tussocky perennial; basal sheaths papery, forming dense, persistent bunches; culms up to 65 cm high, stiffly erect. Leaf-blades filiform, 3–20 cm long, c 1 mm wide, glabrous. Spikes 5–23 cm long, linear-oblong, the spikelets clustered together, imbricate by $>$ 1/2 their length. Spikelets 9–20 mm long, linear, 8–19-flowered, the florets closely imbricate, dull green or purple tinged; glumes shorter than the lemmas, narrowly lanceolate-oblong; lower glume 2.5–3.2 mm long, obtuse to acute; upper glume 3.1–3.8 mm long, obtuse to subacute; floret callus bearded, glabrous at base of rhachilla-internode; lemmas 3–4.4 mm long, ovate-oblong, emarginate to shortly and obtusely 2-lobed, lateral nerves not or only very slightly excurrent; awn up to 1.3 mm long; palea-keels winged, ciliolate along the wing margins; anthers 2, 1–1.5 mm long.

Seasonally wet places on rocky slopes in upland grassland; 1800 m. EW; the Saharan mountains of Air (Niger) and Ennedi and Tibesti (Chad); Kenya; Saudi Arabia, N Yemen. *Pappi* 446.

The elongate, narrow spikelets clustered into a compact, relatively broad spike impart a distinctive facies to this species.

59. OROPETIUM *Trin.* (1822)

Lepturella *Stapf* (1912).

Chaetostichium *C.E. Hubb.* (1937).

Phillips in *Kew Bull.* 30: 467–470 (1975).

Small, densely tufted perennials (rarely annual); leaf-blades narrow, linear to convolute; ligule a ciliate membrane. Inflorescence a solitary terminal spike; spikelets in 2 opposite, subopposite or adjacent ranks, sunk in the usually bilaterally flattened rhachis, this tough or fracturing at maturity into several-spiculate pieces, or completely fragile and disarticulating beneath each spikelet. Spikelets 1(–2)-flowered, dorsally compressed; lower glume adaxial, reduced to a small hyaline nerveless scale or absent; upper glume abaxial, enlarged and coriaceous, closing the cavity in the rhachis, 1–3-nerved, acute, acuminate or awned; floret callus bearded; lemma delicate, hyaline, keeled along the lateral nerves, glabrous to pilose, truncate to bidentate, sometimes mucronate or awned; palea-keels close together near the middle.

6 species; Africa to India.

1. Rhachis tough and conspicuously wavy, the spikelets in 2 opposite rows; florets obovate, 0.7–1 mm long. 1. *O. thomaeum*
- Rhachis fragile, straight or slightly wavy, the spikelets opposite, subopposite or adjacent; florets elliptic-oblong, 1.5–3 mm long. 2
2. Spikes straight or curved; upper glume acute, 2–3(–4) mm long. 2. *O. capense*
- Spikes usually flexuous or coiled; upper glume acuminate to awned, (5–)6–20 mm long including the awn. 3. *O. minimum*

1. *O. thomaeum* (*L.f.*) *Trin.* (1822);
Nardus thomaea *L.f.* (1781); *Rottboellia thomaea* (*L.f.*) *Willd.* (1797) - type: India, König (LINN holo.).

Tiny tufted perennial; culms up to 5 cm high. Leaf-blades convolute, 1.5–3 cm long, up to 0.8 mm wide. Spikes straight or curved, 1–4 cm long, up to 1 mm wide; rhachis tough, conspicuously wavy, somewhat spongy, equally bilateral, the spikelets always in 2 opposite ranks, deeply embedded. Lower glume 0.4 mm long, truncate to acute; upper glume 2–2.5 mm long, 3-nerved, acute, the tip often divergent at maturity; lemma obovate, 0.7–1 mm long, 1(–3)-nerved, obscurely mucronulate.

Acacia-Commiphora bushland on sandy soil; 850 m. SD; Kenya, Tanzania; India. *Friis et al.* 2886.

2. *O. capense* *Stapf* (1900);
Lepturella capensis (*Stapf*) *Stapf* in *A. Chev.* (1912) - types: South Africa, Cape Province, *Burchell* 2057, 2091 & *MacOwan* s.n. (all K syn.).
Oropetium erythraeum *Chiov.* (1905) - types: Eritrea, Amasen, Sabarguma, *Pappi* 3900 & *Asaorta*, *Pappi* 2657 (both FT syn.).



Figure 41. *OROPETIUM MINIMUM*: 1 - habit and inflorescence x 3/4; 2 - section of spike x 4. *O. CAPENSE*: 3 - section of spike x 4. *TRIPOGON MONTANUS*: 4 - habit x 3/4; 5 - spikelet x 9; 6 - lemma x 9. *T. SUBTILISSIMUS*: 7 - spikelet x 9. *T. MINIMUS*: 8 - habit x 3/4; 9 - spikelet x 9. 1 & 2 from Gilbert & Phillips 9092; 3 from Gilbert & Thulin 119; 4-6 from De Wilde 7937; 7 from Gilbert & Thulin 989; 8 & 9 from M.G & S.B. Gilbert 2176. Drawn by Eleanor Catherine.

Small tufted perennial; culms up to 14 cm high. Leaf-blades flat, folded or rolled, 1–4 cm long, up to 1.2 mm wide, glabrous or hairy. Spikes usually curved, stiff, up to 10 cm long, 0.5–1 mm wide; rhachis herbaceous, rarely spongy, fracturing, often tardily, at maturity into 1–4(–8)-spiculate pieces, equally or unequally bilateral; the spikelets in opposite, subopposite, or occasionally adjacent ranks, deeply to shallowly embedded. Lower glume 0.1–0.4 mm long, truncate or absent; upper glume 2–4 mm long, 3-nerved, acute; lemma elliptic-oblong, 1.5–2(–2.5) mm long, 3-nerved, mucronate, mucro up to 0.2 mm long. Fig. 41:3.

Thin soil over rock in open bushland; 700–1400 m. EE AF EW HA; westwards to Mali and Chad; Somalia and East Africa; absent from central southern Africa, occurring again in S Zimbabwe and South Africa; also Saudi Arabia and Yemen. *M.G. & S.B. Gilbert* 2405; *Gilbert & Thulin* 62; *Pappi* 7124.

3. *O. minimum* (Hochst.) Pilg. (1947);

Lepturus minimus Hochst. (1855); *Chaetostichium minimum* (Hochst.) C.E. Hubb. (1937) - type: Ethiopia, Dschadscha, *Schimper* in Herb. Buchinger 1145 (STR holo., P iso.).

Chaetostichium minimum (Hochst.) C.E. Hubb. var. *microchaetum* Chiov. in *Webbia* 8: 107 (1951) - type: Ethiopia, GG, Elolo, *Corradi* 562 (FT holo.).

Chaetostichium minimum (Hochst.) C.E. Hubb. var. *macrochaetum* Chiov. in *Webbia* 8: 108 (1951) - types: Ethiopia, GG, El Banno, *Corradi* 1146, 1226, 1240 & 1241 (all FT syn.).

Chaetostichium majusculum C.E. Hubb. (1957); *Oropetium majusculum* (C.E. Hubb.) Cuf. (1968).

Small, densely tufted perennial; culms up to 15 cm high. Leaf-blades flat, folded or rolled, 2–5 cm long, up to 1 mm wide. Spikes curved, flexuous or coiled, rarely straight, up to 8 cm long, 1 mm wide; rhachis herbaceous, eventually fracturing into 1–2-spiculate segments, spikelets in subopposite to adjacent ranks, shallowly embedded. Lower glume 0.5 mm long, truncate; upper glume acuminate or extended into a flexuous awn, (5–)6–20 mm long (including the awn), (1–)3-nerved; lemma elliptic-oblong, (1.5–)2–3 mm long, 3-nerved, mucronate, mucro up to 0.5 mm long. Fig. 41:1, 2.

Shallow depressions among rocks, or dry sandy soil of bushland or grassy plains; 850–1650 m. TU GD GG SD HA; westwards to Chad; Somalia and East Africa; Saudi Arabia, Yemen. *Burger* 3253A; *Gilbert & Phil-tips* 9092; *Gilbert & Thulin* 157.

60. ODYSSEA Stapf (1922)

Spiny rhizomatous perennials, the glaucous shoots clothed to their tips with numerous, short, distichous, pungent leaves; leaf-sheaths imbricate. Inflorescence a dense head of short crowded racemes on a central axis. Spikelets several-flowered, disarticulating between the

florets; glumes 1-nerved, shorter than the lemmas; lemmas 3-nerved, scarious (wholly or in part), villous along the nerves with silky spreading hairs except towards the tip, minutely emarginate or subentire, mucronate; palea sericeous on the flaps. Grain ellipsoid with a free pericarp.

2 species; eastern and southern Africa, Yemen.

O. mucronata (Forssk.) Stapf (1922);

Festuca mucronata Forssk. (1775); *Aeluropus mucronatus* (Forssk.) Defl. (1889) - type: Yemen, *Forsskål* (C holo.).

Festuca pungens Vahl (1790); *Eragrostis pungens* (Vahl) Schweinf. (1894).

Suffrutescent, glaucous perennial with stiff, hard, much branched culms forming spreading clumps up to 2 m high. Leaf-blades 1–3 cm long, rigid and spiny. Inflorescence narrowly elliptic to almost globose, 1.5–4.5 cm long, composed of a number of crowded, few-spiculate racemes 1–2 cm long. Spikelets 5–9-flowered, elliptic-oblong, 8.5–13.3 mm long; lemmas scarious, narrowly elliptic-oblong, 4–5 mm long, tipped with a mucro up to 0.5 mm long. Fig. 42.

Coastal sand; sea level. EE; Red Sea coast of Saudi Arabia, Yemen, N Somalia, Socotra. *Ash* 708; *Gilbert* 2564; *Hemming* 1267.

A distinctive grass forming prickly bushes along the margins of the Red Sea; a good, drought-resistant binder of sand dunes.

O. paucinervis (Nees) Stapf is found on saline soils from Tanzania southwards to South Africa. It can be distinguished from *O. mucronata* by its low mat-forming habit with culms up to 25 cm high, and by its smaller lemmas (2.3–3.3 mm).

61. LEPTOCHLOA P. Beauv. (1812)

Diplachne P. Beauv. (1812)

Annuals or perennials. Inflorescence open, composed of several to numerous slender racemes of usually imbricate spikelets scattered along a central axis. Spikelets (1–)several-flowered, laterally compressed or subterete, disarticulating between the florets; glumes usually shorter than the lemmas, but occasionally as long as the spikelet; lemmas keeled or rounded, minutely hairy along the nerves or sometimes glabrous, usually emarginate but occasionally entire and acute, awnless or sometimes mucronate to awn-pointed; stamens 2–3. Grain laterally or dorsally compressed.

About 40 species throughout the tropics, and in warm temperate parts of America and Australia.

Leptochloa sensu stricto typically has small, laterally compressed spikelets, imbricate along clearly secund racemes. Species with larger subterete spikelets, usually distant along only indistinctly secund racemes, have traditionally been separated in the genus



Figure 42. *ODYSSEA MUCRONATA*: 1 - habit x 3/4; 2 - spikelet x 7; 3 - lemma x 7. 1 from Glover & Gilliland 852 & McKinnon S.206; 2 & 3 from Glover & Gilliland 852. Drawn by Eleanor Catherine.

Diplachne (*L. fusca* in Ethiopia). However, the boundary between the two groups is very indistinct, particularly in the New World.

Leptochloa uniflora A. Rich. and the closely related *L. rupestris* C. E. Hubb., are exceptional in the genus in possessing relatively broad leaf-blades, spikelets with only a single floret which is exceeded by the elongate glumes, and by the entire, acute lemma tip.

1. Spikelets 8–15 mm long; lemmas rounded on the back, briefly awned. 1. *L. fusca*
- Spikelets 1.6–7 mm long; lemmas keeled, awnless. 2
2. Spikelets 3–14-flowered. 3
- Spikelets 1-flowered. 4
3. Tufted perennial; racemes up to 20; spikelets 6–14-flowered, 4–7 mm long. 2. *L. obtusiflora*
- Stoloniferous semi-aquatic, often annual; racemes numerous; spikelets 3–6-flowered, 2.5–3 mm long. 3. *L. caerulescens*
4. Tufted with erect or ascending culms; leaf-blades lanceolate-oblong to oblong, ascending or spreading, 6–18 mm wide. 4. *L. uniflora*
- Rhizomatous with thin, wiry, scandent culms;

leaf-blades narrowly lanceolate, widely divergent or reflexed, 2–6 mm wide. 5. *L. rupestris*

1. *L. fusca* (L.) Kunth (1829);

Festuca fusca L. (1759); *Diplachne fusca* (L.) P. Beauv. ex Roem. & Schult. (1817); *Uralespis fusca* (L.) Steud. (1854) - type: "Palestine", Hasselquist (LINN holo.).

Diplachne alba Hochst. (1842), nom. nud.; *Uralespis alba* Hochst. ex Steud. (1854); *D. fusca* (L.) P. Beauv. ex Roem. & Schult. var. *alba* (Hochst. ex Steud.) Chiov., *Fl. Somalia* 1: 337 (1929) - type; Sudan, Nubia, Kotschy 200 (K iso.).

[*Diplachne malabarica* sensu Merrill (1933), non *Poa malabarica* L.].

Aquatic or semi-aquatic rhizomatous perennial; culms 60–150 cm high, rooting and branching from the lower nodes. Leaf-blades tough, scabrid, often inrolled, 25–55 cm long, up to 5 mm wide; ligule membranous, 3–8 mm long, acute. Inflorescence 20–35 cm long, composed of 10–30 straight, ascending or spreading racemes 7–15 cm long. Spikelets slightly imbricate, 6–11-flowered, narrowly elliptic, 8–15 mm long, greyish-green or olive; glumes keeled, the lower lanceolate,

2.1–4.6 mm long, acute, the upper narrowly oblong, 3.3–7.4 mm long, acute or obtuse and minutely mucronate; lemmas narrowly oblong, rounded on the back, 3.2–5.9 mm long, 2- or more toothed with a mucro 0.3–1.6 mm long from the sinus; anthers 1.3–2.7 mm long. Grain elliptic-oblong, dorso-ventrally flattened.

Shallow water and marshy ground of lake margins; 500–2100 m. AF SU HA; tropics and subtropics of the Old World, including Australia. *Ash* 1377; *Burger* 3607; *M. G. & S. B. Gilbert* 1072.

A polymorphic species, varying in length of the rhizome (some plants are more or less tufted), height and robustness of the culm, compactness of the inflorescence, and in the lemma tip.

Diplachne caudata K. Schum. from East Africa can be distinguished by its flexuous racemes, short ciliate ligule (0.8–1 mm) and its smaller anthers (0.3–0.6 mm).

2. *L. obtusiflora* Hochst. (1855);

Eleusine obtusiflora (Hochst.) Schweinf. (1894)
- type: Ethiopia, *Schimper* in Herb. Buchinger 1204 (STR holo., P iso.).

Perennial; culms slender, ascending or straggling from a basal tuft, much branched, 40–200 cm long. Leaf-blades linear, 10–35 cm long, 2.5–14 mm wide, long-attenuate. Inflorescence 10–30 cm long, composed of up to 20 loosely ascending spike-like racemes 5–16 cm long clustered towards the culm apex. Spikelets narrowly oblong, 6–14-flowered, 4–7 mm long; glumes subequal, shorter than the lemmas, oblong, obtuse, the lower 1.8–2.3 mm long, the upper 2–2.6 mm long; lemmas oblong, 1.7–2.5 mm long, shortly pilose along the nerves, tip rounded, emarginate. Grain elliptic-oblong, 1–1.2 mm long, concavo-convex, pericarp free. Fig. 43:5, 6.

Deciduous bushland and grassland, often scrambling through bushes, and as a weed of disturbed ground; 800–1700 m. TU GD GG SD HA; Sudan, East Africa, Zaire and Angola; Saudi Arabia, N Yemen. *Friis* et al. 2926; *Gilbert & Phillips* 8860; *Gilbert* 3351 (ETH).

3. *L. caerulea* Steud. (1854);

- type: Senegal, *Leprieur* (P holo.).

Semi-aquatic stoloniferous annual or short-lived perennial; culms erect or decumbent and rooting at the lower nodes, up to 150 cm high, many-noded and leafy. Leaf-blades 10–20 cm long, 4–8 mm wide, widely diverging, glaucous, scabrid, acuminate. Inflorescence 15–30 cm long, narrow, composed of numerous, slender, flexuous racemes along a central axis; racemes 3–10 cm long, purple. Spikelets narrowly oblong, 2.5–3 mm long, 3–6-flowered; lower glume lanceolate, 0.8–1 mm long, subacute; upper glume elliptic-oblong, 1–1.7 mm long, broadly obtuse or emarginate and minutely mucronate; lemmas elliptic-oblong, 1.5–2 mm long,

scaberulous, shortly pilose on the nerves, obtuse. Grain chestnut brown, narrowly obovate, obtusely trigonous in section. Fig. 43:7, 8.

Sandy river banks and in shallow water, forming stands; 650–800 m. IL KF; westwards to Senegal, Zaire, Angola and Zambia. A weed of rice in West Africa. *Friis* et al. 2473; *Gereau* 1253.

L. caerulea is widespread on the western side of Africa, but is replaced towards the east by *L. chinensis* (L.) Nees, a very similar semi-aquatic species occurring from N Kenya southwards to Natal. It can be distinguished by its tufted, non-stoloniferous habit and by its smaller lemmas (0.8–1.4 mm) with sericeous nerves appearing as 3 shiny white lines.

4. *L. uniflora* Hochst. ex A. Rich. (1850);

Craspedorhachis uniflora (Hochst. ex A. Rich.)
Chippend. (1955) - type: Ethiopia, TU-GD, Tacazze valley, *Schimper* 1707 (P holo., K iso.).

Tufted annual or short-lived perennial; culms up to 150 cm high, erect or geniculately ascending; leaf-blades broad, lanceolate-oblong to oblong, 4–12 cm long, 6–18 mm wide, thin, flaccid, acute. Inflorescence narrowly oblong, 15–45 cm long, pale green, composed of numerous racemes; racemes very slender, ascending, straight or slightly arching, 2.5–9 cm long. Spikelets 1-flowered, thinly membranous, 1.9–2.8 mm long; glumes equalling or exceeding the floret, narrow, acuminate, the lower often slightly falcate; lemma elliptic, 1.5–1.7 mm long, appressed-pilose along the nerves, entire, acute. Grain narrowly ellipsoid, trigonous, deeply sulcate on the hilar side.

Shady places, often on damp sandy soils; c 1000 m. TU-GD (Tacazze valley); tropical and South Africa; Yemen, India and Sri Lanka.

A widespread species in Africa, but the type is the only Ethiopian specimen seen by the author. It appears to be largely replaced in Ethiopia by *L. rupestris*.

5. *L. rupestris* C.E. Hubb. (1941);

- type: N Somalia, *Gillett* 4981 (K holo.).

Perennial with slender rhizomes bearing fascicles of thin, wiry, many-noded shoots, these up to 1 m long, erect and straggling or often scandent. Leaf-blades narrowly lanceolate, 3–10.5 cm long, 2–7 mm wide, widely diverging or slightly reflexed, finely acute. Inflorescence narrowly elliptic or narrowly oblong, 6–25 cm long, pale green or tinged reddish, composed of numerous ascending racemes; racemes very slender, 2–5 cm long, straight or slightly flexuous. Spikelets 1-flowered, 1.6–2.4 mm long; glumes equalling the floret, narrow, acuminate, the lower slightly falcate; lemma elliptic, 1.7–2.1 mm long, appressed-pilose on the nerves, entire, acute. Grain like *L. uniflora*. Fig. 43:1–4.

Rocky hillsides in the shade of shrubs and small trees, often straggling through low vegetation; 1100–



Figure 43. *LEPTOCHLOA* spp.: *L. RUPESTRIS*: 1 - habit x 3/4; 2 - inflorescence x 3/4; 3 - spikelet x 11; 4 - lemma x 30; *L. OBTUSIFLORA*: 5 - inflorescence x 3/4; 6 - spikelet x 11. *L. CAERULESCENS*: 7 - inflorescence x 3/4; 8 - spikelet x 11. 1-4 from Gilbert & Phillips 8954; 5 & 6 from Friis et al. 2926; 7 & 8 source not recorded. Drawn by Eleanor Catherine.

1800 m. EW GG SD HA; N Somalia, N Uganda and adjacent parts of Kenya; N Yemen. *Burger* 1162; *Friis* et al. 1034; *Gilbert & Phillips* 8874.

L. rupestris is largely confined to northeast tropical Africa, and closely resembles the much more widespread *L. uniflora* in spikelet details. However, its different habit, with long, wiry, often scandent culms and smaller, divergent or reflexing leaf-blades is very characteristic.

62. LEPTOCARYDION Stapf (1898)

Annual. Leaf-blades broad, flat; ligule a short ciliate membrane. Inflorescence densely spiciform, composed of numerous slender racemes crowded along a central axis. Spikelets several-flowered, laterally compressed, subsessile or shortly pedicelled, imbricate along the slender secund racemes, disarticulating between the florets; glumes persistent, narrow, unequal, keeled, 1-nerved; lemmas exerted from the glumes, membranous, narrow, lightly keeled, conspicuously silky-ciliate along the lateral nerves, awned from the entire or emarginate tip; anthers 2. Grain linear, trigonous.

1 species in eastern and southern Africa, excluding Cape Province.

Leptocarydion is related to *Trichoneura*, but differs by its shorter glumes, keeled lemmas and trigonous grain.

L. vulpiastrum (De Not.) Stapf (1900);

Rhabdochloa vulpiastrum De Not. (1853);
Diplachne vulpiastrum (De Not.) Schweinf. (1867);
Triodia vulpiastrum (De Not.) K. Schum. (1895) -
type: Sudan, *Figari* (GE holo., destr.).

Uralapis alopecuroides Steud. (1854); *Diplachne alopecuroides* (Steud.) Jacks. (1893); *Leptocarydion alopecuroides* (Steud.) Stapf (1900) - type: Ethiopia, without locality, *Schimper* 2055 (P holo.).

Tufted annual; culms erect or geniculate, 10–120 cm high. Leaf-blades lanceolate or lanceolate-oblong, 2–12 cm long, 6–20 mm wide, base constricted, rounded or cordate, tip acute. Inflorescence lanceolate-oblong, dense, feathery, 4–22 cm long, 1–2.5 cm wide, pale green or purple-tinged, the glumes turning reddish-brown; racemes up to 4 cm long. Spikelets 6–14-flowered, narrowly wedge-shaped, 5–11 mm long; lower glume 2–3 mm long, finely acute; upper glume 3–4 mm long, acute or obtuse; lemmas narrowly oblong, 2.5–3.5 mm long, scattered-pilose on the back, the marginal hairs 1–2 mm long; awn fine, straight, 2.5–5 mm long. Fig. 44:5–7.

Open bushland, often on dry sandy soils; 900–1500 m. EW TU GD SU AR GG BA SD HA; southwards through East Africa to Angola, Namibia, Transvaal and Natal; also in Madagascar and N Yemen. *Friis* et al. 2721; *Mesfin & Vollesen* 4282; *Gilbert & Sebsebe* 8828 (ETH).

63. TRICHONEURA Anderss. (1855)

Crossotropis Stapf (1898).

Tufted annuals or perennials; leaf-blades linear; ligule membranous. Inflorescence open or contracted, composed of stiff racemes along a central axis; spikelets subsessile or shortly pedicelled, biseriate, imbricate or distant. Spikelets wedge-shaped, several-flowered with the florets loosely imbricate, disarticulating above the glumes and between the florets; glumes usually as long as the spikelet, at least exceeding the lower lemmas, 1-nerved, very narrow, tapering to a mucro or awn-point; lemmas 3-nerved, membranous, rounded or lightly keeled, conspicuously ciliate along the marginal nerves, obtusely 2-lobed with a fine straight awn arising from the sinus; palea often capitate-pilose between the keels. Grain narrow, flattened, concavo-convex.

7 species; Africa, Arabia, USA (Texas), Galapagos Islands.

1. Inflorescence narrowly elliptic, the branches erect or ascending; spikelets usually imbricate. 2
- Inflorescence ovate or broadly pyramidal, the branches spreading, often horizontal; spikelets distant. 1. *T. grandiglumis*
2. Densely tufted perennial; glumes lanceolate to elliptic-oblong, equalling or slightly shorter than the florets. 2. *T. ciliata*
- Slender annual; glumes linear, caudate, often slightly exceeding the florets. 3. *T. mollis*

1. *T. grandiglumis* (Nees) Ekman (1912);

Leptochloa grandiglumis Nees (1841); *Diplachne grandiglumis* (Nees) Hack. (1890); *Crossotropis grandiglumis* (Nees) Rendle (May 1899) & (Nees) Stapf (June 1899) - types: South Africa, Cape Province, between Witberge Mts. and R. Kraai, *Drège* s.n. (B syn., K isosyn.) & between Brockpoort and Leeuwenfontein, *Drège* s.n. (B syn.).

Perennial forming tough tussocks; culms 20–85 cm high. Leaf-blades up to 20 cm long, 2.5–5.5 mm wide, flat, usually scattered-pilose. Inflorescence open, 7–32 cm long, ovate to broadly pyramidal; racemes 8–30, 3–19 cm long, stiff, straight, divaricate to horizontal, the spikelets distant. Spikelets 4–9-flowered, 5.3–14 mm long, often purplish; glumes caudate or subulate, tapering into a mucro up to 2 mm long, almost always exceeding the florets, scabrid, the lower linear-lanceolate, the upper linear-oblong; lemmas narrowly elliptic-oblong, 3–5 mm long, membranous, appressed-pilose on the back around the central nerve, white-ciliate along the marginal nerves; awn 0.5–1.25 mm long; palea capitate-pilose; anthers 0.5–0.7 mm long.

On rocks in *Acacia* bushland; 1300–1400 m. SD; Tanzania southwards to South Africa. *Gilbert & Sebsebe* 8728.

2. *T. ciliata* (Peter) S.M. Phillips (1974);

Leptochloa ciliata Peter (1931) - type: Tanzania, Gärtner in Peter 52035 (B holo., EA iso.).

Trichoneura hirtella Napper (1963).

Compactly tufted perennial; culms 30–95 cm high. Leaf-blades up to 25 cm long, 2.5–4.5 mm wide. Inflorescence 8–20 cm long, linear-elliptic with erect branches to narrowly pyramidal with loosely ascending branches; racemes 8–25, 2–8 cm long, slender, the spikelets usually imbricate. Spikelets 5–8-flowered, 6.7–8.5 mm long, pale green or purplish; glumes slightly shorter than or ± equalling the florets, densely scabrid, tapering to a mucro 0.1–0.5 mm long, the lower narrowly lanceolate-oblong, the upper narrowly elliptic-oblong; lemmas narrowly oblong, 3.8–4.4 mm long, thinly membranous, pilose on the back, white-ciliate along the marginal nerves; awn 0.6–1.3 mm long; palea glabrous or rarely pilose in the lower half; anthers 0.6–1.1 mm long. Fig. 44:4.

Acacia-Commiphora open woodland on red sandy soil; 1600 m. SD; Kenya, Tanzania. Gilbert & Jefford 4617; Rippstein 1755.

3. *T. mollis* (Kunth) Ekman (1912);

Leptochloa mollis Kunth (1831); *Triodia mollis* (Kunth) Th. Dur. & Schinz (1895); *Crossotropis mollis* (Kunth) Stapf (1899) - type: Senegal, Leprieur 17 (P holo.).

Diplachne arenaria Steud. (1840), nom. nud.; *Leptochloa arenaria* Steud. (1841), nom. nud.; *Uralespis arenaria* Steud. (1854); *Crossotropis arenaria* (Steud.) Rendle (May 1899) & (Steud.) Stapf (June 1899); *Trichoneura arenaria* (Steud.) Ekman (1912) - type: Saudi Arabia, Schimper 808 (P holo., K iso.).

Uralespis ciliata Steud. (1854).

Leptochloa longiglumis Hitchc. (1930).

Slender tufted annual; culms 12–50 cm high. Leaf-blades 3–11 cm long, 3–5.5 mm wide. Inflorescence 5–25 cm long, narrowly elliptic-oblong, usually fairly compact with ascending racemes, less often the racemes widely spreading; racemes 10–40, 1.5–5 cm long. Spikelets 5–9-flowered, 6.2–8 mm long, imbricate by about half their length, green or reddish; glumes as long as or exceeding the florets, scabrid, caudate, the lower linear-lanceolate, the upper linear-oblong; lemmas oblong, 2.5–3.5 mm long, thinly membranous, sparsely to densely appressed-pilose on the back, ciliate along the marginal nerves; awn 0.6–2 mm long; palea glabrous or capitate-pilose; anthers 0.3–0.5 mm long. Fig. 44:1–3.

Acacia-Commiphora bushland on sandy soil; 850–1400 m. Eritrea SD HA; arid country from Senegal to the Red Sea, and in Somalia, Kenya, Saudi Arabia and Oman. M.G. & S.B. Gilbert 2084; Gilbert & Sebsebe 8696U; Glover & Gilliland 399.

64. *DINEBRA* Jacq. (1809)

Phillips in *Kew Bull.* 28: 411–417 (1973).

Annuals; leaf-blades linear, flat; ligule a lacerate or ciliate membrane. Inflorescence composed of several-many secund spikes irregularly arranged along a central axis; spikes varying from short, broad and crowded to linear and distant, deciduous from the central axis at maturity or persistent but with the lower spikelets on each spike replaced by short deciduous branchlets. Spikelets 1-several-flowered, wedge-shaped, laterally compressed, sessile, biseriate, closely imbricate, disarticulating between the florets; glumes subequal, much longer than the florets, strongly keeled, often coriaceous, acuminate-aristate; lemmas 3-nerved, lightly keeled, thinly membranous, pilose on the nerves, acute to 2-lobed.

3 species; tropics and subtropics from Africa to India; one species endemic to Madagascar.

Dinebra is related to *Leptochloa*, but differs by its elongate glumes and deciduous spikes.

1. Spikes linear to oblong or wedge-shaped, often crowded, unbranched, disarticulating from the main axis; spikelets 5.7–9 mm long; lemmas pilose around the lower half of the midnerve, acute to emarginate. **1. *D. retroflexa***
- Spikes linear, distant, persistent on the main axis, deciduous branchlets often present; spikelets 3–5 mm long; lemmas sericeous along the length of the midnerve, 2-lobed. **2. *D. polycarpa***

1. *D. retroflexa* (Vahl) Panzer (1814);

Cynosurus retroflexus Vahl (1791) - type: India, La Mark (C holo.).

Dinebra arabica Jacq. (1809); *Leptochloa arabica* (Jacq.) Kunth (1829).

Dinebra aegyptiaca Del. (1813) as "Dinaeba", nom. superfl.

Dinebra brevifolia Steud. (1854); *D. retroflexa* (Vahl) Panzer var. *brevifolia* (Steud.) Th. Dur. & Schinz, *Consp. Fl. Afr.* 5: 865 (1895) - type: Ethiopia, TU, Shire, Dschogarti Mts., Schimper 527 (P holo., K iso.).

Tufted annual; culms up to 112 cm high, usually straggling from a decumbent base, much branched and rooting at the lower nodes, infrequently erect. Leaves glandular especially on the sheaths; leaf-blades 4.5–28 cm long, 4–8 mm wide; ligule lacerate. Inflorescence 8–34 cm long, linear with short oblong to wedge-shaped densely crowded spikes, varying to elliptic-oblong or pyramidal with longer linear spaced spikes; spikes 0.6–5(–7) cm long, stiff, ascending at first, reflexing and deciduous at maturity. Spikelets 1–3-flowered, narrowly wedge-shaped, 5.7–9 mm long, closely imbricate on the flattened, narrowly green-winged rachis; glumes narrowly elliptic with caudate diverging tips, 6–8 mm



Figure 44: *TRICHONEURA MOLLIS*: 1 - habit x 3/4; 2 - spikelet x 7; 3 - lemma x 11. *T. CILIATA*: 4 - spikelet x 7. *LEPTOCARYDION VULPIASTRUM*: 5 - habit x 3/4; 6 - spikelet x 7; 7 - lemma x 11. 1-3 from Glover & Gilliland 399; 4 from Gilbert & Jefford 4617; 5 from Schimper 223; 6 & 7 from Friis et al. 2721. Drawn by Eleanor Catherine.

long, coriaceous, glandular along the keel; lemmas narrowly ovate, 2–3 mm long, appressed-pilose along the lower part of the nerves, acute to emarginate, mucronulate; palea appressed-pilose on the marginal side of the keels.

Ruderal of open and disturbed places in *Acacia* bushland, usually on black clay soils, sometimes an arable weed; sea level–2300 m.

var. retroflexa

Inflorescence open, narrowly elliptic-oblong to pyramidal; spikes linear, up to 7 cm long, spaced 5.5–30 mm apart; spikelets often 3-flowered.

AF EW TU GD GG; East Africa, westwards to Senegal and northwards to Egypt; Arabia to Iraq and India. *Parker* E480, E408; *Bongor* 52 (ETH).

var. condensata *S.M. Phillips* in *Kew Bull.* 28: 412 (1973);

- type: Tanzania, *Procter* 3209 (K. holo.).

Inflorescence dense, linear; spikes oblong to wedge-shaped, 0.6–1.6 cm long, crowded together, 1.5–6 mm apart; spikelets 1–2-flowered. Fig. 45.

EE EW TU/GD (R. Taccazze) WU SU SD HA; southwards to Transvaal and Natal. *Gilbert* 3326; *Gilbert & Jefford* 4494; *Parker* E242.

African specimens of *Dinebra retroflexa* are very variable in inflorescence structure, and this variation is accommodated in 2 varieties, as detailed above. Var. *retroflexa* is predominantly N African, whereas var. *condensata* apparently represents a development in eastern and southern Africa of an extreme form from one end of the range of variation of the species. Most Ethiopian specimens belong to var. *condensata*, but as there is no discontinuity between the varieties intermediates will sometimes be encountered.

2. D. polycarpha *S.M. Phillips* (1973);

- type: Uganda, *Langdale-Brown* 1574 (K. holo., EA iso.).

Loosely tufted annual; culms 38–120 cm high, slender, erect or ascending. Leaf-blades 5–16 cm long, 4–10 mm wide, soft, acute; ligule ciliate. Inflorescence 13–30 cm long, open, composed of 10–32 widely spreading linear spikes 2.5–7 cm long spaced along the central axis; lower spikelets often replaced by short, tardily deciduous branchlets up to 13 mm long, especially on the lower spikes. Spikelets 2(–3)-flowered, wedge-shaped, 3.2–5 mm long, closely imbricate on the triquetrous unwinged rachis; glumes linear-lanceolate, acuminate-aristate, 3–5 mm long, membranous; lemmas narrowly ovate, 1.3–1.6 mm long, sericeous along the marginal nerves and in a broad band around the central nerve, 2-lobed; palea sericeous on either side of the keels.

Open places in *Acacia* bushland on black clay soil; 1150 m. SD; Uganda, Kenya, Tanzania. *Gilbert* 3451; *Gilbert & Sebsebe* 8761.



Figure 45. *DINEBRA RETROFLEXA* var. *CONDENSATA*: 1 - habit x 2/3; 2 - spikelet x 12; 3 - lemma x 16. Drawn by Maureen Church. (Modified from *Fl. Trop. E. Afr. Gramineae* 2: Fig. 75, with permission of the Editors).

65. **OCHTHOCHLOA** Edgew. (1842)

Stoloniferous perennial; ligule a ciliate membrane. Inflorescence of several short secund spikes, these digitate, deciduous at maturity, their bases silky-hairy. Spikelets imbricate, elliptic-ovate, strongly laterally compressed, disarticulating above the glumes but not between the florets; glumes unequal, shorter than the lemmas, the upper with a thickened 3-nerved keel; lemmas 3-nerved, keeled, elliptic-lanceolate, villous on the lower part of the nerves, entire, acute or mucronate; palea-keels ciliate. Grain ellipsoid, smooth, with a free pericarp.

1 species; lowlands near the Red Sea, coastal Somalia and through Arabia eastwards to NW India.

O. compressa (Forssk.) Hilu (1981);

Panicum compressum Forssk. (1775); *Eleusine compressa* (Forssk.) Ascher. & Schweinf. ex Christ. (1922) - type: Yemen, *Forsskål* 46 (C holo.).

Ochtochloa dactyloides Edgew. (1842).

Eleusine flagellifera Nees (1842).

Eleusine caespitosa A. Rich. (1850); type: Ethiopia, EE, Choho, *Quartin Dillon* s.n. (P holo.).

Sprawling perennial; culms stoloniferous, hard, rooting and much branched at the nodes, ascending to 40 cm high, rarely forming tufts up to 90 cm high, nodes silky-hairy. Leaf-blades mostly cauline, narrowly linear, 2–15 cm long, 2–3 mm wide, glaucous, acuminate. Inflorescence of 2–6 spikes 1.5–5.5 cm long. Spikelets often purplish, 3–8-flowered, 4.5–8 mm long; lower glume elliptic, 1.5–3 mm long; upper glume elliptic-lanceolate, 3–5 mm long, cuspidate or mucronate; lemmas 3.8–5.4 mm long, the lowest villous on the nerves and appressed-pubescent on the lower back, succeeding lemmas much less hairy, the upper almost glabrous; palea appressed-pilose between the ciliate keels. Grain light brown, 1.5–2 mm long. Fig. 46.

Sandy or stony ground in desert; sea level–500 m. EE AF; Egypt, Sudan, Somalia, the Arabian peninsula, Iran, Afghanistan, Pakistan and NW India. *Bally* 6848; *Burger* 2900.

66. **DRAKE-BROCKMANIA** Stapf (1912)

Heterocarpha Stapf & C. E. Hubb. (1929)

Shortly stoloniferous annuals or perennials; ligule membranous. Inflorescence composed of several short broad spikes alternating on the central axis; spikes reflexing and deciduous at maturity. Spikelets several-flowered, strongly laterally compressed, eventually disarticulating between the florets; glumes unequal, the upper (and the lower of the terminal spikelet) conspicuous, many-nerved, 1/3 as long to longer than the spikelet, tip acuminate; lemmas keeled, 3–7-nerved, chartaceous, villous on the lower part of the keel and margins, entire, cuspidate to mucronate; palea-keels gibbous, sometimes winged. Grain ellipsoid.

2 species in east and northeast tropical Africa.

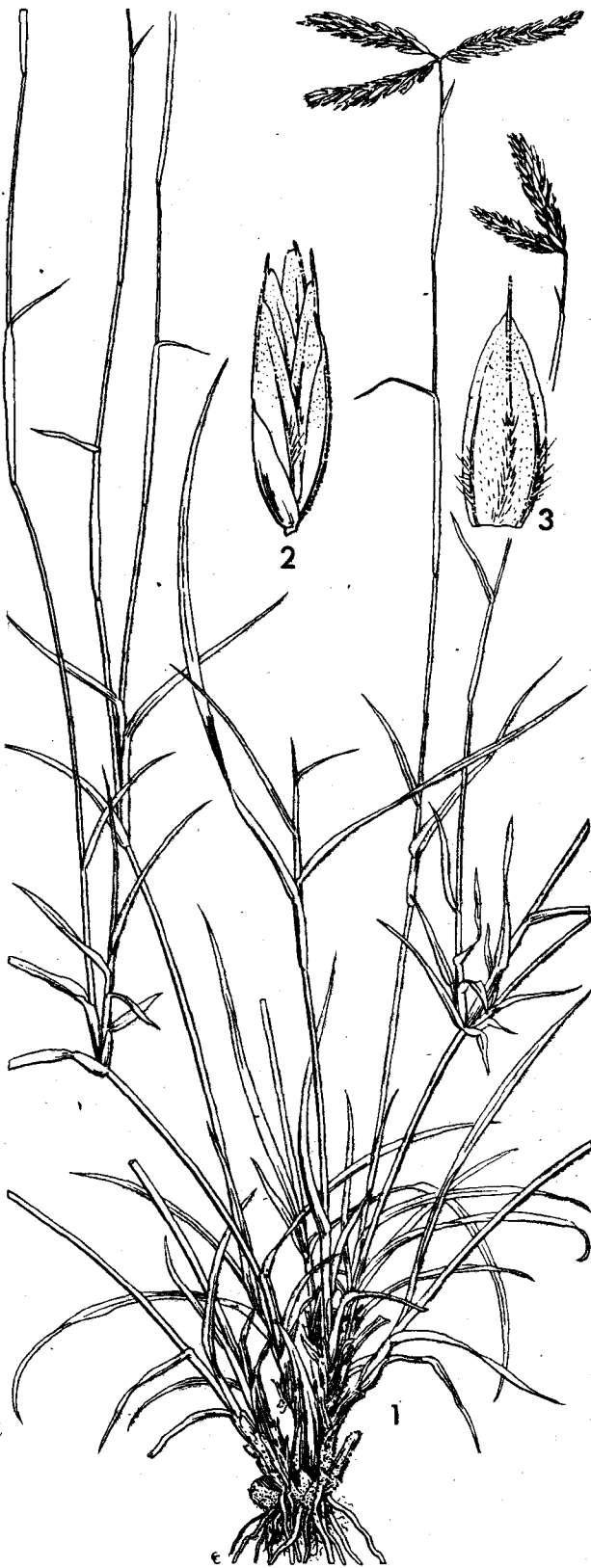


Figure 46. **OCHTHOCHLOA COMPRESSA**: 1 - habit x 3/4; 2 - spikelet x 7; 3 - lemma x 7. All from *Burger* 2900. Drawn by Eleanor Catherine.

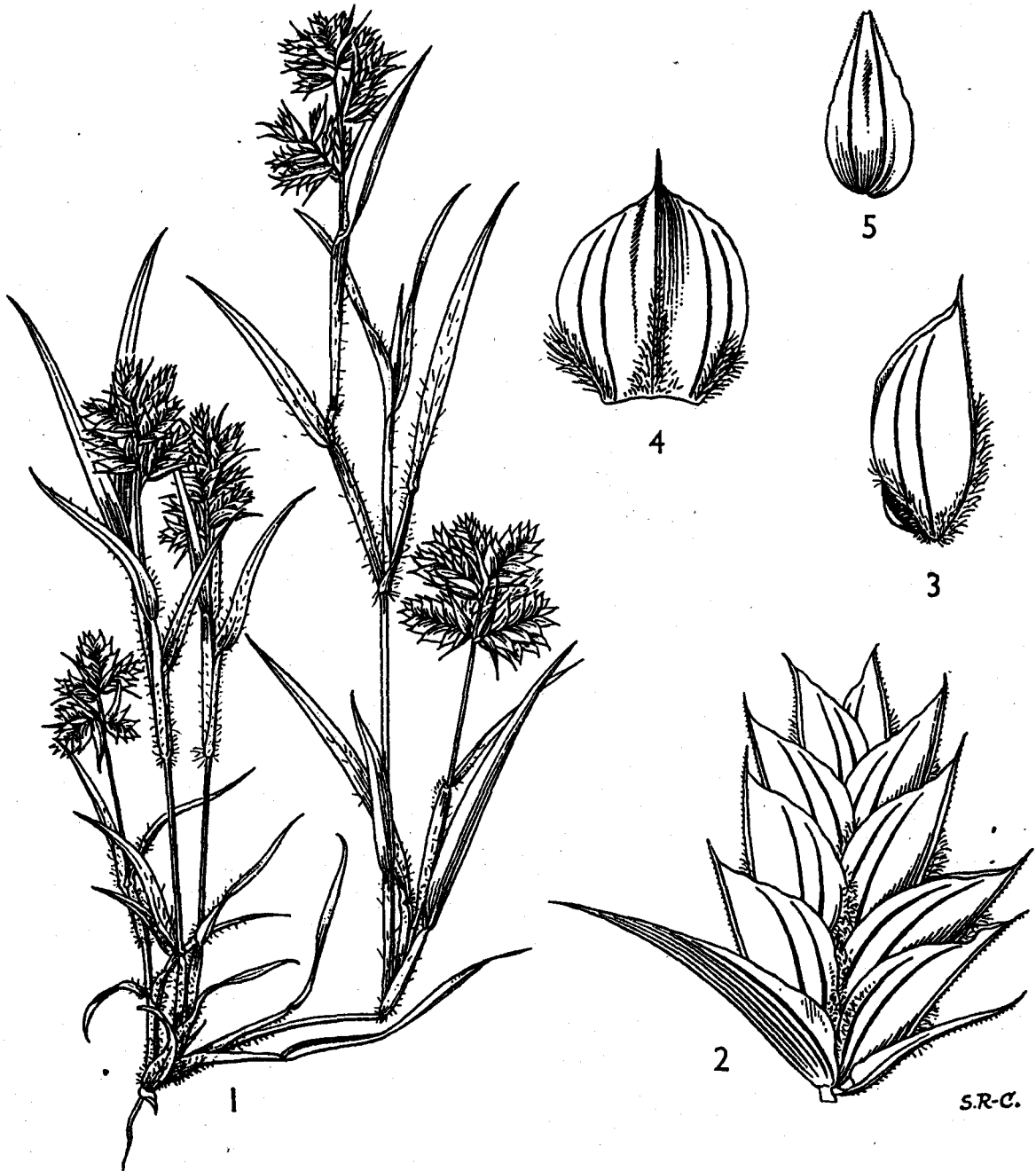


Figure 47. *DRAKE-BROCKMANIA SOMALENSIS*: 1 - habit x 1; 2 - spikelet x 6; 3 - floret x 6; 4 - lemma x 6; 5 - palea x 6. Drawn by Stella Ross-Craig. (Modified from *Fl. Trop. E. Afr. Gramineae* 2: Fig. 58, with permission of the Editors).

***D. somalensis* Stapf (1912);**

- types: N Somalia, Bulhar, *Drake-Brockman* 616, 617, 646, 647 (all K syn.).

Eleusine somalensis Hack. (1900) - type: Ethiopia, HA, Ogaden, Webi Habir, *Keller* 132 (W holo.).

Mat-forming annual; culms spreading, rooting at the nodes, much branched, 5–15 cm high. Leaf-blades up to 9.5 cm long, 2.5–4.5 mm wide, flat, papillose-hispid, acute. Inflorescence often subcapitate, composed of 2–6 ovate spikes 0.7–1.7 cm long on an axis up to 3 cm long. Spikelets 5–9-flowered, broadly oblong to wedge-

shaped, 6–11 mm long, yellowish-green with dark green nerves; lower glume 1–5-nerved, narrowly lanceolate; upper glume 11–17-nerved, half as long to longer than the spikelet, lanceolate-oblong with a diverging acuminate tip; lemmas 5–7-nerved, ovate, 4–7 mm long, cuspidate or stoutly mucronate; palea-keels broadly winged; anthers 0.4–1.2 mm long. Grain narrowly elliptic-oblong, trigonous. Fig. 47.

Silty or saline, often seasonally flooded places on open plains, sometimes forming a thin cover; c 500 m. AF GG; Sudan, Farasan Is. (Red Sea), Somalia, Kenya,

Tanzania. Hemming 1226; Beals & Prosser 80 (ETH); Corradi 1045, 1378 (FT).

The 5-7-nerved lemmas of this species are unusual in *Eragrostideae*, but its position within the tribe is confirmed by its leaf anatomy.

D. haareri (Stapf & C. E. Hubb.) S.M. Phillips, known at present only from *Acacia* bushland near the Kenya-Tanzania border, differs by its perennial habit, taller culms up to 65 cm high, 3-nerved elliptic lemmas and longer anthers (1.7-2.4 mm).

67. *ERAGROSTIS* Wolf (1776)
Diandrochloa de Winter (1960)

Annuals or perennials, often glandular; culms usually slender. Leaf-blades linear or inrolled; ligule ciliate (very rarely membranous). Inflorescence an open, contracted or spiciform panicle, occasionally reduced and racemose. Spikelets several- to many-flowered, laterally compressed, variously disarticulating, the rachilla fragile and breaking up between the florets, or tough with the lemmas and sometimes also the paleas falling from below upwards, or a combination of both methods, or rarely the spikelets falling entire; glumes mostly subequal, 1-nerved, shorter than the florets; lemmas 3-nerved, membranous or cartilaginous, usually glabrous, entire, awnless; palea subequalling the lemma, persistent or not, the keels smooth, scabrid or ciliate; anthers 2-3; grain subglobose to ellipsoid or oblong.

About 350 species in tropical and subtropical regions throughout the world.

Eragrostis is a large and difficult genus to name, many species appearing similar to the superficial glance, and correct identification often depends on careful examination of the spikelets. Some species in our area do have a readily recognizable facies, and these are taken out first in the key, whilst others have fairly easy spot characters for recognition which are noted under the species descriptions, and will become familiar with practice.

Although no critical subdivision of the genus has yet been worked out, spikelet disarticulation has been found to be one of the most useful characters for dividing the genus into broad groups of species. In mature specimens this character is usually obvious under a hand lens, and even in immature specimens a few disarticulating spikelets can often be found towards the top of the panicle. Species with a tough rachilla and disarticulating from the base upwards can often be recognized before disarticulation commences, as the lower florets turn brown whilst the upper florets are still green. These species divide quite neatly into those where the lemma falls long before the palea, and those where the lemma and palea fall more or less together. In the former group the rachillas of the disarticulated spikelets bear 2 rows of persistent paleas (often looking like little ladders), whereas in the latter group the ma-

ture panicle carries bare zig-zag rachillas on the pedicels.

1. Glaucous stoloniferous perennial forming spiny cushions; leaf-blades 0.5-5 cm long, distichous, pungent; culms and stolons clothed in imbricate leaf-sheaths. 11. *E. mahrana*
- Plant not as above. 2
2. Panicle a solitary, dense, globose or ovoid pale green head 1-2 cm long; low tussocky perennial. 12. *E. capitulifera*
- Panicle open, or if contracted not a small globose head. 3
3. Spikelets 1-3-flowered, 1.2-2.2 mm long; grain deeply sulcate, rugulose, enclosed within a free pericarp; delicate annual, panicle diffuse. 1. *E. biflora*
- Spikelets several- to many-flowered; grain not as above. 4
4. Spikelets falling entire from the pedicels at maturity, oblong to suborbicular, 6-18 mm long. 5
- Spikelets variously disarticulating (or remaining entire on the panicle if cultivated). 6
5. Tussocky perennial 50-120 cm high, panicle-branches spaced; spikelets ovate to suborbicular. 2. *E. superba*
- Annual 4-30 cm high, panicle reduced, often racemose; spikelets oblong, serrate, clustered together. 3. *E. sennii*
6. Palea-keels pectinate-ciliate, the cilia extending beyond the lemma margin. 7
- Palea-keels smooth, scabrid or pubescent, included within the lemma. 11
7. Panicle linear, spiciform, the spikelets densely crowded. 4. *E. ciliaris*
- Panicle lanceolate to elliptic, open, the spikelets distant. 8
8. Plant sticky from many glands, especially on the panicle, leaf-sheaths and nodes. 6. *E. viscosa*
- Plant not sticky. 9
9. Slender annual; lemmas 0.8-1.2 mm long. 5. *E. lepida*
- Tufted perennials; lemmas 1.6-3 mm long. 10
10. Spikelets clustered towards the tips of the panicle-branches; palea-keels pectinate-ciliate (hairs c 1 mm long). 7. *E. hispida*
- Spikelets evenly distributed; palea-keels thinly ciliate (hairs 0.2-0.5 mm long). 8. *E. olivacea*
11. Spikelets remaining entire, grain retained on the mature panicle; cultivated. 37. *E. tef*
- Spikelets disarticulating at maturity; wild. 12
12. Spikelets disarticulating regularly from the tip, rachilla fragile between the florets; no persistent paleas. 13
- Spikelets disarticulating from the base, the paleas persistent or not on the tough rachilla (sometimes the upper part of the rachilla becoming fragile and shedding the upper florets). 14
13. Ligule membranous; spikelets 1.3-3 mm long; lemmas 0.7-1 mm long. 9. *E. japonica*

- Ligule ciliate; spikelets 3-8 mm long; lemmas 1-1.5 mm long. 10. *E. aspera*
 - 14. Lemmas falling at maturity leaving 2 ranks of paleas on the rhachilla; rhachilla completely tough or becoming fragile above. **GROUP 1** 15
 - Lemmas and paleas falling approximately together, leaving a bare length of zig-zag rhachilla; rhachilla tough throughout. **GROUP 2** 42
- GROUP 1**
- 15. Panicle dense, spiciform. 16
 - Panicle open to loosely contracted, or reduced and few-spiculate. 18
 - 16. Panicle 1-3 cm wide, pinkish-brown; spikelets 6-24 mm long, 2-2.5 mm wide. 13. *E. chapelieri*
 - Panicle narrow, 0.5-1 cm wide, dark grey-green; spikelets 4-8.5 mm long, 1-2 mm wide. 17
 - 17. Lemmas lanceolate, 1.7-2 mm long, loosely imbricate; anthers 3. 14. *E. braunii*
 - Lemmas ovate, 1.3-1.8 mm long, tightly imbricate; anthers 2. 15. *E. schweinfurthii*
 - 18. Lowermost panicle-branches single or paired. 19
 - Lowermost panicle-branches whorled. 37
 - 19. Lemmas firmly cartilaginous, lateral nerves obscure. 20
 - Lemmas membranous to chartaceous, lateral nerves usually obvious. 23
 - 20. Lemmas 1.3-1.8 mm long; anthers 2; usually annual. 15. *E. schweinfurthii*
 - Lemmas 2-3.8 mm long; anthers 3; perennials. 21
 - 21. Lemmas tightly imbricate, obscuring the rhachilla, subacute; spikelet margin \pm smooth; basal sheaths sometimes fibrous.
 - E. racemosa* (see note under no. 15)
 - Lemmas loosely imbricate, sharply acute; spikelet margin serrate; basal sheaths never fibrous. 22
 - 22. Panicle ovate, loose and open; lemmas 1.8-2.2 mm long. 16. *E. patenti-pilosa*
 - Panicle linear, few-spiculate, sometimes racemose; lemmas 2.5-3.5 mm long. 17. *E. longifolia*
 - 23. Annuals. 24
 - Tufted or tussocky perennials. 35
 - 24. Panicle loose and open; pedicels filiform, often longer than the spikelets; plants not glandular. 25
 - Panicle usually contracted; pedicels stout, shorter than the spikelets; crateriform glands often present on leaf-margins, or leaf-sheaths sticky. 29
 - 25. Spikelets linear to narrowly oblong, 5-30 mm long; spikelet-margin smooth or only slightly serrate; lemmas obtuse to subacute. 26
 - Spikelets narrowly oblong to ovate, 3-9 mm long; spikelet-margin conspicuously serrate; lemmas sharply acute. 28
 - 26. Spikelets dark grey or blackish; lemmas scaberrulous around margins and tip; anthers 3. 18. *E. pascua*
 - Spikelets pale, often flushed pink; lemmas smooth; anthers 2. 27
 - 27. Culms slender, 15-30 cm high; lemmas narrowly lanceolate-oblong, contiguous, the rhachilla visible. 19. *E. elegantissima*
 - Culms 30-100 cm high; lemmas ovate, tightly imbricate, covering the rhachilla. 20. *E. tremula*
 - 28. Coarse annual; leaf-blades 2-8 mm wide; panicle diffuse, lax, green to blackish; glumes subequal. 21. *E. macilentia*
 - Slender annual; leaf-blades 1.5-3 mm wide; panicle neatly elliptic-ovate, purplish; glumes unequal. 22. *E. welwitschii*
 - 29. Spikelets narrowly oblong to ovate, 2.5-4 mm wide; lemmas 2-3.2 mm long. 30
 - Spikelets linear, 1-2.2(-2.5) mm wide; lemmas 1.2-2.3 mm long. 31
 - 30. Plant viscid from glandular hairs, especially the leaf-sheaths; lemmas oblong, truncate. 23. *E. gloeophylla*
 - Glandular hairs absent, but crateriform glands often present on the leaf-margins; lemmas ovate, obtuse to subacute. 24. *E. cilianensis*
 - 31. Leaf-blade margins with crateriform glands. 25. *E. minor*
 - Leaf-blade margins not glandular. 32
 - 32. Lower leaf-sheaths usually subtending reduced panicles; lemmas 1.7-2.3 mm long. 33
 - Lower leaf-sheaths lacking reduced panicles; lemmas 1.2-1.8 mm long. 34
 - 33. Lemmas lanceolate, obtuse; grain trigonous, smooth. 26. *E. barrelieri*
 - Lemmas ovate, subacute; spikelet-margin serrate; grain laterally compressed, rugulose, semi-translucent. 27. *E. astrepta*
 - 34. Lemmas acute; grain dark brown, oblong. 28. *E. mexicana*
 - Lemmas obtuse; grain pale brown, elliptic. 29. *E. papposa*
 - 35. Spikelets 1-3 mm wide, the margins coarsely serrate; basal leaf-sheaths keeled. 30. *E. tenuifolia*
 - Spikelets 1-1.5 mm wide, the margins not serrate; basal leaf-sheaths rounded. 36
 - 36. Basal leaf-sheaths not striate and hairy; anthers 0.1-0.4 mm long. 29. *E. papposa*
 - Basal leaf-sheaths coriaceous, prominently striate and silky-hairy; anthers 0.8-1.2 mm long. 31. *E. curvula*
 - 37. Perennials. 38
 - Annuals. 40
 - 38. Basal leaf-sheaths coriaceous, prominently striate and silky-hairy; nodes not glandular; lemmas 1.8-2.6 mm long. 31. *E. curvula*
 - Basal leaf-sheaths papery, not striate and hairy; culms with a ring of glands below each node; lemmas 1.4-2 mm long. 39
 - 39. Culms robust, to 110 cm high; old leaf-blades persistent, ribbon-like and curling; primary

- panicle-axils ± glabrous; spikelets linear, 5–11-flowered. 32. *E. rigidior*
- Culms slender, to 75 cm high; old leaf-blades not curling; primary panicle-axils usually bearded; spikelets narrowly elliptic, 3–6-flowered. 33. *E. trichophora*
40. Culms eglandular; anthers 0.3–0.4 mm long; lemmas ovate, divergent, acute. 21. *E. macilenta*
- Culms with a glandular ring below each node; anthers 0.6–1 mm long; lemmas oblong, obtuse to truncate. 41
41. Lower glume 1/2 to 2/3 as long as lowest lemma; lemmas broadly obtuse to truncate; leaf-sheaths usually pilose. 34. *E. porosa*
- Lower glume 3/4 to as long as lowest lemma; lemmas narrowly obtuse; leaf-sheaths usually glabrous. 35. *E. cylindriflora*

GROUP 2

42. Annuals. 43
- Perennials. 45
43. Lowermost panicle-branches inserted singly; stamens 2; glumes subequal. 41. *E. gangetica*
- Lowermost panicle-branches usually whorled; stamens 3; glumes unequal, the lower very small and nerveless. 44
44. Lemmas > 1 mm long, subacute; lowermost panicle-branches with long silky hairs. 36. *E. pilosa*
- Lemmas < 1 mm long, obtuse; lowermost panicle-branches usually glabrous. 38. *E. aethiopica*
45. Spikelets linear, 1–1.5 mm wide; lemmas loose, lanceolate-oblong, scaberulous. 39. *E. heteromera*
- Spikelets ovate to ovate-oblong, 1.5–6.5 mm wide; lemmas ovate, smooth or granular. 46
46. Culms wiry, straggling; leaf-blades cauline, reflexed, 2–8 cm long. 40. *E. volkensii*
- Bunch grass with erect or ascending culms and leaf-blades; leaf-blades up to 30 cm long. 47
47. Spikelets 2–3 mm wide, clustered around the distal half of the primary branches. 42. *E. botryodes*
- Spikelets 3–6.5 mm wide, evenly distributed. 48
48. Lemmas imbricate, covering the rhachilla; palea-keels ciliolate; anthers 0.5–0.8 mm long. 43. *E. paniciformis*
- Lemmas loose, exposing the rhachilla; palea-keels scabrid; anthers 1–1.5 mm long. 44. *E. chalarothyrsos*

1. *E. biflora* Hack. (1895);
– type: South Africa, *Rehmann* 3759 & 5364 (both K isosyn.).

Very delicate, soft, tufted annual; culms erect, up to 90 cm high; leaf-blades thin, flat, tapering to a filiform tip. Panicle ovate, diffuse, 8–30 cm long, lowermost branches whorled, the tiny spikelets distant on the capillary branches. Spikelets 1.2–2.2 mm long, 1–3-flowered with spaced florets, glumes and lemmas

falling at maturity, the paleas persistent on the tough, slender rhachilla; glumes subequal, hyaline, 1.2–1.4 mm long, lanceolate-oblong, acute; lemmas broadly elliptic, 1.2–1.4 mm long, membranous with obscure nerves, subacute; anthers 3, 0.3 mm long; grain enclosed within a free pericarp, obovate, 0.5 mm long, reddish-brown, rugulose, deeply hollowed on the hilum side.

Open situations in the shade of *Acacia*; 600 m. HA; Botswana, Namibia and South Africa. *Glover & Gilliland* 341.

A delicate shade species, intermediate between *Eragrostis* and *Sporobolus* but placed in *Eragrostis* as the spikelets are often more than 1-flowered.

2. *E. superba* Peyr. (1860);
– type: Angola, Benguela, *Wawra* 244 (W holo.).

Tough tussocky perennial, glabrous and eglandular; culms erect, 50–120 cm high; leaf-blades flat or in-rolled, glaucous, 4–7 mm wide. Panicle 9–30 cm long, lanceolate to narrowly oblong, primary branches inserted singly, spaced along the main axis, little-branched to subracemose, the spikelets borne on short pedicels up to 3 mm long. Spikelets ovate to suborbicular, 6–16 mm long, strongly laterally compressed, 8–29-flowered with the florets tightly imbricate, falling entire; glumes subequal, lanceolate, 2.3–5.8 mm long; lemmas navicular, cartilaginous, 3–5.8 mm long, lateral nerves conspicuous, keel thickened and scabrid upwards, narrowly obtuse; palea nerves thickened, each with a membranous ciliolate wing; anthers 3, 2 mm long.

Wooded grassland, often on sandy soils and in disturbed situations; 700–1500 m. KF GG; Sudan, East Africa and southwards to South Africa. *Ash* 2270; *Fukui* 1510; *Gilbert & Phillips* 8906.

3. *E. sennii* Chiov. (1932);
– type: Somalia, *Senni* 239 (FT holo.).
E. abrupens Kabuye (1973).

Slender tufted annual; culms 4–30 cm high, ascending, not exerted above the leaves; leaf-blades flat or in-rolled, 2–3 mm wide. Panicle 2–10 cm long, much reduced and often simply racemose, the spikelets clustered towards the culm tip and borne directly on the main axis on short pedicels, or with few-spiculate branches in the lower half. Spikelets oblong, 8–18 mm long, strongly laterally compressed with a serrate outline, 9–32-flowered, pale green, falling entire; glumes equal, 2.5–4 mm long, 3(–5)-nerved, narrowly lanceolate; lemmas narrowly ovate, cartilaginous, lateral nerves conspicuous, tip shortly acuminate and recurved; palea half as long as the lemma, keels thickened into narrow wings; anthers 2, 0.8–0.9 mm long; grain strongly laterally compressed, ovate in side view.

Calcareous soils up to 500 m. SD; S Somalia, Kenya. *Rippstein* 788.

An annual weed of disturbed and denuded lowland areas.

4. *E. ciliaris* (L.) R. Br. (1818);

Poa ciliaris L. (1759) - type: Jamaica (LINN holo.).

E. ciliaris (L.) R. Br. var. *brachystachya* Boiss., *Fl. Orient.* 5: 582 (1884).

Annual or small ephemeral; culms slender, solitary or loosely tufted, 5–65 cm high, erect or spreading. Leaf-blades flat, 2.5–4 mm wide, acuminate; bearded at the collar; leaf-sheaths pilose. Panicle linear, 1–22 cm long and 0.5–1 cm wide, elongate, lobed and interrupted, or contracted to a dense, cylindrical head. Spikelets elliptic-oblong to ovate, 1.6–4 mm long, 5–12-flowered with the florets loose and divergent, covered by the spreading palea-hairs, disarticulating between the florets; glumes equal, lanceolate, 0.8–1.4 mm long; lemmas oblong, 0.8–1.5 mm long, thinly membranous, scaberulous with a few pectinate hairs on the lower keel (at least in the upper lemmas), broadly obtuse, ± mucronate; palea-keels pectinate-ciliate with tubercle-based hairs 0.5–0.7 mm long; anthers 2, 0.1–0.2 mm long; grain ellipsoid, 0.5 mm long, glossy. Fig. 48:3, 4.

Open situations in *Acacia* bushland, overgrazed areas, weedy and arable land on sandy soils; also on coastal sand dunes; sea level–1400 m. EE EW GG SD HA; tropical and South Africa, through Arabia to India, and in tropical America. *M.G. & S.B. Gilbert* 1562; *Glover & Gilliland* 358; *Parker* E274.

A widespread and variable weedy annual of open situations on sandy soils. The panicle may be elongate and somewhat loose with the branches visible, or contracted to a short dense head (var. *brachystachya*), but variation is continuous between these two extremes. It is usually readily recognizable by its spike of many small, fluffy spikelets.

5. *E. lepida* (A. Rich.) Hochst. ex Steud. (1854);

Poa lepida A. Rich. (1851) - type: Eritrea, Modat, Ailet, *Schimper* 1040 (K iso.).

Slender, loosely tufted annual; culms geniculate, spreading or prostrate, 15–50 cm high. Leaf-blades flat, 1–2.5 mm wide, finely tapering; leaf-sheaths scattered-pilose. Panicle delicate, open, lanceolate to narrowly elliptic, 5–15 cm long, eglandular, the spikelets evenly spaced on setaceous branchlets and pedicels. Spikelets elliptic to oblong, 1.7–3.2 mm long, 5–13-flowered with stiff, spreading hairs from the palea-keels, disarticulating between the florets; glumes unequal, lanceolate, the lower 0.6–0.8 mm long, acute, the upper a little longer, often mucronate; lemmas thinly membranous, oblong, 0.8–1.2 mm long, scaberulous, truncate and mucronate; palea-keels pectinate-ciliate with tubercle-based hairs 0.3–0.4 mm long; anthers 2, 0.1 mm long; grain ellipsoid, 0.4–0.5 mm long, glossy.

Open sandy places; sea level–c 1000 m. EE EW; coastal areas along the Red Sea and from adjacent low-

land areas extending round the Horn of Africa and through Somalia to northern coastal Kenya. *Popov* 1416; *Schweinfurth & Riva* 217, 436, 524.

This local species is very similar to the pantropical annual *E. tenella* P. Beauv. ex Roem. & Schult., which is to be expected in Ethiopia. *E. tenella* differs by its obtuse rather than truncate lemma and by the possession of 3 anthers.

6. *E. viscosa* (Retz.) Trin. (1830);

Poa viscosa Retz. (1786) - type: India, König (LD holo.).

Poa viscosa Retz. var. *pilosissima* Hochst. ex A. Rich., *Tent. Fl. Abyss.* 2: 424 (1850); *Eragrostis retinorrhoea* Steud. (1854); *Eragrostis viscosa* (Retz.) Trin. var. *pilosissima* (Hochst. ex A. Rich.) Hochst. in *Flora* 38: 329 (1855) - type: Ethiopia, TU, Gambia, *Schimper* 824 (K iso.).

Sticky, tufted annual; culms erect, 10–40 cm high, glandular below the nodes. Leaf-blades flat, 3–5 mm wide, pilose on the underside and sticky along the keel; leaf-sheaths pilose, sticky on the keel, margins and around the collar. Panicle ovate to narrowly oblong, 5–15 cm long with yellow glandular patches on the axis and branchlets. Spikelets elliptic-oblong, 1.5–4.5 mm long, 5–15-flowered, disarticulating between the florets; glumes subequal, broadly oblong, 0.6–1.2 mm long with a thickened, yellow, glandular keel; lemmas oblong, 0.7–1.4 mm long, membranous with obvious nerves, broadly obtuse; palea-keels pectinate-ciliate with tubercle-based hairs 0.1–0.5 mm long; anthers 3, 0.2–0.3 mm long; grain ellipsoid, 0.5–0.7 mm long, glossy.

Dry shallow soils; TU; westwards to Nigeria and southwards to South Africa; also eastwards to India, Thailand and the Philippines. *Schimper* 1081.

E. viscosa is easily separated from the other annual species with ciliate palea-keels by the sticky glands covering most of the plant, to which sand-grains and debris readily adhere. It is otherwise very similar to *E. tenella*, but has somewhat longer, oblong lemmas and stouter, longer palea-hairs.

7. *E. hispida* K. Schum. (1895);

- type: Kenya, *Hildebrandt* 2675 (K iso.).

Slender, densely tufted perennial, the old basal sheaths becoming fibrous; culms erect, 15–50 cm high. Leaf-blades filiform, flexuous, hispid. Panicle open, ovate, 2–10 cm long; primary branches distant with the spikelets in small clusters on slender, flexuous pedicels towards their tips, each branch extended beyond the spikelets as a fine bristle. Spikelets conspicuously hairy, grey-green, broadly elliptic to ovate, 3–5 mm long, 4–12-flowered, disarticulating between the florets; glumes subequal, equalling the lower lemmas, narrowly lanceolate-acuminate with long scattered hairs; lemmas 2–3 mm long, narrowly elliptic-oblong, membranous, appressed-pilose on the lower back and margins, obtuse; palea-

keels pectinate-ciliate with tubercle-based hairs *c* 1 mm long; anthers 3, 1–1.5 mm long; grain 1 mm long, narrowly ellipsoid.

Shallow soils overlying rock, often along seepage lines; 1500–2900 m. SD; southwards through East Africa to Malawi, Zimbabwe and Angola. *De Wilde* 8427; *Friis* et al. 3308.

A common species on damp shallow soils in eastern and southern Africa, reaching the northern limit of its range in Sidamo.

8. *E. olivacea* K. Schum. (1895);
- type: Tanzania, *Holst* 269 (B holo.).
E. lasiantha Stapf (1906).

Tussocky perennial, the basal sheaths papery, glabrous; culms erect, 30–90(–150) cm high. Leaf-blades tough, usually involute, rarely flat and up to 8 mm wide. Panicle variable, diffuse to contracted, 5–25 cm long, the spikelets evenly distributed, borne on filiform, flexuous pedicels. Spikelets greyish, ovate to oblong, 2.5–4.5(–8) mm long, loosely 5–7(–20)-flowered, the rhachilla fragile, disarticulating between the florets; glumes subequal, lanceolate, slightly shorter than the lowest lemmas, acute; lemmas 1.6–2.2 mm long, narrowly ovate, ± glabrous to pilose, especially near the margins, acute; palea-keels thinly and irregularly ciliate with hairs 0.2–0.5 mm long; anthers 3, 0.5–1 mm long; grain 0.6–0.7 mm long, narrowly ellipsoid.

Open woodland and grassland, *c* 2000 m. SD; East Africa, Zaire and Zambia. *Sebsebe & Tewolde* 865 (ETH).

9. *E. japonica* (Thunb.) Trin. (1830);
Poa japonica Thunb. (1784) - type: Japan, *Thunberg* (UPS-Thunb. 2252 holo.).
E. namaquensis Schrad. (1838); *Diandrochloa namaquensis* (Schrad.) de Winter (1960).
Poa sporoboloides A. Rich. (1850) - types: Ethiopia, TU, Kouaieta, & Adiabo, both *Quartin Dillon & Petit* (both P syn.).
Sporobolus confertiflorus A. Rich. (1850); *Vilfa confertiflora* (A. Rich.) Steud. (1854) - type: Ethiopia, TU, near Adua, *Quartin Dillon* (P holo.).
Catabrosa micrantha Hochst. ex A. Rich. (1850) in synonym.; *Glyceria micrantha* Steud. (1854) nom. superfl. - type: Ethiopia, TU, Scholoda, *Schimper* 406 (K iso.).
Eragrostis diplachnoides Steud. (1854); *Dian-drochloa diplachnoides* (Steud.) Henry (1967); *Roshevitzia diplachnoides* (Steud.) Tzvelev (1971); *Eragrostis namaquensis* var. *diplachnoides* (Steud.) Clayton in *Kew Bull.* 25: 251 (1971).

Tufted annual or occasionally short-lived perennial; culms erect, 10–150 cm high, slender to robust. Leaf-blades flat, 1.5–5 mm wide; ligule membranous, 0.5 mm long. Panicle with numerous tiny spikelets, very variable in shape, 5–55 cm long, linear and contracted or more open with ascending branches; primary

branches inserted singly or subverticillate. Spikelets elliptic to narrowly oblong, 1.3–3 mm long, 0.8–1 mm wide, 4–14-flowered, disarticulating from above, the rhachilla fragile; glumes subequal, narrowly ovate, 0.5–0.8 mm long, subacute to obtuse; lemmas broadly elliptic-oblong, 0.7–1 mm long, thinly membranous with obvious nerves, broadly obtuse; palea-keels smooth or scabrid; anthers 2, 0.2 mm long; grain fusiform, glossy, 0.5 mm long. Fig. 48:1, 2.

Seasonally flooded soils of alluvial flats and water-courses; sea level–1800 m. EE TU GJ GG; southwards to South Africa and from Egypt and Iraq eastwards to India and SE Asia. *IECAMA* BH-63; *Parker* 4316 (ETH); *Schweinfurth* 77.

The name "*E. japonica*" as applied here refers to a highly variable and widespread species complex subdivided into separate species by some authors. Forms with smooth palea-keels are confined to Africa and have been separated as *E. namaquensis* Schrad., whilst sympatric forms, differing only in their scabrid palea-keels, are named *E. diplachnoides* Steud. Great variation also exists throughout the geographical range in panicle form and spikelet size, to which several different specific epithets refer, but both of these are continuously variable and also vary independently of each other. This complex is sometimes treated as the separate genus *Diandrochloa* de Winter on account of the membranous ligule.

10. *E. aspera* (Jacq.) Nees (1841);
- type: cultivated in Europe, seeds from India (W holo., K iso.).
E. devolvens Gand. (1920) - type: Ethiopia, TU, Dscheladscheranne, *Schimper* s.n. (LY holo.).

Tufted, often rather coarse annual; culms slender to robust, ascending, 20–110 cm high. Leaf-blades linear, flat, 1–5 mm wide, long-acuminate, bearded at the sheath-junction. Panicle elliptic to ovate, diffuse and open, 10–50 cm long, the spikelets distant on long, capillary pedicels, branches single or whorled, scabrid, conspicuously bearded in the primary axils. Spikelets linear, 3–8 mm long and 1–1.5 mm wide, 5–20-flowered, the florets contiguous or slightly imbricate, disarticulating from above with a fragile rhachilla, but some lemmas also falling before their paleas; glumes lanceolate-oblong, subequal; lemmas broadly elliptic, 1.1–1.5 mm long, membranous with prominent nerves, obtuse-truncate; palea-keels scabrid; anthers 3, 0.2 mm long; grain ellipsoid to subrotund, 0.5 mm long. Fig. 49:1, 2.

Thin soils among rocks and in the sand and gravel of dry stream-beds; 800–1700 m. EW TU GJ SU AR GG SD HA; tropical and South Africa; India. *M.G. & S.B. Gilbert* 1478, 1929; *Gilbert & Thulin* 199.

E. macilenta has a similar facies to *E. aspera*, both being coarse annuals with a large, lax panicle of diffuse, long-pedicelled spikelets. The spikelets of *E. macilenta* are readily distinguishable, with their relatively longer,



Figure 48. *ERAGROSTIS* spp.: *E. JAPONICA*: 1 - panicle x 3/4; 2 - spikelet x 10. *E. CILIARIS*: 3 - habit x 3/4; 4 - spikelet x 10. *E. SCHWEINFURTHII*: 5 - habit x 3/4; 6 - spikelet x 10. *E. TREMULA*: 7 - spikelet x 10. *E. PATENTI-PILOSA*: 8 - spikelet x 10. 1 from IECAMA BH.63; 2 from Carr 414; 3 & 4 from Schweinfurth & Riva 160; 5 & 6 from De Wilde 8183; 7 from Acres 111; 8 from Hugh Scott 108. Drawn by Eleanor Catherine.

sharply acuminate glumes, acute ovate lemmas, and rows of persistent paleas on the disarticulated spikelets.

Specimens of *E. aspera* with whorled lower panicle-branches may sometimes be confused with *E. cylindriflora*, but this has a less diffuse panicle with the pedicels shorter than the spikelets, caducous glumes, longer anthers (0.7–1 mm) and a glandular ring below each node.

11. *E. mahrana* Schweinf. (1894);

- type: Aden, Schweinfurth 208 (K iso.).

E. hararensis Chiov. (1896) - type: Ethiopia, HA, Robecchi-Bricchetti (FT holo.).

Tough glaucous perennial forming spiny cushions; culms 8–30 cm high, much branched, arising from spreading stolons clothed in imbricate sheaths, their reduced blades often deciduous. Leaf-blades 0.5–5 cm long, narrowly lanceolate, distichous, pungent; leaf-sheaths imbricate. Panicle ovate, 3–7 cm long, the spikelets inserted on short pedicels up to 0.8 mm long. Spikelets linear to narrowly oblong, 4–14 mm long, 5–30-flowered, pallid, longer spikelets often falcately curved; rhachilla fragile with the florets disarticulating in groups from above, some lemmas also falling, their paleas briefly persistent; glumes equal, lanceolate, 1.3–1.5 mm long, acute; lemmas elliptic-oblong, 2 mm long, membranous, scaberulous, broadly obtuse; palea equalling or exceeding the lemma, keels scabrid; anthers 3, 1–1.2 mm long; grain ellipsoid, 0.7 mm long.

Sandy soils of desert regions, in wind-blown sand, shallow soils over limestone pavement, and in the alluvial gravel of water-courses; HA?; N Somalia, Yemen, Oman.

The only record from Ethiopia is the type collection of *E. hararensis* but this old specimen, collected in 1889, was probably collected in Somalia rather than Harerge. However, the species is to be expected in the desert regions of southern Eritrea.

12. *E. capitulifera* Chiov. (1939);

- type: Ethiopia, SD, Yabelo (Javello), Cufodontis 484 (FT holo.).

E. cephalotes Chiov. (1951) sine descr. lat. - types: Ethiopia, SD, Mega, Corradi 1277, 1288 & 1292 (all FT syn.).

Low perennial tussock grass with tough clusters of coriaceous basal leaf-sheaths, the central portion often dead and new shoots arising around the periphery; culms 5–40 cm high. Leaf-blades flat, 2–4 mm wide, softly pilose, acute, bearded at junction of sheath and blade. Panicle 1–2 cm long, a solitary, tight, globose or ovoid head of pale green spikelets shortly exerted from the uppermost sheath, villous in the branch axils. Spikelets oblong, 4–5.5 mm long, 6–8-flowered, disarticulation tardy and irregular, some lower lemmas falling but the rhachilla also becoming fragile; glumes 1-nerved, lanceolate-oblong, acute, the lower 1.5 mm long, the upper slightly longer; lemmas chartaceous with promi-

nent green nerves, lanceolate-oblong, 2–2.5 mm long, acute to obtuse and mucronate; palea-keels scabrid; anthers 3, 0.3 mm long; grain ellipsoid, 0.6 mm long. Fig. 50:8.

Acacia-Commiphora scrubland and short grassland on sandy or loamy soils, often in light shade; 1300–1900 m. SD BA; N Kenya. Friis et al. 2619; Gilbert 3317; Mooney 7309.

A distinctive species of local distribution, immediately recognizable by the solitary, capitate inflorescence.

13. *E. chapelieri* (Kunth) Nees (1841);

- type: Madagascar, Chapelier (P holo.).

Tufted perennial; culms erect, 30–100 cm high, slender to moderately robust. Leaf-blades often inrolled, pilose on the upper surface, finely pointed; leaf-sheaths softly pilose. Panicle densely spiciform, 4–22 cm long, 1–3 cm wide, often interrupted below, the spikelet clusters coalescing above. Spikelets linear, 6–24 mm long and 2–2.5 mm wide, 15–50-flowered, tinged pinkish-brown, disarticulating from below, paleas persistent on the tough rhachilla; glumes subequal, narrowly lanceolate, 1.5–2.3 mm long; lemmas ovate, 1.5–2.5 mm long, membranous with obvious nerves, acute to shortly acuminate; palea-keels scaberulous; anthers 2, *c* 0.5 mm long, purple; grain 0.6 mm long, light brown, laterally compressed, broadly oblong in side view.

Woodland clearings, often along pathsides; 1800 m. SD; Zaire, Sudan and East Africa southwards to South Africa; also in Madagascar. Gilbert 3193.

E. patens Oliver is a similar annual species from eastern and southern Africa. Apart from its more slender annual habit, it can be distinguished from *E. chapelieri* by its narrowly lanceolate lemmas 2.5–4 mm long with slightly recurved, apiculate tips and by the presence of 3 tiny anthers 0.2 mm long.

14. *E. braunii* Schweinf. (1894);

- type: Ethiopia, GD, Dschadscha, Schimper 308 (K iso.).

Tough, tussocky perennial; culms 25–70 cm high, wiry, branching, ascending, a yellow glandular patch just below the panicle. Leaf-blades glaucous, flat or inrolled, upper surface and leaf-sheath margins pilose, bearded at the collar, leaf-sheaths and blade undersurface and margins pitted with small glands. Panicle cylindrical, spiciform, 4–14 cm long, 0.5–1 cm wide, dark grey-green. Spikelets narrowly lanceolate-oblong, 4–7.5 mm long, 1–2 mm wide, 6–12-flowered with the florets loosely imbricate, disarticulating from below, the paleas persistent on the tough rhachilla; glumes unequal, the lower 0–1-nerved, oblong, 0.9–1.2 mm long, the upper 1-nerved, lanceolate to ovate, 1.5–1.7 mm long; lemmas lanceolate in profile, 1.7–2 mm long, membranous, subacute; palea-keels scabrid; anthers 3, 0.4 mm long; grain elliptic-oblong, 0.8 mm long, trigonous, shallowly sulcate on the hilum side.

Thin, overgrazed soils and among rocks; 1600–2500 m. EW TU SD; East Africa, Yemen. *Gilbert & Getachew* 2649, 2708; *Tewelde Berhan* 1123.

E. braunii is the only Ethiopian species of *Eragrostis* with a tough perennial habit and a linear, densely spiciform dark grey panicle. *E. schweinfurthii* var. *kiwuensis* is readily distinguished by its sparser panicle and more slender, often annual habit.

15. *E. schweinfurthii* Chiov. (1908);
- types: Eritrea, Halai, *Pappi* 1675, 1961 and Mt Mamahot, *Pappi* 1245 (FT syn.).

Slender annual or short-lived perennial; culms wiry, up to 35(–55) cm high, tufted and erect or ascending from a straggling, decumbent base. Leaf-blades flat, 1.5–3.5 mm wide, sparsely to densely pilose, acute. Panicle 4–14 cm long, stiff, either open with spreading branches or linear with the branches erect and appressed to the main axis; branches few-spiculate, often simply racemose, the spikelets borne on stout pedicels 0.5–2 mm long. Spikelets ovate to narrowly lanceolate-oblong, dark grey, 4–8.5 mm long and 1.5–2 mm wide, 8–36-flowered with the florets tightly imbricate, disarticulating from below, the paleas persistent on the tough rachilla; glumes subequal, boat-shaped, 1–1.3 mm long; lemmas ovate, 1.3–1.8 mm long, plump, cartilaginous with very obscure lateral nerves, acute; palea-keels scaberulous; anthers 2, 0.3–0.7 mm long; grain broadly ellipsoid to subglobose, 0.5–0.6 mm long, lightly reticulate. Fig. 48:5, 6.

Short grassland on thin soils, often along drainage channels, and in clearings in upland forest; 1800–3600 m. East Africa, Yemen.

The species is divided into two varieties on the basis of panicle shape.

var. *schweinfurthii*

Panicle open, stiffly ovate to elliptic-oblong, the branches divaricate.

EW GJ WG SU AR KF GG SD BA HA. *Gilbert* 3489; *Gillett* 5344; *Sandford* in *Mooney* 7401.

var. *kiwuensis* (Jedw.) S.M. Phillips in *Kew Bull.* 42: 930 (1987);

E. kiwuensis Jedw. (1924) - type: Zaire, L. Kivu, *Mildbraed* 1784 (B holo.).

Panicle linear, spiciform, the branches erect and appressed to the main axis.

GJ SU AR KF SD HA. *De Wilde* 8036; *Gilbert & Tewelde* 3236.

Although of very different facies, the two varieties differ only in the angle of insertion of the primary panicle branches on the main axis, being indistinguishable in all other spikelet and vegetative characters. Both varieties can occasionally be found growing together within the same population.

E. racemosa (Thunb.) Steud., a species with very similar spikelets widespread from Kenya and southern Sudan southwards to the Cape, is to be expected in southern Ethiopia. It is a somewhat more robust species, distinguished from *E. schweinfurthii* by its decidedly perennial habit with dense basal tussocks of old leaf-sheaths, by its longer lemmas (1.7–3.8 mm) and by the presence of 3 longer anthers.

16. *E. patenti-pilosa* Hack. (1908);
- type: Zimbabwe, *Gardner* 33 (W holo.).
E. pseudosclerantha Chiov. (1939) - type: Ethiopia, SD, Javello, *Cufodontis* 538 (FT holo.).

Loosely tufted sprawling perennial; culms slender, 15–30 cm high, geniculately ascending, branching at the lower nodes, sometimes shortly stoloniferous. Leaf-blades flat or convolute, 2–4 mm wide, prominently ribbed, hispid with tubercle-based hairs, bearded at the sheath-junction with stiff hairs 2–3 mm long. Panicle open, ovate, 4–8 cm long, branches inserted singly or the lowermost in a whorl of up to 4, often with brown glandular patches on the pedicels and culm-tip, pedicels slender, 2–8 mm long. Spikelets narrowly elliptic, serrate-margined, grey, 5–11 mm long, 1.8–2.5 mm wide, 7–18-flowered, disarticulating from below, paleas persistent; glumes unequal, narrowly ovate, lower 0.8–1.5 mm long, upper 1.5–2 mm long; lemmas ovate, 1.8–2.2 mm long, cartilaginous with obscure nerves, acute; palea-keels scaberulous; anthers 3, 1–1.2 mm long; grain 0.8 mm long, elliptic-oblong, laterally compressed, dark brown or blackish. Fig. 48:8.

c 2000 m. SU SD; southwards to South Africa. *Scott* 108; *Tewelde Berhan* et al. 1/33.

A species predominantly of southern and South Africa, but occurring sporadically in East Africa and southern Ethiopia.

17. *E. longifolia* Hochst. ex Steud. (1854);
Poa longifolia A. Rich. (1851), nom. illegit., non Trin. (1836) - type: Ethiopia, TU, Mt Kubbi, *Schimper* 272 (P holo., K iso.).

Slender, densely tufted perennial; basal sheaths coriaceous, ribbed, somewhat bulbous; the whole plant softly pilose; culms wiry, erect, 14–30 cm high, often scarcely exceeding the leaves. Leaf-blades narrowly linear to filiform, 0.5–1.5 mm wide, flexuous, setaceous-tipped. Panicle few-spiculate, often reduced to a simple raceme, or with short, erect branches in the lower part bearing up to 4 spikelets. Spikelets dark grey-green, ovate to narrowly oblong, 6–11 mm long, 2.5–4 mm wide, 5–17-flowered with the florets loosely imbricate, disarticulating from below, the paleas persistent on the tough rachilla; glumes 1–3-nerved, 2–3.2 mm long, the lower lanceolate-oblong, the upper ovate; lemmas lanceolate in profile, 2.5–3.5 mm long, firm with obscure lateral nerves, shortly acuminate; palea-keels narrowly winged; anthers 3, 1–1.5 mm long; grain narrowly ellipsoid, 1.4 mm long.

Among rocks and in upland grassland; 1600–2000 m. TU GD SU; N Yemen. *Chiovenda* 785, 2314; *Gilbert & Jefford* 4258.

A seldom-collected species, recognized by its hairy, flexuous leaves arising from a dense tuft of swollen, coriaceous sheaths, and by the sparse panicle of relatively large, dark, serrate-margined spikelets. *E. pobe-guini* Hubb. from West Africa is probably conspecific.

18. *E. pascua* S.M. Phillips (1991);

- type: Eritrea, Ocule Cusai, Decamere, *Pappi* 1705 (FT holo.).

Tufted annual; culms erect or ascending, 40–70 cm high. Leaf-blades 6–20 cm long, 2.5–5 mm wide, gradually acuminate. Panicle open, elliptic or ovate, 10–20 cm long, primary branches inserted singly, the spikelets distant on slender pedicels; pedicels 3–8 mm long, sometimes with a yellow gland near the middle. Spikelets narrowly oblong, dark grey-green, 7–21-flowered with the florets contiguous or lightly imbricate, 6–12 mm long and 2–2.3 mm wide, disarticulating from the base, the paleas persistent on the rhachilla; glumes lanceolate, lower glume 1.4–1.9 mm long, upper glume 1.9–2.2 mm long; lemmas elliptic-oblong in profile, membranous, 2–2.6 mm long, scaberulous near the margins and tip, obtuse; palea-keels scabrid; anthers 3, 0.3–0.4 mm long; grain 0.8–0.9 mm long, elliptic-oblong with rounded top.

Moist grassland; 2000–2500 m. EW TU; unknown elsewhere. *Gilbert & Getachew* 2861; *Pappi* 68 (FT); *Ragazzi* 105 (FT).

E. pascua is closely related to the Indian species *E. nigra* Steud., which has on average smaller spikelets and lemmas, and also smooth palea-keels and a darker, flat-topped grain.

19. *E. elegantissima* Chiov. (1907);

- type: Eritrea, Carajai in Beni Amer, *Pappi* 7146 (FT holo., K iso.).

Slender tufted annual; culms wiry, 15–30 cm high. Leaf-blades narrowly linear, up to 7 cm long and 1.5–2 mm wide, finely acute, silky-pilose on the upper surface and near the margins of the leaf-sheaths. Panicle usually open, elliptic, 7–19 cm long, the branches rather stiff, inserted singly and well spaced along the main axis, occasionally denser and contracted. Spikelets linear, 5–25 mm long, 1–1.8 mm wide, 10–45-flowered, florets contiguous with the rhachilla visible, pallid or reddish tinged, disarticulating from below, the paleas persistent; glumes subequal, narrowly lanceolate, 1.2–2 mm long; lemmas narrowly lanceolate-oblong in profile, 1.7–2.4 mm long, membranous with obvious nerves, obtuse; palea-keels scabrid; anthers 2, 0.1–0.2 mm long; grain light brown, 0.5 mm long, laterally compressed, broadly elliptic in profile.

700 m. EW; westwards through Sudan and Chad to Niger and upper Volta.

A seldom collected annual of the Sahel zone resembling *E. tremula*, but smaller and more delicate in habit, and with looser, narrower lemmas, the rhachilla being usually visible between the two ranks of florets.

20. *E. tremula* Hochst. ex Steud. (1854);

E. serpula Chiov. (1903) - type: Eritrea, Agordat, *Terracciano & Pappi* 2088 (FT holo.).

Tufted annual or short-lived perennial; culms erect, 30–100 cm high; leaf-blades linear, flat, 3–4 mm wide, acuminate, sometimes pilose above. Panicle ovate, diffuse, 10–30 cm long, the spikelets trembling on capillary pedicels, branches inserted singly, a pulvinus in each branch axil, these sometimes bearded. Spikelets linear, 5–30 mm long, 1.5–2.3 mm wide, 15–60-flowered with the florets closely imbricate, disarticulating from below, paleas persistent on the tough rhachilla, pallid tinged with brown or purple; glumes narrowly ovate, the upper longer than the lower, 1.2–1.7 mm long; lemmas ovate in profile, 1.4–2 mm long, membranous with obvious nerves, subacute; palea-keels scaberulous; anthers 2, 0.2–0.5 mm long; grain pale brown, 0.5–0.6 mm long, broadly elliptic in profile, trigonous in cross-section, lightly reticulate. Fig. 48:7.

Weedy places; 500–1000 m. EW TU; tropical Africa, India and Pakistan. *Schimper* 220, 2163; *Pappi* 2533.

21. *E. macilenta* (A. Rich.) Steud. (1854);

Poa macilenta A. Rich. (1851) - type: Ethiopia, TU, Adua, *Quartin Dillon* (P holo.).

E. decidua Hochst. (1855) - type: Ethiopia, GD, Semien, *Schimper* in Herb. Buchinger 770 (STR holo.).

E. pseudonigra Mattei (1909) - type: Eritrea, Mai-Hinsi, *Terracciano & Pappi* 239 (FT iso.).

Tufted, often rather coarse annual; culms 30–80 cm high. Leaf-blades flat, thin, 2–8 mm wide, scaberulous, long attenuate; leaf-sheaths keeled, with slender, tubercle-based hairs along the margins; ligule 0.5 mm long. Panicle diffuse, 10–35 cm long, elliptic to ovate, lower branches single, paired or whorled, spikelets distant on long, capillary pedicels. Spikelets linear to narrowly ovate, 3–7 mm long and 1–2 mm wide, 4–18-flowered with the florets contiguous and divergent to give a serrate outline, pale green to blackish, disarticulating from below, the paleas persistent; glumes subequal, lanceolate, 1–1.6 mm long, acuminate; lemmas narrowly ovate in profile, 1.3–1.7 mm long, thinly membranous, acute; palea-keels scaberulous; anthers 3, 0.3–0.4 mm long; grain reddish-brown, 0.6 mm long, oblong, truncate, shallowly sulcate on the hilum side. Fig. 49:6.

Open situations in dry, evergreen bushland; 900–2200 m. EE EW TU GD WU; westwards to Ivory Coast and southwards through East Africa to Zambia; also in N Yemen. *Gilbert & Aweke* 618, 842; *Mooney* 8081.

The large lax panicle, serrate-margined spikelets with narrow, acuminate glumes and small acute lem-

mas, and the oblong, sulcate grain are the characteristic features of *E. macilenta*. In East Africa the spikelets are usually grey or blackish, the dark pigmentation obscuring the lateral nerves, but Ethiopian collections are usually light green with obvious, green lateral nerves.

22. *E. welwitschii* Rendle (1899);

- type: Angola, *Welwitsch* 2961 (LISU).

Tufted annual, panicle and often the whole plant suffused with purple; culms slender, erect, 15–60 cm high. Leaf-blades flat, 1.5–3 mm wide, acute; ligule a minute rim 0.1 mm long. Panicle open, elliptic to ovate, 5–20 cm long, branches inserted singly, spikelets spaced on filiform pedicels. Spikelets oblong, 3.5–9 mm long and 1.5–2.5 mm wide, 6–30-flowered with the florets contiguous and divergent to give a serrate outline, disarticulating from below, the paleas persistent; glumes usually unequal, lanceolate, acuminate, the lower 0.9–1.6 mm long, the upper 1.1–2.3 mm long; lemmas lanceolate in profile, 1.4–2 mm long, membranous, lateral nerves obvious, shortly acuminate; palea-keels scabrid; anthers 2–3, 0.3 mm long; grain medium brown, 0.3–0.5 mm long, ellipsoid, smooth and shiny. Fig. 49:7.

Open grassland and arable land; 1400–1700 m. WG SU IL; West Africa and from Tanzania southwards into southern tropical Africa. *Mooney* 7556; *Parker* E.145.

E. welwitschii is a more slender, often smaller species than *E. macilenta*, with a rather less diffuse, purple-tinged panicle and a markedly shorter ligule. The spikelets of the two species are very similar, but the glumes are usually unequal in *E. welwitschii* and the lemmas narrowed to a sharper tip. When mature grains are present there can be no confusion, as they differ in colour, size and shape between the two species.

23. *E. gloeophylla* S.M. Phillips (1987);

- type: Somalia, *Roffey* 60037/3 (K holo.).

Tufted annual, the leaf-sheaths, lower surface of the leaf-blades and sometimes the culms viscid due to a covering of glandular hairs to which sand grains adhere; culms erect, 4–45 cm high. Leaf-blades linear, flat or convolute, 2–4 mm wide, acute. Panicle contracted, 2–10 cm long, the spikelets subsessile, clustered on short, lateral branches. Spikelets narrowly oblong, 5–16 mm long, 2.5–3.5 mm wide, 6–19-flowered, disarticulating from above, the rhachilla fragile, the occasional lemma also falling early before its palea; glumes narrowly lanceolate, the lower 1-nerved, 1.5–2.5 mm long, the upper 1–3-nerved, 2–3 mm long; lemmas narrowly oblong in profile, 2–3.2 mm long, cartilaginous, the nerves pronounced, truncate; palea-keels scabrid; anthers 3, 0.3–0.5 mm long; grain medium-brown, plumply ellipsoid, glossy, 0.5 mm long.

Dry *Acacia-Commiphora* bushland on red sandy soils; 980 m. HA; Somalia. *Godding* 31; *Glover & Gililand* 357.

A local annual of the Ogaden region, closely resembling the widespread weedy annual *E. cilianensis*, but differing in its straight-sided spikelets, oblong truncate lemmas, and viscid covering of glandular hairs. These hairs are especially numerous on the leaf-sheaths and undersides of the leaf-blades, which are often coated in sand grains.

E. psammophila S.M. Phillips is another closely related small annual species from red sandy soils in dry bushland. It occurs over the same area of Somalia as *E. gloeophylla* and is to be expected in the Ogaden, although not yet recorded from Ethiopia. The spikelets are essentially the same as those of *E. gloeophylla*, but smaller and borne in a diffuse open panicle, and the plant is not obviously viscid as in *E. gloeophylla*.

24. *E. cilianensis* (All.) Vign. ex Janchen (1904);

Poa cilianensis All. (1785) - type: Italy, *Bellardi* (? holo. destr., TO iso.).

Briza eragrostis L. (1753), non *Poa eragrostis* L. (1753).

Eragrostis megastachya (Koel.) Link (1827).

E. multiflora (Forssk.) Aschers. var. *insularis* Chiov. in *Ann. Ist. Bot. Roma* 8: 65 (1903); *E. pappiana* (Chiov.) Chiov. var. *insularis* (Chiov.) Mattei (1910) - type: Eritrea, Dahlak Is., *Terracciano* 778 (FT holo.).

E. multiflora (Forssk.) Aschers. var. *glandulifera* Chiov. in *Ann. Ist. Bot. Roma* 8: 370 (1908) - type: Eritrea, Assaorta, *Pappi* 2611 (FT holo.).

E. multiflora (Forssk.) Aschers. var. *subbiloba* Chiov. in *Ann. Ist. Bot. Roma* 8: 370 (1908); *E. major* Host var. *subbiloba* (Chiov.) Chiov., *Res. Sci. Miss. Stefan.-Paoli* 1: 187 (1916) - types: Eritrea, *Pappi* 6675, 7248, 6453 and many other syntypes (all FT syn.).

E. pappii Gand. (1920) - type: Eritrea, Beni Amer, *Pappi* 5964 (LY holo.).

Tufted annual; culms geniculately ascending, 10–75 (–100) cm high. Leaf-blades 4–8 mm wide, acuminate, often with crateriform glands along the margins. Panicle lanceolate to narrowly elliptic, 5–20 cm long, usually ± contracted, pedicels and branchlets often glandular. Spikelets ovate-oblong, rarely linear (when many-flowered), 4.5–15 mm long, 2.5–4 mm wide, 8–30-flowered, silvery-green varying to grey-green, disarticulating from below, the lemmas falling leaving the persistent paleas, often the rhachilla also becoming fragile above or breaking off at the pedicel before all the lemmas are shed; glumes subequal, 1.5–2.7 mm long, lanceolate, acute; lemmas ovate, 2–2.5 mm long, papery, lateral nerves distinct, scaberulous, obtuse to subacute; palea-keels scabrid; anthers 3, 0.3 mm long; grain dark reddish-brown, 0.5–0.7 mm long, usually subrotund, occasionally broadly oblong. Fig. 50:3, 4.

Pathsides, overgrazed grassland, in the sand and gravel of riverbanks, and as a weed of arable land; sea level –

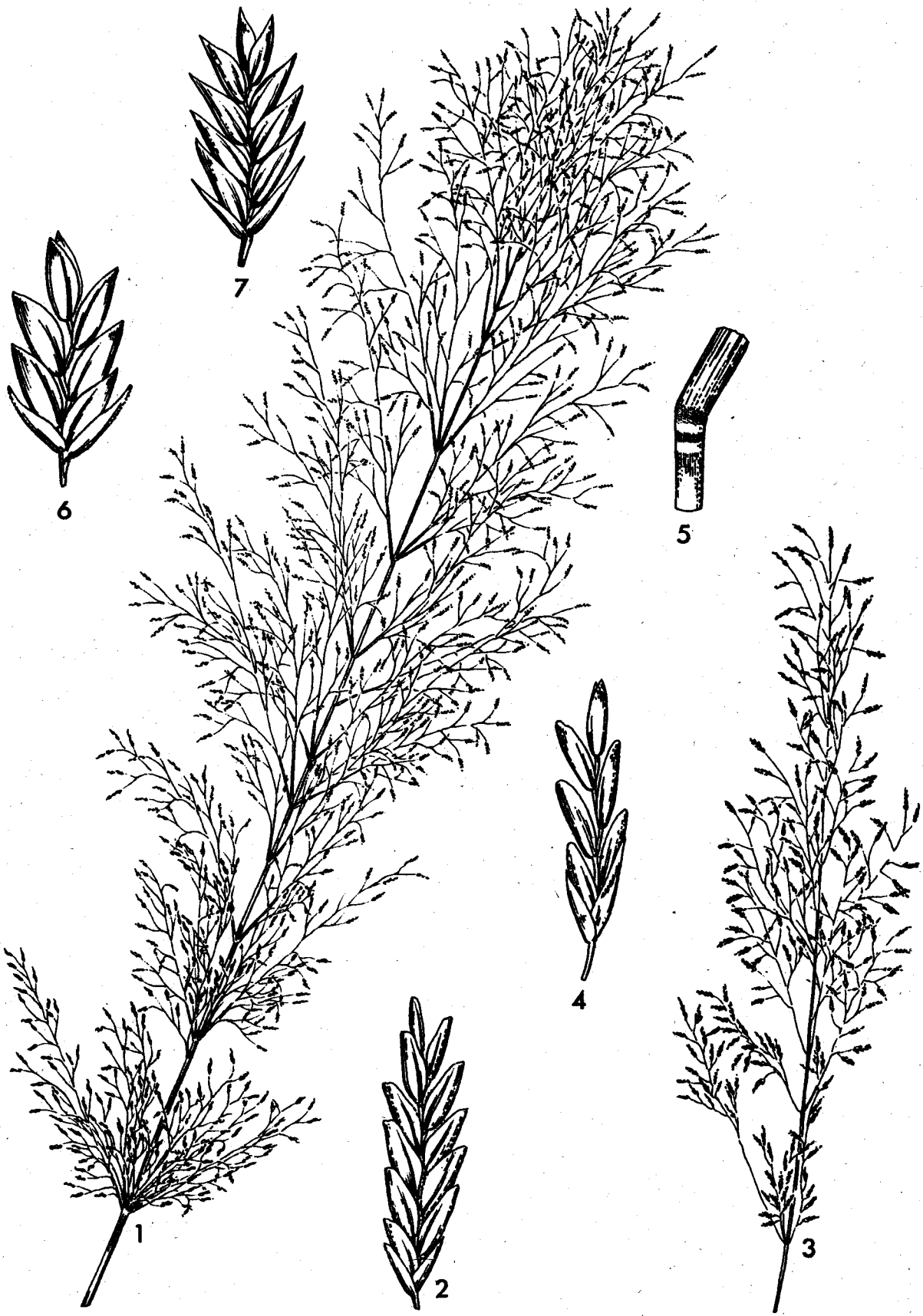


Figure 49. *ERAGROSTIS* spp.: *E. ASPERA*: 1 - panicle x 1/2; 2 - spikelet x 10. *E. CYLINDRIFLORA*: 3 - panicle x 3/4; 4 - spikelet x 10; 5 - node with glandular ring. *E. MACILENTA*: 6 - spikelet x 10. *E. WELWITSCHII*: 7 - spikelet x 10. 1 & 2 from Gilbert & Thulin 308; 3-5 from Harrison 1289; 6 from Aweke & Gilbert 168; 7 from Parker E145. Drawn by Eleanor Catherine.

2400 m. EE AF EW TU SU AR GG SD HA; tropical and warm temperate regions of the Old World; introduced to America. *Bally* 6883; *Burger* 2858; *M.G. & S.B. Gilbert* 1722.

E. cilianensis is a widespread and variable weedy annual, recognized by its relatively large, papery spikelets of obtuse imbricate lemmas, with small anthers and a subrotund grain. The leaf-margins and panicle are often glandular, but eglandular plants are also common. The panicle is often contracted, but there is a good deal of variation, with larger, loose panicles also occurring, usually on vigorous plants. The species is known to include several ploidy levels ($2n=20, 40, 60$).

25. *E. minor* Host (1809);

based on *Poa eragrostis* L. (1753) - type: Italy, *Baek* (LINN holo.).

E. poaeoides P. Beauv. (1812).

E. multiflora (Forssk.) Aschers. var. *pappiana* Chiov. in *Ann. Ist. Bot. Roma* 8: 65 (1903); *E. pappiana* (Chiov.) Chiov. (1908) - types: Eritrea, *Pappi* 2913, 2868, 2874 and many other syntypes (all FT syn.).

Slender, loosely tufted annual; culms ascending, 10–60 cm high. Leaf-blades 2–4 mm wide, acute, with crateriform glands along the margins. Panicle elliptic to ovate, 3–20 cm long, open, the branchlets and pedicels glandular. Spikelets linear to narrowly oblong, 4.8–9 mm long, 1.5–2.2(–2.5) mm wide, 8–16-flowered, greyish-green to dark grey, disarticulating from below, the paleas persistent on the tough rhachilla; glumes subequal, lanceolate, 1.3–1.8 mm long; lemmas ovate, 1.6–1.8(–2) mm long, papery, lateral nerves distinct, scaberulous, obtuse; palea-keels scabrid; anthers 3, 0.3 mm long; grain dark reddish-brown, 0.6–0.8 mm long, broadly oblong or occasionally subrotund. Fig. 50:5, 6.

Weedy places; EE TU HA; warm temperate and subtropical regions of the Old World; introduced elsewhere. *Pappi* 5140; *Parker* 4356 (ETH); *Schimper* 1068.

E. minor is very similar to *E. cilianensis*, with which it intergrades. It is generally a more slender plant with a loose panicle of grey linear spikelets, which are narrower than those of *E. cilianensis* and have smaller lemmas. Additionally, the rhachilla remains tough, bearing a long row of persistent paleas, whereas in *E. cilianensis* the upper part often becomes fragile, and the grain is usually oblong rather than subglobose. However, no single character can be relied upon to separate the two species, and intermediates will be found occasionally.

E. minor has a warm temperate and subtropical distribution, penetrating southwards only into northern Ethiopia, whereas *E. cilianensis* occurs over the whole of Africa, but *E. minor* may be found further south as an introduction.

26. *E. barrelieri* Dav. (1894);

- types: Mediterranean, many syntypes including Egypt, *Ascherson* 336; Sicily, *Todaro* s.n.; Algeria, *Balansa* 734 (all P syn., K isosyn.).

Tufted annual; culms loosely ascending, up to 60 cm high. Leaf-blades linear, flat or inrolled, 1.5–4 mm wide, eglandular; lower leaf-sheaths often subtending reduced panicles. Panicle lanceolate to elliptic, 3–15 cm long, spikelets evenly spaced or somewhat contracted into loose fascicles, axis and branchlets often glandular. Spikelets linear, 6–15 mm long, 1.5–2 mm wide, 8–25-flowered, disarticulating from below with persistent paleas, pallid or tinged greyish or reddish; glumes lanceolate, the lower 1–1.5 mm long, the upper 1.3–2.1 mm long; lemmas lanceolate-oblong, 1.7–2.3 mm long, conspicuously nerved, scabrid upwards, obtuse; palea-keels scabrid; anthers 3, 0.2 mm long; grain light brown, elliptic-oblong, trigonous, 0.65–1 mm long.

Weedy places, often on damp soil; 1000–2400 m. EW SU HA; Mediterranean, N Sudan, through the Arabian peninsula to Pakistan, N Somalia. *Drake-Brockman* 94; *Parker* E104; *Ryding* 1223.

E. barrelieri is easily confused with *E. minor*, but lacks the glandular leaf-margins of the latter species. It also has narrower lemmas and a narrower, lighter coloured grain. The reduced panicles in the lower leaf-sheaths, although not always present, are a good spot character for *E. barrelieri*.

E. barrelieri is often also confused with the compact-panicked, glandular form of *E. papposa*, but this species has an ovate panicle of dark grey spikelets with slightly smaller lemmas (1.2–1.8 mm) and a shorter lower glume (0.3–1 mm) less than half as long as the lowermost lemma.

27. *E. astrepta* S.M. Phillips (1991);

- type: Ethiopia, SD, Bitata, *Gilbert & Ermias* 8440 (K holo., ETH UPS iso.).

Small tufted annual; culms 8–23 cm high, ascending, rigid, dotted with glands below the nodes. Leaf-blades 1–4 cm long, 2–3.5 mm wide, rigid, the margins eglandular, subacute; leaf-sheaths thinly glandular-punctate. Panicles terminal and axillary, contracted, 3–7 cm long, the short primary branches inserted singly; pedicels thick, sometimes glandular, 0.5–1.5 mm long. Spikelets linear-lanceolate with serrate margins, 10–14-flowered, 5.5–7.5 mm long, 1.5–2 mm wide, the florets contiguous, disarticulating from the base, the paleas persistent; lower glume 0.3–1 mm long; upper glume 1–1.8 mm long; lemmas ovate, firmly membranous, 1.7–2.2 mm long, subacute; anthers 3, 0.2 mm long. Grain 0.8–1.1 mm long, strongly laterally compressed, lightly rugulose, semitranslucent.

Open ground over weathered rock in *Combretum* woodland; 1500–1600 m. GG SD; unknown elsewhere. *Gilbert & Jefford* 4653; *Gilbert & Phillips* 8899; *Vatova* 136 (FT).

E. astrepta closely resembles some forms of *E. minor* with contracted panicles, but differs by its stiff habit, slightly firmer, more acute lemmas and especially by its non-glandular leaf-margins and different grain.

28. *E. virescens* Presl (1830);
(1985) - type: Chile, *Haenke* (PR holo.).

E. mexicana (Hornem.) Link subsp. *virescens* (Presl) Koch & Sanchez in *Phytologia* 58: 380 (1985).

Laxly tufted annual; culms slender, procumbent to erect. Panicle open, the lowermost branches solitary or clustered. Spikelets linear, 3–5 mm long, *c* 1 mm wide, loosely 3–9-flowered, disarticulating from the base, the paleas persistent. Glumes narrowly lanceolate, subequal, 0.8–1.5 mm long; lemmas ovate, 1.3–1.5 mm long, acute; palea-keels scaberulous; anthers 3, 0.2 mm long; grain dark brown, oblong, 0.8 mm long, finely reticulate.

Weedy places. 1700 m. KF; a native of South America, introduced into scattered locations elsewhere; fairly widespread in South Africa. *Friis* et al. 2032.

29. *E. papposa* (Roem. & Schult.) Steud. (1840);
Megastachya papposa Roem. & Schult. (1817) -
type: Spain, *Dufour* (NTM holo., destr.).

Poa aulacosperma Fresen. (1837); *Eragrostis aulacosperma* (Fresen.) Steud. (1840) - type: Ethiopia, *Rüppel* s.n. (FR holo.).

E. rigidifolia Schweinf. (1894) - types: Ethiopia, TU, Dschadscha, *Schimper* 374 (K isosyn.) & *Schimper* 189.

Slender, compactly tufted short-lived perennial (probably sometimes annual); culms wiry, erect, 15–55 cm high. Leaf-blades stiff, usually glaucous, forming a basal cushion, 2–7(–12) cm long, inrolled, a conspicuous circlet of hairs *c* 3 mm long at the junction of blade and sheath, the blades of older leaves often disarticulating from the sheaths. Panicle open, ovate, 5–20 cm long, very delicate with filiform divaricate branches and long capillary pedicels, or more compact with shorter stouter pedicels, eglandular or with a yellow glandular patch at the culm tip and insertion of the primary branches. Spikelets linear, 5–18-flowered, 3.2–10.7 mm long, *c* 1 mm wide, dark grey, disarticulating from below, the paleas persistent on the tough rhachilla; glumes small, linear-lanceolate, the lower 0.3–1 mm long, the upper 1–1.4 mm long; lemmas narrowly ovate, 1.2–1.8 mm long, obtuse; anthers 3, 0.1–0.2 mm long; grain pale brown, 0.5–0.8 mm long, elliptic, trigonous. Fig. 50:1–2.

Dry hill slopes in open *Acacia* scrubland and grassland; 1100–2100 m. AF EW TU WU SU GG SD HA; Spain, N Africa, eastwards through Arabia to Pakistan and southwards to N Tanzania. *Burger* 473; *M.G. & S.B. Gilbert* 1253; *Mooney* 7049.

Two forms are recognizable within *E. papposa*; the typical form with a large, open, eglandular panicle and spikelets borne on long capillary pedicels, and a smaller

form with a more compact panicle provided with yellow glandular patches along the main axis and with the spikelets borne on stouter pedicels which are usually shorter than the spikelets themselves. The large form occurs from southern Spain and North Africa across the Saharan mountains, the Horn of Africa and the Arabian Peninsula into Pakistan and Nepal. The compact form is frequent in Kenya and N Tanzania, where it is especially associated with the Rift Valley, but extends northwards through Ethiopia to N Somalia and the Arabian Peninsula. The division between the two forms is fairly clear-cut in Africa, but becomes much less obvious in Arabia where a division into 2 subspecies would often be unworkable. The typical form, with its basal cushion of short glaucous leaves, and large delicate panicle of dark grey spikelets, is easily recognizable, but the compact form is often confused with *E. barrelieri*.

30. *E. tenuifolia* (A. Rich.) Steud. (1854);
Poa tenuifolia A. Rich. (1851) - type: Ethiopia, TU, Adwa, *Schimper* 92 (P holo., K iso.).

Tufted perennial, basal leaf-sheaths strongly flattened; culms erect, 20–90 cm high. Leaf-blades linear, flat or folded, 1–4 mm wide; leaf-sheaths pilose along the margins, often glandular above the nodes. Panicle open, pyramidal with divaricate branches, 7–25 cm long, sparsely branched or simple above, the slender pedicels often with an annular gland about halfway along, axils hairy or not. Spikelets linear, dark olive-green, 5–16-flowered, 5–16 mm long, 1–3 mm wide, the florets spreading to give a serrate outline, disarticulating from the base, the lemmas falling leaving the persistent paleas; glumes very small, lanceolate, the lower 0.4–0.8 mm long, the upper longer but scarcely reaching the base of the second lemma; lemmas narrowly ovate-oblong, 1.8–2.2 mm long, subacute; anthers 3, 0.4–0.5 mm long; grain oblong, truncate, strongly laterally compressed. Fig. 50:7.

Roadsides, field margins, overgrazed pastureland and other disturbed situations; 1400–2500 m. EW TU GD GJ SU AR KF GG SD HA; tropical Africa; also in India, Australia and South America. *Burger* 559; *M.G. & S.B. Gilbert* 1895; *Mooney* 5907.

E. tenuifolia is a weedy grass, recognized by its distinctive, dark green, linear spikelets with tiny glumes and a conspicuous serrate outline, the flattened grain and keeled, flattened basal shoots providing confirmatory characters.

31. *E. curvula* (Schrad.) Nees (1841);
Poa curvula Schrad. (1821) - type: South Africa, Cape, *Hesse* (whereabouts uncertain).

E. thunbergiana Steud. var. *atrata* Schweinf. in *Bull. Herb. Boiss.* 2, App. 2: 101 (1894); *E. curvula* var. *atrata* (Schweinf.) Cuf. in *Bull. Jard. Bot. Nat. Belg.* 38: 1251 (1968) - type: Eritrea, Kohaito, *Schweinfurth* 75 (K iso.).



Figure 50. *ERAGROSTIS* spp.: *E. PAPPOSA*: 1 - habit x 2/3; 2 - spikelet x 9. *E. CILIANENSIS*: 3 - habit x 3/4; 4 - spikelet x 9. *E. MINOR*: 5 - spikelet x 9; 6 - detail of leaf x 9. *E. TENUIFOLIA*: 7 - spikelet x 9. *E. CAPITULIFERA*: 8 - inflorescence x 3/4. 1 from M.G. & S.B. Gilbert 2051; 2 from Mooney 7049; 3 & 4 from Mooney 8133; 5 & 6 from Popov 1365; 7 from Reading University 6; 8 from Rippstein 719. Drawn by Eleanor Catherine.

Densely tufted perennial, basal leaf-sheaths coriaceous and often yellowish, strongly ribbed and appressed silky-hairy; culms erect, 30–120 cm high. Leaf-blades narrow, usually convolute, filiform with a flexuous, setaceous tip. Panicle variable, open to contracted, 6–30 cm long, the lowermost branches whorled or not, sparsely to densely hairy in the axils. Spikelets linear, 4–13-flowered, 4–10 mm long, 1–1.5 mm wide, grey-green to dark grey, rhachilla tough below with persistent paleas, fragile above; glumes ovate, acute, the lower 1/3–3/4 as long as the lowermost lemma; lemmas lanceolate-oblong, 1.8–2.6 mm long, obtuse to subacute; anthers 3, 0.8–1.2 mm long; grain ellipsoid, 0.7 mm long.

Among rocks; 2600–2700 m. EW; South Africa, introduced into East Africa and elsewhere in the tropics as a forage grass.

E. curvula is an extremely variable grass, which has been subdivided into a number of varieties and cultivars, but these are all completely intergrading. Populations growing among rocks and on cliff ledges in Eritrea and N Yemen appear to be native, although remote from the main area of distribution in southern Africa. These northern plants have a compact habit and very dark, blackish-grey spikelets.

E. curvula is distinguished from other similar perennial species by the hard, yellowish, prominently ribbed and silky-hairy basal leaf-sheaths.

32. *E. rigidior* Pilg. (1912);

- type: Namibia, *Grossart* in *Dinter* 1532 (B holo., destr.).

Robust, densely tufted perennial; culms 40–110 cm high, erect or geniculate, often with a glandular ring below each node. Leaf-blades flat, tough, 3–8 mm wide, glabrous or tuberculate-pilose, the old blades persisting, ribbon-like and often curling; leaf-sheaths eglandular, glabrous or pilose along the margins. Panicle ovate, 10–40 cm long, lowermost branches whorled, glabrous or sparsely hairy in the axils. Spikelets linear, 4–8 mm long, 1–1.5 mm wide, 5–11-flowered, grey, rhachilla fragile above, some lower paleas persisting after the lemmas have fallen; glumes lanceolate, the lower equalling or very slightly shorter than the lowermost lemma; lemmas oblong, 1.5–2 mm long, obtuse (subacute in profile); anthers 3, 0.8–1 mm long; grain 0.6 mm long, ellipsoid.

Bushland; c 1500 m. SD; southwards through East Africa to South Africa. *Rippstein* 1813.

Primarily a species of eastern and southern Africa, just extending at its northern limit over the Kenyan border into Sidamo.

There is little to distinguish the inflorescence and spikelets of *E. rigidior* from those of *E. cylindriflora*. However, *E. rigidior* is distinctly perennial and usually more robust, with flatter, wider leaf-blades. The ribbon-like curling old leaf-blades are a characteristic feature

of *E. rigidior*. It can also be confused with forms of *E. curvula* with whorled lowermost panicle branches, but lacks the conspicuous, ribbed and hairy basal leaf-sheaths of that species.

33. *E. trichophora* Cass. & Dur. (1855);

- type: Algeria, *Durieu de Maisonneuve* (P holo., K iso.).

Slender, compactly tufted perennial, the basal sheaths papery, often shortly appressed-pilose just above the roots; culms wiry, erect, 30–75 cm high, often softly pilose, the nodes glandular. Leaf-blades linear to filiform, 1.5–4 mm wide; leaf-sheaths usually scattered-pilose and glandular. Panicle broadly lanceolate, delicate, 7–20 cm long, lowermost branches whorled, usually conspicuously bearded in the axils. Spikelets linear-elliptic, 3–6-flowered, 3–5 mm long, greyish, the rhachilla tough below with persistent paleas, fragile above; glumes narrowly lanceolate, acuminate, the lower equalling or only slightly shorter than the lowermost lemma; lemmas elliptic-oblong, obtuse (subacute in profile), 1.4–2 mm long; anthers 3, 0.7–0.8 mm long.

Field margins on slopes with granite outcrops; 1500–2100 m. EW TU; Zambia southwards to South Africa, probably introduced in Ethiopia. *Gilbert & Getachew* 2719, 2754.

E. trichophora is distinguished from *E. rigidior* mainly by habit, being a more slender grass, with a basal tuft of narrow leaves and a delicate panicle of fewer-flowered spikelets. The whole plant is often softly pilose with the hairs extending to the panicle axis and with the panicle axils also conspicuously hairy, but the degree of hairiness is very variable. Sparsely hairy plants with glabrous panicle-axils may occasionally be found.

34. *E. porosa* Nees (1841);

- types: South Africa, Cape, Gamka R., *Drège* s.n. (K isosyn.) & Camdeboo, *Drège* s.n. (whereabouts uncertain).

E. podotricha Chiov. (1951) - types: Ethiopia, GG, Gondaraba, *Corradi* 128, 265 (FT syn., K isosyn.) and many other syntypes (all FT syn.).

Tufted annual; culms erect or geniculate, up to 80 cm high, a glandular ring just below each node. Leaf-blades usually flat, often pilose with tubercle-based hairs; leaf-sheaths usually glandular and pilose. Panicle lanceolate to ovate, 8–25 cm long, lowermost branches whorled, usually glabrous in the primary axils. Spikelets linear, 5–12-flowered, 3–5 mm long, grey, the rhachilla tough below with persistent paleas, fragile above; glumes ovate, acute, the lower 1/2–2/3(–3/4) as long as the lowermost lemma; lemmas oblong in profile, 1.1–1.5 mm long, broadly obtuse to truncate and emarginate; anthers 3, 0.6–0.9 mm long.

Dry bushland; 500–1000 m. TU GG-SD; Zimbabwe to South Africa, a few records from N Kenya. *Schimper* 189, 2297.

E. porosa is primarily a southern African species, belonging to the same species complex as *E. cylindriflora* and not completely separable from it. It is distinguished by its shorter lower glume, broader lemma tip and hairy leaf-sheaths, but none of these characters is completely reliable. The few specimens from Ethiopia with *E. porosa* characteristics are very doubtfully specifically distinct from *E. cylindriflora*.

35. *E. cylindriflora* Hochst. (1855);

- type: Ethiopia, GD, Semien, *Schimper* in Herb. Buchinger 772 (STR. holo.).

E. cylindriflora var. *gymnorrhachis* Schweinf. in *Bull. Herb. Boiss.* 2, App. 2: 40 (1894) - types: Eritrea, Geleb, *Schweinfurth* 1102, 1151, 1289, 1489 (B syn.) & 1623 (K isosyn.).

E. annulata Chiov. (1903) non Rendle (1891), nom. illegit. - types: Eritrea, Samhar, Sceik Said island, *Terracciano & Pappi* 2730 (FT syn.) & 2732 (FT syn., K isosyn.).

E. multipilosa Hochst. ex Mattei in Borzi (1909) - type: Ethiopia, TU, Gageros, *Schimper* 2279 [= *Schimper* in Herb. Buchinger 772 & *Schimper* 117, see *Cufodontis Enum.*: 1254 (1968)] (K iso.).

Tufted annual; culms erect or geniculate, 40–80 cm high, a glandular ring just below each node. Leaf-blades usually convolute, 2.5–3 mm wide when flattened, glabrous or scattered-pilose with tubercle-based hairs; leaf-sheaths glabrous (rarely pilose). Panicle lanceolate to ovate, 12–25 cm long, lowermost branches whorled and hairy in the primary axils. Spikelets linear, 4–12-flowered, 4.7–7.2 mm long, 1–1.5 mm wide, grey, the rhachilla tough below, the lemmas falling and the paleas persisting a little longer, fragile above, the upper florets disarticulating; glumes lanceolate-oblong, early deciduous, acute, the lower 3/4 to as long as the lowest lemma; lemmas narrowly oblong in profile, 1.5–1.7 mm long, obtuse (often subacute in profile); anthers 3, 0.7–1 mm long; grain 0.5–0.7 mm long, broadly oblong, light brown with a conspicuous dark embryo. Fig. 49:3–5.

Dry rocky places up to 1500 m. EE EW TU GD GG SD; tropical and South Africa. *Gilbert & Phillips* 9090; *Pappi* 2519; *Schimper* 1064.

The leaf-sheaths of Ethiopian plants of *E. cylindriflora* appear to be eglandular, but elsewhere in Africa the sheaths are normally dotted with crateriform glands.

E. cylindriflora, *E. porosa*, *E. rigidior* and *E. trichophora* form a closely related group of species with very similar spikelets, and are often difficult to distinguish from one another. The group as a whole is characterized by an open panicle with whorled lowermost branches, membranous spikelets with inconspicuously nerved, obtuse lemmas, 3 relatively long anthers, and culms with a ring of glands just below the nodes. Although the lower lemmas tend to fall early leaving some paleas on the rhachilla, the spikelets also break up readily from the apex, so that rows of persistent paleas on a long, tough rhachilla, do not occur in this group.

E. cylindriflora may be confused with *E. pilosa*, another annual with a similar panicle of whorled panicle-branches and narrow greyish spikelets. However, *E. pilosa* has a very much shorter lower glume, tiny anthers, and no ring of glands beneath the nodes.

36. *E. pilosa* (L.) P. Beauv. (1812);

Poa pilosa L. (1753) - type: Italy, *Triumphettus* (whereabouts uncertain).

Tufted annual; culms erect or geniculately ascending, 15–65 cm high; leaf-blades flat, 2–6 mm wide. Panicle lanceolate to narrowly elliptic, 8–30 cm long, often slightly flexuous, the lowermost branches usually whorled and rather sparsely silky-hairy in the axils. Spikelets narrowly oblong, 3–6 mm long and 1–1.3 mm wide, loosely 4–12-flowered, disarticulating from the base, the paleas falling soon after the lemmas from the persistent rhachilla; glumes very unequal, the lower a nerveless hyaline scale 0.3–0.7 mm long, the upper scabrid on the keel, 1–1.4 mm long; lemmas lanceolate in profile, 1.2–1.7 mm long, membranous, subacute; palea-keels scaberulous; anthers 3, 0.2 mm long; grain elliptic-oblong, lightly laterally compressed, 0.7–0.9 mm long. Fig. 51:4, 5.

Open places and as a weed of cultivation, often near ditches; 1400–1900 m. EW TU GD SU; tropical and warm temperate regions of the Old World; introduced to America. *Gilbert & Getachew* 2737, 2927; *Ash* 2639.

A widespread annual of diverse habit, sometimes with fairly robust culms but varying to slender, delicate forms. The whorled lower panicle-branches with hairy axils and the narrow, loose-flowered spikelets with very unequal glumes are the best distinguishing features.

E. pilosa is considered to be the wild ancestor of the cultivated cereal tef (see note under no. 37). Some plants found growing in a plot of tef at the Berlin Botanic Garden show characteristics intermediate between *E. pilosa* and *E. tef*. They are considered by Scholz (1988) to be a weedy tef showing signs of reversion to wild *E. pilosa*. He places them in the following subspecies:

E. pilosa (L.) P. Beauv. subsp. *subspontanea* H. Scholz in *Willdenowia* 18: 218 (1988) - type: *Cult. Hort. Bot. Berol.* 1957, from Ethiopian seed "Fofain gangero, 2400 m, *Straube* 203" (B holo.). Panicle loose and delicate; spikelets 1–3-flowered; lower glume 1.2–1.8 mm long; upper glume 1.7–2 mm long; lemma 1.5–2 mm long; grain brownish, plump, 0.8–1 mm long.

37. *E. tef* (Zucc.) Trotter (1918);

Poa tef Zucc. (1775); *E. pilosa* (L.) P. Beauv. var. *tef* (Zucc.) Fiori, *Nuov. Fl. Anal. Ital.* 1: 123 (1923) - type: cultivated at Florence from Ethiopian seed collected by *Bruce* (FT holo.).

Poa abyssinica Jacq. (1781 & 1782); *P. cerealis* Salisb. (1796), nom. superfl.; *Cynodon abyssinicus* (Jacq.) Rasp. (1825); *Eragrostis abyssinica* (Jacq.) Link (1827); *E. pilosa* (L.) P. Beauv. subsp. *abyssinica* (Jacq.) Aschers. & Graebn., *Syn. Mitteleur. Fl.*

2(1): 374 (1900).

Further subspecific synonymy is listed by Cufodontis in *Enum.*: 1259 (1968).

Tufted annual; culms erect, 30–100(–200) cm high; leaf-blades flat, 2–5 mm wide. Panicle 10–60 cm long, narrowly elliptic and contracted to diffuse and ovate with loosely ascending, flexuous branches, lowermost branches often whorled, the axils bearded or not, spikelets borne on long, filiform pedicels. Spikelets narrowly oblong, 4–9 mm long, 1.5–3 mm wide, 4–12-flowered with the florets contiguous, mostly remaining entire at maturity and retaining the grain, but some lemmas and paleas falling tardily from the tough rhachilla; glumes unequal, lanceolate, acuminate, the lower 1–2.8 mm long, the upper 1.5–3 mm long; lemmas narrowly lanceolate-oblong in profile, 2–3 mm long, the nerves prominent, scaberulous on the keel and towards the acute tip; palea-keels scaberulous; anthers 3, 0.3–0.5 mm long; grain turgid, broadly ellipsoid, 1–1.2 mm long.

Widely cultivated throughout Ethiopia as a staple cereal crop, also occurring as an escape up to 2500 m.

When mature, tef is easily recognized by its panicle of oblong, non-shattering spikelets full of plump grains retained within the swollen florets. Immature specimens are similar to *E. pilosa*, but with bigger spikelets of longer, prominently-nerved lemmas.

Teff is grown as a cereal only in Ethiopia, where it is widely cultivated for the production of flour, used in making the local bread ("injera"). It has also been introduced into other tropical and subtropical countries (mainly within Africa) as a hay crop, its rapid leafy growth and short life-span making it particularly suitable for areas subject to drought after short rains.

Teff appears to have been cultivated in Ethiopia since antiquity. It is very variable, and a large number of cultivars have been described based on grain colour (white, red or black), panicle shape and colour, and differences in the vegetative cycle. Details of the cultivation of teff and descriptions of its cultivars are given by Tadesse Ebba [*Exp. Station Bull.*, Addis Ababa Univ. Coll. Agric., Dire Dawa, no. 60 (1969) & no. 66 (1975)].

It is generally considered that *E. pilosa*, which has morphologically similar spikelets and is a tetraploid annual like teff, is its most probable wild progenitor [Jones et al. in *Ann. Bot.* 42: 1369–1373 (1978) and Bekele & Lester in *Ann. Bot.* 48: 717–725 (1981)]. A review of the literature is given by Costanga, de Wet & Harlan in *Econ. Bot.* 33: 413–424 (1979).

38. *E. aethiopica* Chiov. (1899);

- types; Somalia, *Robecchi-Bricchetti* 193, 247 & 254 (all FT syn.).

Delicate annual; culms slender, solitary or tufted, 15–65 cm high, often with pitted glands below the nodes. Panicle 6–25 cm long, diffuse with fine branches and

long, capillary pedicels, elliptic, lowermost primary branches usually whorled (but occasionally solitary or paired), the axils glabrous or shortly hairy, main axis often glandular, especially around the lowermost whorl. Spikelets grey-green, linear to narrowly oblong, 3–6.8 mm long, 0.5–1 mm wide, loosely 4–19-flowered, disarticulating from the base, the paleas falling soon after the lemmas from the persistent rhachilla; glumes unequal, hyaline, the lower nerveless, 0.3–0.4 mm long, the upper 0.6–0.7 mm long; lemmas narrowly elliptic in profile, 0.7–1 mm long, thinly membranous, obtuse; palea-keels smooth; anthers 3, 0.1–0.2 mm long; grain 0.4–0.5 mm long, elliptic.

Disturbed situations, often on sandy soils in semi-desert areas; up to 1000 m. AF EW SD HA; southwards to South Africa and in southern parts of the Arabian Peninsula. *Burger* 3772; *Mooney* 5601.

A slender annual, very similar to *E. pilosa*, but differing in its more delicate habit, smaller spikelets with blunter lemmas, smaller grain, and lack of long silky hairs in the lower panicle axils. Additionally, specimens of *E. aethiopica* from Ethiopia and Somalia are often dotted with pitted glands below the nodes and around the insertion of the lower panicle-branches, whereas *E. pilosa* is never glandular. *E. pilosa* is a tetraploid ($2n=40$) but *E. aethiopica* is diploid ($2n=20$).

39. *E. heteromera* Stapf (1900);

- types: South Africa, *Drège* s.n. & *Krauss* 43 & *Buchanan* 241, 245a (all K syn.).

Tufted perennial, the old basal sheaths papery; culms 70–115 cm high. Leaf-blades 2–4 mm wide, rolled, tapering to a filiform, flexuous tip. Panicle 15–40 cm long, narrowly elliptic to ovate, primary branches inserted singly or the lowermost sub-whorled, spikelets on short pedicels contracted about the secondary branchlets. Spikelets linear, 3.5–8.5 mm long, 1–1.5 mm wide, loosely 4–12-flowered, usually dark green, disarticulating from the base, lemmas and paleas falling \pm together from the persistent rhachilla; glumes unequal, lanceolate, the lower 0.5–1.5 mm, the upper 1–2 mm; lemmas narrowly lanceolate-oblong in profile, 1.6–2.2 mm long, prominently nerved, scaberulous, obtuse and emarginate; palea-keels scaberulous; anthers 3, 0.5–1 mm long; grain narrow, fusiform, 0.8–1.1 mm long, reddish-brown.

Grassland, often on seasonally damp, heavy black soils; c 2000 m. TU SU KF; southwards to South Africa. *Stewart* 79; *Tewolde Berhan* et al. 1/45.

The large panicle of dark-coloured, narrow spikelets with very unequal glumes, the loose, scaberulous, obtuse lemmas, and the narrow grain are the best spot characters for *E. heteromera*.

40. *E. volkensii* Pilg. (1909);

- type: Tanzania, *Volkens* 713 (K iso.).

Tufted perennial with slender rhizomes; culms thin and wiry, straggling, 40–120 cm long. Leaf-blades cauline,

flat or rolled, often reflexed, 2–8 cm long, 1–5 mm wide. Panicle ovate, 3–13 cm long, the spikelets shortly pedicellate either directly on the stiffly spreading primary branches or on short secondary branchlets. Spikelets ovate to oblong, olive-green 6–16-flowered, 3.5–7 mm long, 1.5–4 mm wide, the florets contiguous to imbricate and obscuring the rhachilla, disarticulating from the base, lemmas and paleas falling \pm together from the persistent rhachilla; glumes broadly ovate, subequal; lemmas broadly ovate in profile, 1.3–2.5 mm long, firmly cartilaginous with obscure nerves, obtuse; palea-keels winged and scaberulous, the wings c 0.2 mm wide; anthers 3, 1 mm long; grain narrowly ovoid, 1 mm long.

Upland grassland; 1900 m. SD; Cameroon, Zaire and southwards to South Africa (Transvaal). *Gilbert & Phillips* 8851.

E. volkensii can be recognized by its wiry, straggling culms with relatively short reflexing blades along their length, topped by an often rather small panicle of dark spikelets.

41. *E. gangetica* (Roxb.) Steud. (1854);

Poa gangetica Roxb. - type: India, Roxburgh (BM hol.).

Poa ovina A. Rich. (1851); *Eragrostis ovina* (A. Rich.) Hochst. ex Steud. (1854) - type: Ethiopia, TU, Shire, *Schimper* 1831 (K isosyn.) & *Quartin Dillon* (P syn.).

Loosely tufted annual; culms 15–65 cm high. Leaf-blades linear to filiform, 1–3 mm wide, tapering to a narrow, acute tip. Panicle 5–20 cm long, ovate and open with the spreading primary branches inserted singly (or occasionally loosely contracted), spikelets distant on long, capillary pedicels. Spikelets greyish-green, linear to narrowly oblong, 3–10 mm long, 1–1.5 mm wide, 6–35-flowered with the florets contiguous or slightly imbricate, disarticulating from the base, paleas often remaining a little longer than the lemmas, but soon also falling from the persistent rhachilla; glumes subequal, lanceolate, 0.6–1.8 mm long; lemmas narrowly ovate in profile, 1.2–1.7 mm long, acute; palea-keels scabrid; anthers 2, 0.1 mm long; grain 0.6 mm long, broadly elliptic. Fig. 51:6.

Open, weedy places; c 500 m. TU WG IL; tropical Africa, India. *Gilbert & Thulin* 676; *Pavlov* 321 (ETH).

E. atrovirens (Desf.) Steud. is a perennial species closely related to *E. gangetica*, but with larger spikelets (1.5–2.5 mm wide) and 3 longer anthers. It occurs throughout Africa, and is to be expected in Ethiopia.

42. *E. botryodes* W.D. Clayton (1972);

E. atrovirens (Desf.) Steud. var. *congesta* Robyns & Tournay in *Bull. Jard. Bot. Brux.* 25: 243 (1955) - type: Zaire, Kivu, *Scaetta* 1462 (K iso.).

Tufted perennial; culms 20–80 cm high, erect or loosely geniculately ascending; leaf-blades flat, 2–3 mm wide. Panicle ovate, 7–15 cm long, primary branches inserted singly, divaricate, undivided in the adaxial half, the spikelets clustered in the distal half on short branches and pedicels. Spikelets narrowly ovate-oblong, 4–9 mm long, 2–3(–3.5) mm wide, dark grey-green, 7–25-flowered, the base of the florets imbricate and covering the rhachilla, disarticulating from the base, lemmas and paleas falling together from the persistent rhachilla; glumes narrowly ovate, subequal; lemmas narrowly ovate in profile, 1.9–2.2(–2.4) mm long, firmly membranous with obvious nerves, abruptly acute; palea-keels shortly pubescent; anthers 3, 0.4–0.6 mm long; grain ellipsoid, 0.7–1 mm long. Fig. 51:3.

Moist situations among rocks and in marshy grassland; 1500–2700 m. WU GJ WG SU AR IL KF GG SD HA; southwards through East Africa to Zambia and Malawi. *M.G & S.B. Gilbert* 1354; *Gilbert & Phillips* 9224; *Mooney* 9162.

E. paniciformis, *E. botryodes* and *E. chalarothyrsos* belong to a group of intergrading species, all centred on East Africa and favouring moist habitats, especially swampy grassland. *E. paniciformis* typically has a much-branched panicle of ovate spikelets, larger than those of *E. botryodes*, distant on slender pedicels and with clearly hairy palea-keels. In typical *E. botryodes* the spikelets are distinctly clustered towards the ends of the primary panicle-branches, and the spikelets themselves are usually narrower and with only minutely hairy or almost scabrid palea-keels. However, the spikelets of *E. paniciformis* are sometimes loosely contracted around the primary branches, and the spikelet dimensions of *E. botryodes* may approach those of *E. paniciformis*. In doubtful specimens the palea-keels are the most reliable distinguishing feature.

43. *E. paniciformis* (A. Br.) Steud. (1854);

- type: cultivated in Germany at Karlsruhe from seed collected by *Schimper* in Ethiopia (K iso.).

Tufted perennial, the lower leaf-sheaths purple-tinged; culms 20–80 cm high; leaf-blades flat, 2–3 mm wide. Panicle ovate, 5–22 cm long, primary branches inserted singly and often branched almost to the base, spikelets distant on slender pedicels or less often loosely contracted around the primary branches. Spikelets ovate to ovate-oblong, 4–9 mm long, 3–4.5 mm wide, dark grey-green, 7–25-flowered, the base of the florets imbricate and covering the rhachilla, disarticulating from the base, lemmas and paleas falling \pm together from the persistent rhachilla; glumes narrowly ovate, subequal; lemmas narrowly ovate in profile, 2–2.8 mm long, firmly membranous with obvious nerves, minutely granular, abruptly acute; palea-keels ciliolate, the hairs 0.1–0.2 mm long and included within the lemma; anthers 3, 0.5–0.8 mm long; grain narrowly ellipsoid, 0.8–1.2 mm long. Fig. 51:1, 2.



Figure 51. *ERAGROSTIS* spp.: *E. PANICIFORMIS*: 1 - habit x 3/4; 2 - spikelet x 10. *E. BOTRYODES*: 3 - portion of panicle x 3/4. *E. PILOSA*: 4 - panicle x 3/4; 5 - spikelet x 10. *E. GANGETICA*: 6 - spikelet x 10. 1 & 2 from Mesfin et al. 1779; 3 from Gilbert 107A; 4 & 5 from Ash 2639; 6 from Gilbert & Thulin 676. Drawn by Eleanor Catherine.

Moist situations in grassland and arable land, often in ditches and irrigation channels; 1400–2400 m. EW TU GD GJ WG SU KF SD BA; Sudan and southwards through East Africa to Zambia. *Gilbert* 2573; *Friis* et al. 2310; *Mooney* 8911.

E. exasperata Peter is an East African species closely related to *E. paniciformis* which may occur in southern Ethiopia. *E. exasperata* has the ciliolate palea-keels of *E. paniciformis*, but smaller anthers (0.2–0.3 mm) and a delicate open panicle of plump, ovate, paler yellowish-green, slightly smaller spikelets (2.5–3 mm wide) on long capillary pedicels.

44. *E. chalarothyrsos* C.E. Hubb. (1936);
- type: Sierra Leone, *Glanville* 240 (K holo.).

Densely tufted or shortly rhizomatous perennial, basal leaf-sheaths often keeled and purple-tinged; culms erect, 60–100 cm high. Leaf-blades narrow, often convolute and filiform. Panicle ovate, up to 25 cm long, ample, loose and open, the spikelets distant on long, slender pedicels. Spikelets ovate to narrowly ovate-oblong, serrate-margined, 4–15 mm long, 3.5–6.5 mm wide, dark grey, 9–34-flowered, the bases of the florets not imbricate, the rhachilla exposed between the two opposite rows of florets, disarticulating from the base, lemmas and paleas falling \pm together; glumes subequal, lanceolate; lemmas narrowly ovate in profile, 2.2–3.3 mm long, firmly membranous, acute; palea-keels scabrid or very shortly ciliolate; anthers 3, 1–1.5 mm long; grain ellipsoid, 1 mm long.

Seasonally swampy places in grassland and bushland; 800–1600 m. SD; East Africa, also Sierra Leone and Ghana. *Gilbert & Ermias* 8441; *Mooney* 9896 (ETH).

E. chalarothyrsos is generally a more robust grass than *E. paniciformis*, with a larger, more diffuse panicle of big, serrate-margined spikelets. However, none of the key characters are completely reliable on their own, and there is some overlap between the species. In cases of doubt, the palea-keels are the best distinguishing feature.

68. *ERAGROSTIELLA* Bor (1940)

Lazarides in *Contrib. Herb. Austral.* 22: 1–7 (1976).

Slender tufted perennials; culms erect, unbranched; leaf-blades mainly basal, usually filiform; ligule a ciliate membrane. Inflorescence a solitary subsecund spike of biseriate spikelets. Spikelets many-flowered with tightly imbricate florets, narrow, laterally compressed, often linear-oblong, the lemmas falling at maturity leaving the persistent paleas, sometimes also the rhachilla fracturing and the upper part of the spikelet falling away; glumes subequal, shorter than the lemmas, the lower 1-nerved, the upper 1–3-nerved; lemmas 3-nerved, keeled, cartilaginous, ovate, glabrous, acute to emarginate; palea-keels narrowly winged. Grain ellipsoid, trigonous to subterete.

5 species; East Africa eastwards to Burma and in N Australia.

Eragrostiella is an offshoot from the large and widespread genus *Eragrostis*, in which the paniculate inflorescence of the latter is reduced to a single spike.

E. bifaria (Vahl) Bor (1940);

Poa bifaria Vahl (1791); *Eragrostis bifaria* (Vahl) Steud. (1854) - type: India, collector unknown (C holo.).

Densely tufted perennial; culms 23–55 cm high, surrounded at the base by the fibrous remains of old leaf-sheaths; leaf-blades filiform, 4–16 cm long, 0.6–2 mm wide, pilose on the upper surface and margins. Inflorescence 8–22 cm long, the spikelets imbricate by half their length or more, olive-grey. Spikelets 9–50-flowered, 6–20 mm long, elliptic to linear-oblong and slightly sinuous, varying greatly in size, even within the same spike, rhachilla fracturing at maturity near its base, sometimes also a few lemmas falling; lemmas 2–2.5 mm long, acute; palea-keels broadly winged, ciliate along the wing margins. Grain c 0.5 mm long, broadly ovate, trigonous. Fig. 52.

Dry volcanic soils, often among rocks; 1000–2500 m. SU SD; Kenya, Tanzania, India, Sri Lanka, Burma and NE Australia. *Ash* 2648; *M.G & S.B. Gilbert* 1282; *Corradi* 992, 1222 (FT).

69. *HARPACHNE* A. Rich. (1850)

Tufted perennials; leaf-blades linear or convolute; ligule ciliate. Inflorescence a "bottlebrush", a single, erect, oblong raceme of crowded, reflexed spikelets hanging from the rhachis on slender pedicels. Spikelets strongly laterally compressed, several- to many-flowered, the florets usually increasing in size up the spikelet, falling entire with the pedicel remaining attached as a pungent, often hooked appendage; glumes shorter than the lemmas, 1-nerved, narrowly oblong; lemmas strongly keeled, 3-nerved, lanceolate to linear-lanceolate, glabrous except for the ciliate margins, acute to setaceously acuminate; palea much shorter than the lemma, gibbous with winged keels. Grain laterally compressed, obliquely elliptic.

2 species in east and northeast tropical Africa.

H. schimperii Hochst. ex A. Rich. (1850);

Eragrostis schimperii (Hochst. ex A. Rich.) Benth. (1881) - types: Ethiopia, TU, *Quartin Dillon* s.n. (P syn.) & *Adua, Schimper* 171 (P syn., K iso-syn.).

Slender tufted perennial; culms 13–52 cm high. Leaf-blades up to 20 cm long, 2–5 mm wide, pilose. Inflorescence 2.5–10 cm long, the spikelets hanging from villous pedicels 2–8 mm long. Spikelets wedge-shaped, 7.2–20 mm long, 6–13-flowered, the florets loosely imbricate, with the slender, sinuous rhachilla often visible;



Figure 52. *ERAGROSTIELLA BIFARIA*: 1 - habit x 2/3; 2 - spikelet x 6. Drawn by Maureen Church. (Modified from *Fl. Trop. E. Afr. Gramineae* 2: Fig. 67, with permission of the Editors).

lemmas 3.5–7 mm long (measured in centre of the spikelet), membranous or sometimes cartilaginous below, lowermost lemma lanceolate and acute, successive lemmas progressively more linear-lanceolate and setaceously acuminate with mucros up to 2.6 mm long; palea 1/3–1/2 lemma length, the gibbous keels often protruding. Fig. 53.

Open grassland and bushland, often on dry, sandy or stony soil; 1000–2400 m. EE EW TU WU SU AR KF

GG SD BA HA; Sudan, N Somalia and southwards through East Africa to Zambia; Saudi Arabia, N Yemen. *Ash* 311; *Burger* 982; *Mesfin & Vollesen* 4135.

H. schimperi is a polymorphic species with ill-defined geographical variants, different populations varying especially in the size of the spikelets and the degree to which the lemma-tips are acuminate extended into awns. An extreme variant from Sidamo and N Kenya has small, few-flowered spikelets (7.2–8 mm long) and relatively broad lemmas with acute or only shortly acuminate tips. Specimens from the Rift Valley are intermediate in size (c 10.5 mm long) with narrowly lanceolate, acuminate-aristate lemmas; whilst most specimens from the uplands of Harerge and Tigray have very large, many-flowered spikelets (up to 16.7 mm long) with long-acuminate lemmas. Other variants exist elsewhere in the geographical range of the species.

70. *POGONARTHRIA* Stapf (1898)

Launert in *Senck. Biol.* 47: 303–307 (1966).

Annuals or perennials; leaf-blades flat; ligule short, densely ciliate. Inflorescence composed of numerous short stiff slender racemes of crowded biserial spikelets arranged along a central axis; racemes deciduous at maturity. Spikelets several-flowered, laterally compressed, disarticulating between the florets or the lemmas falling leaving the persistent paleas on the rhachilla, a few stiff hairs at the tip of each rhachilla-internode; glumes 1-nerved, keeled, unequal, shorter than the lemmas, membranous, acute to acuminate; lemmas 3-nerved, keeled, lanceolate, membranous, glabrous, acuminate or acuminate-aristate.

4 species in tropical and South Africa, mainly on sandy soils.

P. squarrosa (Roem. & Schult.) Pilg.;

Poa squarrosa Roem. & Schult. (1817) - type: South Africa, *Lichtenstein* 66 (B holo.).

Pogonarthria hackelii Chiov. (1912) - types: Eritrea, Coatit, *Pappi* 2011 (FT syn., K isosyn.) & Dembelas, *Pappi* 6100 (FT syn.).

Densely tufted perennial; culms 40–150 cm high, stiffly erect, unbranched. Leaf-blades 4–33 cm long, 2–5.5 mm wide, flat or convolute. Inflorescence linear-oblong to pyramidal, 10–45 cm long; racemes 1–6.5 (–8.5) cm long, ascending or spreading, often falcately curved, tardily deciduous. Spikelets 4–10-flowered, elliptic to narrowly elliptic-oblong, 3.3–7.8 mm long, disarticulating between the florets but often also the glumes and lemmas falling irregularly leaving the persistent paleas, tips of rhachilla-internodes shortly and sparsely bearded; glumes lanceolate, dark reddish-brown, the lower 0.8–1.5 mm long, the upper 1.6–2.3 mm long; lemmas 2–3 mm long, divergent, scabrid, sharply acuminate. Fig. 54:4–7.

Light sandy soils, especially in disturbed places; 1800 m. EW; Sudan (Jebel Marra); W Africa from Gha-

na to Nigeria and Cameroon; Zaire (Shaba); E and S tropical Africa southwards to Namibia and Natal.

A common grass in eastern and southern Africa, but known in Ethiopia only from the types of *P. hackelii*. It is also apparently absent from most of N Kenya.

P. squarrosa is very variable in vigour and especially in the facies of the inflorescence, depending on the length, direction and degree of crowding of the racemes, and the length of the spikelets. The spikelets are juvenile at emergence, completing their development later in the exerted inflorescence. The Eritrean material, from the extreme northern limit of the distributional range, has an unusually narrow, dense inflorescence of very short, closely crowded racemes.

71. *DESMOSTACHYA* (Hook.f.) Stapf (1900)

Rhizomatous perennial; leaf-blades linear; ligule a short ciliate membrane. Inflorescence long and narrow, composed of numerous, short, 1-sided spikes of closely imbricate, biseriate spikelets along an elongate central axis. Spikelets several- to many-flowered, strongly laterally compressed, falling entire; glumes shorter than the lemmas, unequal, lanceolate, membranous, lightly keeled, 1-nerved, acute; lemmas chartaceous to coriaceous, obscurely 3-nerved, keeled, glabrous, acute. Grain ovoid, trigonous.

1 species in warm regions of the Old World, from N and NE Africa through the Middle East to India and Indo-China.

D. bipinnata (L.) Stapf (1900);

Briza bipinnata L. (1759); *Uniola bipinnata* (L.) L. (1762); *Leptochloa bipinnata* (L.) Hochst. (1855); *Pogonarthria bipinnata* (L.) Chiov. (1907); *Eragrostis bipinnata* (L.) K. Schum. (1895); *Stapfiola bipinnata* (L.) O. Ktze. (1903) - type uncertain.

Cynosurus durus Forssk. (1775), non L. (1753).

Poa cynosuroides Retz. (1786); *Eragrostis cynosuroides* (Retz.) P. Beauv. (1812).

Coarse perennial forming large tussocks, also with widely spreading rhizomes, the basal sheaths coriaceous, yellowish; culms c 1 m high. Leaf-blades mainly basal, flat or inrolled, up to 50 cm long, 3.8–10.5 mm wide, tough with scabrid margins, sharply acute. Inflorescence linear, 20–60 cm long, the numerous spreading or ascending spikes crowded or spaced, up to 4 cm long. Spikelets 5–10(–18)-flowered, elliptic to elliptic-oblong, 3–10 mm long; glumes elliptic, the lower 0.7–1.5 mm long, the upper 1.1–2 mm long; lemmas elliptic, 1.8–2.7 mm long. Fig. 54: 1–3.

Damp situations along the banks of watercourses; 800–1500 m. AF EW GD/TU (Takazze valley) SU (Awash); Sudan westwards to Mauretania and Egypt to Algeria; Middle East eastwards through Afghanistan and India to Indo-China. *M.G. & S.B. Gilbert* 1379; *Pappi* 5949; *Handlos* 8 (ETH).



Figure 53. *HARPACHNE SCHIMPERI*: 1 - habit x 2/3; 2 - spikelet with attached pedicel x 4; 3 - grain x 30. Drawn by Maureen Church. (Modified from *Fl. Trop. E. Afr. Gramineae* 2: Fig. 74, with permission of the Editors).

72. *COELACHYRUM* Hochst. & Nees (1842)

Cypholepis Chiov. (1908)

Annuals or perennials, usually stoloniferous; leaf-blades linear to lanceolate, flat; ligule membranous, sometimes with a ciliate fringe. Inflorescence variable, an open panicle or composed of loose to dense racemes, these spaced or clustered on a central axis. Spikelets several-flowered, broadly elliptic to ovate, sessile or pedi-



Figure 54. *DESMOSTACHYA BIPINNATA*: 1 - base of plant x 3/4; 2 - inflorescence x 3/4; 3 - spikelet x 7. *POGONARTHRIA SQUARROSA*: 4 - habit x 3/4; 5 - inflorescence x 3/4; 6 - spikelet x 7; 7 - disarticulating spikelet with one remaining lemma and persistent paleas x 7. 1 from M.G. & S.B. Gilbert 1379; 2 & 3 from Petter 74; 4-7 from Faden & Kabuye 71/578. Drawn by Eleanor Catherine.

celled, disarticulating between the florets; glumes 1-3-nerved, rounded or lightly keeled, shorter than the lemmas, persistent; lemmas 3(-5)-nerved, elliptic to ovate, rounded on the back, often deeply concave, usually thinly chartaceous, glabrous or hairy on the back, flanks or nerves, obtuse, sometimes mucronate; palea glabrous or hairy along the keels or flaps. Grain broadly elliptic to subrotund, strongly dorso-ventrally flattened, concave on the hilar side, ornamented, often rugulose, enclosed within a free hyaline pericarp.

8 species; Africa from Mauretania to Somalia and Tanzania; through Arabia to Pakistan; also in South Africa.

Coelachyrum is a rather heterogeneous assemblage of semi-desert grasses grouped together mainly on account of the rounded lemma back and broad, ornamented grain enclosed within a free pericarp. However, the species vary considerably in inflorescence structure and in the hairiness of the spikelets. It forms a link between *Eragrostis* and *Eleusine*.

C. piercei (Benth.) Bor (syn. *C. stoloniferum* C.E. Hubb.) occurs in desert scrub and on sand dunes, especially over limestone, in Somalia and Arabia, and may occur in semi-desert parts of eastern Ethiopia.

1. Inflorescence an open panicle, or the branches loosely racemose, the spikelets ± distant. 2
- Inflorescence composed of scattered or subdigitate racemes with subsessile, imbricate spikelets. 3
2. Tufted annual; lemmas densely asperulous, glabrous. 1. *C. longiglume*
- Perennial with knotty base and woody stolons; lemmas smooth, ± glabrous or shortly pilose on the lower back and flanks.
- C. piercei* (see note above)
3. Racemes spaced along an elongate axis; lemmas appressed-pilose with clavate hairs in the lower half, the nerves glabrous. 2. *C. yemenicum*
- Racemes subdigitate, clustered towards the culm-tip; lemmas lanate on the nerves, or the back pilose with simple hairs. 4
4. Lemmas 1.6-2.2 mm long, membranous, shortly pilose on the back, glabrous along the nerves. 3. *C. brevifolium*
- Lemmas 2.3-3.1 mm long, scarious, glabrous on the back, conspicuously villous along the nerves. 4. *C. poiflorum*

1. *C. longiglume* Napper (1963);
- type: Kenya, Kirrika 23 (EA holo., K iso.)

Slender tufted annual; culms 17-70 cm high, geniculately ascending. Leaf-blades linear, 6-16 cm long, 2.5-4 mm wide, soft, smooth and glabrous. Inflorescence an ovate open panicle 6-12 cm long, the branches sometimes simply racemose. Spikelets 5-10-flowered, broadly elliptic, 5.4-6.8 mm long; glumes shorter than or slightly exceeding the lowermost lemmas, subacute and

sometimes mucronulate, the lower 3-nerved, lanceolate to elliptic-oblong, 2.8-5 mm long, the upper 3-4-nerved, elliptic-oblong, 3.6-5.7 mm long; lemmas prominently 3-nerved, broadly elliptic, 3-4.3 mm long, densely asperulous, tip broadly rounded to truncate and often mucronulate; palea densely asperulous like the lemma. Grain broadly elliptic, 1.75-2 mm long, shallowly concave on the hilar side, finely rugulose. Fig. 55:1, 2.

Kenya, S Somalia. To be expected near the Somali border in S Bale, in dry calcareous grassland.

This grass has the facies of an *Eragrostis*, but can be distinguished by its 3-nerved glumes, asperulous florets and distinctive rugulose grain within a free pericarp.

2. *C. yemenicum* (Schweinf.) S.M. Phillips (1982);
Eragrostis yemenica Schweinf. (1894); *Cypholepis yemenica* (Schweinf.) Chiov. (1908) - types: Yemen, Schweinfurth 1332 & Eritrea, below Gheleb, Schweinfurth 1272 (whereabouts uncertain).
Leptochloa appletonii Stapf (1907).

Densely tufted perennial; culms slender, erect or ascending, 30-100 cm high. Leaf-blades narrowly linear, 7-32 cm long, 2.5-5.5 mm wide. Inflorescence narrow, 3.5-19 cm long, composed of 2-8 distant, erect, linear to linear-oblong racemes 2-6 cm long lying close to the main axis, the spikelets imbricate by half their length or more. Spikelets 7-12-flowered with the florets closely imbricate, elliptic to narrowly lanceolate-elliptic, 5-10 mm long, pale green with dark green nerves; glumes 2.1-4 mm long, narrowly lanceolate-oblong, obtuse to acute; lemmas ovate, 2.5-4.7 mm long, membranous, glabrous and lightly keeled above the middle, thinly coriaceous, rounded and appressed-pilose with clavate hairs in the lower half; palea ciliate on the keels, glabrous or clavate-pilose on the lower back. Grain broadly elliptic, 1.2-1.4 mm long, smooth. Fig. 55:5, 6.

Grassland or open *Acacia* bushland, on dry, often stony soil among rocks; 1300-2000 m. EW SU SD HA; Somalia and East Africa; South Africa (Transvaal and adjacent parts of Cape Province); Yemen, Oman (Dhofar) and Saudi Arabia. Friis et al. 977; Gilbert 3353; Mooney 8004.

This is the only species of *Coelachyrum* to have a smooth grain, but in shape and the possession of a free pericarp it agrees with the rest of the genus.

3. *C. brevifolium* Hochst. & Nees (1842);
Eleusine brevifolia (Hochst. & Nees) Steud. (1854) - type: Arabia, Schimper 799 (K iso.)

Annual forming a sprawling tuft; culms stoloniferous, 9-40 cm high; basal leaf-sheaths golden-yellow, leaf-blades 2-6 cm long, up to 5 mm wide. Inflorescence composed of 3-8 racemes 1-5.5 cm long clustered towards the top of the culm, the spikelets shortly pedicellate, densely imbricate on a triquetrous rachis. Spikelets 6-10-flowered with the florets closely imbricate, plumply ovate, 2.4-4 mm long, yellowish green with

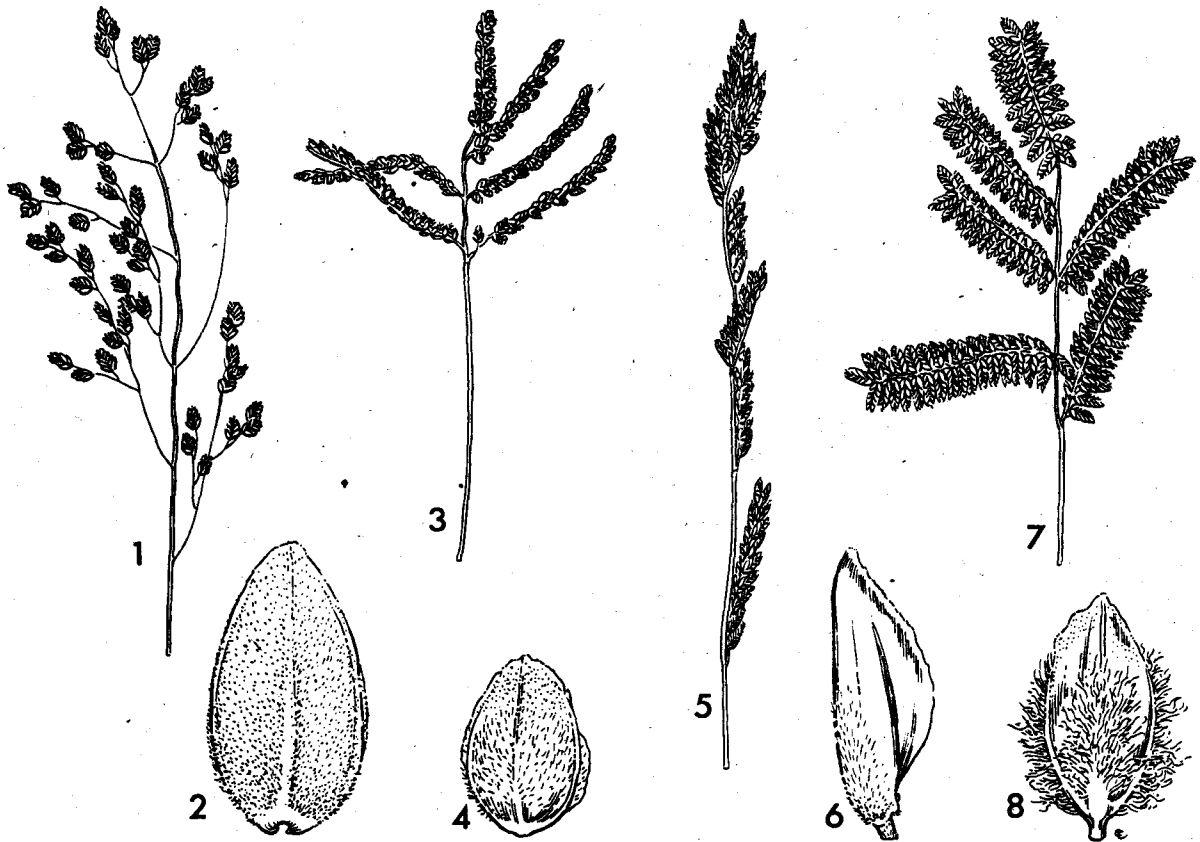


Figure 55. *COELACHYRUM* spp.: *C. LONGIGLUME*: 1 - inflorescence x 3/4; 2 - lemma x 10. *C. BREVIFOLIUM*: 3 - inflorescence x 3/4; 4 - lemma x 10. *C. YEMENICUM*: 5 - inflorescence x 3/4; 6 - lemma x 10. *C. POIFLORUM*: 7 - inflorescence x 3/4; 8 - lemma x 10. 1 & 2 from Kirrika 23; 3 & 4 from Andrews 128; 5 from Mooney 8004; 6 from Burger 2918, 7 & 8 from Burger 3209. Drawn by Eleanor Catherine.

dark green nerves; glumes obtuse, the lower 1-nerved, ovate, the upper 3-4-nerved, broadly elliptic; lemmas ovate, 1.6-2.2 mm long, softly pilose on the back, broadly obtuse; palea softly pilose. Grain radiately rugose, circular in outline, deeply hollowed on the hilar side. Fig. 55:3, 4.

Sandy soils of the coastal plain; sea level. EE; Red Sea coast of Sudan, Egypt and Arabia; coastal Somalia; extending westwards to the subdesert zone of W Africa. Bally 6908; Gilliland 4087.

4. *C. poiflorum* Chiov. (1898);

Eleusine poiflora (Chiov.) Chiov. (1912) - type: Ethiopia, HA, Ogaden, Riva 303 (150) (FT holo.).

Stoloniferous perennial forming dense tufts at the nodes; culms 13-60 cm high. Leaf-blades up to 15 cm long and 4 mm wide. Inflorescence composed of 4-7 spikes 1-4 cm long clustered towards the top of the culm, sometimes forming a compact head, the spikelets sessile, densely biseriate on a flattened rhachis. Spikelets 4-18-flowered, oblong to ovate, 3-7 mm long, greyish-green; glumes 1-nerved, broad, obtuse; lemmas broadly elliptic, 2.3-3.1 mm long, villous with spreading hairs on the midnerve and flanks in the lower half; palea-keels villous. Grain broadly ovate, strongly dorso-

ventrally compressed, flat or shallowly concave on the hilar side, finely rugose. Fig. 55:7, 8.

Grassland on thin soil over rock; 800-1800 m. AF TU SU AR HA; N Somalia, Djibouti, Saudi Arabia and Yemen. Burger 3209; de Wilde 7975; Gilbert 1647.

The spikelets vary widely in the number of florets they contain, those specimens with elongate many-flowered spikelets having a quite different facies from those with small, ovate, few-flowered spikelets.

73. *DACTYLOCTENIUM* Willd. (1809)

Annuals or perennials, sometimes stoloniferous; leaf-blades linear; ligule membranous, often ciliate. Inflorescence of paired or digitate spikes; spikes linear to narrowly oblong, the uppermost spikelets abortive and the spike terminating in a pointed extension of the flattened rhachis, finally disarticulating from the culm tip though sometimes very tardily. Spikelets several-flowered, elliptic to ovate, laterally compressed, biseriate, closely imbricate, disarticulating above the glumes but not between the florets; glumes shorter than the lemmas, 1-nerved, persistent, lower glume sharply acute, upper glume with a stout oblique awn from just below the broadly rounded emarginate tip; lemmas keeled, 3-nerved with the lateral nerves obscure, membranous,

glabrous, entire, acute to shortly awned; palea-keels sometimes winged. Grain angular, ornamented, enclosed within a free hyaline pericarp which ruptures to release the grain.

13 species; mainly from the eastern side of Africa to India; *E. indica* widespread in warm regions of the Old World and introduced to America; one species confined to Australia.

The genus *Dactyloctenium* is easy to recognize by its digitate spikes, each terminating in a bare point. However, the species are closely related and the annuals in particular are often difficult to separate, although the species present in Ethiopia seldom present problems.

1. Annuals. 2
- Stolonerous perennials. 3
2. Inflorescence open; spikes 1.2–6.5 cm long, linear to narrowly oblong, radiating from the culm tip; lemmas acute, cuspidate or mucronate; grain rugose. 1. *D. aegyptium*
- Inflorescence compact; spikes 0.8–1.8 cm long, oblong to broadly oblong, clustered in a dense head; lemmas acuminate-mucronate; grain granular. 2. *D. aristatum*
3. Culms 7–45 cm high; inflorescence a compact head of 3–4(–5) oblong, falcate, readily disarticulating spikes 0.8–2 cm long. 3. *D. scindicum*
- Culms 35–112 cm high; inflorescence open, composed of linear to narrowly oblong spikes 2–7 cm long. 4. *D. geminatum*

1. *D. aegyptium* (L.) Willd. (1809), as "*aegyptiacum*"; *Cynosurus aegyptius* L. (1753); *Eleusine aegyptia* (L.) Desf. (1798) as "*aegyptica*" - described from Egypt and India.

Slender to moderately robust spreading annual; culms up to 70(–100) cm high, geniculately ascending to shortly stoloniferous and mat-forming, less often erect. Leaf-blades flat, 3–25 cm long, 2.5–7.5(–12) mm wide, papillose-hispid especially along the margins. Inflorescence of 1–9 linear to narrowly oblong spikes 1.2–6.5 cm long often radiating horizontally from the culm tip. Spikelets 3–4-flowered, broadly ovate, 3.5–4.5 mm long; glumes 1.5–2.2 mm long, the lower narrowly lanceolate with a thick scabrid keel, the upper elliptic to narrowly obovate, the smooth keel extended into a stout scabrid awn 1/2–2 times as long as the glume-body; lemmas ovate, 2.6–4 mm long, keel gibbous, concave, scabrid above the middle, often extended into a stout cusp or mucro up to 1 mm long; palea-keels sometimes winged; anthers 0.3–0.8 mm long. Grain ± 1 mm long, broadly obovate to obtriangular, transversely rugose. Fig. 56:2–4.

A widespread weed of disturbed ground and open situations in grassland and bushland, on light sandy or gravelly soils; sea level–2400 m. EE AF EW TU SU AR IL GG SD HA; tropical and warm temperate regions of

the Old World; introduced to America. Ash 309; Gilbert & Getachew 2720; Ryding 1341.

An exceedingly variable pantropical weed, typically with sprawling, geniculately ascending culms and linear spikes radiating in a star-like manner from the culm-tip, but including taller, erect plants and also plants with compact oblong spikes similar to those of *D. aristatum*.

D. giganteum Fisher & Schweick. is a closely related annual species occurring from Kenya southwards to South Africa. It has more robust, erect culms than are usual in *D. aegyptium*, a longer upper glume awn (1.5–4 times as long as the glume-body), narrower, awn-pointed lemmas, and longer anthers (1.3–2.1 mm long).

2. *D. aristatum* Link (1827);

D. aegyptium (L.) Willd. var. *aristatum* (Link) A. Chev. in *Rev. Bot. Appliq.* 14: 130 (1934) - type: Egypt, Ehrenberg (whereabouts uncertain).

D. seminipunctatum Courb. (1862) - type: Eritrea, Dissei I., Courbon (P holo.).

Sprawling tufted annual; culms 4–38 cm high, geniculately ascending and often rooting at the lower nodes. Leaf-blades flat, 1–13 cm long, 1.5–7 mm wide, usually conspicuously papillose-hispid. Inflorescence compact, composed of (2–)4–7(–11) oblong spikes 0.8–1.8 cm long clustered together in a dense, often subglobose head. Spikelets 3–5-flowered, broadly ovate, 4–5.2 mm long; glumes 1.7–2.3 mm long, the lower lanceolate-oblong with a thick, scabrid, often narrowly winged keel, the upper elliptic-oblong, the keel extended into a stout awn shorter than or equalling the glume-body; lemmas narrowly ovate, 3–4.3 mm long, acuminate, the keel concave, thick and scabrid above the middle, extended into a stout mucro up to 1 mm long; palea-keels winged; anthers 0.3–0.5 mm long. Grain 0.8–1.1 mm long, broadly elliptic to obovate, dome-shaped across the top, finely granular or granular-striate. Fig. 56:5.

Coastal sand; sea level. EE; coastal sand and coral outcrops from Kenya to Sudan and eastwards around the Arabian peninsula to Pakistan and NW India. Bally 6838; Edwards & Tewolde Berhan 3904; Hemming 1155.

D. aristatum is sometimes confused with small specimens of *D. aegyptium*. The granular grain provides the easiest means of separation, but in the absence of grains it can be recognized by the compact inflorescence and conspicuously pointed lemmas imparting a "spiky" appearance.

3. *D. scindicum* Boiss. (1859);

- type: Pakistan, Sind, Stocks 637 (G holo., K iso.).

D. glaucophyllum Courb. (1862); *Eleusine glaucophylla* (Courb.) Benth. (1881) - type: Eritrea, Dissei I., Courbon (P holo.).



Figure 56. *DACTYLOCTENIUM* spp.: *D. SCINDICUM*: 1 - habit x 3/4. *D. AEGYPTIUM*: 2 - habit x 3/4; 3 - spikelet x 9; 4 - grain x 20. *D. ARISTATUM*: 5 - shoot with inflorescence x 1. 1 from Burger 2170; 2-4 from Burger & Amare Getahun 331; 5 from Stower, Smith & Gilliland 4027. Drawn by Eleanor Catherine.

D. glaucophyllum Courb. var. *elongator* Courb. in *Ann. Sci. Nat.*, sér. 4, 18: 134 (1862) - type: Eritrea, near Massaua, Ennecoullou, *Courbon* (P holo.).

D. glaucophyllum Courb. var. *robustior* Courb. in *Ann. Sci. Nat.*, sér. 4, 18: 134 (1862) - type: Eritrea, Dumeira I., *Courbon* s.n. (P holo.).

Stoloniferous perennial forming extensive spreading mats; culms slender with swollen bases, 7–45 cm high, erect. Leaf-blades tough, rather glaucous, 1–11 cm long, 1.5–3 mm wide, loosely papillose-hispid especially along the margins. Inflorescence composed of 3–4(–5) slightly falcate oblong spikes 0.8–2 cm long forming a compact head, readily disarticulating at maturity from the culm-tip. Spikelets 3–9-flowered, broadly lanceolate to ovate, 4–8 mm long; glumes broadly elliptic, the lower 1.7–2.5 mm long with a narrowly winged keel, the upper 1.5–2.3 mm long, with a prominent scabrid keel extended into an awn 1/2 as long to equalling the glume-body; lemmas lanceolate, 3–3.8 mm long, obtuse to acute, the scabrid keel extended into a mucro up to 0.8 mm long; palea-keels finely scabrid, unwinged; anthers 1–2 mm long. Grain 0.7–1 mm long, transversely rugose. Fig. 56:1.

Damp hollows in grassy plains or dry deciduous bushland, on stony or sandy soils; 300–1600 m. EE AF EW SU (Awash) SD BA HA; Kenya, Somalia, Red Sea coast of Sudan, eastwards to NW India. *Burger* 9260; *Friis* et al. 896; *M.G. & S.B. Gilbert* 1862.

A well-defined species, recognized by its small tufts of often rather glaucous leaves on spreading stolons, and by the compact inflorescence of short falcate spikes.

4. *D. geminatum* Hack. (1899);

- type: Mozambique, Delagoa Bay, *Junod* (Z holo.).

D. bogdanii S.M. Phillips (1974).

Tough stoloniferous perennial with dense leafy tussocks along stout stolons; culms 35–100 cm high, erect. Leaf-blades tough, glaucous, broadly linear, up to 28 cm long, 3–9 mm wide, usually glabrous except for the papillose-hispid margins, infrequently softer and pilose. Inflorescence composed of 2–6 linear to narrowly oblong ascending spikes 2–7 cm long. Spikelets 3–7-flowered, elliptic to ovate, 3–6.7 mm long; lower glume elliptic, 1.3–2 mm long, upper glume broadly elliptic, 1.5–2.2 mm long, the keel extended into an awn 2/3–1½ times as long as the glume-body; lemmas lanceolate, 2.8–4 mm long, the keel smooth or scaberulous above the middle, cuspidate or subacute with a mucro up to 0.8 mm long; palea-keels finely scabrid, unwinged; anthers 1.1–2.3 mm long. Grain 0.8–1 mm long, transversely rugose.

Seasonally moist hollows in grassland, especially on alluvial or alkaline clays and sand, sometimes forming large patches; c 500 m. GG (lower Omo R.); lowlands of eastern Africa southwards to Natal, especially near the coast, often in damp depressions in coastal sand; a sand-binder. *Brown* 6, 89; *Carr* 210.

74. ACRACHNE Chiov. (1907)

Annuals; leaf-blades linear; ligule a ciliate membrane. Inflorescence composed of spikes arranged subdigitately or in whorls along an elongate axis; spikes with imbricate, sessile spikelets on a slender flattened rhachis, the terminal spikelet abortive. Spikelets several- to many-flowered, laterally compressed, lemmas falling at maturity from below upwards, paleas persistent on the rhachilla, but often the spikelet falling wholly or in part when only a few lemmas have been shed; glumes 1-nerved, keeled, shorter than the lemmas and falling before or soon after them; lemmas 3-nerved, strongly keeled, firmly membranous or cartilaginous, glabrous, cuspidate or awn-pointed. Grain ornamented, usually deeply sulcate on the hilar side, enclosed within a free hyaline pericarp which ruptures to release the grain.

3 species; Old World tropics; one species widespread, one in S India and one in Madagascar.

Eleusine, *Acrachne* and *Dactyloctenium* are closely related genera remarkable for their unusual ornamented grains within a free pericarp. *Acrachne* is intermediate between the other two in possessing an abortive spikelet at the spike-tip, but differs from both by its tendency to a racemose inflorescence and by the mode of spikelet disarticulation.

A. racemosa (Roem. & Schult.) Ohwi (1947);

Eleusine racemosa Roem. & Schult. (1817) - type: India, *Heyne* (B holo., destr.).

Eleusine verticillata Roxb. (1820); *Acrachne verticillata* (Roxb.) Lindl. ex Chiov. (1907).

Leptochloa schimperiana Hochst. (1855) - type: Ethiopia, Dschadscha, *Schimper* in Herb. *Buchinger* 1407 (STR holo., P iso.).

Tufted annual; culms 15–75 cm high, erect or geniculately ascending. Leaf-blades broadly linear, 7–20 cm long, 5–11.5 mm wide, soft, rounded at the base, tapering to a setaceous tip. Inflorescence composed of slender ascending spikes 1.5–10 cm long, these mainly grouped in whorls of 2–5 and either clustered subdigitately towards the top of the culm or spread along an axis up to 15 cm long. Spikelets 6–25-flowered, oblong with a serrate outline, 5.5–13 mm long; lower glume linear-oblong, 1.2–2.9 mm long, acute, mucronate; upper glume lanceolate, 1.5–3 mm long, acuminate, awn-pointed; lemmas narrowly ovate, 2–2.8 mm long, the keel scabrid, shallowly concave above the middle and excurrent into a stout awn-point 0.3–0.9 mm long, lateral nerves also fractionally excurrent. Grain ellipsoid, blackish, rugose, the surface finely granular. Fig. 57.

Stony ground or among rocks in deciduous bushland; sea level–1500 m. EE AF EW TU SU HA; westwards to Senegal and southwards to Namibia and Transvaal; Old World tropics including Australia, also Pakistan and Kashmir. *Ash* 1246, 2509; *Gilbert & Thulin* 198.

JCW

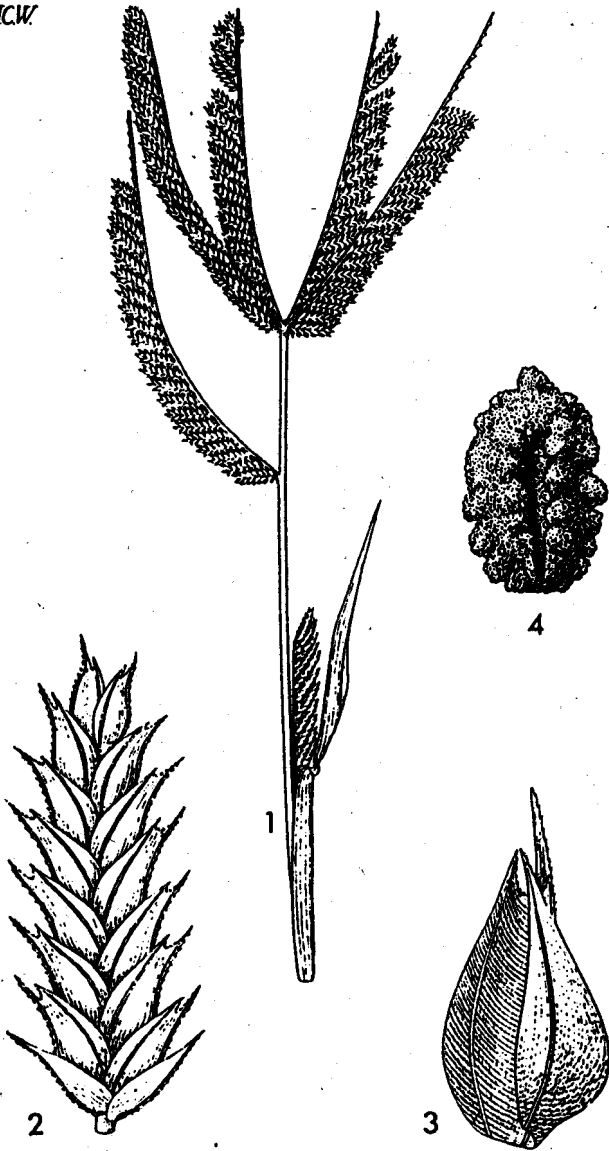


Figure 57. *ACRACHNE RACEMOSA*: 1 - inflorescence x 2/3; 2 - spikelet x 9; 3 - lemma x 14; 4 - seed, ventral view x 34. Drawn by Miss J.C. Webb. (Modified from *Fl. Trop. E. Afr. Gramineae* 2: Fig. 71, with permission of the Editors).

75. *ELEUSINE* Gaertn. (1788)

Phillips in *Kew Bull.* 27: 251-270 (1972).

Annuals or tussocky perennials; culms compressed; leaf-blades linear, folded; leaf-sheaths strongly keeled; ligule membranous, often ciliate fringed. Inflorescence digitate or shortly racemose, composed of several secund spikes of closely imbricate, biseriate spikelets clustered at the top of the culm. Spikelets several-flowered, laterally compressed, disarticulating between the florets (except when cultivated); glumes shorter than the lemmas, 1-to several-nerved, persistent; lemmas 3-nerved, membranous, strongly keeled, the keel sometimes with additional nerves, glabrous, obtuse to acute. Grain blackish (except *E. coracana*), ornamented, ellip-

soid and trigonous to subglobose, enclosed within a free pericarp.

9 species; mainly in east and northeast tropical Africa; one species a pantropical weed and one cultivated as a cereal.

A well-defined genus of closely related, mostly rather locally distributed species. Among the annuals in particular, introgression has resulted in indistinct boundaries between the species. The grains, with their free pericarp and testa ornamentation, are unusual among grasses. The different patternings are a useful aid to identification, and can easily be observed if the pericarp is removed after soaking the grain in a drop of water.

1. Annuals; midnerve of lemmas with 1-3 subsidiary nerves, forming a thickened keel. 2
- Perennials; midnerve of lemmas usually simple. 5
2. Inflorescence shortly racemose; spikes oblong to ovate, 1.5-3 cm long; lemmas cuspidate or mucronate. 1. *E. multiflora*
- Inflorescence digitate (a few spikes often set below the rest); spikes linear to linear-oblong, 3.5-15.5 cm long; lemmas acute to obtuse. 3
3. Spikes 9-15 mm wide; spikelets ovate, non-shattering; grain plump, almost globose, usually brown, often exposed between the gaping lemma and palea when ripe (cultivated). 2. *E. coracana*
- Spikes 3-7 mm wide; spikelets elliptic, disarticulating between the florets; grain blackish, elliptic to oblong, never exposed when ripe (wild). 4
4. Lemmas 3.3-4.8 mm long; grain 1.2-1.6 mm long, granular, obliquely ridged; ligule with a definite ciliate fringe; culms moderately robust. 3. *E. africana*
- Lemmas 2.1-2.8 mm long; grain 1-1.3 mm long, obliquely striate; ligule membranous; culms slender. 4. *E. indica*
5. Leaf-blades with tufts of white hairs scattered along the margins. 5. *E. floccifolia*
- Leaf-blades without marginal tufts of hairs. 6
6. Inflorescence digitate (1 spike often set below the rest); lower glume narrowly winged on the keel; upper glume with a 3-nerved keel. 6. *E. kigeziensis*
- Inflorescence shortly racemose to subdigitate, the spikes spread along a short axis; lower glume not winged; upper glume with a 1-nerved keel. 7
7. Leaf-blades not tough and scabrid; ligule 0.6-1 mm long, a ciliate membrane; spikelets elliptic; grain 1.2-1.3 mm long, finely striate. 7. *E. intermedia*
- Leaf-blades tough with scabrid margins; ligule < 0.3 mm long, a yellow-brown rim with contrasting white ciliate fringe; spikelets narrowly oblong; grain 1.6-1.7 mm long, rugulose. 8. *E. jaegeri*

1. *E. multiflora* A. Rich. (1850);

- type: Ethiopia, TU, Adua, *Schimper* 110 (P holo., K iso.).

Loosely tufted annual; culms ascending, up to 45 cm high. Leaf-blades 6–26 cm long, 3–6 mm wide, sparsely pilose, abruptly acute; ligule c 1 mm long, truncate. Inflorescence composed of 2–8 short broad spikes alternating on a short axis, often forming a compact cluster at the culm tip; spikes oblong to ovate, 1.5–3 cm long, ascending or spreading, pale green usually tinged with grey, rhachis narrowly winged. Spikelets 5–15-flowered, ovate, 7–11 mm long; glumes winged on the keel, the lower 1-nerved, the upper 3-nerved; lemmas narrowly ovate, 3.3–5.2 mm long, 1–3 subsidiary nerves close to each side of the keel, cuspidate or obtuse and mucronate. Grain laterally compressed with a deep sulca on the hilar side, the surface obliquely rugose and finely granular. Fig. 58:5–7.

Disturbed land, often as a weed of cultivation; 1800–2400 m. EW TU GD SU KF HA; Kenya, Tanzania. *Ash* 2745; *Friis* et al. 2029; *Ryding* 1133.

An easily recognizable species on account of its short broad spikes. Occasionally a lemma may disarticulate and fall before its palea, as occurs in *Acrachne*. *E. multiflora* is also unusual in that the free pericarp splits along a central hyaline band, often shedding the grain before the floret disarticulates, the conspicuous persistent styles protruding from the florets.

E. tristachya (Lam.) Lam. is a South American species with similar short broad spikes which occurs rarely in Africa as an adventive. It can be distinguished by its narrower, oblong-lanceolate, obtuse to subacute lemmas and much broader, trigonous, coarsely striate grain.

2. *E. coracana* (L.) Gaertn. (1788);

Cynosurus coracana L. (1759); *C. coracanus* L. (1762) - type: illustration in Plukenet (1691).

E. stricta Roxb. (1820); *E. coracana* (L.) Gaertn. var. *stricta* (Roxb.) Nees, *Fl. Afr. Austr.* 1: 251 (1841).

E. tocussa Fresen. (1837); *E. coracana* (L.) Gaertn. var. *tocussa* (Fresen.) Franch. in *Bull. Soc. Hist. Nat. Autun* 8: 377 (1895) - type: cultivated at Frankfurt from Ethiopian seed collected by *Rüppell* s.n. (FR holo.).

E. coracana (L.) Gaertn. vars. *alba*, *atra*, *fusca* Koern., *Handb. Getreid.* 1: 329 (1855) - based on descriptions by A. Braun in *Flora* 31: 92 (1848) of seed sent to Karlsruhe Bot. Gard. from Ethiopia by *Schimper*.

Tufted annual; culms robust, erect or ascending, up to 170 cm high. Leaf-blades 30–60 cm long, 6–12 mm wide. Inflorescence subdigitate, composed of 4–20 linear-oblong, brown spikes 4–14 cm long and 8–15 mm wide clustered together at the culm tip, straight or inwardly curving at maturity. Spikelets 6–9-flowered, ovate, 5–9 mm long, very closely imbricate, non-shat-

tering at maturity; lower glume 3-nerved, 1.5–3 mm long; upper glume with additional nerves in the keel, 1.8–5 mm long; lemmas narrowly ovate, 2.2–4.7 mm long, subacute. Grain almost globose, finely striate-punctate, varying from black through reddish-brown to whitish.

Cereal widely cultivated on sandy soils up to 2200 m, also found along roadsides as an escape; widely grown in the tropics and subtropics of the Old World, particularly in Africa and India, both for beer ("talla" in Ethiopia) and food.

Cytogenetical and morphological data show *E. coracana* ("Finger Millet; Dagussa; Tocussa") to have been domesticated from *E. africana*, probably in eastern Africa (de Wet et al. in *Amer. J. Bot.* 71: 550–557, 1984). Evolution within the crop is thought to have progressed from the uplands to the lowlands of eastern Africa (Hilu & de Wet in *Amer. J. Bot.* 63: 1311–1318, 1976; de Wet et al. in *Amer. J. Bot.* 71: 550–557, 1984). It was then taken to India by man some 3000 years ago. Differentiation into races is dependent upon inflorescence morphology rather than grain colour.

Plants of *E. coracana* occurring as escapes are often small and slender, but can be recognized by their broad spikes of closely packed, non-shattering spikelets.

3. *E. africana* Kenn.-O'Byrne (1957);

E. indica (L.) Gaertn. subsp. *africana* (Kenn.-O'Byrne) S.M. Phillips in *Kew Bull.* 27: 259 (1972); *E. coracana* (L.) Gaertn. subsp. *africana* (Kenn.-O'Byrne) Hilu & de Wet in *Econ. Bot.* 30: 202 (1976) - type: South Africa, *Wilman* H.K.1 (K holo.).

Tufted annual; culms moderately robust, geniculately ascending, frequently rooting at the lower nodes, up to 90 cm high. Leaf-blades 5–35 cm long, 2.5–6 mm wide, usually folded; ligule with a definite ciliate fringe. Spikes 3–15, subdigitate, 4–17 cm long and 4–8 mm wide. Spikelets disarticulating, 4–8 mm long, elliptic; lower glume often 2–3-nerved, 2–3.2(–3.9) mm long; upper glume 3–4.7 mm long, small additional nerves in the thickened keel; lemmas lanceolate, 3.5–5 mm long, the keel with small additional nerves, acute. Grain oblong, 1.2–1.6 mm long, uniformly granular and obliquely ridged. $2n=36$. Fig. 58:8, 9.

Disturbed weedy places, often in *E. coracana* fields; 500–2200 m. EW TU GJ IL KF; throughout tropical Africa, but mainly in the eastern and southern uplands, rare in West Africa; also in Arabia. *Aweke & Gilbert* 952; *Parker* E171; *Stewart* 95.

E. africana is a robust tetraploid species related to the pantropical diploid weed *E. indica*. It is distinguished mainly by its stronger habit and longer spikelet parts, but where the size approaches subsp. *indica* it can be recognized by its different ligule and grain. *E. africana* hybridizes readily with the tetraploid cereal *E. coracana*. It commonly occurs as a weed of the crop,



Figure 58. *ELEUSINE* spp.: *E. FLOCCIFOLIA*: 1 - habit x 3/4; 2 - detail of leaf-blade margin x 7; 3 - spikelet x 9; 4 - grain x 9; *E. MULTIFLORA*: 5 - habit x 3/4; 6 - spikelet x 9; 7 - grain x 9. *E. AFRICANA*: 8 - spikelet x 9; 9 - grain x 9. 1-3 from Burger 391; 4 from Pappi 97; 5 from Parker 262; 6 & 7 from Jimma Agric. Tech. School A83; 8 & 9 from Pappi 154. Drawn by Eleanor Catherine.

giving rise to a range of intermediates with longer and narrower spikes than true *E. coracana*, and sometimes also with disarticulating spikelets. It is considered to be the wild progenitor of the crop (Hilu & de Wet in *Econ. Bot.* 30: 199–208, 1976) and is sometimes relegated to subspecific rank. It is maintained here at the species level for convenience, whilst recognizing that there is free gene flow between the cultivated species and its wild parent.

4. *E. indica* (L.) Gaertn. (1788);

Cynosurus indicus L. (1753) - type: ? illustration in Burman, *Thes. Zeyl.* (1737).

Tufted annual; culms slender, 15–85 cm high; ligule membranous, at most sparsely ciliolate. Inflorescence subdigitate, composed of 1–10(–17) linear ascending spikes 3.5–15.5 cm long and 3–5.5 mm wide. Spikelets 3–9-flowered, elliptic, 3–5 mm long; lower glume 1-nerved, 1–2.3 mm long; upper glume with small additional nerves in the thickened keel, 1.8–2.9 mm long; lemmas lanceolate, 2.1–3.6 mm long, the keel with small additional nerves, acute. Grain elliptic, 1–1.3 mm long, obliquely striate with very fine close lines running vertically between the striae. $2n=18$.

A weed of disturbed ground; 500–2800 m. IL GG; throughout the tropics and subtropics, in Africa mainly in the west and along the eastern and southeastern coast. Mooney 8790; Mulvany 90; Jansen 4903 (ETH).

E. indica is mostly replaced in Ethiopia by *E. africana*.

5. *E. floccifolia* (Forssk.) Spreng. (1824);

Cynosurus floccifolius Forssk. (1775); *Chloris floccifolia* (Forssk.) Poir. (1811) - type: Yemen, Forsskål (C holo.).

Densely tufted perennial from a tough branching rhizome; culms 20–70 cm high, surrounded at the base by many whitish leaf-sheaths. Leaf-blades tough, 8–55 cm long, 2.5–5 mm wide, pale green, tufts of woolly white hairs scattered along the margins, tip subacute; ligule 0.3–0.5 mm long, a ciliolate membrane. Inflorescence subdigitate, composed of 2–8 slender, ascending or spreading spikes 2.5–12 cm long. Spikelets 4–7-flowered, elliptic, 3.3–6.8 mm long; glumes 1-nerved, dark grey; lemmas narrowly elliptic, often slightly falcate, 2.8–4.6 mm long, keel 1-nerved, pale green tinged with grey, acute. Grain elliptic-oblong to broadly oblong, 0.9–1.4 mm long, flat on the hilar side, minutely rugulose. Fig. 58:1–4.

Field margins, pasture land and roadsides on heavy clay soils; 1800–3200 m. EW TU GD GJ SU AR KF HA; N Somalia, N Yemen. Burger 555; Gilbert 3318; Mooney 7077.

E. floccifolia can usually be recognized immediately by the tufts of white hairs along the leaf-margins. However, these tufts are sometimes inconspicuous, being reduced to only 2 or 3 hairs, although the tubercles are

still present. Such specimens can be identified by their habit, unique among the perennial species, of branching almost entirely at ground level, the tough leaves all arching upwards at approximately the same level from the thick basal cluster of whitish leaf-sheaths.

6. *E. kigeziensis* S.M. Phillips (1972);

- type: Uganda, Purselove 3384 (K holo., EA iso.).

Tufted perennial from a short ascending rhizome; culms 35–60 cm high, branching at the lower nodes to form bunches of leaf-sheaths. Leaf-blades folded, 10–30 cm long, 4–6 mm wide, scattered-pilose on the upper surface, margins scabrid only near the subacute tip; ligule 0.5 mm long, a ciliate rim. Inflorescence digitate, composed of 2–6 spikes with 1 often set below the rest; spikes 7.5–14 cm long, loosely ascending to widely spreading. Spikelets 3–5-flowered, narrowly oblong, 6–7.4 mm long, olive-grey; lower glume 1-nerved with a narrowly winged keel; upper glume with a thickened 3-nerved keel; lemmas with a small subsidiary nerve close to each side of the central keel, acute; palea-keels scabrid or sometimes very narrowly winged. Grain reddish-black, elliptic, 1.5–2 mm long, concave on the hilar side, minutely rugulose and obliquely striate.

Grassland and pathsides in forest, favouring damp ground; 1800 m. KF; Uganda, Rwanda, Burundi, Zaire. Friis et al. 351, 2260.

E. kigeziensis can be distinguished from the other perennial species by the 3-nerved keel of the upper glume and lemmas, multi-nerved keels being otherwise associated with the annual species where they are rather more prominent. The grain has a similar surface patterning to that of *E. intermedia*, but is longer and narrower. *E. kigeziensis* also has a shorter ligule than *E. intermedia*.

7. *E. intermedia* (Chiov.) S.M. Phillips (1972);

E. indica (L.) Gaertn. var. *intermedia* Chiov. in *Webbia* 8: 113 (1951) - types: Ethiopia, SD, Tertale Plateau, El Dire, Corradi 702 & 703 (FT syn.).

Tufted perennial from a stout ascending rhizome; culms 60–120 cm high. Leaf-blades flat or loosely folded, 15–50 cm long, 4–7 mm wide, pilose on the upper surface near the ligule, margins scabrid only near the subacute tip; ligule 0.6–1 mm long, a ciliolate membrane. Inflorescence composed of 4–15 ascending or spreading spikes up to 12 cm long clustered towards the top of the culm, the upper spikes subdigitate. Spikelets 5–10-flowered, elliptic, 5–8.3 mm long, pale green or olivaceous; glumes 1-nerved; lemmas lanceolate-oblong, 2.5–3.8 mm long, keel 1-nerved, obtuse to subacute. Grain broadly elliptic, 1.2–1.3 mm long, concave on the hilar side, minutely rugulose and obliquely striate.

Deciduous bushland; c 1800 m. BA SD; N Kenya. Friis et al. 818; Gilbert 3351; Haugen 2009 (ETH).

A species of apparently very local distribution.

8. *E. jaegeri* Pilg. (1909);

- types: Tanzania, *Jaeger* 378 & *Uhlig* 758 (both B syn.).

Coarse tussocky perennial from a short ascending rhizome. Culms 40–130 cm high, fasciculately branching to form thick bunches of whitish sheaths at the lower nodes. Leaf-blades tightly folded, 20–45 cm long, 4–7 mm wide, pale green, tough, glabrous, the margins conspicuously scabrid, tapering to a fine tip; ligule 0.2–0.3 mm long, a yellow-brown rim with contrasting white ciliate fringe. Inflorescence of 2–13 spikes clustered towards the culm tip, the upper often subdigitate; spikes 4–17 cm long, slender, loosely ascending to horizontally spreading. Spikelets 3–9-flowered, narrowly oblong, 6–10 mm long, olive-grey; glumes 1-nerved; lemmas narrowly oblong, 3.6–5.2 mm long, keel 1-nerved, scaberulous towards the subacute tip. Grain elliptic-oblong, 1.6–1.7 mm long, flat on the hilar side, minutely rugulose.

Upland grassland; up to 3000 m. Uganda, Kenya, N Tanzania.

Reported from Ethiopia (Fröman & Persson, *Ill. Guide Grasses Eth.*: 55, 1974).

76. *CRYPISIS* Ait. (1789), *nom. conserv.*

Heleochoa Host ex Roem. (1807)

C. E. Hubbard in Hook., *Jc. Pl.* 35: t.3457 (1947).

Low growing annuals; leaf-blades usually short, linear to narrowly lanceolate; ligule ciliate. Panicle contracted into a dense spiciform head, cylindrical and ± exserted or obovoid to capitate and protruding from 1–2 sheathing, bract-like leaf-sheaths with reduced blades. Spikelets 1-flowered, strongly laterally compressed, disarticulating below the floret or rarely falling entire; glumes narrow, strongly keeled, long, equalling the floret or slightly shorter, acute or awn-pointed; lemma membranous, 1-nerved, likewise acute or awn-pointed; palea 1–2-nerved; lodicules absent; stamens 2–3; grain ellipsoid with a free pericarp, the embryo very long, 3/4 the length to as long as the grain.

8 species centred on the Mediterranean and Middle East, but extending to China and tropical Africa. Found mainly on seasonally wet, often saline soils in semi-arid areas.

C. vaginiflora (Forssk.) Opiz (1824)

Phalaris vaginiflora Forssk. (1775) - type: Egypt, *Forsskål* (C holo.).

Prostrate annual forming mats or low cushions; culms profusely branched, at length ascending but seldom exceeding 10 cm high. Leaf-blades broadly linear, tough, usually 0.5–6 cm long, 1–3 mm wide, often thinly villous; leaf-sheaths loose, slightly inflated, the margins and collar ciliate, the blades caducous. Inflorescence axillary, obovoid to ellipsoid, 0.5–2 cm long, protruding from 2 broad, inflated, enveloping sheaths, a further branch arising within the lower subtending sheath.

Spikelets 2.5–3.5 mm long, disarticulating below the floret; glumes and lemma all ± equal, acute with a strongly thickened, prominent keel; lower glume linear in profile, pectinate-ciliate on the keel and pilose upwards on the margins; upper glume similar but slightly broader; lemma narrowly lanceolate; palea 2-nerved; anthers 3, 0.6–0.7 mm long; grain 1.2–1.5 mm long. Fig. 59.

Seasonally flooded mud flats of river banks and lake shores, sometimes dominant and forming a turf; 1500–2400 m. EW TU/GD SU; North Africa, tropical Africa (occasional scattered records from Senegal, Sudan, Tanzania and Mozambique), Madagascar, eastwards to India; introduced to USA. *Ash* 257; *Pappi* 4430; *Fiori* 1286.

C. vaginiflora has often been confused with *C. schoenoides* (L.) Lam., a very similar species from Europe, the Mediterranean and temperate Asia, with scattered records elsewhere. This has glabrous leaf-sheaths and glume margins, unequal glumes shorter than the lemma and anthers c. 0.9 mm long [see Hammel & Reeder in *Syst. Bot.* 4: 267–280 (1979) for further details].

77. *SPOROBOLUS* R. Br. (1810)

Annuals or perennials of variable habit; leaf-blades convolute or flat, linear to lanceolate, sometimes pectinate or glandular on the margins; ligule ciliate. Inflorescence an open or contracted panicle, rarely tightly spiciform, the branches sometimes whorled. Spikelets 1-flowered, fusiform, membranous, not compressed or keeled, glabrous and unawned, disarticulating above the glumes; glumes as long as or shorter than the spikelet, finally deciduous from the pedicel; lower glume 0–1-nerved, often small and hyaline; upper glume 1-nerved, truncate to acute, rarely mucronate; lemma 1(–3)-nerved, usually narrowly ovate, obtuse to acute; palea subequalling the lemma, 2-nerved with the nerves close together, the hyaline tissue between often split by the expanding grain; lodicules 2; anthers 2–3; grain ellipsoid, obovoid or spherical, sometimes laterally compressed, the pericarp free, becoming mucilaginous when wet and expelling the grain, which often adheres to the spikelet-tip.

About 160 species in the tropics and subtropics, extending into warm temperate regions.

Sporobolus is a large pan-tropical genus varying from delicate annuals to robust tussocky or rhizomatous perennials. A significant number are adapted to saline or calcareous habitats, whilst others are colonisers of open disturbed situations. Whilst some species are clearly delimited, especially those restricted to specialized habitats, for example in the Ogaden, the genus characteristically comprises a number of complexes of only weakly defined intergrading species. The number of taxa which should be recognized within these com-



Figure 59. *CRYPISIS VAGINIFLORA*: 1 - habit x 3/4; 2 - inflorescence x 3; 3 - spikelet x 9; 4 - grain x 18. All from *Baldrati* s.n. Drawn by Eleanor Catherine.

plexes is still open to doubt and intermediates will frequently be encountered.

The genus does not fall easily into natural divisions, so obvious differences in the form of the panicle are the conventional first steps in a key to species.

- 1. Lowermost panicle-branches whorled, upper branches usually also \pm whorled. **GROUP 1** 2
- Panicle-branches not whorled. **GROUP 2** 11

GROUP 1

- 2. Panicle linear, spiciform; slender annual. 4. *S. piliferus* 3
- Panicle open or loosely contracted.
- 3. Grain spherical, 1-1.3 mm in diameter, obviously protruding from the floret at maturity, slender annuals. 4
- Grain elliptic to obovate; annual or perennial. 5
- 4. Grain disc-like, strongly flattened; panicle-branches 4-6-spiculate, spikelets of lowermost whorl well-developed. 1. *S. discosporus* 4
- Grain spheroid; panicle-branches 1-4-spiculate, spikelets of lowermost whorl often abortive or absent. 2. *S. panicoides* 4
- 5. Annuals. 6
- Tussocky perennials. 10
- 6. Culms <15 cm high; leaf-blades convolute, 0.8-1 mm wide. 5. *S. minutus* 4
- Culms usually >15 cm high; leaf-blades flat, 2-8 mm wide. 7
- 7. Lower glume lanceolate, acuminate, 1/2-3/4 of spikelet length; panicle-branches in neat regular tiers. 3. *S. micranthus* 4
- Lower glume up to 1/3 spikelet length, usually smaller, ovate and obtuse; upper panicle-branches subverticillate. 8

- 8. Spikelets 1.2-1.4 mm long. 9
- Spikelets 1.6-2 mm long. 8. *S. cordofanus* 9
- 9. Leaf-blades 2-5 mm wide, the margins not pectinate; culms ascending; anthers 3. 6. *S. coromandelianus* 9
- Leaf-blades 5-8 mm wide, the margins pectinate-setose; culms spreading, often shortly stoloniferous; anthers 2. 7. *S. microprotus* 9
- 10. Spikelets 1.9-2.2 mm long; culms ascending, basal sheaths not expanded; leaf-blades flat, 3-7 mm wide. 9. *S. ioclados* 9
- Spikelets 2.5-3.8 mm long; culms erect, basal sheaths expanded, papery; leaf-blades involute, 1-2.5 mm wide. 10. *S. mauritanus* 9

GROUP 2

- 11. Panicle dense and spike-like, or with the spikelets clothing the entire length of the primary branches. 12
- Panicle open and diffuse, or if the spikelets clustered, then the primary branches bare of spikelets and branchlets towards their base. 21
- GROUP 3** 21
- 12. Panicle slender, tightly cylindrical, 2-4 mm wide; leaf-blades pungent; plant stoloniferous. 17. *S. spicatus* 21
- Panicle open to contracted, >5 mm wide; leaf-blades not pungent. 13
- 13. Both glumes about as long as the spikelet, 1-nerved, acute. 14
- Glumes unequal; lower glume up to 3/4 the length of the spikelet but usually much less, nerveless; tussocky perennials. 15
- 14. Culms 1.5-2.5 m high, robust and cane-like, 3-8 mm in diameter; plant caespitose; glumes acute. 18. *S. consimilis* 15

- Culms to 65 cm high, wiry, 1 mm in diameter; plant stoloniferous; glumes acuminate. 19. *S. helvolus*
- 15. Panicle open, the primary branches spreading or ascending. 16
- Panicle linear to spiciform, the primary branches erect, appressed. 19
- 16. Upper glume obtuse, 1/4-1/2 the length of the spikelet; panicle narrowly pyramidal, the branches progressively shorter upwards; grain truncate. 11. *S. pyramidalis*
- Upper glume acute, 1/2 as long to equalling the spikelet. 17
- 17. Plant arising from a short rhizome; upper glume 2/3 to as long as the spikelet. 21. *S. fimbriatus*
- Plant forming a dense tussock. 18
- 18. Old basal sheaths papery; upper glume 1/2 the length of the spikelet. 12. *S. natalensis*
- Old basal sheaths fibrous; upper glume 1/2-3/4 the length of the spikelet. 16. *S. pellucidus*
- 19. Spikelets 1.8-2.5 mm long, greyish-green; basal sheaths papery to subcoriaceous. 20
- Spikelets 2.6-4 mm long, dark blackish-green; basal sheaths hard, yellow and shiny, becoming fibrous. 15. *S. olivaceus*
- 20. Grain elliptic, 0.8-1.1 mm long; leaf-blades lacking woolly hairs at the collar. 13. *S. africanus*
- Grain broadly obovoid, 0.7-0.8 mm long; leaf-blades woolly at the collar and along the lower margins. 14. *S. quadratus*
- Plants forming dense tussocks; basal sheaths yellow, indurated, becoming fibrous; leaf-blades mainly basal, 1-3 mm wide. 28
- 27. Plant tufted from a knotty rootstock; leaf-blades 6-9 mm wide; panicle 15-40 cm long. 22. *S. agrostoides*
- Plant with long thin rhizomes; leaf-blades 3-5 mm wide; panicle 8-16 cm long. 23. *S. confinis*
- 28. Spikelets 1.6-2.1 mm long, clustered in bunches with some pedicels very short (*c* 0.2 mm); upper glume 3/4 the length of the spikelet or more. 24. *S. nervosus*
- Spikelets 2-3 mm long on setaceous pedicels all >0.5 mm long; upper glume 1/2-3/4 the length of the spikelet. 25. *S. angustifolius*
- 29. Loose stoloniferous perennial; culms wiry, the leaf-sheaths not imbricate. 26. *S. ruspolianus*
- Dense cushion-forming perennial; culms woody, clothed with tightly imbricate leaf-sheaths. 27. *S. tourneuxii*
- 30. Perennial with stout scaly stolons, without basal fibres; leaf-blades flat, tough, glaucous, mostly <2 cm long. 28. *S. somalensis*
- Tufted perennials with a dense basal clump of fibres; leaf-blades slender, usually convolute. 31
- 31. Basal fibres glabrous; spikelets 1-1.5 mm long; anthers 0.6-0.8 mm long. 29. *S. festivus*
- Basal fibres woolly; spikelets 1.4-2.2 mm long; anthers 0.8-1.2 mm long. 32
- 32. Basal sheaths herbaceous; lemma acute. 30. *S. stapfianus*
- Basal sheaths yellow, indurated; lemma obtuse. 31. *S. airiformis*

GROUP 3

- 21. Perennials. 22
- Delicate annual. 32. *S. pectinellus*
- 22. Spikelets clustered on the branchlets; upper glume (1/2-2/3) to as long as the spikelet. 23
- Spikelets evenly distributed, the panicle diffuse; upper glume 1/3-2/3 as long as the spikelet. 30
- 23. Panicle often over 8 cm long, the branches slender, usually filiform and much-branched; leaf-blades not deciduous. 24
- Panicle 1-6.5 cm long, the branches stiff, short; leaf-blades glaucous, <7 cm long, deciduous from the sheaths. 29
- 24. Culms robust, 1-2 m high and 3-6 mm in diameter at the base; leaf-blades long and narrow, stiff with a broad white midrib. 20. *S. macranthelus*
- Culms not usually exceeding 1 m high and 2-3 mm in diameter at the base. 25
- 25. Panicle with the spikelets on branchlets usually appressed along the length of the primary branches. 21. *S. fimbriatus*
- Panicle with the primary branches clearly visible, the spikelets grouped on spreading secondary branchlets. 26
- 26. Plants forming loose tufts; basal sheaths not indurated or fibrous; leaf-blades 3-9 mm wide. 27
- 1. *S. discosporus* Nees (June 1841);
Triachyrum discosporum (Nees) Steud. (1854) - type: South Africa, Drège s.n. (K iso.).
Triachyrum adoense Hochst. ex A. Braun (Dec. 1841); *Sporobolus blephariphyllus* A. Rich. (1850), nom. superfl. - type: Ethiopia, TU, Mt Scholoda, Schimper 81 (BM K TUB iso.).
- Slender tufted annual; culms erect, unbranched, 10-30 cm high. Leaf-blades broadly linear to lanceolate, glaucous, 1-4 cm long, 2-6 mm wide, the margins pectinate-setose. Panicle lanceolate, 3-10 cm long; primary branches whorled, horizontally spreading, the spikelets evenly spaced mostly directly on the primary branches. Spikelets 1.3-1.7 mm long, fusiform but soon gaping under pressure from the swelling grain, purplish; lower glume linear-lanceolate, 1/4-1/2 spikelet length; upper glume elliptic, subequalling the spikelet, sometimes sparsely aculeate, acute; lemma as long as the spikelet, lanceolate, acute; anthers 3, 0.3-0.5 mm long; grain disc-like, strongly laterally compressed, *c* 1 mm in diameter. Fig. 60:3, 4.
- Open disturbed and overgrazed places, often on shallow or compacted soils where rainwater collects; 1400-2400 m. EW TU GD GJ SU BA SD; Kenya, Tan-

zania and South Africa. Friis et al. 869; Mooney 8906; Thulin & Hunde 3960.

A distinctive species on account of its conspicuous, flattened, disc-like grains.

2. *S. panicoides* A. Rich. (1850);

Triachyrum longifolium Hochst. ex A. Rich. (1850) in syn., Hochst. ex Steud. (1854) nom. illegit. - types: Ethiopia, TU, Shire [Chiré], *Quartin Dillon* s.n. & near Adua, *Gaptia* [Gafta], *Schimper* 1181 (both P syn., K isosyn.).

Slender annual; culms solitary or tufted, unbranched, 25–50 cm high. Leaf-blades linear, flat, light green, 7–20 cm long, 2–3 mm wide, glabrous or loosely pilose above, tubercle-based setae sometimes present on the lower margins, finely acuminate. Panicle narrowly elliptic, 6–13 cm long, few-spiculate; primary branches whorled, capillary, each bearing only 1–3(–4) spikelets, branches of the lowermost whorl frequently with abortive spikelets or lacking spikelets altogether. Spikelets 2–2.5 mm long, fusiform but soon gaping; lower glume lanceolate, 1/3–2/3 spikelet length; upper glume elliptic-oblong, as long as the spikelet, acute; lemma similar but slightly shorter; anthers 3, 1.2 mm long; grain spherical, 1.2–1.3 mm in diameter. Fig. 60:1, 2.

Shallow soil among rocks or on stony hillsides, in both sunny and lightly shaded situations; 900–2100 m. EW TU GD SU AR GG SD BA HA; Sudan, Somalia and southwards to South Africa. *Gilbert & Phillips* 9141; *Robertson* 1208; *Thulin* 1342.

The frequently espiculate branches of the lowermost panicle whorl are a useful aid to recognition. It also has a much more sparsely spiculate panicle than the other annuals with whorled panicle-branches.

A few specimens from Tigre (*Gilbert & Getachew* 2943; *Schimper* 1091) have larger spikelets than usual, to 3 mm long, in panicles with a fertile lowermost whorl and primary branches bearing up to five spikelets.

3. *S. micranthus* (Steud.) Th. Dur. & Schinz (1895);

Triachyrum micranthum Steud. (1854) - type:

Ethiopia, TU, *Gaptia*, *Schimper* (P holo.).

Sporobolus regularis Mez (1921).

S. psammophilus Stent & Rattray (1933).

Delicate annual; culms solitary or tufted, 15–60 cm high, usually erect and unbranched. Leaf-blades broadly linear, flat, 1.5–9 cm long, 2–5 mm wide, a row of raised glands along the margins, also some marginal setae, sometimes pectinate, tip sharply acute. Panicle lanceolate to narrowly oblong (rarely linear-oblong), 5–20 cm long, the primary branches whorled in neat tiers, the lower third of their length bare; spikelets borne directly or on 2–3-spiculate branchlets on slender pedicels. Spikelets narrowly elliptic, 1.1–1.6(–1.8) mm long, thinly membranous, smooth or scaberulous, acute, dark red; lower glume lanceolate, 1/2–3/4 spikelet length; upper glume and lemma as long as the spikelet;

anthers 3, 0.3–0.5 mm long; grain broadly elliptic, 0.7–1 mm long, medium-brown.

Dry open places on banks and among rocks; 1500 m. EW TU; eastwards to Nigeria and Upper Volta; Tanzania and southern tropical Africa. *Mooney* 8044.

S. micranthus belongs to a complex of very similar and intergrading species, and the number of species which should be recognized is still open to doubt. *S. paniculatus* (Trin.) Th. Dur. & Schinz, mainly found in West Africa from Sierra Leone to Nigeria and in Zaire, is a somewhat larger, tufted grass with longer spikelets (1.7–2.2 mm), longer anthers (0.5–1 mm), longer dark-brown grain (1–1.5 mm) and often eglandular leaf-blade margins.

S. stolzii Mez has a mainly more southern distribution from Kenya to Zimbabwe, but also occurs in West Africa and is to be expected in Ethiopia. It differs principally from *S. micranthus* by its globose grain only 0.3–0.6 mm in diameter, but the distinction is not absolute and specimens without mature grains can be very difficult to determine. Additionally, *S. stolzii* has invariably pectinate-setose leaf-margins. In well-grown specimens the leaf-blades tend to be broader than in *S. micranthus* and the lower leaves are often conspicuously distichous with imbricate sheaths and divaricately spreading, slightly falcately curved blades.

4. *S. piliferus* (Trin.) Kunth (1833);

Vilfa pilifera Trin. (1824) - type: Nepal (LE holo.).

Sporobolus stachydanthus A. Rich. (1850); *Vilfa stachydantha* (A. Rich.) Steud. (1854); *Triachyrum stachydanthum* (A. Rich.) Schweinf. (1867) as "stachyanthum" - type: Ethiopia, TU, Shire [Chiré], *Quartin Dillon* (P holo., K iso.).

Slender tufted annual; culms erect, unbranched, 5–40 cm high. Leaf-blades linear, flat, 2–15 cm long, 1–3 mm wide, loosely pilose, a row of raised glands along the margins, sometimes also marginal setae, tip acute. Panicle linear, spiciform, 2–10 cm long; primary branches subverticillate, short, erect, mostly unbranched, spotted with small glands. Spikelets narrowly lanceolate-oblong, 1.8–2.2 mm long, yellowish-green; lower glume lanceolate, 2/3–3/4 spikelet length, acuminate; upper glume and lemma oblong, as long as the spikelet, subacute; anthers 3, c 0.5 mm long; grain ellipsoid, lightly laterally compressed, 0.8–1.2 mm long. Fig. 60:7.

Open situations among rocks, on earth banks and pathsides; 1500–2100 m. TU GJ SU WG GG SD BA; tropical Africa and eastwards through India to SE Asia. *De Wilde* 8818; *Friis* et al. 1060; *Mesfin & Kagnew* 2125.

S. piliferus resembles *S. micranthus* in its glandular leaf-blade margins and long lanceolate lower glume. Some forms of the *S. micranthus* complex from East Africa which have a narrow panicle closely approach *S. piliferus*.



Figure 60. *SPOROBOLUS* spp.: *S. PANICOIDES*: 1 - habit x 3/4; 2 - spikelet x 17. *S. DISCOSPORUS*: 3 - habit x 3/4; 4 - spikelet x 17. *S. IOCLADOS*: 5 - habit x 3/4; 6 - spikelet x 17. *S. PILIFERUS*: 7 - habit x 3/4. 1 from Gilbert, Thulin & Aweke 429; 2 from Thulin 1342; 3 & 4 from Thulin et al. 3760; 5 from Gilbert & Thulin 86; 6 from M.G & S.B. Gilbert 1850; 7 from Gilbert & Thulin 816. Drawn by Eleanor Catherine.

S. ciliatus Presl is a very similar tropical American species often misidentified as *S. piliferus*, but differing in its broader hispid leaf-blades.

5. *S. minutus* Link (1827);

Vilfa minuta (Link) Trin. (1840) - type: cultivated at Berlin, seed from Dahlak Is., Eilet, Eritrea (K iso.).

Tiny tufted ephemeral; culms delicate, geniculately ascending, 5–16 cm high. Leaf-blades convolute, firm, 1–5 cm long, 0.8–1 mm wide, subacute. Panicle lanceolate, 2–3.5 cm long, the lowermost branches whorled, upper branches subverticillate, thinly scattered with glandular dots; spikelets appressed or spreading along the whole length of the primary branches, borne either directly or on 2-spiculate branchlets. Spikelets narrowly lanceolate, 1.1–1.3 mm long, purple; lower glume 0.2–0.4 mm long, obtuse; upper glume lanceolate, 0.8–0.9 mm long, acuminate; lemma narrowly ovate, as long as the spikelet, acute; anthers 2, 0.3 mm long; grain ellipsoid, 0.5–0.7 mm long.

Saline plains; sea level. EE; Somalia, Saudi Arabia (Jeddah). *Schweinfurth & Riva* 219.

S. minutus is a local species restricted to saline flats; it occurs in the Somali Ogaden and is to be expected on the Ethiopian side of the border. *S. minimus* Cope is another tiny annual also to be expected in this area and differing in its subglobose grain (0.3 mm in diameter), broader leaf-blades, spikelets only 0.7 mm long and 3 anthers, 0.1 mm long.

6. *S. coromandelianus* (Retz.) Kunth (1829);

Agrostis coromandeliana Retz. (1786); *Vilfa coromandeliana* (Retz.) P. Beauv. (1812) - type: India, König (LD, holo.).

Slender, loosely tufted annual; culms ascending, branched, 10–35 cm high. Leaf-blades linear, flat, 3–10 cm long, 2–5 mm wide, the margins firm, scaberulous, sometimes with a few setae but not pectinate, tip acute. Panicle ovate, 2–7 cm long, the lowest primary branches whorled, succeeding branches subverticillate, bare for the lower 1/3–1/2 of their length and with a linear glandular patch on this portion; spikelets borne on 2–4-spiculate branchlets or directly on the primary branches on slender pedicels. Spikelets narrowly elliptic, 1.2–1.4 mm long, usually scaberulous, acute, grey; lower glume a tiny ovate scale 0.2–0.4 mm long; upper glume as long as the spikelet, elliptic; lemma similar but slightly shorter; anthers 3, 0.3–0.4 mm long; grain obovate-oblong with a rounded top, 0.7–0.8 mm long, laterally compressed.

On sand, especially fixed coastal dunes; sea level. EE; E Sudan, coastal Somalia and Kenya, southern Arabian peninsula; main distribution areas India and South Africa; extending to Burma and Thailand. *Stower, Smith & Gilliland* 4026; *Terracciano & Pappi* 2581.

S. coromandelianus is easily confused with *S. microprotus* as both species have a whorled panicle of almost identical spikelets. *S. coromandelianus* is a more slender species, never stoloniferous, and with narrower, non-pectinate leaf-blades. It also has 3 smaller anthers.

7. *S. microprotus* Stapf (1912);

- types: Chad, *Chevalier* 9605 & 9640 (P syn., K isosyn.).

S. scabriflorus Stapf ex Massey (1926) - types: Sudan, *Schweinfurth* 184 & 2379 (both K syn.).

Annual forming a spreading tuft; culms often shortly stoloniferous, rooting and branching at the nodes, ascending to 15–55 cm high. Leaf-blades broadly linear, flat, 4–20 cm long, 5–8 mm wide, the margins pectinate-setose, becoming scabrid towards the acute tip. Panicle elliptic to pyramidal, 5–12 cm long, the primary branches whorled, with scattered yellow glandular patches, bare for the lower 1/4–1/3 of their length; spikelets mostly sessile on secondary branchlets. Spikelets elliptic-oblong, 1.2–1.3 mm long, scabrid, subacute, dark grey; lower glume a tiny ovate scale 0.2–0.4 mm long; upper glume and lemma as long as the spikelet, elliptic-oblong; anthers 2, 0.5–0.7 mm long; grain obovate with a flattened top, strongly laterally compressed, *c* 0.7 mm long.

Dry open places. TU or GD; westwards through Sudan to Senegal, Uganda, N Zaire and Central African Republic. *Schimper* 1071.

S. microprotus is a predominantly Sahel zone species which is probably under-collected in lowland northern Ethiopia. The combination of a spreading, stoloniferous annual habit; broad, pectinate-margined leaf-blades and panicle of small spikelets on whorled branches serves to distinguish it from similar annual species. The presence of only 2 stamens is a good confirmatory character, but they must be searched for in young spikelets as the anthers are shed early.

8. *S. cordofanus* (Hochst. ex Steud.) Cass. (1889);

Triachyrum cordofanum Hochst. ex Steud. (1854); *Sporobolus commutatus* (Trin.) Kunth var. *cordofanus* (Steud.) Th. Dur. & Schinz, *Consp. Fl. Afr.* 5: 820 (1895) - type: Sudan, *Kotschy* 30 (BM K TUB iso.).

Tufted annual; culms ascending, 8–60(–100) cm high. Leaf-blades linear, 4–20 cm long, 3–6 mm wide, glabrous or stiffly pilose, scabrid or pilose on the margin towards the base. Panicle ovate, 2–15 cm long, the spreading primary branches whorled, often reddish, the spikelets borne on secondary branchlets. Spikelets 1.6–2 mm long, olive-green to dark grey; lower glume 1/4–1/3 spikelet length, oblong, obtuse; upper glume narrowly ovate, as long as the spikelet; lemma similar but slightly shorter; anthers 3, 0.7–1.4 mm long; grain ellipsoid, 0.6–1 mm long.

Sandy soils in weedy or overgrazed places; 400 –

1400 m. EW SU (Awash); westwards to Senegal and southwards through East Africa to Zimbabwe. *Boulos* 9330; *Gilbert* 1656; *Hemming* 1228.

S. cordofanus is the annual counterpart of *S. ioclados* and the two species merge into one another through forms with a weakly perennial base. Typical *S. cordofanus* forms a clearly annual tuft producing many flowering culms and favours weedy situations, where it may form large patches. It is quite common in Sudan and East Africa in areas below 1600 m, but appears to be of only sporadic occurrence in Ethiopia.

9. *S. ioclados* (Trin.) Nees (1841);

Vilfa ioclados Trin. (1840) - types: South Africa, Drège s.n. (several syntypes, some isosyn. at K).

S. marginatus Hochst. ex A. Rich. (1850); *Vilfa marginata* (Hochst. ex A. Rich.) Steud. (1854) - types: Ethiopia, TU, Shire [Chiré], *Quartin Dillon* (P syn.) & Eritrea, Modat [Meda], *Schimper* 1777 (P syn., K TUB isosyn.).

S. marginatus A. Rich. var. *anceps* Chiov. in *Ann. Ist. Bot. Roma* 8: 51 (1903) - type: Eritrea, Mensa, Curo to Colfu, *Pappi* 1118 (FT holo.).

S. marginatus A. Rich. var. *scabrifolius* Chiov. in *Ann. Ist. Bot. Roma* 8: 339 (1908) - type: Ethiopia, TU, Gageros, *Schimper* 2302 (K iso.).

Perennial forming dense tussocks, sometimes with stolons, the vegetative shoots with strongly flattened leaf-sheaths; culms geniculately ascending from a spreading base, 30–100 cm high. Leaf-blades linear, flat, tough, 5–20 cm long; 3–7 mm wide, often pilose, the margins cartilaginous, scaberulous and aculeate towards the base, tip acute. Panicle ovate to pyramidal, 9–20 cm long, the primary branches whorled, bare for the lower 1/4–1/3 of their length, often purplish; spikelets borne in secund clusters on the secondary branchlets. Spikelets 1.9–2.2 mm long, grey-green; lower glume lanceolate, 1/4–1/3 spikelet length; upper glume and lemma narrowly ovate, both as long as the spikelet, acute; anthers 3, 1–1.6 mm long; grain ellipsoid, 0.8–1 mm long. Fig. 60:5, 6.

Open *Acacia* woodland and grassland on dry, stony, sometimes saline soils; 800–1800 m. EE AF TU SU (Awash valley) KF GG BA HA; throughout Africa; also in Arabia and India. *Burger* 624; *Gilbert* 2031; *Phillips* 45.

10. *S. mauritanus* (Steud.) Th. Dur. & Schinz (1895);

Vilfa mauritiana Steud. (1854) - type: Mauritius, *Urville* (P holo.).

Perennial forming dense tussocks, the old basal sheaths expanded, firmly papery, yellowish, rarely becoming fibrous; culms 20–80 cm high, erect. Leaf-blades filiform or involute, up to 25 cm long, 1–2.5 mm wide (the culm leaves sometimes flat and up to 5 mm wide). Panicle narrowly ovate or sometimes contracted, 4–16 cm long, the primary branches whorled, the lower half of their length bare; spikelets borne directly or on

few-spiculate branchlets. Spikelets 2.5–3.8 mm long, dark grey, acute; lower glume lanceolate, acuminate, 1/2–3/4 spikelet length; upper glume lanceolate, as long as the spikelet; lemma similar but slightly shorter; anthers 3, 1.8–2.5 mm long; grain ellipsoid, laterally compressed, 1.8–2 mm long.

Wooded grassland on black clay soil; 1500 m. IL; tropical and South Africa, Madagascar, Mauritius. *Friis* et al. 2402.

S. mauritanus forms part of a variable complex of intergrading perennial tussock-forming species, commonest in wooded grassland in eastern and southern Africa. *S. sanguineus* Rendle (linear panicle 20–35 cm long; reddish spikelets) and *S. centrifugus* (Trin.) Nees (basal sheaths horny, lower glume 3/4 as long to equaling spikelet) are other members of this complex which are likely to occur in Ethiopia.

Ash 2921, collected from rock crevices at 3100 m in Bale, belongs to this complex, but was found at an unusually high altitude. It has a narrow, contracted, blackish panicle and fibrous basal leaf-sheaths.

11. *S. pyramidalis* P. Beauv. (1816);

Vilfa pyramidalis (P. Beauv.) Steud. (1841); *Sporobolus indicus* (L.) R. Br. var. *pyramidalis* (P. Beauv.) Peter, *Fl. Deut. Ost-Afr.* 1: 291 (1931) - type: Nigeria, *Palisot de Beauvois* (G holo.).

S. rueppellianus Fresen. (1837) - type: Ethiopia, *Rüppell* s.n. (FR holo.).

S. hypseloteros Chiov. (1951) - types: Ethiopia, GG, R. Caschei, *Corradi* 522, 1067 & *Seghido*, *Corradi* 195, 913 & 916 (all FT syn.).

Tough tussocky perennial; culms moderately robust, 60–150 cm high. Leaf-blades linear, 25–50 cm long, 3–5 mm wide, tapering to a long filiform tip. Panicle narrowly pyramidal, open or loosely contracted, 20–60 cm long; primary branches ascending or spreading, lowest branch 3–8 cm long, upper branches progressively shorter, densely clothed in spikelets on short appressed branchlets along their whole length. Spikelets 1.5–2.1 mm long, lanceolate, greyish-green or dark grey, both glumes obtuse to truncate; the lower 1/4–1/3 spikelet length, ovate, the upper 1/4–1/2 spikelet length, broadly oblong; lemma equalling the spikelet, tip often slightly incurving, acute; anthers 3, 0.7–1.2 mm long; grain obovate, markedly truncate, 0.7–1 mm long. Fig. 61:1, 2.

Grassland or bushland, often associated with disturbance, especially in seasonally damp places; 700–2300 m. TU GD GJ SU KF GG SD BA HA; tropical and South Africa, Madagascar, Mauritius, Arabia. *Burger & Amare Getahun* 359; *De Wilde* et al. 6974; *Gilbert & Phillips* 8952.

S. pyramidalis is much the commonest African member of a pantropical cluster of intergrading species comprising the *S. indicus* (L.) R. Br. complex [discussed by Clayton in *Kew Bull.* 19: 287–293 (1965)]. The complex is characterized by the possession

of long ± contracted panicles, with the generally short, numerous primary branches densely clothed along their entire length with crowded, short-pedicellate spikelets on appressed branchlets. Further members of the group in Ethiopia are species nos. 12–16. *S. pyramidalis* is best distinguished by its short blunt glumes and conspicuously truncate grain.

Where the upper glume approaches half the spikelet length the boundary with *S. natalensis* becomes very unclear and intermediates occur. Typical *S. natalensis* has an upper glume narrowing uniformly to an acute tip, whereas in *S. pyramidalis* the glume-tip is broadly rounded, although there may be a small central apiculum.

12. *S. natalensis* (Steud.) Th. Dur. & Schinz (1895);
Vilfa natalensis Steud. (1854) - type: South Africa, Drège s.n. (K iso.).

Tussocky perennial, the basal leaf-sheaths rather papery, culms erect, moderately robust, 70–115 cm high. Leaf-blades narrowly linear, folded or inrolled, 15–55 cm long, 2–5 mm wide, tapering to a long filiform tip. Panicle loosely contracted, narrowly pyramidal, 20–33 cm long; primary branches ascending, lowest branch 4–8 cm long, upper branches progressively shorter, densely clothed in spikelets on short appressed branchlets along their whole length. Spikelets 1.6–2.4 mm long, lanceolate, dark grey; lower glume oblong, 1/4–1/3 spikelet length, obtuse; upper glume ovate, c 1/2 spikelet length, acute; lemma equalling the spikelet, tip often slightly incurving, acute; anthers 3, 0.8–1 mm long; grain obovoid-oblong, truncate, 1 mm long.

Rough grassland and weedy places; 1600–2400 m. EW TU GJ SU KF SD HA; Cameroon, Zaire and southwards to South Africa. *De Wilde et al.* 7468; *Jimma ATS A38; West 5905.*

S. natalensis differs from *S. pyramidalis* in scarcely more than its acute upper glume, which is on average a little longer than in *S. pyramidalis*, the grain also tends to be a little longer. In these characters *S. natalensis* resembles *S. africanus* and Clayton [*Kew Bull.* 19: 289 (1965)] has postulated a hybrid origin for this species.

13. *S. africanus* (Poir.) Robyns & Tournay (1955);
Agrostis africana Poir. (1810); *A. spicata* Thunb. (1794) non Vahl (1790); *Sporobolus capensis* (P. Beauv.) Kunth (1833) nom. illegit. - type: South Africa, Thunberg (UPS-Thunb. 2102 holo.).

Tufted or tussocky perennial, the basal leaf-sheaths keeled, papery; culms erect, 25–80(–100) cm high. Leaf-blades narrowly linear, flat or folded, 10–30 cm long, 2–5 mm wide, tapering to a filiform tip. Panicle linear, spiciform, 10–30 cm long; primary branches numerous, crowded, erect, mostly 1–2 cm long (the lowest up to 3 cm long), densely clothed in spikelets on short appressed branchlets along their whole length. Spikelets narrowly lanceolate, 1.8–2.5 mm long, dark



Figure 61. *SPOROBOLUS* spp.: *S. PYRAMIDALIS*: 1 - panicle x 3/4; 2 - spikelet x 20. *S. AFRICANUS*: 3 - panicle x 3/4; 4 - spikelet x 20. 1 & 2 from *Aweke & Gilbert 947*; 3 & 4 from *Mooney 7563*. Drawn by Eleanor Catherine.

greyish-green; lower glume broadly oblong, 1/3 spikelet length or slightly more, obtuse; upper glume ovate, 1/2–3/4 spikelet length, acute; lemma equalling the spikelet, narrowly ovate, acute; anthers 3, 0.6–1.1 mm long; grain elliptic, broadly rounded to truncate across the top, 0.8–1.1 mm long. Fig. 61:3, 4.

Roadsides, upland grassland and clearings in montane forest; 1500–2900 m. GJ SU AR IL KF GG SD; South Africa, extending northwards into the highlands of tropical Africa; Arabia. Friis et al. 1561; Mooney 7026; Thulin 1371.

The panicle is typically densely spiciform with appressed branches, but may be somewhat looser in well-grown specimens with long panicles. However, the panicle is never as loose as in *S. natalensis*, which has longer panicle-branches and often a taller, more robust habit.

In South Africa *S. africanus* has slightly longer spikelets (2.1–2.8 mm) and grains (1.1–1.2 mm). The tropical African form is very difficult to distinguish from the Asiatic species *S. fertilis* (Steud.) Clayton.

14. *S. quadratus* W. D. Clayton (1965);

- type: Kenya, McCallum Webster K.88 (K holo.).

Tufted perennial, the basal sheaths papery to subcoriaceous; culms erect, 30–90 cm high. Leaf-blades tough, inrolled, up to 30 cm long and 2–3 mm wide, tapering to a flexuous filiform tip, densely bearded at the collar with woolly hairs 1–2 mm long, similar hairs extending along the sheath and blade margins. Panicle spiciform, 6–18 cm long, primary branches crowded, erect, appressed, densely spiculate, 0.5–1.5 cm long. Spikelets narrowly lanceolate-oblong, 2.2–2.8 mm long, greyish-green; lower glume oblong, *c* 1/3 spikelet length, obtuse to truncate; upper glume elliptic, 2/3–3/4 spikelet length, acute; lemma equalling the spikelet, narrowly ovate, narrowed to an acute incurving tip overtopping the palea; anthers 3, 0.6–1 mm long; grain broadly obovoid, 0.7–0.8 mm long and almost as wide, truncate.

Heavily grazed grassland; 2000–2400 m. KF SD; Kenya. Stewart 92.

S. quadratus is very similar to *S. africanus* but has a shorter, squarer grain and a more elongate lemma-tip which usually exceeds the palea. The panicle is always densely spiciform and often a paler colour than in *S. africanus*. The dense woolly fringe of long hairs at the collar, extending along the lower leaf-margins, is a good confirmatory character.

15. *S. olivaceus* Napper (1963);

- type: Tanzania, Stolz 2621 (EA holo., K iso.).

Densely tufted perennial, the basal sheaths indurated, yellow and shiny, finally splitting into fibres; culms erect, slender, 10–90 cm high. Leaf-blades convolute,

up to 30 cm long and 2 mm wide with a fine flexuous tip. Panicle spiciform, 3–20 cm long; primary branches crowded, erect, appressed, densely spiculate, 0.5–1.5 cm long. Spikelets narrowly lanceolate-oblong, 2.6–4 mm long, dark grey-green to blackish; lower glume elliptic, 1/3 spikelet length, obtuse or acute; upper glume ovate, 1/2 spikelet length, acute; lemma equalling the spikelet, acute; anthers 3, 1.2–1.7 mm long; grain oblong to obovoid with a rounded top, 1.1–1.3 mm long.

Upland grassland and *Erica* bushland; 3500 m. AR; southwards through East Africa to Zambia. Mooney 5290.

The panicle of *S. olivaceus* is densely spiciform as in *S. africanus* but of a darker almost blackish colour, and it is further distinguished by its tough basal clump of hard yellow sheaths. *S. olivaceus* also occupies a higher altitudinal range than the other members of the *S. indicus* complex (see under no. 11).

The degree to which the old sheaths split into fibres is rather variable. In extreme cases a dense tuft of fibres results, reminiscent of *S. pellucidus*, but this species has spaced, ascending panicle-branches.

16. *S. pellucidus* Hochst. (1855);

Vilfa pellucida (Hochst.) Schweinf. (1867); *Sporobolus indicus* (L.) R. Br. var. *pellucidus* (Hochst.) Chiov. in *Miss. Biol. Borana, Racc. Bot.*: 277 (1939) - type: Ethiopia, TU, Semien, Schimper in Herb. Buchinger 1174 (STR holo., P iso.).

Densely tufted perennial, the old basal leaf-sheaths splitting into fibres; culms slender, 20–65 cm high, 2–3-noded. Leaf-blades mainly basal, narrowly linear to filiform, flexuous, flat or inrolled, 7–27 cm long, 1–2.5 mm wide, thinly pilose on the upper surface. Panicle narrowly lanceolate, open, 10–20 cm long; primary branches stiffly ascending, the lowest 1–3.5(–4) cm long, densely clothed in spikelets on short appressed branchlets along their whole length. Spikelets 1.7–2.4 mm long, narrowly lanceolate-oblong, usually dark grey-green; lower glume lanceolate to oblong, 1/3–1/2 spikelet length, acute or obtuse; upper glume 1/2–3/4 spikelet length, lanceolate, acute to acuminate; lemma equalling the spikelet, acute; anthers 3, 0.8–1.2 mm long; grain obovate to oblong, strongly laterally compressed, 0.7–1 mm long.

Dry grassland, scrub and degraded open woodland; 800–2300 m. AF EW TU SU AR SD HA; Somalia, Uganda, Kenya, Tanzania, Yemen, Socotra. Burger 3225; Gilbert & Jefford 4571; Gilbert & Getachew 2732.

S. pellucidus is easily distinguished from the other perennial species with spikelets densely covering the entire length of the primary branches by its fibrous base, older plants forming a thick basal clump of fibres. It is a shorter, more slender species than *S. pyramidalis*.

17. *S. spicatus* (Vahl) Kunth (1829);

Agrostis spicata Vahl (1790) - type: Egypt, Suez, *Forsskål* (C hol.).

Mat-forming perennial, densely tufted with radiating wiry stolons bearing tight fascicles of leafy shoots at the nodes; culms 10–55 cm high. Leaf-blades glaucous, tough, 3–20 cm long, 2–4 mm wide, usually inrolled, pungent. Panicle linear, spiciform, 4–14 cm long, 2–5 mm wide, whitish-green or golden-tinged; primary branches 1–5 mm long, appressed to the central axis, completely obscured by the tightly overlapping spikelets. Spikelets narrowly lanceolate, 1.5–2.5 mm long, acute; lower glume 1/4–1/3 spikelet length, scarious, nerveless, obtuse; upper glume (1/2–)2/3–7/8 spikelet length, lanceolate-oblong; lemma narrowly oblong with broad infolding margins; anthers 3, 1.2–1.5 mm long; grain ellipsoid, 0.8 mm long, the endosperm pale and translucent. Fig. 62: 4, 5.

Coastal sand and salt flats, inland on brackish sandy shores of alkaline lakes, hot springs and moist soil over limestone; sea level–1650 m. EE AF SU (Awash and Rift Valley lakes) GG SD HA; drier areas of Africa from the Mediterranean to South Africa (Transvaal); extending eastwards through Arabia to India. *Ash* 314; *Bally* 7046; *M.G. & S.B. Gilbert* 1273.

18. *S. consimilis* Fresen. (1837);

Vilfa consimilis (Fresen.) Steud. (1841) - type: Eritrea, Massaua, *Rüppell* s.n. (FR hol.).

[*S. robustus* sensu Cufodontis, *Enum.*: 1281 (1968), non Kunth (1832)].

Tall tussocky perennial from a short rhizome; culms robust, erect and cane-like (4–7 mm wide at base), 1.5–2.5 m high, many-noded and branching. Leaf-blades cauline, flat, tough and glaucous, up to 60 cm long, 3–8 mm wide with a broad white midrib, margins scabrid, tip filiform. Panicle linear-lanceolate, 25–40 cm long; primary branches ascending, 3–9 cm long, the lower sometimes with well developed secondary branchlets to 2 cm long, densely clothed with spikelets on short appressed branchlets along their whole length. Spikelets 1.8–2.4 mm long, narrowly elliptic-oblong, greenish-yellow or greenish-grey; glumes and lemma all of approximately equal length or the lower glume slightly longer, 1-nerved, scaberulous upwards, acute; anthers 3, 1.2–1.4 mm long; grain oblong with a rounded top, 0.7–1 mm long. Fig. 62:3.

Salt flats and flood plains, forming tall belts around soda lakes and hot springs, and moist depressions in saline grassland; 600–1500 m. EE AF SU (Awash Valley) HA; Chad, Sudan, Somalia and southwards to South Africa (Transvaal) and Namibia; Arabia. *Burger* 2881; *Gilbert* 3478; *Gilbert & Thulin* 100.

19. *S. helvolus* (Trin.) Th. Dur. & Schinz (1895);

Vilfa helvola Trin. (1840) - types: Arabia, *Ehrenberg* & *Senegal*, *Leprieur* s.n., *Lelièvre* s.n. (all LE syn.).

Tufted perennial with long stolons; culms hard, swollen at the base, thin and wiry, (c 1 mm wide), 25–65 cm high. Leaf-blades mainly cauline, flat, glaucous, 2–15 cm long, 2–4 mm wide, pilose or ± glabrous, tip acuminate to filiform; old blades deciduous from the sheaths. Panicle linear to narrowly lanceolate, 8–16 cm long, contracted; primary branches 0.5–4 cm long, loosely erect, densely clothed with spikelets on short appressed branchlets along their whole length. Spikelets 1.2–2 mm long, pale greenish-brown; glumes hyaline, lanceolate, 1-nerved, smooth or scaberulous, equalling the lemma or the lower slightly shorter, acuminate; lemma elliptic, acute; anthers 3, 0.7–0.8 mm long; grain ellipsoid, 0.5–0.7 mm long. Fig. 62:1, 2.

Open deciduous bushland, often in silty, seasonally flooded depressions or on black clay; sometimes the dominant ground cover; sea level–750 m. EE AF GG SD HA; westwards to Mauretania, East Africa, Somalia, Arabia and India. *Glover & Gilliland* 418; *Hemming* 1184; *Sandford* 5.

Some of the ordinary shoots of this grass loop down, root at the nodes and grow away as horizontal stolons. *S. ruspolianus* has a similar habit, but a much smaller ovate panicle and conspicuously scabrid spikelets.

20. *S. macranthelus* Chiov. (1932);

- type: Somalia, Kolbio, *Senni* 276 (FT hol.).

Robust tussocky perennial, the basal sheaths papery; culms 1–2 m high and 3–6 mm wide at the base, hard and cane-like, many-noded. Leaf-blades mainly cauline, narrowly linear, glaucous, parallel-sided, up to 45 cm long, 4–7 mm wide with an obvious broad white midrib on the upper surface, pilose or glabrous, the margins scabrid, tip filiform. Panicle ample, much branched, 35–75 cm long, linear to narrowly ovate; primary branches filiform, bare at the base, the spikelets secondarily arranged along the branchlets on short pedicels mostly <0.5 mm long. Spikelets 1.6–2.4 mm long, dark green; lower glume lanceolate, c 1/2 spikelet length, acuminate; upper glume ovate, 3/4–4/5 spikelet length, acute; lemma equalling the spikelet; anthers 3, 1–1.4 mm long; grain broadly elliptic, 0.6–0.7 mm long.

Deciduous bushland. Sudan, Somalia, eastern and southern tropical Africa.

S. macranthelus is not yet recorded from Ethiopia, but has been collected in southeast Sudan (Liwana) within a few miles of the Gamo Gofa border and also occurs in northern Kenya.

21. *S. fimbriatus* (Trin.) Nees (1841);

Vilfa fimbriata Trin. (1840) - types: South Africa, *Ecklon & Drège* s.n. (K isosyn.).

Tufted perennial from a short oblique rhizome, the basal sheaths papery; culms up to 1 m high, 2–3 mm in diameter at the base. Leaf-blades mainly basal, linear, usually flat, 10–30 cm long, 2–5 mm wide, often pilose below, the white midrib prominent above, the secondary

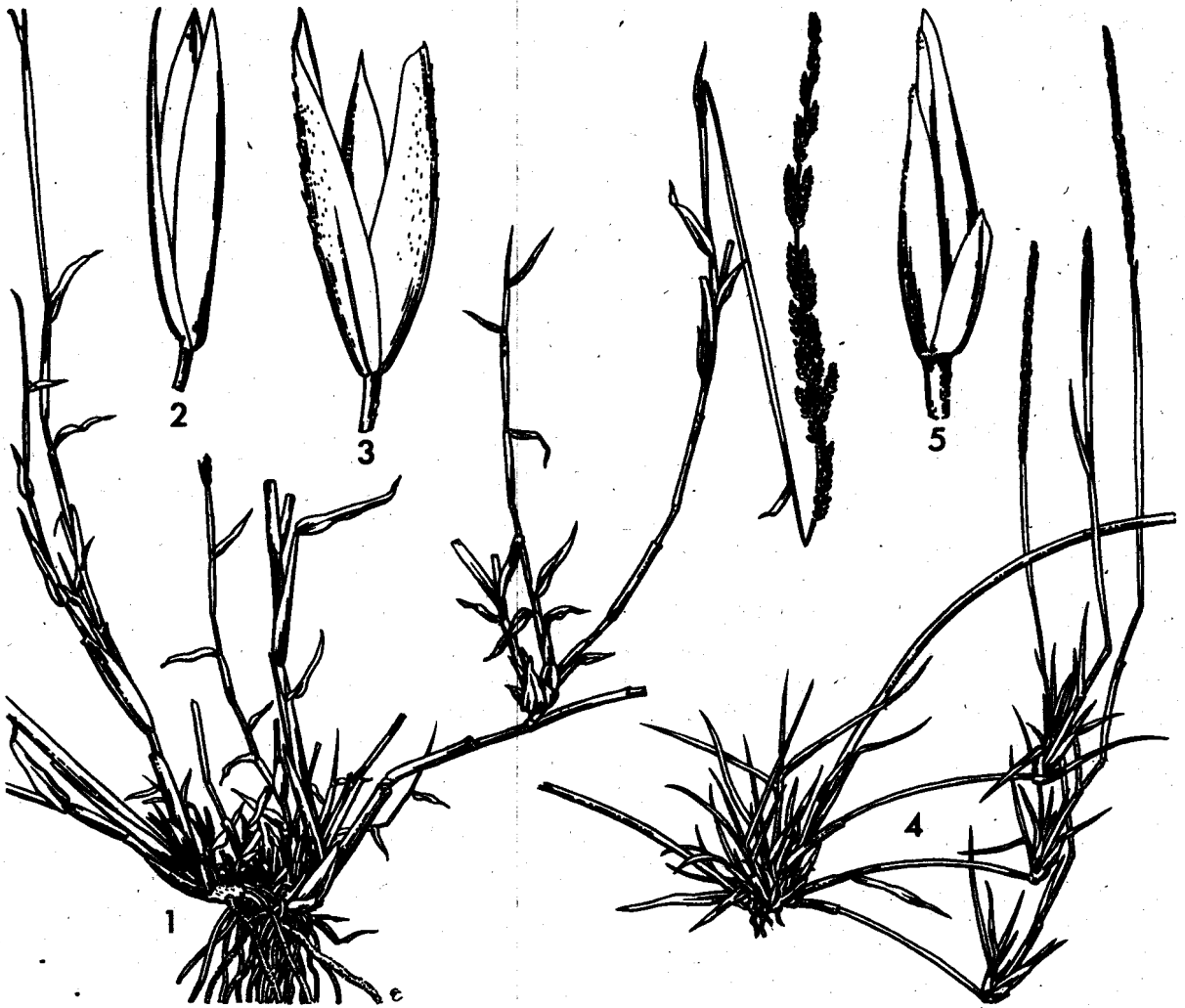


Figure 62. *SPOROBOLUS* spp.: *S. HELVOLUS*: 1 - habit x 3/4; 2 - spikelet x 20. *S. CONSIMILIS*: 3 - spikelet x 20. *S. SPICATUS*: 4 - habit x 3/4; 5 - spikelet x 20. 1 & 2 from Beals 82; 3 from Gilbert 3478; 4 & 5 from Mooney 8576. Drawn by Eleanor Catherine.

nerves obscure, tapering to a filiform tip. Panicle linear to lanceolate, 15–50 cm long; primary branches 2–9(–15) cm long, usually clothed in spikelets on short appressed branchlets along their whole length or the lower third bare, rarely the branchlets spreading. Spikelets 1.4–2.2 mm long, dark green; lower glume narrowly oblong to lanceolate, 1/4–3/4 the spikelet length; upper glume narrowly ovate, 2/3 as long to equalling the spikelet, acute; lemma narrowly ovate, equalling or slightly shorter than the spikelet; anthers 3, 0.9–1.2 mm long; grain obovoid, 0.6 mm long, truncate.

Open deciduous bushland or grassland; 1600 m. AR HA/Somalia; Sudan and Somalia southwards to South Africa. *Godding* 50; *Thulin* 1318.

When the panicle branches are completely clothed with appressed spikelets, it may be confused with *S. pyramidalis* or *S. natalensis*, and is best distinguished by its longer acute upper glume and somewhat rhizomatous base. *S. fimbriatus* grades into several other neighbouring species, including *S. macranthelus* and *S. agrostoides*.

22. *S. agrostoides* Chiov. (1897);

- type: Somalia, Sidlei [Sidleg], Ganane, *Riva* 1207 (FT holo.).

S. filipes Stapf ex Napper (1964).

Loosely tufted perennial from a knotty rootstock, sometimes shortly rhizomatous, the basal sheaths papery, keeled; culms slender, ascending, 35–140 cm high. Leaf-blades cauline, linear, flat, 20–40 cm long, 6–9 mm wide, soft, rather thin and prominently nerved, smooth or finely scaberulous along the margin, tapering to a filiform tip. Panicle large, lax and open, 15–40 cm long; primary branches filiform, ascending, branched only in the distal half, the spikelets loosely appressed along the branchlets on slender pedicels mostly >1 mm long. Spikelets 1.6–2 mm long, dark greyish-green; lower glume narrowly lanceolate, 1/2 spikelet length, acute; upper glume lanceolate-oblong, 3/4 as long to almost equalling the spikelet, smooth or scaberulous, acute; lemma narrowly ovate, equalling the spikelet; anthers 3, 0.8–1 mm long; grain ellipsoid, 0.7–0.8 mm long. Fig. 63:3, 4.

Woodland shade; 1000–2200 m. SD; Somalia, Uganda, Kenya, Tanzania and the eastern border of Zaire. *Friis et al.* 3213; *Mooney* 5562.

A rather lush, leafy East African shade species extending into southern Ethiopia.

23. *S. confinis* (Steud.) Chiov. (1908);

S. affinis A. Rich. (1851) non Kunth (1829), nom. illegit.; *Vilfa confinis* Steud. (1854) - type: Ethiopia, TU, Shire [Chiré], *Quartin Dillon* (P holo.).

S. phyllotrichus Hochst. (1855); *Vilfa phyllotricha* (Hochst.) Schweinf. (1867) - type: Ethiopia, *Schimper* in Herb. *Buchinger* 1312 (STR holo.).

Slender perennial with extensive thin rhizomes, the basal sheaths herbaceous; culms slender, often weak and loosely ascending, 25–50 cm high. Leaf-blades linear, flat, fairly short, 5–23 cm long, 3–5 mm wide, tapering from rounded base to acuminate tip, pilose (sometimes sparsely) with tubercle-based hairs, some hairs marginal, occasionally pectinate towards the ligule; sheath-margins pilose. Panicle narrowly elliptic, 8–16 cm long, primary branches loosely ascending, branched, all branches bare in the lower part, the spikelets gathered into secund clusters on the branchlets, some pedicels very short (<0.3 mm). Spikelets 1.6–2.2 mm long, slightly scaberulous, olive-grey; lower glume narrowly oblong, 1/2–2/3 spikelet length, obtuse; upper glume narrowly ovate, 3/4–4/5 spikelet length, acute; lemma lanceolate, equalling the spikelet; anthers 3, 0.9–1.2 mm long; grain ellipsoid, 0.8 mm long.

Open grassy and weedy places; 1300–2400 m. EW TU GD WU SU KF SD HA; Kenya, Tanzania; Yemen. *Aweke & Gilbert* 831; *Friis et al.* 2607; *W. de Wilde* 6488.

Most easily distinguished from other species with partially bare panicle-branches and clustered spikelets by its long thin rhizomes, flat leaf-blades and lax, slender culms.

24. *S. nervosus* Hochst. (1855);

Vilfa nervosa (Hochst.) Schweinf. (1867) - type: Ethiopia, Agau, Gurrarfa, *Schimper* in Herb. *Buchinger* 1309 (STR holo., P iso.).

S. ioclados Hook. f. (1896) non (Trin.) Nees (1841); *S. stocksii* Bor (1948), nom. nov.; *S. iocladoides* Chiov. ex Chiarugi (1951), nom. superfl.

Sporobolus longibrachiatus Stapf (1907).

Perennial forming congested tussocks from a short rhizome, the basal sheaths yellowish, indurated, finally splitting into segments or fibres; culms erect, slender, 1–2-noded, 20–56 cm high. Leaf-blades mainly basal, narrowly linear, flat, up to 20 cm long, 1–3 mm wide, glabrous or pilose, the tip filiform. Panicle ovate, 10–20 cm long, primary branches filiform, spreading, branched, all branches bare for much of their length, the spikelets gathered towards the tips of the branchlets, some pedicels very short (c 0.2 mm). Spikelets 1.6–

2.1(–2.5) mm long, scaberulous, pallid or dark grey-green; lower glume narrowly oblong, 2/5–1/2 spikelet length, obtuse; upper glume lanceolate, (2/3–)3/4 as long to equalling the spikelet, obtuse or acute; lemma narrowly ovate, equalling the spikelet, acute; anthers 3, 0.8–1.2 mm long; grain ellipsoid, 0.7–0.8 mm long. Fig. 63:5–7.

Denuded areas in open *Acacia-Commiphora* bushland on sandy soils; 450–1600 m. TU SD HA; Somalia, Kenya, Tanzania, Mauretania, Namibia; southern Arabia. *Gilbert & Sebsebe* 8819; *Glover & Gilliland* 313; *Corradi* 378 (FT).

S. nervosus is a species of moderate height, the few-noded erect culms rising above the tough basal tussock of narrow leaves. The spikelets are aggregated in clusters on the ultimate branchlets, leaving the branch system exposed. There is some regional variation within the species; populations from N Somalia and the Oga-den have glabrous leaves and basal sheaths which split with age into segments rather than fibres, whereas Tanzanian plants always have densely pilose leaves and bases invested with clumps of fine fibres.

It is reported to be a good grazing grass which springs up rapidly after rain.

25. *S. angustifolius* A. Rich. (1850);

Vilfa angustifolia (A. Rich.) Steud. (1854); *Sporobolus indicus* (L.) R.Br. var. *angustifolius* (A. Rich.) Chiov. in *Ann. Ist. Bot. Roma* 8: 338 (1908) - type: Ethiopia, TU, Shire [Chiré], *Quartin Dillon & Petit* (P holo.).

Densely tufted perennial, the basal sheaths yellowish and coriaceous, becoming fibrous with age; culms erect, slender, 30–70 cm high. Leaf-blades mainly basal, convolute with a flexuous filiform tip, 10–25 cm long, 1–2 mm wide, the sheath-margins and collar pilose. Panicle narrowly ovate to narrowly elliptic, 8–19 cm long, primary branches ascending, bare at the base, the spikelets loosely contracted along the branchlets on slender pedicels mostly >1 mm long. Spikelets narrowly lanceolate, 2–3 mm long, grey-green to olive-grey; lower glume oblong, 2/5–1/2 spikelet length, acute to obtuse or laciniate; upper glume lanceolate, 1/2–3/4 spikelet length, acute; lemma equalling the spikelet or shortly overtopped by the palea, narrowly ovate; anthers 3, 1–1.5 mm long; grain ellipsoid, 1–1.2 mm long, truncate.

Shallow stony soils in grassland and bushland; 2600–2700 m. EW TU GD; Sudan, East Africa, Zambia and Malawi; Yemen and Oman. *Schweinfurth* 54; *Chiovenda* 781.

S. angustifolius has a similar habit to *S. nervosus*, both being tussock grasses of moderate height with narrow leaf-blades and tough yellow basal sheaths which become fibrous with age. *S. angustifolius* has a less copiously branched panicle with longer, more delicate setaceous pedicels, and also a slightly longer spikelet, upper glume and grain. It usually occurs at higher altitudes than *S. nervosus*.



Figure 63. *SPOROBOLUS* spp.: *S. FESTIVUS*: 1 - habit x 3/4; 2 - spikelet x 17. *S. AGROSTOIDES*: 3 - leaves and panicle x 3/4; 4 - spikelet cluster x 9. *S. NERVOSUS*: 5 - habit x 3/4; 6 - spikelet cluster x 9; 7 - spikelet x 17. 1 & 2 from Mooney 8063; 3 & 4 from Gillett 14262; 5-7 from Glover & Gilliland 313. Drawn by Eleanor Catherine.

26. *S. ruspolianus* Chiov. (1906);

- type: Ethiopia, between Danna and Web [Ueb]-Karanle (near the Webi Shebele), Riva 1057 (383) (FT holo.).

Tufted perennial with long stolons; culms thin, hard and wiry, up to 40 cm high, swollen at the base, fasciculate branched, remaining green below after the leaf-blades have fallen and contrasting with the brown persistent sheaths. Leaf-blades cauline, tough, glaucous, 1–7 cm long, 1–2 mm wide, flat, acute, the blades at length deciduous. Panicle ovate, 2.5–6.5 cm long, sparsely branched; primary branches stiffly spreading, bare below, the spikelets clustered in dense bunches on the secondary branchlets on short stout pedicels all <0.5 mm long. Spikelets 1.4–2.3 mm long, pale greenish-grey or greenish-brown; glumes conspicuously scabrid, acute or obtuse, the lower narrowly lanceolate, c 1/2 spikelet length, the upper oblong, 2/3–3/4 spikelet length; lemma lanceolate, scabrid above the middle; anthers 3, 0.9–1.1 mm long.

Open deciduous bushland, usually over limestone or gypsum; 370–400 m. BA HA; Somalia, Socotra, Oman. *Sandford* 13; *Simmons* S.186.

Well-grown plants form large suffrutescent patches, and it is reported to be a good grass for both grazing and erosion control.

S. helvolus has a rather similar wiry stoloniferous habit, but has longer broader leaves, a much longer narrower panicle with the spikelets densely clothing the primary branches, and longer acuminate glumes.

27. *S. tourneuxii* Cosson (1889).

Perennial forming tough glaucous cushions up to 10 cm high; culms much-branched, woody and densely clothed in many imbricate leaf-sheaths below, the flowering stems rising to 20 cm. Leaf-blades distichous with closely imbricate sheaths, flat, 1–2(–3) cm long, 2–3 mm wide, pungent, the margins pectinate-setose near the ligule. Panicle 1–4 cm long, sparsely branched, spotted with glands, ovate with the primary branches stiffly divaricate or narrow with erect branches, these bare in the lower part, the spikelets clustered in dense bunches towards the branch tips on short stout pedicels. Spikelets 1.8–2.1 mm long, usually conspicuously scabrid or subhirtellous, occasionally almost smooth; glumes subequal, 1/2–2/3 spikelet length; lemma as long as the spikelet, lanceolate, the nerve thickened; anthers (2–)3, 1–1.5 mm long; grain obovoid, 0.5–0.6 mm long.

Open bushland on shallow soils overlying limestone or gypsum; 1200 m. HA; N Somalia; N Africa through Arabia to NW India. *M.G & C.I. Gilbert* 3981.

The distinctive cushions of *S. tourneuxii* are known in Ethiopia only from the Ogaden on limestone near the northern Somali border. The small stiff panicles and scabrid spikelets closely resemble those of *S. ruspolia-*

mus, except that the glumes are unequal in that species.

28. *S. somalensis* Chiov. (1896);

- type: Somali Ogaden, *Robecchi-Brichetti* (FT holo.).

S. variegatus Stapf (1907).

Cushion-forming perennial arising from stout, branching stolons densely clothed in imbricate cataphylls; vegetative shoots numerous, crowded, seldom exceeding 3 cm high; flowering culms slender, up to 30 cm high, sometimes pilose. Leaf-blades distichous, stiff and glaucous, lanceolate, 0.8–1.5 cm long, 2–2.5 mm wide (culm leaves linear, to 5 cm long), pilose or glabrous, the margins cartilaginous, tip acute; leaf-sheaths tightly imbricate. Panicle diffuse, ovate, 5–9 cm long, the branches and pedicels capillary. Spikelets 2–2.4 mm long, violet-tinged; glumes narrowly oblong, acute to irregularly truncate, the lower 1/3–1/2 spikelet length, the upper 2/3 spikelet length; lemma equalling the spikelet, lanceolate-oblong, 3-nerved, narrowly truncate; anthers 3, 1.3–1.5 mm long; grain elliptic, 1.2–1.4 mm long, pale brown.

Open *Acacia bussei* woodland or grass plains on calcareous soils; 1200m. HA/Somali boundary; Somalia. *Gillett* 4082; *Hemming* 2022.

This distinctive species is essentially a Somali endemic, just extending into the Ethiopian, Ogaden. It is unusual in possessing clearly 3-nerved lemmas, most *Sporobolus* having lemmas with a single central nerve. The spreading cushions trap blown sand, slowing soil erosion.

29. *S. festivus* Hochst. ex A. Rich. (1850);

Vilfa festiva (A. Rich.) Steud. (1854) - types: Ethiopia, TU, Djeladjeranne [Tchelatcheranne], *Schimper* 1692 (BM K TUB isosyn.) & Avar Semmaka, *Quartin Dillon* (P syn.).

S. festivus var. *dilloniana* Schweinf. in *Bull. Herb. Boiss.* 2, App. 2: 97 (1894) - types: Eritrea, Kohaito, *Schweinfurth* 57 & 58 (whereabouts uncertain, not B).

Delicate, densely tufted perennial, the old basal sheaths forming bunches of fine fibres; culms slender, erect, 20–50 cm high. Leaf-blades mainly basal, convolute (flat in shade), 4–12 cm long, 1–2 mm wide; leaf-sheath margins shortly ciliate. Panicle diffuse, very delicate, lanceolate to narrowly ovate, 3–20 cm long, the branches and pedicels capillary, reddish. Spikelets 1–1.5 mm long, brown-purplish or grey; lower glume narrowly oblong, 1/3 to almost 1/2 spikelet length, obtuse; upper glume elliptic, 1/2–2/3 spikelet length, acute; lemma narrowly ovate, equalling the spikelet, acute; anthers 3, 0.5–0.8 mm long, purple; grain ellipsoid to obovoid, 0.4–0.7 mm long, pale brown. Fig. 63:1, 2.

Shallow gravelly or sandy soils in deciduous bushland or open woodland, or often in rock crevices; 730–

2300 m. EE EW TU GD SU AR KF WG GG SD BA HA; westwards to Mauretania and southwards to South Africa and Namibia; Yemen. *Gereau* 1392; *Gilbert & Phillips* 8952; *M.G. & S.B. Gilbert* 2054.

30. *S. stapfianus* *Gand.* (1920);

-types: South Africa, *Schlechter* 3595, & 3900 (both K isosyn.).

Slender densely tufted perennial, the basal sheaths herbaceous, splitting into fine fibres, these woolly within and eventually forming a compacted mass; culms erect, 20–40(–75) cm high. Leaf-blades mainly basal, usually convolute, 5–15 cm long, 1–2 mm wide; leaf-sheath margins woolly with curly hairs. Panicle diffuse, ovate, 3–15(–25) cm long, the branches and pedicels capillary, reddish. Spikelets 1.6–2.2 mm long, olive-green; lower glume narrowly oblong, 1/3 to almost 1/2 spikelet length; upper glume elliptic, 1/2–2/3 spikelet length, acute; lemma narrowly ovate, equalling the spikelet, acute; anthers 3, 0.9–1.2 mm long; grain ellipsoid, 0.6–1 mm long.

Open sandy ground or among rocks in deciduous woodland, bushland and grassland; 1200–1900 m. SD BA HA; southwards to South Africa (Transvaal, Natal); Madagascar, Yemen. *Friis et al.* 827; *Gilbert & Jefford* 4367; *Stewart* 190.

S. stapfianus is often confused with *S. festivus* as the woolly hairs on the basal fibres are often not immediately apparent, but must be sought within the fibrous clump. It also has a slightly less delicate panicle and longer spikelet parts.

31. *S. airiformis* *Chiov.* (1939);

-types: Ethiopia, SD, Arero, *Cufodontis* 335 (FT syn.) & Somalia, *Gillett* 4898 (K isosyn.).

Slender, densely tufted perennial, the basal sheaths yellow and indurated, woolly within, splitting into segments and finally into fibres; culms erect, 15–55 cm high. Leaf-blades mainly basal, flat or convolute, 2–9 cm long, 1–2 mm wide. Panicle diffuse, ovate, 5–14 cm long, the branches and pedicels capillary, reddish. Spikelets 1.4–2 mm long, purplish; lower glume oblong, 1/3 to almost 1/2 spikelet length, raggedly obtuse; upper glume ovate-oblong, 1/2 spikelet length or slightly more, obtuse and cuspidate; lemma narrowly ovate, equalling the spikelet, obtuse to broadly rounded; anthers 3, 0.8–1.2 mm long; grain obovoid, c 1 mm long.

Open *Acacia* woodland on limestone or sandstone; 1000–1600 m. TU SD BA HA; Somalia, Yemen. *M.G. & S.B. Gilbert* 2364 & 2419; *Thulin et al.* 3738.

S. airiformis is a local segregate from *S. stapfianus*, into which it grades through forms with indurated basal sheaths and acute lemmas e.g. *Friis et al.* 2711, *Gilbert & Jefford* 4616.

S. myrianthus *Benth.*, from East Africa, Zaire and Nigeria southwards, has similar indurated and fibrous basal sheaths but lacks woolly hairs. It is a generally taller species (up to 120 cm) with much shorter pedicels and a frequently mucronate upper glume.

32. *S. pectinellus* *Mez* (1921);

-type: Nigeria, *McGregor* 140 (K iso.).

Delicate tufted annual; culms slender, 10–45 cm high. Leaf-blades 1–8 cm long, 1–3 mm wide, flat or convolute. Panicle ovate-oblong, diffuse, 2–18 cm long with capillary branches and pedicels. Spikelets 0.8–1.6 mm long, dark grey or violet tinged; lower glume broadly oblong, 1/4–1/3 spikelet length, irregularly truncate; upper glume ovate-oblong, 1/2–2/3 spikelet length, cuspidate or abruptly acuminate, the nerve often shortly excurrent; lemma narrowly ovate, equalling the spikelet, obtuse to subacute; anthers 3, 0.3–0.8 mm long; grain ellipsoid with a rounded top, reddish-brown, 0.6–1.2 mm long.

Thin soil among rocks; 1300–1800 m. WG IL; mainly W Africa but extending to Sudan, N Zaire and W Uganda and Tanzania. *Gilbert & Thulin* 637, 818, 908; *Pavlov* 324 (ETH).

S. pectinellus is often confused with *S. festivus* which has an almost identical panicle and spikelets, but *S. pectinellus* always has a clearly annual habit lacking the basal clumps of fine fibres characteristic of *S. festivus*. In West Africa the nerve of the upper glume is shortly excurrent at the abruptly acuminate tip, and this provides a good character for separating it from the closely related *S. infirmus* *Mez*, also mainly of West African distribution. However, outside West Africa this character is less reliable, the tip often being merely cuspidate or with the nerve only exposed on one side of the tip, and the distinction between the two species becomes very unclear.

S. tenuissimus (*Schrank*) *Kuntze* is a ruderal annual species of low altitudes, extending from Senegal to India, and although not yet recorded from Ethiopia it occurs in Kenya and Arabia. It has a similar diffuse panicle but is a rather taller species with flat leaf-blades, tiny spikelets not exceeding 1 mm, a simply acute upper glume and a conspicuously truncate grain only 0.5 mm long.

Uncertain species

S. ghikae *Schweinf. & Volkens* (1897) - type: Ethiopia, HA, R. Salul, *Ghika-Comanesti* (B holo., destr.).

This is described as a perennial species with whorled panicle-branches. The protologue matches *S. iocladas* quite well except that the glumes are hirtellous with the upper glume only half as long as the spikelet.

78. UROCHONDRA C. E. Hubb. (1947)

Perennial; ligule ciliate; leaf-blades narrow, convolute. Inflorescence a contracted panicle, spiciform, cylindrical, exerted from the uppermost sheath. Spikelets 1-flowered, strongly laterally compressed, disarticulating above the glumes; glumes 1-nerved, keeled, narrow, unequal to subequal, a little shorter than the floret; lemma 1-nerved, keeled, mucronate; palea 2-nerved; lodicules absent; anthers 3. Grain ellipsoid, the embryo equalling about half its length, the styles connate, forming a pallid, thickened beak at maturity about half the length of the grain; pericarp free, becoming mucilaginous and expelling the grain when wet.

One species on coastal sand and salt-marsh from NE Africa to NW India.

Urochondra is closely related to *Crypsis* on the basis of spikelet structure, differing principally in the unique, thickened beak surmounting the grain. It also differs in its tussocky perennial habit and shorter embryo.

U. setulosa (Trin.) C. E. Hubb. (1947);

Vilfa setulosa Trin. (1840); *Sporobolus setulosus* (Trin.) Terrac. (1893); *Crypsis setulosus* (Trin.) Mez (1921) - type: Arabia, Ehrenberg & Hemprich (LE holo.).

Tough, tussocky perennial from a short rhizome, the lower sheaths coriaceous, yellowish, imbricate; culms rigid, up to 90 cm high, pubescent. Leaf-blades tough, glaucous, mostly convolute, up to 30 cm long and 8 mm wide, strongly ribbed and pubescent on the inner (upper) surface, pungent; leaf-sheaths pubescent to pruinose. Inflorescence narrowly cylindrical, 4.5–16 cm long with tightly congested, sessile spikelets, pale green or purple-tinged. Spikelets oblong, 2–3 mm long, membranous; glumes linear, thinly ciliate on the keel and margins, the lower 1.5–2.5 mm long, acute or obtuse, the upper 2.6–3 mm long, acute or mucronate; lemma lanceolate, ± glabrous or thinly pilose, subacute with a mucro or awnlet 0.3–0.7 mm long; anthers 1–1.5 mm long; grain glossy, 0.8 mm long. Fig- 64.

Sand dunes of the Red Sea coast. EE; shores of the southern Red Sea; shores of the Indian Ocean from Somalia, Socotra and Arabia to Sind and NW India. Ash 1818; Hemming 1139; Pappi 6166.

The glaucous, pungent leaf-blades and thin cylindrical inflorescence are reminiscent of *Sporobolus spicatus* (Vahl) Kunth, which occurs in similar coastal habitats but has a strongly stoloniferous habit.

CYNODONTEAE Dumort. (1824)

Chlorideae Rchb. (1828)

Zoysieae Benth. (1881)

Annuals or perennials; leaf-blades narrow, flat; ligule ciliate or a ciliolate membrane. Inflorescence composed of tough, secund spikes (looser racemes in *Lintonia*), these solitary, digitate or spread along an axis, the



Figure 64. *UROCHONDRA SETULOSA*: 1 - habit x 1; 2 - spikelet x 16; 3 - lemma x 16; 4 - grain showing liberation of seed from pericarp x 24. (Modified from Hook., *lc. Pl. t.* 3457).

spikelets closely imbricate, in a few genera the spikes very short, contracted into a cylindrical spiciform inflorescence and deciduous from the main axis at maturity. Spikelets with a single fertile floret (more in *Lintonia*, *Tetrapogon*), accompanied or not by sterile lemmas above or below, disarticulating above the glumes but not between the florets, or falling entire; glumes hyaline to herbaceous, 1-3-nerved, shorter than or exceeding the lemmas, the lower adaxial (tiny or suppressed in *Tragus*), the upper occasionally dorsally awned; lemma 1-3-nerved, (5-11-nerved in *Lintonia*), membranous to coriaceous, keeled or flattened across the back, often hairy especially along the nerves, tip entire, emarginate or bifid, often with a straight apical or subapical awn. Caryopsis trigonous to dorso-ventrally flattened, with a large embryo and punctiform hilum, the pericarp sometimes free.

59 genera throughout the tropics, extending into N America.

Cynodonteae is closely related to *Eragrostideae*, differing mainly in the possession of spikelets which have only one fertile floret (although there are a few exceptions) and generally disarticulate only above the glumes. There is also a distinctive difference in facies, the inflorescence never being paniculate in *Cynodonteae*, but composed of close-packed secund spikes and often cuneate spikelets. There is a trend to reduction of the spikes to only a few spikelets, and to the spike itself becoming deciduous, and hence forming the disseminule. This trend reaches its culmination in the "bottlebrush" inflorescences of subtribe *Zoysiinae* (genera 89-94), where the spike may even be reduced to a single spikelet.

- 1. Spikelets with 2-5 fertile florets. 2
- Spikelets with a single fertile floret (often accompanied by reduced sterile florets). 3
- 2. Lemmas 5-11-nerved. 79. *Lintonia*
- Lemmas 3-nerved. 80. *Tetrapogon*
- 3. Spikes elongate, persistent on the main axis; spikelets disarticulating above the glumes. 4
- Spikes reduced to short clusters or single spikelets, deciduous from the main axis; glumes often ornamented. 11
- 4. Fertile floret accompanied by male or sterile lemmas, or if 1-flowered the lemmas with long intertwining awns. 5
- Fertile floret solitary. 10
- 5. Spikes clothed in long, intertwining, curling awns from the lemmas. 81. *Schoenefeldia*
- Spikes without long intertwining awns. 6
- 6. Upper glume with an oblique dorsal awn; spike curling. 82. *Ctenium*
- Upper glume awnless, or awned from near the tip. 7
- 7. Spikelets golden to dark brown; upper glume broad with a stout subapical awn. 83. *Eustachys*

- Spikelets pallid, purplish or blackish; upper glume acute to acuminate, unawned or with a fine terminal mucro. 8
- 8. Lemma entire to shortly bidentate. 9
- Lemma deeply cleft with 2 hyaline lobes exceeding the lemma body. 84. *Afrotrichloris*
- 9. Lemma keeled; grain trigonous to subterete; spikes digitate. 85. *Chloris*
- Lemma back flat; grain dorsally compressed; spikes solitary (except *E. priurii*). 86. *Enteropogon*
- 10. Glumes longer than and enclosing the floret. 87. *Microchloa*
- Glumes shorter than the floret, this exposed. 88. *Cynodon*
- 11. Inflorescence 1-sided, of spaced, burr-like spikelet clusters; spikelets 2-3-flowered. 89. *Melanocenchris*
- Inflorescence densely cylindrical; spikelets 1-flowered. 12
- 12. Glumes awnless or stiffly awn-pointed. 13
- Glumes with long slender awns. 15
- 13. Lower glume tiny or suppressed; upper glume with rows of stout hooked spines. 90. *Tragus*
- Both glumes well developed; variously ornamented but without spiny ribs. 14
- 14. Spikes of 2-3 spikelets separated by an internode; glumes beaked. 91. *Dignathia*
- Spikelets solitary or 2 side by side; glumes tuberculate, one lower glume extended into a flattened recurved tip. 92. *Leptothrium*
- 15. Spikelets ± glabrous, solitary, 2-awned. 93. *Perotis*
- Spikelets villous, paired, the disseminule 4-awned. 94. *Tetrachaete*

79. *LINTONIA* Stapf (1911)

Negria Chiov. (1912), non F. Muell. (1871), nom. illegit.; *Joannegria* Chiov. (1913), based on *Negria* Chiov.

Perennials; leaf-blades linear; ligule membranous. Inflorescence composed of several slender racemes arranged digitately or scattered along a central axis. Spikelets plump, several-flowered with 2-4 fertile florets and several progressively smaller sterile florets, disarticulating above the glumes but not between the florets; glumes shorter than the lemmas, membranous, 1-3-nerved, persistent; lemmas broad, rounded on the back, 5-11-nerved with the laterals confluent towards the base, tough and cartilaginous (at least partly), appressed-villous usually in longitudinal stripes, emarginate or 2-lobed with a stout subapical mucro or awn. Grain strongly dorso-ventrally compressed, the pericarp free.

2 species in eastern and southeastern Africa.

- 1. Inflorescence digitate; spikelets wedge-shaped; leaf-blades usually glabrous. 1. *L. nutans*
- Inflorescence racemose; spikelets broadly elliptic to subrotund; leaf-blades densely pilose. 2. *L. brizoides*

1. *L. nutans* Stapf (1911);

- type: Kenya, Nairobi, *Linton* 193 (K holo.).

Negria melicoides Chiov. (1912); *Joannegria melicoides* (Chiov.) Chiov. (1913); *Lintonia nutans* var. *melicoides* (Chiov.) Chiov. (1951) - type: Ethiopia, HA, road to Mt Assabot, *Negri* 1327 (FT holo.).

Shortly stoloniferous tussock grass; culms 25-75 cm high. Leaf-blades up to 22 cm long, 2.5-5 mm wide, usually glabrous. Inflorescence digitate, composed of (1)-2-4(-6) slender, curving racemes 4-11.5 cm long. Spikelets 4-10-flowered, wedge-shaped, 5.3-11 mm long; glumes 1-nerved, the lower narrowly lanceolate, 1.9-4.5 mm long, acuminate, the upper oblong, 3.3-5.8 mm long, obtuse; lemmas broadly elliptic to obovate, 4.4-6.7(-9.2) mm long, 7-11-nerved, the nerves thick, prominent, the outer confluent towards the base forming a toughened band, appressed-villous in 6 intercostal bands in the lower half, the hairs with thickened sharp-pointed tips, or occasionally more diffusely hairy, strigillose above; awn 0.8-10.5 mm long, scabrid, outwardly curving from a stout base, much shorter in the upper florets. Fig. 65:1-4.

Acacia bushland or grassland on black clay; a good indicator of black cotton soil; 600-1700 m. SU (eastern edge from Awash northwards), GG SD BA HA; southwards through East Africa to South Africa (Transvaal and Natal). *Burger* 2214; *Friis* et al. 3343; *Gilbert & Jefford* 4504.

The length of the awn is very variable and it may be reduced to a short stout mucro.

2. *L. brizoides* (Chiov.) C. E. Hubb. (1937);

Joannegria brizoides Chiov. (1929) - type:

Ethiopia, Darro, *Basile* in *Exped. Duke of Abruzzi* 364 (TO holo.).

Tussock-forming, stoloniferous perennial; culms 22-70 cm high. Leaf-blades 6-17 cm long, 3.5-5.5 mm wide, densely pilose. Inflorescence 8-12 cm long, composed of 6-8 loosely ascending, few-spiculate racemes up to 5 cm long scattered along a central axis. Spikelets 4-7-flowered, plump, broadly elliptic to subrotund, 5-7 mm long, loosely spaced on pedicels up to 1.2 mm long; lower glume broadly lanceolate, 0-1-nerved, 1.3-2 mm long, acute, upper glume broadly ovate, 3-nerved, 2.2-3.2 mm long, subacute to emarginate; lemmas ovate, deeply concave, 5-7-nerved (the lateral nerves grouped together and visible only from the inside), 3.6-4.3 mm long, tough, cartilaginous and appressed-villous with capitate hairs in 3 longitudinal bands over the central nerve and each group of laterals, membranous and glabrous between, tip minutely emarginate with a stout subapical awn-point 0.2-1.0 mm long. Fig. 65:5-8.

In shade of bushes in *Acacia-Commiphora* bushland on red sandy soil; SD (BA Webi Shebeli?); N Kenya. *Drake-Brockman* 179, 180; *Cufodontis* 513.

A rare grass, collected only a few times.

80. **TETRAPOGON** Desf. (1799)

Tufted annuals or perennials; leaf-blades linear; leaf-sheaths keeled, often flabellate; ligule a ciliolate membrane. Inflorescence composed of 1-8 digitate, secund spikes of biseriate, often villous spikelets. Spikelets plump, turbinate, several-flowered, disarticulating above the glumes, lower florets fertile, the lemmas progressively smaller and the upper florets reduced to one or more truncate, sterile, empty scales; glumes membranous, 1-nerved, usually acuminate-mucronate, ± equalling or exceeding the florets; lowest lemma broad, rounded or lightly keeled, coriaceous with marginal wings usually of thinner texture, hairy on the nerves, often conspicuously, tip emarginate with a subapical awn; palea-keels shortly ciliate; grain elliptic to obovate or rotund, trigonous to dorso-ventrally flattened.

5 species in tropical and North Africa, and Macaronesia, extending eastwards to India.

Tetrapogon is very closely related to *Chloris*, representing a branch from the main body of *Chloris* in which there is regularly more than one fertile floret per spikelet. Additionally, the large papery glumes and coriaceous lemmas characteristic of *Tetrapogon* are unusual in *Chloris*, which normally has smaller, firmer glumes and strongly keeled, cartilaginous lemmas.

1. Inflorescence embraced by the inflated uppermost leaf-sheath; glumes conspicuous, 6-10 mm long. 1. *T. cenchriformis*
- Inflorescence exerted, uppermost leaf-sheath not inflated; glumes 2.3-6 mm long. 2
2. Spikes 5-8; spikelets ferruginous. 2. *T. ferrugineus*
- Spikes 1-3; spikelets not ferruginous. 3
3. Lemmas shortly appressed-pilose on the nerves, 4-6 mm long. 3. *T. tenellus*
- Lemmas conspicuously villous, 2.5-3.7 mm long. 4. *T. villosus*

1. *T. cenchriformis* (A. Rich.) Clayton (1962);

Lepidopironia cenchriformis A. Rich., *Tent. Fl. Abyss.* 2: 442 & Atlas t. 101 (1850); *Chloris cenchriformis* (A. Rich.) Baill. (1893) - type: Ethiopia, TU, Ouodgerate, *Quartin Dillon & Petit* (P holo.).

Chloris geminata Hochst. (1855); *Tetrapogon geminatus* (Hochst.) Chiov. (1896) - type: Ethiopia, TU, Goelleb, *Schimper* in *Herb. Buchinger* 1370 (STR holo., P iso.).

Chloris spathacea Hochst. ex Steud. (1854); *Tetrapogon spathaceus* (Hochst. ex Steud.) Hack. ex Dur. & Schinz (1895) - type: Sudan, *Kotschy* 98 (P holo., K iso.).

Tetrapogon macranthus (Desv.) Benth. (1881) forma *monostachyus* Chiov. & forma *spathaceus* (Hochst. ex Steud.) Chiov. & forma *geminatus* (Hochst.) Chiov. in *Ann. Ist. Bot. Roma* 8:352 (1908) - types from Eritrea (FT syn.).



Figure 65. *LINTONIA* spp.: *L. NUTANS*: 1 - habit x 1/2; 2 - inflorescence x 1/2; 3 - spikelet x 5; 4 - lemma x 7. *L. BRIZOIDES*: 5 - habit x 1/2; 6 - inflorescence x 1/2; 7 - spikelet x 5; 8 - lemma x 7. 1 from Gilbert 1646; 2-4 from Mooney 8119A; 5 from Gillett 13354; 6-8 from Gilbert & Thulin 1666. Drawn by Eleanor Catherine.

Tufted annual or short-lived perennial; culms leafy, branching, prostrate or ascending to 50 cm, nodes blackish. Leaf-blades flat or folded, 2–10 cm long, obtuse; basal leaf-sheaths keeled, sometimes forming flabellate clusters. Spike solitary, partially enclosed by the inflated, spathe-like uppermost leaf-sheath, oblong, 2–7 cm long, silky-villous, curling at maturity as the florets are shed. Spikelets (5–)7–8-flowered, all the florets awned, lower 3 to 5 florets fertile, pallid or reddish-tinged; glumes lanceolate, exceeding the florets, the upper 6–10 mm long, the lower shorter and narrower; lowest lemma 3–6 mm long, coriaceous with membranous wings, conspicuously silky-villous around the midnerve and on the lateral nerves above with hairs 3–5 mm long, its awn 7–10.5 mm long; grain obovate, dorso-ventrally flattened. Fig. 66:3.

Dry, sandy or stony soils (often volcanic) in *Acacia* scrubland, open grass plains and by roadsides; 300–2600 m. EE AF EW TU SU AR GG SD BA HA; westwards to Mauretania and the Cape Verde Is.; East Africa; Arabia. *Gilbert & Getachew* 3070; *Hemming* 1534; *Thulin* 1315.

2. *T. ferrugineus* (Renvoize) S.M. Phillips (1987);

Chloris ferruginea Renvoize (1973) - type: Kenya, *Bally & Radcliffe-Smith* 14603 (K. holo.).

Tufted perennial from a short ascending rhizome; culms erect, 50–65 cm high. Leaf-blades tough, in-rolled, smooth and glabrous, the tip setaceous; ligule 2–4 mm long. Inflorescence subdigitate, composed of 5–8 racemes along an axis c 4 cm long; racemes 5–11 cm long, loosely ascending, flexuous. Spikelets plump, silky-hairy, glistening, golden-brown, 3-flowered with a pair of similar awned florets surmounted by a reduced, awnless empty lemma; glumes exceeding the florets, both acuminate-mucronate, 4–6 mm long; lowest lemma ovate, coriaceous with a membranous tip, rounded on the back, 2–2.5 mm long, villous, bearded on the upper margins with dense encircling hairs 2.5–3 mm long, abruptly acuminate, awned from above the middle, awn 4–4.8 mm long; 2nd lemma fertile or male, similar but slightly smaller; 3rd lemma empty, c 1.5 mm long; grain circular, dorso-ventrally flattened.

Dry limestone hills; 200–1100 m. SD; Somalia, N Kenya. *Rippstein* 894; *Gilbert & Vollesen* 7592, 7713.

T. ferrugineus is a very local grass, known only from a limited area of SW Sidamo and adjacent parts of NE Kenya and Somalia.

3. *T. tenellus* (Roxb.) Chiov. (1908);

Chloris tenella Roxb. (1820) - type: India, Roxburgh painting no. 2022 (K).

Chloris triangulata Hochst. ex A. Rich. (1850); *Tetrapogon triangulatus* (Hochst. ex A. Rich.) Schweinf. (1894); *Lepidopironia triangulata* (Hochst. ex A. Rich.) Hochst. ex Schum. in Engler (1895) as "*triangularis*" - type: Eritrea, Modat, *Schimper* 1048 (P holo.).

Tetrapogon triangulatus (A. Rich.) Schweinf. var. *agowensis*, Chiov. in *Ann. Ist. Bot. Roma* 6: 171 (1896), nom. nud. based on *Schimper* in Herb. Hohenacker 2207 (K).

T. triangulatus (A. Rich.) Schweinf. var. *sericatus* Chiov., l.c. (1896) - type: Ethiopia, TU, Soea, *Schimper* in Herb. Hohenacker 2207B (K iso.).

Slender tufted annual or short-lived perennial; culms erect or ascending, 30–60 cm high. Leaf-blades flat, scabrid on the upper surface, acuminate; leaf-sheaths keeled. Spikes solitary or paired, 3–7 cm long. Spikelets yellowish-green with purplish awns, 4–7 flowered, 3–4 awned with the 2 lower awns longer and conspicuous, the lower 3 to 5 florets fertile, the sterile upper lemmas reduced to small awnless scales; glumes equalling or slightly shorter than the spikelet, the upper ovate, 3.6–6 mm long, sharply acute, the lower a little shorter and narrower; lowest lemma lightly keeled, narrowly obovate in profile, 4–6 mm long, coriaceous throughout, shortly appressed-pilose on the nerves, its awn 4–11 mm long; grain narrowly trigonous, laterally compressed. Fig. 66:4, 5.

Stony or sandy soils in bushland, open woodland, along roadsides and as a weed of cultivation; 400–1700 m. EE AF EW TU SU KF GG SD BA HA; Sudan, southwards through East Africa to Zimbabwe and Angola; eastwards to India. *Burger* 901; *de Wilde* 10610; *Friis et al.* 3229.

4. *T. villosus* Desf. (1799);

Chloris villosus (Desf.) Pers. (1805) - type: Tunisia, *Desfontaines* (P holo.).

Densely tufted perennial, the leaves mainly basal with tough, tightly flabellate clusters of leaf-sheaths at the shoot bases; culms slender, up to 60 cm high, the nodes blackish. Leaf-blades tough, glaucous, tightly folded, pilose on the lower margins. Spikes 3–7 cm long, paired, villous, erect, adaxially adpressed and knitted together to appear as one, the tips occasionally separating at maturity. Spikelets 4–6-flowered, all florets awned, the lower 1–2 fertile; lower glume narrowly lanceolate-oblong, 2.3–3 mm long, acute; upper glume oblong, 3–4 mm long, obtuse and mucronate; lowest lemma elliptic to obovate, 2.6–3.7 mm long, coriaceous with membranous wings, ciliate along the lateral nerves and around the midnerve with conspicuous spreading hairs 2–3 mm long; its awn 6–9 mm long; grain plump, elliptic, shallowly trigonous. Fig. 66:1, 2.

Rocky, eroded hillsides, often with sparse ground cover; 1100–1800 m. EW TU SU SD HA; Canary Is. and North Africa, Sudan, Somalia, Uganda and eastwards to India. *Burger* 622; *M.G. & S.B. Gilbert & Te-wolde* 2478; *Gilbert* 3390.

T. bidentatus Pilg. is a similar perennial species with hairy spikelets from Kenya and N Tanzania. It is distinguished from *T. villosus* by its looser mode of



Figure 66. *TETRAPOGON* spp.: *T. VILLOSUS*: 1 - habit x 3/4; 2 - florets x 7. *T. CENCHRIFORMIS*: 3 - inflorescence x 3/4. *T. TENELLUS*: 4 - habit x 3/4; 5 - glumes and florets x 7. 1 & 2 from M.G. & S.B. Gilbert & Tewolde 2478; 3 from Thulin 1315; 4 & 5 from M.G. & S.B. Gilbert 1498. Drawn by Eleanor Catherine.

growth, with softer leaf-blades and less obvious basal flabellate leaf-sheath clusters. It also has pallid nodes, 2-3 spikes which are usually clearly separate, and an acuminate upper glume.

81. SCHOENEFELDIA Kunth (1829)

Tufted annual or perennial; leaf-blades linear; ligule a narrow ciliate rim. Inflorescence of solitary, paired or digitate slender spikes, these clothed with the long, interweaving, curling awns. Spikelets with one fertile floret, with or without a second reduced floret above it, disarticulating above the glumes; glumes exceeding the floret, hyaline, 1-nerved, lanceolate, the lower mucronate to short-awned, the upper slightly longer, sharply acuminate; lemma keeled, elliptic-oblong; membranous, becoming thinly cartilaginous and shining, pilose on the back or nerves, bidentate, a long, sinuous, scabrid awn arising between the teeth; second floret (when present) also awned; palea subequalling the lemma; callus short, laterally bearded. Grain with a free pericarp.

2 species in tropical Africa, Madagascar, Arabia, Pakistan and India.

The genus *Schoenefeldia* can be readily recognized by its sinuous, interweaving awns clothing the slender spikes.

1. Annual; spikelets strictly 1-flowered without a rhachilla-extension. 1. *S. gracilis*
- Perennial; spikelets 2-flowered, the upper an awned vestige on a rhachilla-extension. 2. *S. transiens*

1. *S. gracilis* Kunth (1830);
- type: Senegal, Roger (K iso.).

Annual; culms slender, geniculately ascending, 20-90 cm high, smooth and glabrous. Leaf-blades tough, flat or loosely rolled, 2-9 cm long, long-pilose near the ligule. Inflorescence of 1-2(-4) pale green, straight spikes 4-8(-11) cm long. Spikelets 1-flowered without a rhachilla-extension; glumes scabrid on the keel, the lower 2-2.8 mm long, acute and tipped with a mucro 0.3-0.6 mm long, the upper 2.7-4 mm long; lemma 1.7-2.5 mm long, dark greyish-brown, appressed-pilose; awn 2-4 cm long. Fig. 67:1, 2.

Dry grassland on sandy soils; 450-1000 m. AF EW TU GD; westwards to Senegal and eastwards through the Arabian peninsula to Pakistan and India; Madagascar. *Burger* 2165; *Hemming* 1032; *Pappi* 6019.

2. *S. transiens* (Pilg.) Chiov. (1916);
Chloris transiens Pilg. (1914) - type: Tanzania, Uhlig 882 (B holo., EA iso.).

Densely tufted perennial; culms erect or geniculately ascending, 70-120 cm high. Leaf-blades up to 35 cm long, scaberulous on both sides or smooth below, glabrous or loosely pilose. Inflorescence of 2-4, pale green, straight or flexuous, slender spikes 10-20 cm long. Spikelets 2-flowered with the reduced upper floret tip-

ping a rhachilla-extension; lower glume 2-3 mm long with an awn 1-2.5 mm long; upper glume 3.5-5 mm long; fertile lemma 3-4 mm long, ciliate on the nerves, with a scaberulous awn 2.5-4 cm long; sterile lemma 0.5-1 mm long with an awn 1-1.6 cm long.

Dry grassland on sandy soils; up to 1100 m. SE Sudan, S Somalia, N Kenya and southwards along the coastal lowlands to Mozambique. Reported from Ethiopia [Fröman & Persson, *Ill. Guide Grasses Eth.*: 116 (1974)].

82. CTENIUM Panzer (1813), nom. conserv.

Clayton in *Kew Bull.* 16: 471-476 (1963).

Tufted annuals or perennials; leaf-blades linear or involute; ligule a narrow membranous rim. Inflorescence composed of solitary or digitate 1-sided spikes, these usually curling or spirally coiled. Spikelets strongly laterally compressed, disarticulating above the persistent glumes, the florets enclosed within the large upper glume, the two lowermost florets sterile, composed only of empty lemmas, third floret fertile, fourth floret smaller, male or sterile, sometimes with a palea, the rhachilla prolonged above it; glumes very unequal, divergent, thinly membranous, sometimes with lines of yellow glands, cuspidate or awn-tipped, the lower lanceolate, the upper much longer, oblong with a stout, oblique, dorsal awn; lemmas thinly membranous, strongly keeled, finely awned from or near the tip, conspicuously ciliate on the nerves, sometimes also pilose on the back; palea subequalling the lemma.

About 17 species, 8 in tropical Africa, the remainder in tropical and subtropical America.

The oblique dorsal awns of the upper glumes overlap to form a line down the spike parallel with the rhachis, and provide an easy character for the recognition of the genus.

C. somalense (Chiov.) Chiov. (1919);

C. nubicum De Not. var. *somalense* Chiov. in *Ann. Ist. Bot. Roma* 7: 72 (1897) - type: Ethiopia, SD, Gobbo Duaya near Coromma, Riva 180 (1486) (FT lecto.).

C. concinnum sensu Fröman & Persson, *Ill. Guide Grasses Eth.*: 44 (1974), non Nees (1841).

Slender, densely tufted perennial; culms erect, up to 1 m high, surrounded at the base by a dense mass of fine fibres from the old leaf-sheaths; leaf-blades involute, aromatic, flexuous. Spikes solitary (rarely paired), 5-10 cm long, curling, bearded at the junction with the culm. Spikelets greyish-green; glumes with yellow glands on the nerves, the upper 4.5-5 mm long, its dorsal awn 3-6 mm long; two lower sterile lemmas elliptic-oblong, 1.7-3 mm long, glabrous or thinly appressed-pilose between the ciliate nerves, an awn 4.5-9 mm long arising below the tip; fertile lemma ovate, 2.7-3.5 mm long, long-ciliate on the upper part of the marginal



Figure 67. *SCHOENEFELDIA GRACILIS*: 1 - habit x 3/4; 2 - glumes and floret x 7. *AFROTRICHLORIS HYALOPTERA*: 3 - habit x 3/4; 4 - inflorescence x 3/4; 5 - glumes x 7; 6 - lower lemma x 7. 1 & 2 from Hemming 1032; 3 from Wieland 4329; 4-6 from Elmi & Hansen 4052. Drawn by Eleanor Catherine.

nerves, otherwise glabrous, an awn 3–5 mm long arising from the tip. Fig. 68.

Open places in deciduous bushland; up to 2000 m. SU (near Awash) SD; southwards through East Africa to Zambia, Sudan (Jebel Marra), Zaire; Madagascar. *Drake Brockman* 126; *Mooney* 9975 (ETH); *Yoseph K11* (ETH).

C. concinnum Nees is a similar species with a more southerly distribution in Africa, with chaffy, non-fibrous basal sheaths and a longer fertile lemma (4–4.5 mm long).

83. EUSTACHYS Desv. (1810)

Annuals or perennials. Leaf-blades linear, leaf-sheaths keeled, flabellate; ligule a ciliate rim. Inflorescence a digitate head of slender brown spikes with closely packed spikelets. Spikelets 2-flowered, lower floret fertile, the upper male or sterile, disarticulating above the glumes; glumes broad, a little shorter than the spikelet, membranous, the upper slightly longer with a stout, oblique awn arising below the tip; fertile lemma broad, keeled, cartilaginous to chartaceous, hairy on the nerves, acute to emarginate, sometimes with a fine, subapical awn-point; palea equalling the lemma; 2nd lemma smaller, often lacking a palea.

10 species; tropics and subtropics, mainly in the New World.

Eustachys is closely related to *Chloris*, the chief distinction being the broad, subapically awned upper glume. The spikes of brown, very tightly packed spikelets, lacking conspicuous awns, also give *Eustachys* species a different facies from *Chloris*.

E. paspaloides (Vahl) Lanza & Mattei (1910);

Cynosurus paspaloides Vahl (1791) - type: South Africa, Cape, *Bulow* (C holo.).

Chloris petraea Thunb., *Prodr.*: 20 (1794), non *C. petraea* Sw. (1788).

Chloris equitans Trin. (1836).

Chloris paspaloides Hochst. (1855) - type: Ethiopia, TU, Dschadscha, *Schimper* in Herb. Buchinger 1400 [400 in protologue] (STR holo.).

Eustachys muticus sensu Cuf., *Enum.*: 1293 (1969), non *Andropogon muticus* L. (1763). See note in *Fl. Trop. E. Afr.*, *Gramineae*: 337 (1974).

Loosely tufted perennial from a knotty rhizome; culms ascending to 80 cm, much branched at the lower nodes with flabellate clusters of keeled leaf-sheaths. Leaf-blades glabrous, flat or folded, abruptly acute. Inflorescence of 2–10 erect or ascending, golden to dark brown spikes 2.5–9 cm long. Spikelets 1.7–2.2 mm long; lower glume narrowly ovate, 1–1.5 mm long, subacute; upper glume oblong, 1.4–1.7 mm long, an awn 1–2 mm long arising below the broad, emarginate tip; fertile lemma ovate, 1.5–2.4 mm long, shortly ciliate on the margins

and lower keel, broadly emarginate with hyaline, rounded lobes, awn 0.5–0.7 mm long; 2nd lemma male or sterile, oblong, 1.2–1.7 mm long, its palea often reduced; rachilla filiformly extended and crowned with a minute third lemma. Fig. 69.

Forest, deciduous woodland and dry bushland, often on limestone slopes; 1100–2500 m. EW TU SU SD HA; southwards to the Cape, also in southern parts of the Arabian peninsula. *Friis* et al. 895; *M.G. & S.B. Gilbert* 2191; *Ryding* 1314 (ETH).

*84. AFROTRICHLORIS Chiov. (1915)

Tufted perennials. Leaf-blades narrow, convolute; ligule a narrow ciliate membrane. Inflorescence a solitary, terminal, 1-sided spike with closely imbricate, biseriate, sessile spikelets along a tough, flattened rachis. Spikelets several-flowered with only the lowest floret fertile, the remainder reduced to a cluster of sterile, empty lemmas, disarticulating above the glumes; glumes shorter than the lemmas, scarious, narrowly lanceolate, acuminate, unequal, the lower 1-nerved, the upper longer, 3–5-nerved; fertile lemma ovate, coriaceous, rounded on the back, villous, hairy along the margins, the tip deeply bifid, long-awned from the sinus, the lobes scarious, longer than the lemma body, acuminate or aristulate; palea equalling the lemma body; sterile lemmas long-awned, similar to the fertile lemma but progressively smaller.

2 species in northeast tropical Africa.

Afrotrichloris can be recognized by its deeply cleft lemmas.

A. hyaloptera Clayton (1967);

- type: Somalia, Bulu Burti, *Roffrey* 60041/5 (K holo.).

Densely tufted perennial; culms erect, 30–70 cm high. Leaf-blades tough, flexuous or curling, smooth and glabrous, setaceous-tipped; ligule 0.5 cm long, bearded behind at the blade base. Spike linear, 14–20 cm long. Spikelets 6–8-flowered, straw-coloured with purplish awns; lower glume 7 mm long, upper glume 5-nerved, 9.5–10.5 mm long; fertile lemma 4–5 mm long, spreading-villous on the back, silky-ciliate on the margins, awn 2–2.5 cm long, curving, apical lobes acuminate, 7–9 mm long, without nerves or awns; sterile lemmas 5–7 clustered together. Fig. 67:3–6.

Open bushland on dry, sandy soils; 400 m. HA; Somalia. *Simmons* 165.

The second species in the genus, *A. martinii* Chiov., appears to be confined to the coastal sand-dunes of central Somalia. It is distinguished by its shorter, oblong-ovate spike, by the longer central awn (3–4 cm long) and elongate lateral lemma lobes (c 35 mm long), each with a central nerve attenuate into a fine awn.

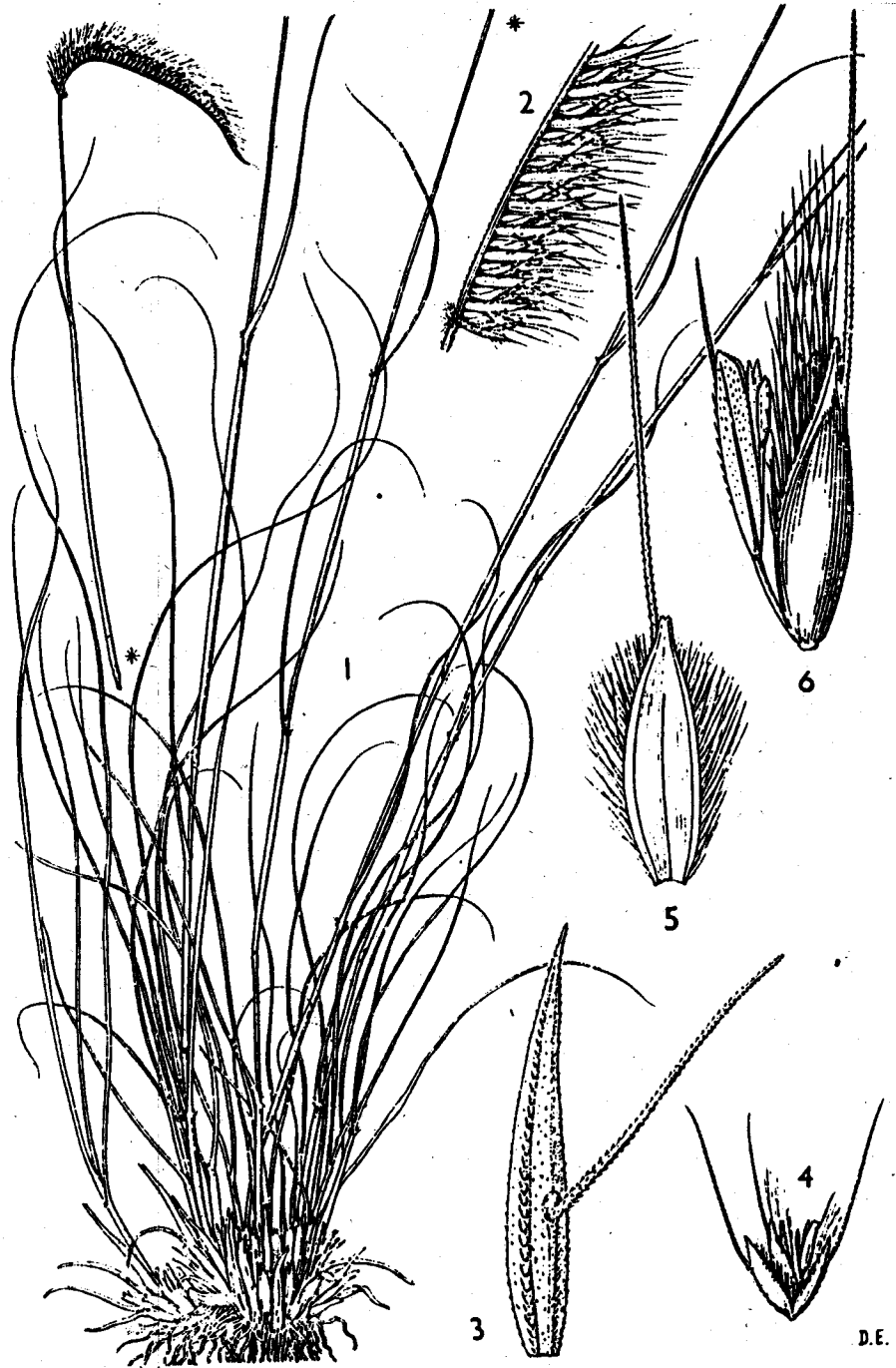


Figure 68. *CTENIUM SOMALENSE*: 1 - habit x 2/3; 2 - part of spike x 2; 3 - upper glume x 12; 4 - spikelet with glumes removed; 5 - lowest lemma x 12; 6 - fertile floret and upper sterile lemmas x 12. All from Verdcourt 3308. Drawn by D. Erasmus. (Modified from *Fl. Trop. E. Afr. Gramineae* 2: Fig. 91, with permission of the Editors).

85. *CHLORIS* Sw. (1788)

Anderson in Brigham Young Univ. Sci. Bull., Biol. Ser. 19, 2 (1974).

Tufted or stoloniferous annuals or perennials. Leaf-blades linear; ligule a short ciliolate membrane; basal leaf-sheaths rounded or keeled. Inflorescence composed of digitate or subdigitate, slender, 1-sided spikes (very rarely the spikes racemose), with closely overlapping, short-pedicelled, biseriate spikelets. Spikelets 2- to several-flowered with only the lowermost floret fertile, successive florets male or sterile and progressively reduced, disarticulating above the glumes; glumes usually shorter than the florets, unequal with the upper longer, lanceolate, 1-nerved, membranous, often acuminate-

mucronate; fertile lemma cartilaginous or infrequently coriaceous, lanceolate to obovate, usually keeled, glabrous or pilose, especially on the keel and margins, subapically mucronate or awned; palea equalling the lemma; callus shortly bearded; subsequent florets reduced, similar to the fertile floret, or different in shape or vestigial; grain trigonous.

About 55 species in tropical and warm temperate regions throughout the world.

1. Spikes crowded along an axis up to 10 cm long, numerous, forming a feathery head.

1. *C. roxburgiana*

— Spikes digitate or subdigitate, not exceeding 20, usually much fewer, rarely solitary.



Figure 69. *EUSTACHYS PASPALOIDES*: 1 - habit x 2/3; 2 - glumes x 24; 3 - florets x 24. All from Glover & Samuel 3165. Drawn by D. Erasmus. (Reproduced from *Fl. Trop. E. Afr. Gramineae* 2: Fig. 95, with permission of the Editors).

- D.E.
- | | | | |
|---|----------------------|--|---|
| 2. Lemmas conspicuously silky-hairy from the margins, with spreading hairs > 1.5 mm long. | 3 | 5. Spikelets 0-2-awned. | 5 |
| - Lemmas glabrous or only shortly hairy. | 4 | 5. Awns absent or up to 10 mm long; 1st lemma elliptic to obovate; 2nd lemma well developed, 1.5-3 mm long. | 6 |
| 3. Spikes (1-)2-3(-4), embraced by the inflated uppermost leaf-sheath; fertile lemma usually dark brown at maturity, bearded along the length of the margins. | | - Awns (6-)10-25 mm long; 1st lemma narrowly lanceolate; 2nd lemma vestigial, 0.1-1 mm long on a filiform rhachilla. | 8 |
| 2. <i>C. lamproparia</i> | | 6. Perennials, often stoloniferous; 1st lemma elliptic; 2nd lemma narrowly lanceolate or oblong. | 7 |
| - Spikes 4-15, clearly exserted; fertile lemma pallid or purplish, bearded on the upper margins only. | 3. <i>C. virgata</i> | - Tufted annual; 1st lemma obovate, the keel gibbous; 2nd lemma broadly cuneate, inflated. | |
| 4. Spikelets 3(-4)-awned. | 4. <i>C. barbata</i> | 5. <i>C. pilosa</i> | |

7. Spikelets 3(-4)-flowered, 2-awned; awn 2.4-10 mm; spikes 5-20; leaf-blades tapering.
6. *C. gayana*
- Spikelets 2-flowered, 0-1-awned; awn 0.1-2.5 (-4) mm; spikes 4-8; leaf-blades abruptly acute.
7. *C. amethystea*
8. Annual; leaf-blades obtuse; spikes 2-10, purple-tinged.
8. *C. pycnothrix*
- Perennial; leaf-blades setaceous-tipped; spikes 2-4, olive-green.
9. *C. mensensis*

1. *C. roxburghiana* Schult. (1824);
- type: India, Roxburgh painting no. 2023 (K).
C. myriostachya Hochst. (1855) - type: Ethiopia, TU, Gageros, Schimper in Herb. Buchinger 1416 (STR holo., BR iso.).
C. myriostachya Hochst. var. *minor* Chiov. in *Ann. Ist. Bot. Roma* 8: 54 (1903) - types: Eritrea, Terracciano & Pappi 1530 & 1531 (FT syn.).

Coarse tussocky perennial with tough spreading stolens; culms up to 1.5 m high. Leaf-blades flat or folded, scabrid; basal sheaths strongly keeled, flabellate. Inflorescence dense, soft and feathery, pale or purplish, composed of many slender spikes 3-7 cm long crowded along a central axis up to 10 cm long. Spikelets usually 3-flowered, the single fertile floret surmounted by 2(-3) sterile florets on a slender rachilla, all 3 florets long-awned; glumes unequal, the lower 0.8-1.5 mm long, acuminate, the upper linear-lanceolate, 1.3-2.7 mm long, acute, usually mucronate; fertile lemma narrowly elliptic, 1.5-2 mm long, sparsely pubescent on the keel and margins, sometimes also on the flanks, emarginate, a slender, flexuous awn 8-15 mm long arising from the sinus; sterile lemmas reduced to small, glabrous, long-awned scales. Fig. 70:1, 2.

Grassland and *Acacia* bushland, often on dry sandy soils; 600-1600 m. EE AF EW TU WU SU KF GG SD BA HA; Yemen; eastern Africa southwards to South Africa (Transvaal); also in S India. *Burger* 2899; *Friis* et al. 2865; *Mooney* 8117.

C. roxburghiana is easily distinguished from all other species of *Chloris* by its soft brush-like head of numerous spikes spread over an elongate axis.

2. *C. lamproparia* Stapf (1912);
- type: Chad, Chevalier 9633 (P holo., K iso.).

Tufted annual; culms 10-60 cm high, erect or ascending, sometimes rooting at the lower nodes. Leaf-blades flat, 4-20 cm long, 2-5 mm wide with long scattered hairs, especially near the ligule, acuminate. Inflorescence of (1-)2-4, paired or closely digitate, silky golden brown spikes c 4 cm long embraced by the inflated uppermost leaf-sheath. Spikelets 3-4-flowered, 2-awned; glumes sickle-shaped, acuminate; lower glume 2-4.5 mm long, golden brown, papery; upper glume 4.2-8 mm long, pale brown, membranous; fertile lemma obliquely lanceolate in profile, 3-4 mm long, coriaceous, usually dark brown at maturity but occasionally pallid, appressed-ciliate on the keel, ciliate along the

margins with spreading hairs 1.5-4 mm long, awn 4-6 mm long; sterile lemmas 2 or 3, truncate, aggregated into a clavate appendage projecting from the side of the lowest lemma, 2nd lemma bearing an awn 2.2-4 mm long, subsequent sterile lemmas awnless.

Open places on shallow sandy soils over rock; 1400 m. GD; Uganda, Tanzania, Sudan, Chad and N Nigeria. *Tewolde B.G.E.* 821 (ETH).

3. *C. virgata* Sw. (1797);
- type: Antigua, Swartz (S holo.).
C. multiradiata Hochst. (1855); *C. polydactyla* Sw. subsp. *multiradiata* (Hochst.) Chiov. in *Ann. Ist. Bot. Roma* 8: 54 (1903) - type: Ethiopia, without precise locality, coll. 1853, Schimper in Herb. Buchinger 486 (STR holo., K iso.).
C. notocoma Hochst. (1855) - type: Ethiopia, without precise locality, Schimper in Herb. Hohenacker 2125 (P iso.).

Tufted annual; culms erect or geniculately ascending, 15-100 cm high. Leaf-blades flat or folded, scabrid especially on the upper surface and margins, acuminate; basal leaf-sheaths strongly keeled. Inflorescence of 4-15 digitate, silky, erect spikes 2-8 cm long. Spikelets 2(-3)-flowered, 2-awned; lower glume 1.8-2.2 mm long; upper glume 2.7-4 mm long; fertile lemma narrowly obovate, 3-3.5 mm long, the keel gibbous, conspicuously bearded on the upper margins with encircling silky hairs 2.5-3.5 mm long, silky-ciliate on the keel and lower margins (or the keel glabrous), awn 6.5-10 mm long; 2nd lemma narrowly cuneate, empty, glabrous, about 2/3 as long as the fertile lemma, awned; a vestigial 3rd lemma occasionally present. Fig. 70:5.

Acacia scrubland, grassland, disturbed situations and as a weed of cultivation; sea level-1700 m. EE EW TU GD SU AR HA; tropics and warm temperate regions throughout the world. *Burger* 970; *Gilbert & Getachew* 2942; *Mooney* 8134.

A widespread and variable annual, recognized by the conspicuous tufts of spreading silky hairs on the lemma shoulders.

4. *C. barbata* Swartz (1797);
Andropogon barbatus L. (1771) non L. (1759), nom. illegit. - type: India (LINN holo.).
C. inflata Link (1821).

Loosely tufted annual or short-lived perennial; culms up to 1 m high, ascending or decumbent at the base and rooting at the lower nodes. Leaf-blades flat or folded, scabrid especially on the upper surface, acute. Inflorescence of 5-15 digitate, ascending, purple-awned spikes 3-8 cm long. Spikelets 3(-4)-flowered, 3(-4)-awned, the upper lemmas sterile, empty, overlapping to form a knob at the side of the fertile floret; glumes acute, the lower 1.2-1.5 mm long, the upper 1.7-2.5 mm long; fertile lemma elliptic, 1.7-2.5 mm long, lightly keeled, pilose on the keel, ciliate on the upper margins with

hairs 1–1.5 mm long, the awn 4.5–7 mm long; 2nd lemma clavate, 1–1.5 mm long, glabrous or sparsely appressed-pilose on the keel, its awn ± as long as the awn of the fertile floret, 3rd (and 4th) lemma orbicular, inflated, the awn somewhat shorter.

Poor dry soils, and as a weed in waste areas; EE AF; widespread in tropical and warm temperate regions, particularly in coastal areas. *Gezahegne* 6.

5. *C. pilosa* Schumach. (1827);

- type: Ghana [Guinea], *Thorning* s.n. (C holo.).

Tufted annual; culms slender to fairly robust, 25–100 cm high, erect or geniculately ascending and rooting at the lower nodes. Leaf-blades flat, scabrid, tapering to a fine point, bearded at the junction with the sheath. Inflorescence of 4–13 loosely digitate spikes 2–7 cm long. Spikelets 3-flowered, 2-mucronate or awned, turbinate, conspicuously flat-topped, pallid or blackish; lower glume 1.5–2 mm long, upper glume 2.5–3.5 mm long including the mucro; fertile lemma narrowly obovate, 2.5–3.5 mm long, the keel gibbous, sericeous, the margins silky-pilose with the hairs slightly longer upwards but not prominently bearded, mucronate or with an awn to 6 mm long; 2nd lemma broadly cuneate, inflated, 1.5–2.5 mm long, empty, mucronate or short-awned; 3rd lemma turbinate, an inflated empty scale 1–1.5 mm long.

Disturbed weedy situations; usually below 1000 m. EW GD (Sudan border); East Africa, Zaire, and westwards to Senegal and the Cape Verde Is. *Pappi* 5986; *Schweinfurth* 1007.

C. pilosa exhibits a wide range of awn length, and those specimens in which the awn is reduced to a small mucro present a rather different facies from those with longer awns. It is related to *C. virgata*, but is much rarer in Ethiopia, and lacks the long, silky lemma hairs of that species. The broad, inflated, flat-topped sterile lemmas are a characteristic feature of *C. pilosa*.

6. *C. gayana* Kunth (1830);

Eustachys gayana (Kunth) Mundy (1922) - types: Senegal, *Herb. Gay* 21 & 40 (both K isosyn.).

C. abyssinica Hochst. ex A. Rich. (1850) - types: Ethiopia, TU near Adoa, *Schimper* 79 & near Djeladjeranne, *Schimper* 1800 (both P syn., K isosyn.) & *Quartin Dillon* s.n. (P syn.).

C. repens Hochst. (1855) - type: Ethiopia, GD, Semien, *Schimper* in Herb. *Buchinger* 1110 (STR holo., P iso.).

C. multiradiata Hochst. var. *ragazzi* Pirota in *Ann. Ist. Bot. Roma* 6: 157 (1896) - type: Ethiopia, SU, Cora, *Ragazzi* s.n. (FT holo.).

Robust perennial, usually stoloniferous; culms 0.5–1.5(–3) m high. Leaf-blades flat, scabrid, finely tapering. Inflorescence of 5–20 digitate, greenish-brown spikes 4–12 cm long, loosely erect or somewhat divaricate, often slightly flexuous. Spikelets 3(–4)-flowered, 2-awned; lower glume 1.5–2.5 mm long; upper glume

2–4 mm long including the awn-point; fertile lemma elliptic, 2.5–3.5 mm long, shortly appressed-sericeous on the lower margins, a tuft of hairs 0.5–1.5 mm long on the upper margins, the keel glabrous or sparsely to densely sericeous, awn 2.4–10 mm long; 2nd lemma usually male, narrowly lanceolate or cuneate, glabrous, the body and awn a little shorter than the fertile floret; 3rd (and 4th) lemma reduced to a small, clavate, awnless scale. Fig. 70:6.

Open grassland, *Acacia* scrubland and in woodland clearings; 700–2000 m. EW TU GD WU GJ WG SU AR GG SD; tropical and South Africa, widely introduced as a fodder grass (Rhodes Grass) and naturalized throughout the tropics and subtropics. *Gilbert & Te-wolde* 2479; *Mesfin Tadesse & Kagne* 1797; *Mooney* 8114.

A valuable forage grass, which varies widely in habit, plant height, lemma pubescence and awn length. It is usually a robust, strongly stoloniferous grass but tufted forms also occur occasionally.

7. *C. amethystea* Hochst. (1855);

- type: Ethiopia, GD, Semien, *Schimper* in Herb. *Buchinger* 1267 (STR holo., P iso.).

Loosely tufted perennial, usually stoloniferous; culms 60–90 cm high. Leaf-blades flat or folded, scabrid, abruptly acute; basal leaf-sheaths strongly keeled, sometimes flabellate. Inflorescence of 4–8 loosely ascending or spreading flexuous spikes 7–10 cm long, digitate or subdigitate over a short axis to 1 cm long. Spikelets 2-flowered, 0–1-awned; glumes narrowly oblong, the lower 2–2.2 mm long, the upper 3–3.5 mm long; fertile lemma narrowly elliptic, 3–4 mm long, lightly keeled, often becoming flattened above, appressed-pilose on the keel and margins, obtuse, inconspicuously mucronate or a fine awnlet to 2.5(–4) mm long arising below the tip; 2nd lemma 1.5–2.5 mm long, a sterile, empty, cuneate scale, unawned or rarely with a mucro to 1 mm long. Fig. 70:7.

Grassland with *Acacia*, and woodland margins; 1500–1800 m. TU GD GG SD; Kenya. *Friis, Mesfin & Vollesen* 3092; *Gilbert & Getachew* 2647; *Gilbert & Phillips* 9074.

C. amethystea is most likely to be confused with *C. gayana*, a commoner, generally taller, more robust grass with longer, more tapering leaf-blades and a strictly digitate head of usually more numerous spikes. The 2-flowered, inconspicuously awned spikelets of *C. amethystea* provide a reliable means of distinguishing it from *C. gayana*, which always has at least 3 florets in the spikelet.

8. *C. pycnothrix* Trin. (1824);

- type: Brazil, *Chamisso* (LE holo.).

C. leptostachya Hochst. ex A. Rich. (1850) - type: Ethiopia, TU, Adua, *Schimper* 951 (P holo., K iso.).



Figure 70. *CHLORIS* spp.: *C. ROXBURGHIANA*: 1 - habit x 3/4; 2 - florets x 11. *C. PYCNOTHRIX*: 3 - habit x 3/4; 4 - florets x 11. *C. VIRGATA*: 5 - florets x 11. *C. GAYANA*: 6 - florets x 11. *C. AMETHYSTEAE*: 7 - florets x 11. 1 & 2 from Thulin et al. 3558; 3 & 4 from Ash 2591; 5 from Burger 970; 6 from Mooney 8114; 7 from Friis et al. 3092. Drawn by Eleanor Catherine.

C. intermedia A. Rich. (1850); *C. leptostachya* var. *intermedia* (A. Rich.) Th. Dur. & Schinz, *Consp. Fl. Afr.* 5: 861 (1895) - type: Ethiopia TU, Shire, *Quartin Dillon & Petit* s.n. (P holo.).

C. radiata sensu Cuf., *Enum.*: 1291 (1969), non Swartz (1788).

Loosely tufted annual; culms 15–80 cm high, ascending or decumbent at the base, sometimes shortly stoloniferous and rooting at the lower nodes. Leaf-blades broadly linear, 1.5–13 cm long and 3–6 mm wide, flat or folded, the tip rounded. Inflorescence digitate or subdigitate, composed of 2–10 feathery, long-awned, purple-tinged spikes 3–9 cm long; spikes ascending at first, spreading or outwardly curling at maturity. Spikelets 2-flowered, 1–2-awned; glumes linear-lanceolate, acuminate-mucronate, the lower 1–1.8 mm long, the upper 1.5–3 mm long; fertile lemma narrowly elliptic, 2–3 mm long, scabrid in the upper half, acute, the awn 10–25 mm long; 2nd lemma a sterile, narrow rudiment 0.1–1.0 mm long, borne on a filiform rhachilla 1–1.5 mm long, awnless or with a fine awn up to 8 mm long.

Fig. 70:3, 4.

Short grassland, woodland margins, roadsides and other disturbed places; 1200–2000 m. EW TU GD GJ WU SU AR IL KF GG SD BA HA; tropical and South Africa; S America. *Burger* 1116; *De Wilde & Gilbert* 254; *Friis et al.* 1052.

9. *C. mensensis* (*Schweinf.*) Cuf. (1968);

Gymnopogon mensense Schweinf. (1894) - type:

Eritrea, Gheleb, *Schweinfurth* 1510 (B holo.).

C. somalensis Rendle (1899).

[*C. incompleta* auct., non Roth (1821)].

Tufted perennial; culms lax, 55–100 cm high. Leaf-blades flat or inrolled, glabrous, the tip setaceous; basal leaf-sheaths strongly flattened. Inflorescence of 2–4 digitate, olive-green, loosely ascending or widely spreading spikes 6–16 cm long. Spikelets 2-flowered, long-awned; glumes linear-lanceolate, both acuminate and mucronate, the lower 1.8–3.5 mm long, the upper 4.2–5.8 mm long; fertile lemma narrowly lanceolate, 3.4–4.7 mm long, lightly keeled, scattered-pilose near the margins and towards the tip, callus bearded, the awn (6–)10–20 mm long; 2nd lemma borne on a filiform rhachilla 2 mm long, usually a sterile rudiment 0.5 mm long (rarely larger and male), its awn very variable, 2–15 mm long.

Dry open scrubland and grassland; 1300–2200 m. EW TU SU SD BA; Somalia. *Friis et al.* 970; *Gillett* 14296; *Gilbert & Vollesen* 7707.

C. mensensis appears to be a local, little collected species. It can be recognized by its tufted habit and open inflorescence of relatively few, olive-green, long-awned spikelets with a normally rudimentary second floret.

86. ENTEROPOGON Nees (1836)

W. D. Clayton in *Kew Bull.* 21: 107 (1967) & 37: 418 (1982).

Tufted perennials (very rarely annual); leaf-blades linear or filiform, tapering to a setaceous tip; ligule ciliate. Inflorescence usually a solitary, 1-sided, slender spike of biseriate, imbricate, awned spikelets, occasionally composed of several digitate spikes. Spikelets narrow, 2–3(–6)-flowered, disarticulating above the glumes, only the lowest floret fertile, 2nd floret male or sterile, remaining lemmas (when present) empty and reduced; glumes unequal with the upper longer, lanceolate, 1-nerved, membranous; fertile lemma with a bearded callus, narrowly elliptic, dorsally flattened, the central nerve prominent, scabrid, awned from the acute or emarginate tip; 2nd lemma resembling the fertile lemma but somewhat smaller, often also with callus hairs at its base; grain narrowly oblong, dorsally flattened.

17 species throughout the tropics and subtropics.

Enteropogon is very closely related to *Chloris*. The two genera have traditionally been separated by their inflorescence, *Chloris* having a digitate head of spikes and *Enteropogon* a single, terminal, slender, drooping spike. However, in some species of *Enteropogon* more than one spike may be present, and a more natural separation of the two genera can be achieved by considering characteristics of the lemma and grain. *Chloris* typically has an ovate, keeled lemma and a trigonous grain, whilst *Enteropogon* has a narrow, dorsally compressed lemma with a prominent raised midnerve, and a dorsally flattened grain. Whilst most species can be satisfactorily assigned to either *Chloris* or *Enteropogon* on this basis, there remain a few intermediate species whose placement is still doubtful. *E. prieurii* is one such species, put here under *Enteropogon* on account of its dorsally flattened lemma and grain, but in its general facies, annual habit and hairy lemmas it more closely resembles *Chloris*.

1. Inflorescence of 4–9 digitate spikes. 1. *E. prieurii*
– Spikes solitary (very rarely paired). 2
 2. Callus hairs of lowest floret 3–5 mm long; leaf-sheaths keeled, hairy along the margins. 2. *E. barbatus*
– Callus hairs of lowest floret 1–2 mm long; leaf-sheaths rounded, glabrous. 3
 3. Awns 10–20 mm long. 3. *E. macrostachyus*
– Awns 1–5 mm long. 4. *E. rupestris*
1. *E. prieurii* (*Kunth*) Clayton (1982);
Chloris prieurii Kunth (1831) - type: Senegal, *Leprieur* (P holo., K iso.).

Tufted annual; culms geniculately ascending, 15–110 cm high. Leaf-blades flat; leaf-sheaths keeled. Inflorescence a digitate head of 4–9 ascending racemes 5–12 cm long. Spikelets 4–6 flowered, long-awned, the flo-

rets becoming blackish at maturity; lower glume 1.2–2.5 mm long; upper glume 2.2–4.5 mm long, mucronate; fertile lemma 3–5 mm long, glandular along each side of the midnerve, pilose on the upper margins, callus acute and bearded, awn 7–25 mm long; palea glandular between the keels; upper lemmas reduced to sterile, narrow, long-awned scales.

Dry sandy soils. EW; Macaronesia, west tropical Africa, Sudan, Tanzania, Namibia, and in Arabia. *Hemming* 1027 (pro parte).

2. *E. barbatus* C. E. Hubb. (1941);
- type: Somalia, *Gillett* 4196 (K holo.).

Perennial forming dense tussocks; culms erect, 40–80 cm high. Leaf-blades narrowly linear or inrolled and filiform; basal leaf-sheaths keeled, loosely hairy along the margins. Spike solitary, 10–20 cm long, silky-hairy and glistening. Spikelets 2–3-flowered, callus hairs 3–5 mm long; lower glume 3–3.5 mm long, upper glume as long as the spikelet, 6–7.7 mm long, bidentate and mucronate; fertile lemma 6–7.7 mm long, scabrid, bidentate, the awn 3.5–5 mm long. Fig. 71:3.

Acacia bushland on dry sandy soils; 1200 m. HA; Somali Republic, Kenya. *M.G. & S.B. Gilbert* 2056; *Hemming* 1447.

E. barbatus is readily distinguished from other species of *Enteropogon* by its long, silky callus hairs.

3. *E. macrostachyus* (Hochst. ex A. Rich.) Benth. (1881);

Chloris macrostachya Hochst. ex A. Rich. (1850); *Megastachya abyssinica* Steud. (1854), in synon., based on *Macrostachya abyssinica* Hochst., in sched. - type: Ethiopia, Mai-Mezano, *Schimper* 1477 (K iso.).

Chloris simplex Schumach. (1827), nom. superfl.; *Enteropogon simplex* (Schumach.) A. Chev. (1934).

Densely tufted perennial, often with clusters of dead leaf-sheaths around the base; culms slender, erect, 50–100 cm high. Leaf-blades flat or involute, 30–50 cm long; leaf-sheaths glabrous, rounded or lightly keeled. Spike solitary (rarely paired), 10–20 cm long, green with purplish awns, straight or gently arching. Spikelets 3-flowered, callus hairs 1.5–2 mm long; lower glume 3–5 mm long, upper glume 5.6–7.5 mm long, short-awned; fertile lemma 7–11 mm long, scabrid in the upper half, the awn 10–20 mm long. Fig. 71:1, 2.

Acacia bushland or grassland, often in shade along water courses; 450–1700 m. EE EW TU SU KF GG SD BA HA; tropical Africa. *Frits* et al. 2889; *Gilbert* 1650; *Mooney* 7051.

4. *E. rupestris* (J. A. Schmidt) A. Chev. (1935);
Ctenium rupestre J. A. Schmidt (1852) - type: Cape Verde Is., *Schmidt* s.n. (whereabouts uncertain).

E. ruspolianus Chiov. (1897) - type: Ethiopia, Ogaden, *Riva* 303 (FT holo.).

Tufted perennial from a short, woody rhizome; culms wiry, leafy and much-branched, 30–90 cm high. Leaf-blades flat, 5–20 cm long; leaf-sheaths glabrous, rounded. Spike solitary (very rarely paired), 6–12 cm long. Spikelets 2(–3)-flowered, callus hairs 1.5–2 mm long; lower glume 2.2–3.3 mm long, upper glume as long as the spikelet, 4–6.4 mm long; fertile lemma 4.4–5.5(–8) mm long, scabrid, the awn 1–3(–5) mm long; 2nd lemma sterile, empty. Fig. 71:4.

Open *Acacia* bushland; 1000–1800 m. SD HA; Cape Verde Is. and Mauretania; Sudan, Somalia and East Africa; Botswana and Namibia. *Frits* et al. 3350; *IECAMA* BH-13; *Sandford* A4 (ETH).

E. rupestris is well-marked by its inconspicuously awned spikes. It is further distinguished from *E. macrostachyus* by its shorter leaf-blades and characteristic bushy mode of growth, lacking a basal tussock of old leaf-sheaths. The spikelets are typically 2-flowered, but a third floret is occasionally present in vigorous specimens.

87. MICROCHLOA R. Br. (1810)

Launert in *Senck. Biol.* 47: 291–301 (1966).

Slender annuals or perennials; leaf-blades linear to setaceous; ligule a minute ciliate membrane. Inflorescence a solitary, very slender, curving spike (scarcely wider than the culm), often enclosed at the base by the uppermost leaf-sheath. Spikelets very small, narrowly elliptic-oblong, lightly dorsally compressed, the single fertile floret enclosed within, and concealed by the glumes, rachilla-extension and sterile florets absent; glumes equal, 1-nerved, firmly membranous with infolding margins, the lower keeled, the upper rounded, subacute; lemma shorter than the glumes, keeled, ovate, hyaline, ciliate on the nerves, acute to minutely emarginate and mucronulate; palea subequalling the lemma, ciliate on the keels.

About 6 species; tropics and subtropics.

A small genus, recognizable by the solitary, very slender, awnless, curling spikes.

1. Loosely tufted annual, lacking basal clumps of fibres. 1. *M. indica*
- Densely tufted perennial, the base surrounded by a dense mass of fibres. 2. *M. kunthii*

1. *M. indica* (L. f.) P. Beauv. (1812);
- type: India, *König* (LINN).

Small delicate annual; culms very slender, solitary or loosely tufted, up to 15 cm high. Leaf-blades cauline, the tips obtuse; leaf-sheaths keeled, not fibrous. Spikes up to 15 cm long, c 1 mm wide. Spikelets 2–3 mm long, falling entire; lemma 1.2–1.7 mm long; anthers 0.3–0.6 mm long.



Figure 71. *ENTEROPOGON* spp.: *E. MACROSTACHYUS*: 1 - habit x 3/4; 2 - florets x 7. *E. BARBATUS*: 3 - florets x 7. *E. RUPESTRIS*: 4 - dorsal view of fertile lemma x 7. 1 & 2 from Mooney 7051; 3 from Hemming 1447; 4 from Friis et al. 3350. Drawn by Eleanor Catherine.



Figure 72. *MICROCHLOA KUNTHII*: 1 - habit x 2/3; 2 - part of spike x 4; 3 - spikelet x 18; 4 - lower glume x 18; 5 - upper glume x 18; 6 - lemma x 18; 7 - palea x 18. Drawn by Miss J.C. Webb. (Modified from *Fl. Trop. E. Afr. Gramineae* 2: Fig. 88, with permission of the Editors).

Bare or open places on shallow, often sandy soils; 900–1800 m. TU SU SD; throughout the tropics. *Gilbert & Getachew* 2902; *Gilbert & Thulin* 954

2. *M. kunthii* Desv. (1831);

- type: tropical America, *Desveaux* (P holo.).

M. abyssinica A. Rich. (1850) - type: Ethiopia, TU, Adua, *Schimper* 321 (K iso.).

Slender, densely tufted perennial; culms erect, wiry, 5–50 cm high, surrounded at the base by the brown fibrous

remains of old leaf-sheaths. Leaf-blades mainly basal, the tips obtuse. Spikes 5–20 cm long, 1–2 mm wide. Spikelets 2.5–4 mm long, disarticulating above the glumes, these persistent or the upper deciduous; lemma 1.5–2.2 mm long; anthers 0.5–1.2 mm long. Fig. 72.

Low open scrubland and overgrazed thin grassland on shallow, stony or sandy soils, or among rocks; often on sloping ground; 1200–3100 m. EW TU GD SU AR WG IL GG SD BA HA; throughout the tropics. *Gilbert & Getachew* 2922; *Gillett* 5442; *Friis et al.* 3016.

M. caffra Nees, a species primarily of southern and South Africa, is very similar to *M. kunthii*. It is distinguished by its larger spikelets (3–5.5 mm) and longer anthers (1–2.2 mm), but there is some overlap and the two species intergrade. A single specimen with the dimensions of *M. caffra* (*M.G. & S.B. Gilbert* 1992), collected in Addis Ababa, is possibly introduced.

88. *CYNODON* Rich. (1805), *nom. conserv.*

Clayton & Harlan in *Kew Bull.* 24: 185–189 (1970); *de Wet & Harlan* in *Taxon* 19: 565–569 (1970).

Stoloniferous perennials, sometimes also with underground rhizomes, often sward-forming; culms leafy, slender to robust. Leaf-blades linear, flat, or occasionally filiform; ligule membranous, often ciliate. Inflorescence of (1) to several slender, secund spikes arranged digitately at the culm tip in a single whorl, or spread in several whorls over a short axis. Spikelets 1-flowered, narrowly ovate, laterally compressed, imbricate, biseriate, disarticulating above the glumes; glumes keeled, 1-nerved, lanceolate, shorter than the spikelet, unequal with the upper longer; lemma lanceolate-ovate in profile, acute, usually pubescent on the keel, awnless; palea equalling the lemma.

8 species; one cosmopolitan, 2 from the Indian Ocean islands, India and SE Asia, the remainder in Africa.

With a few notable exceptions, spikelet structure is remarkably uniform within *Cynodon*, and hence reliance must be placed on vegetative differences for the delimitation of species. In earlier years most specimens from eastern Africa were simply placed under the cosmopolitan *C. dactylon*, but recent biosystematic studies have enabled a much better classification to be worked out, and several species are now recognized. Whilst the difference in facies between the various species is usually readily apparent in the field, it is often much less obvious in herbarium specimens, and when the basal portion is lacking (especially the underground rhizomes), identification to species may not be possible. Additionally, both diploid and tetraploid races exist in several species, and intercrossing sometimes occurs, leading to the occasional occurrence of intermediates.

1. Leaf-blades filiform; spikes 1–2(–4); low delicate perennial with both rhizomes and stolons.

1. *C. transvaalensis*
– Leaf-blades linear; spikes 4–20. 2

2. Glumes tiny, the upper not exceeding 0.5 mm; ligule membranous, 1–2 mm long; lemma and palea keels ciliate; robust stoloniferous perennial. **2. *C. plectostachyus***
 – Glumes conspicuous, the upper half as long as the spikelet or more; ligule 0.3 mm long, a ciliolate rim; lemma keel shortly pilose, palea keels glabrous. 3
3. Plant with underground rhizomes as well as surface stolons; low-growing and sward-forming. **3. *C. dactylon***
 – Plant stoloniferous but lacking underground rhizomes. 4
4. Culms slender or robust; leaf-blades green or glaucous, often soft; spikes usually simply digitate, often green, slightly flexuous, not stiffly spreading. **4. *C. nlemfuensis***
 – Culms robust, hard and woody; leaf-blades stiff and glaucous; spikes stiff, reddish-purple, often spread over a short axis. **5. *C. aethiopicus***

1. *C. transvaalensis* *Burt-Davy* (1921);
 - type: South Africa, *Burt-Davy* 18156 (K holo.).

Very slender, sward-forming perennial with both underground rhizomes and slender prostrate stolons; culms delicate, 4–15 cm high. Leaf-blades inrolled and filiform, 1–4 cm long, occasionally flat and up to 1 mm wide, pale green; ligule a minute ciliolate rim. Spikes 0.7–1.5 cm long, usually solitary or paired, occasionally 3 or 4 in a single whorl. Spikelets 2.2–2.7 mm long, thinly membranous; glumes subequal, 1/3–1/2 as long as the spikelet; lemma glabrous or sparsely pilose along the keel; palea glabrous. $2n = 18$.

Lawns and as an escape along roadsides; 1700–2100 m. KF (Jimma Agricultural School) HA (Alemaya); a native of South Africa, occasionally planted as a lawn grass and occurring as an adventive in disturbed situations. *Friis* et al. 2033; *Getahun* s.n. (ETH).

A diploid species closely related to *C. dactylon*, and crossing readily with diploid forms of the latter, from which it is distinguished by its very delicate, low habit, fine leaf-blades, fewer spikes and shorter glumes.

2. *C. plectostachyus* (*K. Schum.*) *Pilg.* (1907);
Leptochloa plectostachya *K. Schum.* (1895) - type: Tanzania, *Volkens* 477 (B holo.).
C. ruspolianus *Chiov.* (1897); *C. plectostachyus* var. *ruspolianus* (*Chiov.*) *Chiov.* in *Webbia* 8: 111 (1951) - type: Ethiopia, Ogaden, near Milmil, *Riva* 248 (FT holo.).

Robust perennial mat grass with tough arching stolons; culms 30–90 cm high, leaf-sheaths and stolons strongly compressed. Leaf-blades soft, flat, 10–30 cm long and 4–7 mm wide, harshly scabrid on both surfaces, sparsely to densely pilose; ligule 1–2 mm long, membranous. Inflorescence composed of 6–20 spikes 3–7 cm long clustered at the culm tip in 2–7 whorls, tending to curl inwards at maturity. Spikelets 2.5–3 mm long;

glumes reduced to 2 tiny scales at the base of the spikelet, the lower very inconspicuous, 0.2 mm long, the upper often divergent, 0.5 mm long; lemma narrowly winged and stiffly ciliate on the keel with hairs 0.3–0.4 mm long, puberulous along the margins and sometimes also on the flanks; palea keels stiffly ciliate. $2n=18$. Fig. 73:3.

Deciduous bushland, usually in disturbed places; 1000–2000 m. GG HA; southwards through East Africa to Zambia. *Drake-Brockman* 66; *Ersado* 62 (ETH).

A distinctive species, easily distinguished from the other robust species of *Cynodon* by its tiny glumes and relatively large, membranous ligule. It is a diploid species, genetically isolated from other members of the genus.

3. *C. dactylon* (*L.*) *Pers.* (1805);
Panicum dactylon *L.* (1753) - type: Portugal (LINN holo.).
C. glabratus *Steud.* (1854).

Slender, sward-forming perennial with both underground rhizomes and creeping surface stolons; culms 8–40 cm high. Leaf-blades linear, flat, or sometimes almost filiform, up to 12 cm long (often much shorter), 1–4 mm wide, glaucous; ligule 0.3 mm long, a ciliolate rim. Inflorescence composed of a single digitate whorl of 4–6 green or purplish spikes 1.5–6 cm long. Spikelets 2–2.5 mm long; upper glume 1/2–3/4 as long as the spikelet; lemma silky-pubescent on the keel; palea glabrous. $2n = 18, 36$. Fig. 73:4, 5.

Disturbed, heavily grazed and trodden situations near habitations, roadsides, field margins, and in short open grassland; 1600–2700 m. AF EW TU GD GJ WU SU AR WG IL KF GG SD BA HA; tropical and warm temperate regions. *Gillett* 5437; *Mooney* 6805; *Aweke & Gilbert* 835.

C. dactylon (Bermuda Grass, Star Grass) is universally employed in warm climates as a lawn and fodder grass, and many cultivars have been bred for these purposes. It is also a ubiquitous cosmopolitan weed, but although variable in the wild, is generally a low, rather slender species, best distinguished from similar species by the presence of wiry underground rhizomes in addition to the usual surface stolons. It is usually tetraploid ($2n = 36$).

4. *C. nlemfuensis* *Vanderyst* (1922);
 - types: Zaire, *Vanderyst* 6095, 6400 & 7672 (all BR syn.).

Stoloniferous perennial without rhizomes; stolons stout, usually lying flat on the ground, occasionally forming bulbous structures at the nodes consisting of swollen leaf-sheaths; culms fairly slender to robust, 30–60 cm high. Leaf-blades linear, flat, tough and glaucous or softer and green; ligule 0.3 mm long, a ciliolate rim. Inflorescence composed of slender, slightly flexuous spikes, usually digitate in a single whorl. Spikelets 2–3 mm long, green or purplish-red; upper glume half as

long as, to almost equalling the spikelet; lemma silky-pubescent on the keel; palea glabrous. $2n = 18$ (36).

The species includes 2 varieties, both of which are diploid in the wild, although tetraploid forms are known in cultivation.

var. nlemfuensis

Culms fairly slender to moderately robust, 1–1.5 mm wide; leaf-blades green or glaucous, 2–5 mm wide; spikes 4–9, each 4–7 cm long.

Open, weedy places up to 2400 m. AF GJ SU IL SD BA/HA; southwards to Zambia and Zimbabwe. *Mooney* 5314, *Mesfin T. & Sebsebe D.* 317 (ETH); *Edwards* 694 (ETH).

Var. *nlemfuensis* is very similar in habit to large forms of *C. dactylon*, and in herbarium specimens lacking the basal portions it is often impossible to distinguish between them. The distinction is clearer in the field, *C. nlemfuensis* forming usually more robust tufts rather than a sward, from which grow widely spreading stolons which sometimes climb into surrounding vegetation. It lacks the wiry, underground rhizomes of *C. dactylon*. Var. *nlemfuensis* crosses readily with diploid *C. dactylon*.

var. robustus *Clayton & Harlan* in *Kew Bull.* 24: 189 (1970) - type from Kenya.

Culms robust, 2–5 mm wide; leaf-blades green, soft, 5–6 mm wide; spikes 6–13, each (4–)6–10 cm long.

Disturbed situations, especially in river bottomlands; 600–1400 m. AF GG HA; East Africa and southwards to Zimbabwe. *Burger* 2875; *Gilbert & Phillips* 9048.

Var. *robustus* is a much larger, stouter plant than var. *nlemfuensis*, and typical forms of each variety do not cross. However, intermediates exist which cross readily with both varieties, and preclude treating var. *robustus* as a separate species. It is distinguished from *C. aethiopicus* by its softer, green foliage and longer, somewhat flexuous spikes, and from the other robust species, *C. plectostachyus* by its longer glumes.

5. *C. aethiopicus* *Clayton & Harlan* (1970);

- type: Ethiopia, KF, Jimma (cultivated in USA), *de Wet* in OKLA 9224 (K holo.).

Coarse stoloniferous perennial without rhizomes; stolons stout, woody, with long internodes lying flat on the ground; culms robust, becoming hard and woody, 25–100 cm high. Leaf-blades flat, 5–25 cm long and 3–7 mm wide, tough and glaucous, scaberulous; ligule 0.3 mm long, a ciliolate rim. Inflorescence composed of 5–20 stiff, purple or reddish spikes 4–8 cm long, these either in a single whorl or more usually subdigitate along a short axis, spreading or gently outwardly curved. Spikelets 2–3 mm long, upper glume 3/4 as long to almost equalling the spikelet; lemma shortly pubescent on the keel; palea glabrous. $2n=18, 36$. Fig. 73:1, 2.

Moist situations along river valleys and lake margins, also old cultivations and rough grassland; 400–2400 m. GD SU IL KF SD BA HA; southwards through eastern Africa to the Transvaal, mainly associated with the Rift Valleys. *Pichi-Sermolli* 889; *Siegenthaler* 1524; *Friis et al.* 1764.

Some forms are considerably more vigorous than others, but the tough, woody stolons and mature culms, the subdigitate cluster of deeply pigmented, straight or outwardly curving spikes, and the coarse foliage are all typical features of *C. aethiopicus*. It has sometimes been confused with *C. plectostachyus*, but this species has much smaller glumes, softer, hairier foliage, arching stolons, and a tendency for the spikes to curve inwards rather than outwards. *C. aethiopicus* is fairly well isolated genetically, crossing only reluctantly with *C. dactylon* and *C. nlemfuensis*.

89. MELANOCENCHRIS *Nees* (1841)

Slender annuals or perennials. Leaf-blades linear, ligule ciliate. Inflorescence composed of shortly peduncled deciduous racemes spaced along a tough, flexuous axis; racemes secund, turbinate, hairy, ending in a forked bristle, composed of 5–8 spikelets with the lower 2 fertile, the remainder progressively reduced. Fertile spikelets dorsally compressed, 2–3-flowered, the lowest floret fertile, 2nd floret smaller, male or sterile, 3rd floret much reduced. Glumes narrow, coriaceous, each extended into a long stout awn, villous on the back and lower part of the awn, lower glume sometimes absent in sterile spikelets, upper glume with a membranous wing on either side of the glume body, fertile lemma ovate, rounded on the back, glabrous or pubescent with short, capitate hairs, narrowed to a 3-cuspidate or 3-aristate tip; palea equalling the lemma, capitate-pubescent, 2-cuspidate.

3 species; Chad to NE tropical Africa, Egypt, Arabia and eastwards to India and Sri Lanka. •

M. abyssinica (*R. Br. ex Fresen.*) *Hochst.* (1855);

Eutriana abyssinica *R. Br. ex Fresen.* (1837); type: Ethiopia, *Rüppell* s.n. (FR holo.).

Ptiloneilema plumosum *Steud.* (1854), nom. superfl.; *Melanocentris plumosa* (*Steud.*) *Hochst.* (1855), nom. illegit. - type: Arabia, *Schimper* 794 (K iso.).

Delicate annual; culms solitary or loosely tufted, wiry, 10–25 cm high. Leaf-blades flat or folded, 2–5.5 cm long, blades and sheaths with scattered tubercle-based hairs. Inflorescence axis 1.5–3.5 cm long, bearing 3–6 racemes 10–15 mm long spaced along it. Glumes with spreading white or purplish hairs; lower lemma 6–7 mm long (including tip), 3-cuspidate-aristate, the central awn 2.2–3 mm long, the lateral lobes similar but shorter. Fig. 74:5–8.

Dry plains and stony hillsides; sea level–1000 m. EE AF EW TU SD; Sudan, Egypt and through Arabia



Figure 73. *CYNODON* spp.: *C. AETHIOPICUS*: 1 - habit x 3/4; 2 - spikelet x 17. *C. PLECTOSTACHYUS*: 3 - spikelet x 17. *C. DACTYLON*: 4 - habit x 3/4; 5 - section of spike x 9. 1 from Hazel 245; 2 from Langdale Brown 2091; 3 from Drake-Brockman 66; 4 & 5 from ILCA 15725. Drawn by Eleanor Catherine.

to Pakistan and NW India. *Burger* 2892; *Bally* 6878; *Hemming* 1017.

A small desert grass, easily recognized by its burr-like, deciduous racemes of hairy spikelets spaced along a slender axis.

The Indian species *M. jacquemontii* Jaub. & Spach, also known from Socotra, differs in its smaller, more numerous spikelet-clusters (5–10 clusters up to 8 mm long).

90. **TRAGUS** *Haller* (1768), *nom. conserv.*

Anton in Kew Bull. 36: 55–61 (1981).

Annuals or perennials. Inflorescence linear, cylindrical, spiciform, the rachis bearing numerous, usually sessile racemelets; each 2- to several-flowered, falling entire at maturity as a spiny burr. Spikelets elliptic to lanceolate; lower glume adaxial, reduced to a small hyaline scale; upper glume as long as the spikelet, prominently 5–7-nerved, the nerves forming ribs armed with conspicuous, stout, spreading spines, often with hooked tips; lemma membranous, flattened across the back, appressed-pilose around the midnerve.

7 species in warm regions throughout the World, but particularly in Africa.

Tragus heptaneuron Clayton, known from dry sandy places in Somalia, Kenya and Tanzania, may occur in the Ogaden. The racemelets consist of a pair of subequal spikelets 3–3.5 mm long. It is further distinguished from *T. berteronianus* by its 7-nerved upper glume, and from both *T. berteronianus* and *T. racemosus* by the spikelets arising at the same level with no intervening internode.

1. Spikelets paired with one spikelet sessile and the other pedicelled, 2–3 mm long; upper glume 5-nerved.
 1. *T. berteronianus*
- Spikelets alternating on a short axis in 3–5(–8)-flowered clusters, 3.6–5.2 mm long; upper glume 7-nerved.
 2. *T. racemosus*

1. *T. berteronianus* *Schult.* (1824);

Lappago berteroniana (*Schult.*) *Steud.* (1854); *Tragus racemosus* (*L.*) *All.* var. *berteronianus* (*Schult.*) *Hack.* in *Oesterr. Bot. Zeitschr.* 51: 195 (1901) - type: West Indies, *Bertero* s.n. (M hol.).

Lappago phleoides *Fig. & De Not.* (1853).

Sprawling annual mat-grass; culms decumbent or ascending to 35 cm, rooting at the lower nodes and often shortly stoloniferous; leaf-blades tough, flat, the margins pectinate-ciliate. Inflorescence dense, 3–10 cm long; racemelets 2-flowered, each with a sessile, elliptic, fertile spikelet and a smaller, narrowly elliptic, usually sterile spikelet on a pedicel 0.2–0.8 mm long. Sessile spikelet 2–3 mm long, pedicelled spikelet 1.2–1.7(–2.4) mm long, usually reduced to the upper glume; upper glume acute, 5-nerved, the nerves forming thick ribs bearing hooked, usually swollen-based spines; lemma

narrowly elliptic-oblong, 1.8–2.1 mm long, sharply acute. *Fig.* 74:3–4.

Open situations in dry grassland and bushland, and as a weed of disturbed sites; sea level–1700 m. EE AF EW WU SU AR GG SD HA; widespread in Africa and warm parts of America; also from Arabia to Pakistan and in China. *Burger* 3527; *M.G. & S.B. Gilbert* 1125; *Thulin* 1325.

Although the smaller pedicelled spikelet is usually reduced to an empty upper glume, at least in Ethiopian material, it may occasionally be almost as large as the sessile spikelet, with a well developed lemma and palea enclosing a fertile grain.

2. *T. racemosus* (*L.*) *All.* (1785);

Cenchrus racemosus *L.* (1753); *Lappago racemosa* (*L.*) *Honck.* (1792) - types from southern Europe.

Lappago decipiens *Fig. & De Not.* (1854); *Tragus racemosus* var. *decipiens* (*Fig. & De Not.*) *Dur. & Schinz, Consp. Fl. Afr.* 5: 733 (1895); *Tragus decipiens* (*Fig. & De Not.*) *Chiov.* (1932).

Tragus paucispina *Hack.* (1901).

Sprawling annual; culms ascending to 35(–50) cm from a decumbent base, rooting and branching at the lower nodes; leaf-blades tough, flat, the margins conspicuously scabrid or pectinate-ciliate. Inflorescence 2.5–10.5 cm long; racemelets composed of 3–5(–8) spikelets alternating along a short axis 2.6–6 mm long, uppermost spikelets reduced or vestigial. Spikelets narrowly lanceolate, 3.6–5.2 mm long; upper glume acuminate, 7-nerved with the spines tapering from a stout base to a ± straight or curving tip; lemma narrowly lanceolate, 3–3.8 mm long, finely acuminate.

A weedy grass of open situations, usually on light sandy or stony soils with some moisture; 1000–2200 m. AF EW TU GD SU AR HA; Sudan, Somalia, Botswana and South Africa; Mediterranean and Middle East; introduced in N America. *Ash* 334; *Vollesen* 7326; *Moohey* 8014.

The nerve on either side of the midnerve of the upper glume is usually weaker than the rest with smaller spines, so the number of nerves is often more easily counted on the inner side where all can usually be clearly seen as seven green lines. Rarely these two nerves are reduced or even absent, but such forms can easily be distinguished from the 5-nerved *T. berteronianus* by the other key characters.

T. racemosus has a disjunct distribution in north-eastern and southern Africa. Although clearly referable to the same species, the two populations do show certain differences, with the southern form approaching *T. berteronianus* more closely. The spines in the north-eastern form have ± straight or slightly curving tips, whereas those in the southern form are more strongly hooked as in *T. berteronianus*. Additionally, the southern form has racemelets of usually only two fertile spikelets with a third vestigial one, and they are rather



Figure 74. *DIGNATHIA HIRTELLA*: 1 - habit x 3/4; 2 - spikelet pair x 7. *TRAGUS BERTERONIANUS*: 3 - habit x 3/4; 4 - spikelet pair x 7. *MELANOCENCHRIS ABYSSINICA*: 5 - habit x 3/4; 6 - lower glume x 7; 7 - upper glume x 7; 8 - fertile lemma x 7. 1 & 2 from Gilbert & Sebsebe 8585; 3 & 4 from Friis et al. 2831; 5-8 from Burger 2892. Drawn by Eleanor Catherine.

small, lying at the lower end of the size range of the northern form.

91. *DIGNATHIA* Stapf (1911)

Annuals or perennials. Inflorescence spiciform, cylindrical, composed of densely or laxly arranged racemelets, these deciduous at maturity; each racemelet 2–3-spiculate with the spikelets alternating on a short curvaceous axis, the uppermost reduced to the glumes. Spikelets laterally compressed, lanceolate to suborbicular; glumes as long as the spikelet, narrow with tapering, often diverging tips, thickly coriaceous with membranous margins, scaberrulous to hairy (sometimes copiously) on the coriaceous part; lemma membranous, keeled, elliptic to ovate, shortly hairy especially along the keel, awn-pointed.

5 species, mainly in east and northeast tropical Africa; also in NW India (Cutch).

1. Annual; inflorescence open with laxly arranged racemelets; glumes shortly pubescent.
 1. *D. hirtella*
- Perennials; inflorescence dense with crowded racemelets; glumes conspicuously villous or ciliate.
 - 2
2. Culms 12–33 cm high, much branched near the tips forming dense fascicles; inflorescence 1.3–2.8 cm long, embraced below by the much inflated uppermost leaf-sheath; glumes copiously villous, completely enveloped by spreading hairs except near the margins.
 2. *D. villosa*
- Culms 25–65 cm high, branching throughout; inflorescence 3–6 cm long, usually exserted; glumes silky-ciliate, the hairs confined to a line along the keel.
 3. *D. ciliata*

1. *D. hirtella* Stapf (1911);

– type: Kenya, Linton 4 (K holo.).

Loosely tufted annual; culms 10–25 cm high, wiry, erect. Leaf-blades 1–6 cm long, 1–3 mm wide. Inflorescence 2–5 cm long, exserted from the leaf-sheath; racemelets 5–9 mm long, contiguous, comprising (1–)2 fertile spikelets and a reduced terminal spikelet of 2 gaping glumes. Spikelets suborbicular with rostrate tip, 5–7 mm long; glumes appressed pubescent, ciliate on the margins; lower glume crescent-shaped, shorter than the spikelet; upper glume with a gibbous body 1.5–2 mm long, extended upwards into a stiff pointed beak. Fig. 74:1, 2.

Open ground and among rocks in deciduous bushland; 250–1400 m. SD BA; Kenya, N Yemen, Oman and NW India. Gilbert et al. 7512; Gilbert & Sebsebe 8585; Friis et al. 3683.

2. *D. villosa* C. E. Hubb.;

– type: Somalia, Godfrey Fausset s.n. (K holo.).

Tough tussocky perennial from a short woody rhizome; culms erect, 12–30 cm high, clothed with imbricate leaf-sheaths and branching near the tips to form fascicles of shoots with the inflorescences protruding from the inflated upper leaf-sheaths; leaf-blades 1–5 cm long and 2–3 mm wide. Inflorescence narrowly to broadly oblong, 1.3–3 cm long, villous. Spikelets suborbicular below, in pairs on an axis 1.6–3 mm long, completely enveloped by copious spreading hairs 1.5–2 mm long from the axis and glumes; lower spikelet 3.8–4.7 mm long; glumes reddish-brown, subequal or the lower a little shorter, narrowly lanceolate with finely acuminate curving tips, the coriaceous part encrusted externally with numerous papillose-based hairs, pubescent internally; lemma narrowly ovate in profile, 2.8–3 mm long, acuminate with an awn-point 0.3–0.5 mm long.

Acacia-Commiphora bushland on stony soil; 400–760 m. HA; Somalia. M.G. & S.B. Gilbert 2107; Glover & Gilliland 413; Hemming 1540.

3. *D. ciliata* C. E. Hubb.;

– type: Somalia, Godfrey Fausset 46 (K holo.).

Tufted perennial with erect, wiry, much branched culms 25–65 cm high. Inflorescence a dense, narrowly oblong, silky-hairy head 3.5–6 cm long. Spikelets elliptic, in pairs on a laterally long-ciliate axis 2.9–3.6 mm long; lower spikelet 4.2–5.8 mm long; glumes narrowly elliptic with finely acuminate tips, the lower slightly shorter than the upper, keeled, silky-ciliate along the keel like the axis margins, scabrid internally; lemma narrowly ovate in profile, 3.3–3.8 mm long, acute with an awn-point 0.7–1 mm long.

Dry, sandy, open bushland; 500–1600 m. SD HA; N Somalia. Gilbert et al. 7694; Hemming 1497; Simmons S.183.

92. *LEPTOTHRIUM* Kunth (1829)

Latipes Kunth (1829)

Perennial. Inflorescence spiciform, open with the spikelets spaced singly or in pairs along the rachis; spikelets in each pair sessile on the top of a flattened peduncle and falling entire with it at maturity. Glumes well developed, longer than the floret which is tightly enclosed within the upper glume, coriaceous, smooth or tubercled, marginally hispid, the lower glume of one spikelet narrow, flattened, the caudately elongate tip often recurved; lemma 1-nerved, thinly membranous, acute.

2 species, one from tropical Africa to Pakistan, the other in the Caribbean.

The spikelets or spikelet-pairs represent reduced racemes, in which the pedicels have united to form a single flattened peduncle bearing the spikelets on its truncate tip.



Figure 75. *LEPTOTHRIUM SENEGALENSE*: 1 - habit x 3/4; 2 - spikelet pair x 7; 3 - lower glume x 9; 4 - upper glume x 9; 5 - lemma x 9. Drawn by D. Erasmus. (Modified from *Fl. Iraq* Vol. 9 *Gramineae*, Fig. 179.)

L. senegalense (Kunth) Clayton (1972);

Latipes senegalensis Kunth (1830) - type: Senegal, Herb. Gay s.n. (K iso.?).

Latipes inermis Chiov. (1928).

Densely tufted perennial with slender, wiry, leafy culms 15–72 cm high; leaf-blades 1.4–5.5(–7.5) cm long, often inrolled. Inflorescence linear, 6.5–17.5 cm long, the spikelets usually spaced along the rachis in pairs on the truncate top of a cuneate, 1.2–6.5 cm long peduncle, often borne singly towards the tip, occasionally all the spikelets arranged singly. Spikelets narrow,

pale green blotched with purple, 2.8–6.7 mm long, slightly heteromorphous when paired; lower glume of one spikelet in a pair (or of the solitary spikelet when borne singly) linear-oblong, flattened, the caudate tip conspicuously recurved, marginally ciliate with coarse, hooked, coalescing hairs; remaining glumes rostrate, coarsely ciliate on the margins especially towards the tips, the hairs tending to coalesce and usually forming prominent tubercles on the body of the glume. Fig. 75.

Open bushland (especially *Acacia*) on dry, stony or sandy soils, often among rocks; 430–1700 m. EE EW



Figure 76. *PEROTIS PATENS*: 1 - habit and inflorescence x 3/4; 2 - spikelet x 17; 3 - lemma x 17. All from Gilbert, Thulin & Aweke 313. Drawn by Eleanor Catherine.

TU SU GG SD BA HA; dry country from Senegal to the Red Sea and southwards to Tanzania; also through Arabia to Pakistan. Friis et al. 972; Gilbert 1658; Mooney 7310.

Specimens with the peduncle bearing only a single spikelet instead of a pair are particularly common in the Ogaden and Somalia, and collections from these regions often also have narrower, more hispid glumes with fewer or no tubercles (*Latipes inermis* Chiov.). However, as every intermediate stage exists between this variant and typical tuberculate *L. senegalense* it does not merit separate specific rank.

93. *PEROTIS* Ait. (1789)

Annuals or perennials; leaf-blades short and broad, often with pectinate-ciliate margins. Inflorescence a delicate cylindrical raceme of long-awned, shortly pedicelled (*P. patens* sessile) spikelets seated directly on the main axis. Spikelets linear-elliptic (excluding awns), terete or slightly laterally compressed, falling entire with the pedicel at maturity; glumes subequal, 1-nerved, as long as the spikelet, overlapping to enclose the floret, membranous, scaberulous, tipped by a long slender awn far exceeding the glume body (lower glume awn usually longer than the upper); lemma lanceolate, hyaline, up to 2/3 as long as the glumes, 1-nerved, acute.

10 species in the Old World tropics.

Perotis somalensis Chiov., from Somalia, has a soft "bottlebrush" inflorescence of large pilose spikelets 3.5 mm long, with a villous callus 0.8 mm long, and very long (35–50 mm) pale awns.

1. Spikelets without a basal pedicel; glumes similar, scabrid. **1. *P. patens***
- Spikelets with a basal villous pedicel 0.5–1 mm long; glumes dissimilar, the lower scabrid, the upper smooth except for a prominent row of spinulose teeth along the sunken nerve.

2. *P. hildebrandtii*

1. *P. patens* Gand. (1920);

- type: South Africa, Natal, *J. M. Wood* 5925 (LY holo., K iso.).

P. patens Gand. var. *parvispicula* Robyns & Tournay in *Bull. Jard. Bot. Brux.* 25: 241 (1955); *P. scabra* Trin. var. *parvispicula* (Robyns & Tournay) Cuf., *Enum.*: 1302 (1969) - type: Kenya, *Gillet* 14081 (K holo.).

P. scabra sensu Cuf., l.c. (1969), non Trin. (1824).

[*P. indica* auct. non (L.) O. Kuntze].

Loosely tufted annual or short-lived perennial with culms ascending to 40–70 cm; leaf-blades glaucous, lanceolate-oblong with an amplexicaul base and sharply acuminate tip, 2.5–7 cm long and 6–11 mm wide, the margins pectinate-ciliate. Inflorescence linear, 6–30 cm long, with crowded, ascending or horizontally spread-

ding purple-awned spikelets. Spikelets 1.3–2.8 mm long, terete, rounded at the base and lacking a pedicel; glumes narrowly oblong, both scabrid, rounded on the back, acute; lower glume awn 7–18 mm long, the upper 3.5–12 mm long. Fig. 76.

A weedy grass of open situations, often on sandy soils; 450–1700 m. EE EW SU IL GG SD HA; tropical and South Africa, Madagascar. *Pappi* 7878; *Burger* 870; *Thulin* 1487.

Easily distinguished from other *Perotis* species as it is the only member of the genus lacking a callus at the base of the spikelet.

P. patens is a variable grass, specimens differing especially in the length of the inflorescence and size of the spikelets. Particularly small spiculate forms are sometimes separated as var. *parvispicula*, but variation appears to be continuous and without taxonomic significance. Normally both awns are far longer than the glume body, but in *Burger* 870, collected southeast of Harar, the upper glume awn is reduced to a short mucro less than 0.5 mm long. However, the occasional spikelet does have a longer awn, showing this to be no more than a minor variation.

2. *P. hildebrandtii* Mez (1921);

- type: Zanzibar I., *Hildebrandt* 1097 (K iso.).

Loosely tufted annual; culms geniculately ascending, 15–50 cm high. Leaf-blades broadly linear to narrowly lanceolate, 1–7 cm long, 1.5–5 mm wide. Inflorescence 2–20 cm long, the spikelets usually loosely spaced, horizontally spreading. Spikelets 2.5–3.5 mm long with a conspicuous pedicel 0.5–1 mm long; glumes puberulous to sparsely hispidulous on the flanks, the lower scabrid, the upper smooth except for the broad, green, slightly depressed, spinulose-scabrid midrib; awns slender, flexuous, 5–15 mm long.

Degraded bushland; 1000 m. SD/Kenya border (Moyale); Somalia and southwards to Tanzania, West Africa, Seychelles. *Ash* 2793.

94. *TETRACHAETE* *Chiov.* (1903)

Annual. Inflorescence a dense spiciform head. Spikelets arranged in pairs, each spikelet-pair face to face on top of a short bearded peduncle and falling entire from the rachis at maturity; glumes similar, both arising on the dorsal side of the lemma, ± reduced to elongate awns far exceeding the floret; lemma firmly membranous, keeled with the keel projecting between the gaping bases of the glumes, awned from the tip.

1 species in eastern Africa and Arabia.

T. elionuroides *Chiov.* (1903);

- type: Eritrea, Assaorta, Hamas plain, *Terracciano* 2656 (FT holo.).

Delicate tufted annual; culms 10–24 cm high, leafy. Inflorescence a fluffy oblong head 1–2.7 cm long projecting from the inflated uppermost leaf-sheath.

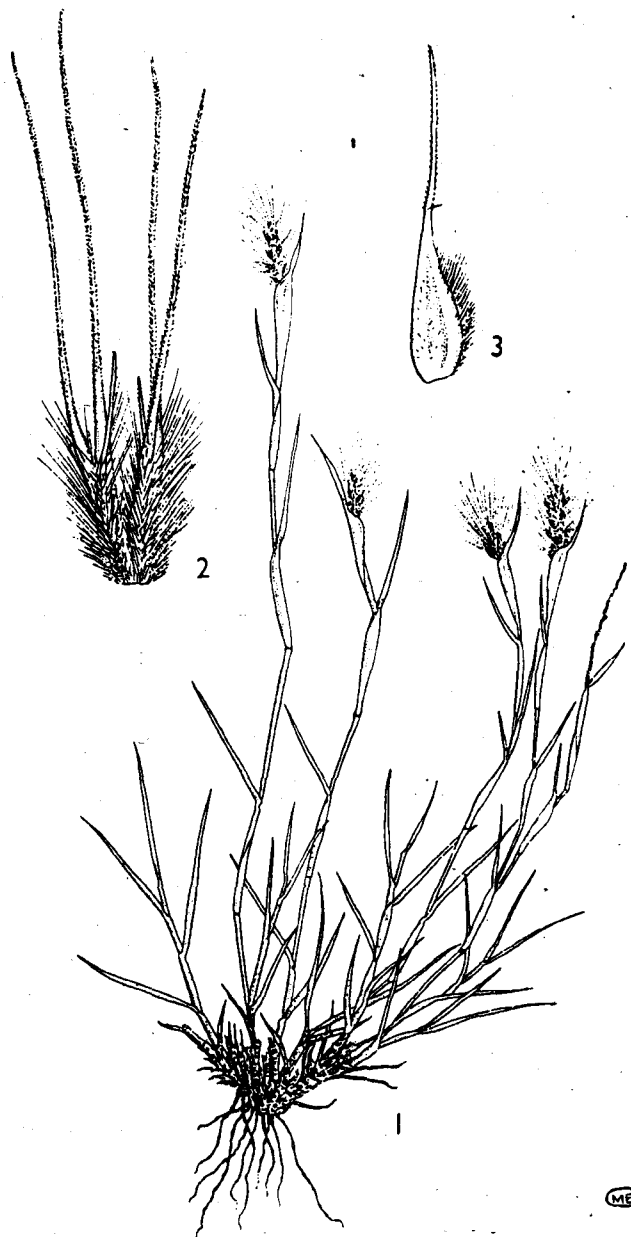


Figure 77. *TETRACHAETE ELIONUROIDES*: 1 - habit x 1; 2 - spikelet pair x 8; 3 - lemma x 12. All from *Greenway & Kanuri* 12882. Drawn by Maureen Church. (Reproduced from *Fl. Trop. E. Afr. Gramineae* 2: Fig. 107, with permission of the Editors).

Spikelet pairs silky-hairy basally with the glumes forming 4 slender diverging awns; glumes 7.2–13.5 mm long, narrowly winged and conspicuously silky-bearded with spreading hairs 2–4 mm long near the base; lemma ovate, 1.7–2.6 mm long, densely ciliate on the keel, the tip acuminate, extended into a fine straight awn 1.9–4 mm long. Fig. 77.

Dry open bushland on stony soils; 670–1300 m. EE HA; Yemen, Oman (Dhofar), Somalia, Kenya and N Tanzania. *Burger* 3364; *M.G. & S.B. Gilbert* 2352; *Rippstein* 1343.

PANICEAE R. Br. (1814)

Annuals or perennials, sometimes tall and robust. Leaf-blades usually linear or lanceolate, occasionally filiform, falsely petiolate or plicate; ligule membranous or ciliate, rarely absent. Inflorescence variable, an open, contracted or spiciform panicle, this usually terminal but sometimes axillary, or composed of secund racemes, these digitate or spread along a central axis, the spikelets single, paired or clustered along a triquetrous or flattened rhachis, sometimes supported by bristles, or a spiny or scaly involucre. Spikelets all alike, 2-flowered without a rhachilla extension, lower floret male or barren, upper floret bisexual, dorsally or infrequently lightly laterally compressed, falling entire at maturity, rarely the fertile floret also disarticulating and shed separately; glumes and lower lemma herbaceous, rarely awned; lower glume variable, usually $< 1/2$ spikelet length and sometimes sheathing or very small or suppressed; upper glume usually as long as the spikelet; lower lemma resembling the upper glume, with or without a palea; upper floret commonly indurated, smooth and shiny or sometimes rugose or papillose, the lemma awnless or occasionally mucronate but the mucro not exerted from the glumes, its margins narrow and clasping only the edges of the similarly textured palea or broad and hyaline; stamens 3; stigmas 2. Grain with a large embryo and punctiform (rarely linear) hilum.

A large tropical tribe of 101 genera, extending into temperate North America.

Panicaceae is a distinctive tribe on account of the uniform pattern of deciduous, 2-flowered spikelets with a barren lower floret, and a fertile indurated upper floret which encloses and protects the grain. It is a very natural tribe, dominated by the genus *Panicum*, which possesses the basic open paniculate inflorescence from which racemose forms are derived, and also contracted bristly inflorescences by sterilisation of panicle branches.

The distinction between paniculate and racemose inflorescences, although a useful key character, is unfortunately not clear-cut as paniculate types may contract around the primary branches and racemose types frequently produce secondary branchlets, especially near the base of the racemes. The uniformity of the spikelets leads to indistinct generic boundaries, resulting in the rather frequent occurrence of intermediate species, which often cause difficulty in keys.

1. Spikelets not subtended by bristles, spines or involucre scales. 2
- Spikelets (at least some of them) subtended by bristles, or surrounded by a spiny or scaly involucre. KEY 3 21
2. Inflorescence terminal. 3
- Inflorescences axillary from the upper leaf-sheaths, slenderly cylindrical; spikelets pedicel-

late all round the rhachis; lower lemma usually awned. 114. *Snowdenia*

3. Inflorescence an open or spiciform panicle, sometimes condensed around the primary branches. 4
- Inflorescence composed of 1-sided spikes or racemes, the spikelets usually single or paired (secondary branchlets in some *Echinochloa*, *Brachiaria* and *Poecilostachys*; loose with long pedicels in *Brachiaria deflexa*). KEY 2 8
4. Panicle densely cylindrical, spiciform; spikelets gibbous. 100. *Sacciolepis* 5
- Panicle \pm open with obvious branches. 5
5. Upper lemma coriaceous to crustaceous; lower lemma entire, awnless; lower glume distinct. 6
- Upper lemma cartilaginous; lower lemma often bilobed or awned; lower glume tiny or absent. 7
6. Inflorescence paniculate throughout; spikelets without a basal bead-like swelling. 101. *Panicum*
- Inflorescence subpaniculate, the spikelets contracted around the primary branches, upper branches often racemose; spikelets with a basal bead-like swelling. 105. *Eriochloa*
7. Upper floret laterally compressed; the stigmas emerging laterally. 95. *Melinis*
- Upper floret dorsally compressed; the stigmas emerging terminally. 96. *Tricholaena*

KEY 2

8. Racemes very short and few-spiculate, \pm embedded in an enlarged and thickened axis. 111. *Stenotaphrum*
- Racemes free, spreading or occasionally appressed to the axis. 9
9. Tips of upper glume and lower lemma laterally nipped; upper lemma with a green crest. 102. *Acroceras*
- Spikelet parts without compressed or crested tips. 10
10. Spikelets laterally compressed or the lower glume awned; leaf-blades lanceolate to ovate; trailing forest grasses. 11
- Spikelets dorsally compressed; lower glume usually awnless, at most with a brief awn-point. 13
11. Both glumes awned, the awns often sticky. 97. *Oplismenus*
- Lower glume awnless. 12
12. Glumes hispid with stout bristles. 98. *Poecilostachys*
- Lower glume smooth, upper glume armed with hooks at maturity, gibbous. 99. *Pseudechinolaena*
13. Spikelets densely packed in 4 rows or congested into clusters; plump, mostly cuspidate or awned; tip of upper palea reflexed. 103. *Echinochloa*
- Spikelets mostly in 1-2 rows; tip of upper palea tucked in (reflexed in *Paspalidium*). 14

14. Upper lemma awned; upper glume ciliate on the margins. 104. *Alloteropsis*
 - Upper lemma awnless. 15
15. Spikelets with a bead-like swelling at the base; lower glume usually vestigial. 105. *Eriochloa*
 - Spikelets without a basal bead, although sometimes with a barrel-shaped basal stipe (lower glume then well developed). 16
16. Upper lemma hard, crustaceous to coriaceous, the margins narrow, usually inrolled and clasping only the edge of the palea. 17
 - Upper lemma softer, cartilaginous to chartaceous, the margins hyaline and flat, covering much of the palea. 20
17. Spikelets plumply elliptic, ± obtuse; back of upper lemma turned away from the rhachis. 106. *Brachiaria*
 - Spikelets plano-convex; back of upper lemma lying against the rhachis. 18
18. Spikelets cuspidate, enclosing a pronounced mucro from the upper lemma. 107. *Urochloa*
 - Spikelets ovate to orbicular; upper lemma as long as the spikelet, not mucronate. 19
19. Lower glume absent (rarely minute); spikelets ± orbicular. 108. *Paspalum*
 - Lower glume well developed; spikelets elliptic to ovate; racemes short, erect, appressed to hollows in the elongate rhachis. 110. *Paspalidium*
20. Spikelets with long intertwining awns. 112. *Acritochaete*
 - Spikelets awnless. 113. *Digitaria*

KEY 3

21. Bristles persisting on the axis after the spikelets have fallen. 109. *Setaria*
 - Bristles, spines or scales falling with the spikelets. 22
22. Each spikelet subtended by a single bristle and supported on a pungent stipe; trailing, mat-forming perennial. 115. *Paratheria*
 - Spikelets usually sessile (if pedicellate or stipitate, bristles several or involucre scaly). 23
23. Involucre of slender bristles, free to the base. 116. *Pennisetum*
 - Involucre of bristles or spines united at least below, often forming a cup or involucre of one or more scales. 24
24. Involucre of flattened bristles or spines, often connate into a cup. 117. *Cenchrus*
 - Involucre of one or more scales. 25
25. Each spikelet surrounded by a sheathing lobed scale, one lobe long and awn-like; aquatic grass with spongy, trailing culms. 118. *Odontelytrum*
 - Spikelets in clusters surrounded by an involucre of indurated scales. 119. *Antheophora*

95. MELINIS P. Beauv. (1812)
Rhynchelytrum Nees (1836)G. Zizka in *Bibliotheca Botanica* no. 138 (1988).

Tufted or caespitose annuals or perennials; leaf-blades linear; ligule a ciliate rim. Inflorescence a panicle; pedicels slender, glabrous or with a few long hairs at the tip. Spikelets oblong or elliptic in profile, laterally compressed, hairy or glabrous; lower glume small or suppressed; upper glume as long as the spikelet, 5-, 7- or 9-nerved, membranous to coriaceous, emarginate to acute, awnless to awned, sometimes gibbous on the back and tapering to a beak; lower floret male or sterile; lower lemma resembling the upper glume, 3-, 5- or 7-nerved, awnless to awned, its palea with ciliate or scaberulous keels, or sometimes lacking; upper floret laterally compressed, readily deciduous, its lemma membranous to thinly cartilaginous.

22 species, mainly Africa (especially southern tropical Africa), 1 species extending to SW Asia, 2 species introduced throughout the tropics.

The genera *Melinis* and *Rhynchelytrum* have traditionally been regarded as distinct, the number of nerves in the upper glume being the diagnostic criterion for separating them. Whilst this distinction does coincide with a broad difference in facies, recent research has shown the character to be artificial, leading to a separation which does not accurately reflect overall similarities between the species. They are thus best included within the scope of a single genus (Zizka, 1988).

1. Palea of lower floret present (rarely somewhat reduced). 2
 - Palea of lower floret absent. 4
2. Palea of lower floret ciliate on the keels. 1. *M. repens*
 - Palea of lower floret scaberulous on the keels. 3
3. Upper glume 5-nerved. 2. *M. longiseta*
 - Upper glume 7-nerved. 3. *M. ambigua*
4. Pedicels smooth except for a few long hairs towards the apex; upper glume 5-nerved; spikelets 1–1.5 mm long. 4. *M. tenuissima*
 - Pedicels scaberulous; upper glume 7-nerved; spikelets usually longer than 1.5 mm. 5
5. Upper glume with an awn (0.5–)0.8–4.5 mm long; spikelets 2.4–3.4 mm long. 3. *M. ambigua*
 - Upper glume awnless or with an awn up to 0.5 mm long; spikelets 1.5–2.2 mm long (if awn longer than spikelet < 2.2 mm long). 6
6. Upper glume deeply grooved between the prominent nerves. 6. *M. minutiflora*
 - Upper glume not grooved, finely nerved. 7

7. Pedicels with a few long hairs towards the apex; lower glume a tiny scale 0.2–0.4 mm long; lower lemma 5-nerved. **5. *M. effusa***
 – Pedicels glabrous; lower glume an inconspicuous scale up to 0.2 mm long; lower lemma 3–5-nerved. **7. *M. macrochaeta***

1. ***M. repens* (Willd.) Zizka (1988);**

Saccharum repens Willd. (1798); *Rhynchelytrum repens* (Willd.) C.E. Hubb. (1934); *Tricholaena repens* (Willd.) Hitchc. (1936) - type: Ghana, Isert s.n. (B holo.).

Rhynchelytrum dregeanum Nees in Lindley (1836); *Tricholaena dregeana* (Nees) Th. Dur. & Schinz (1894).

R. dregeanum Nees var. *annuum* Chiov. in *Ann. Ist. Bot. Roma* 8: 309 (1907) - type: Eritrea, Dembeles, Mai Albo, Pappi 6094 (FT holo.).

R. dregeanum Nees var. *intermedium* Chiov., l.c.: 310 (1907) - types: Eritrea, Keren, Tellini 933 & Debarroa, Pappi 450, 468 & Mansura R., Pappi 7158 (all FT syn.).

Tricholaena rosea Nees (1836); *Monachyron roseum* (Nees) Parl. (1850); *Panicum roseum* (Nees) Steud. (1854) non Willd. ex Spreng. (1825); *Melinis rosea* (Nees) Hack. (1901); *Rhynchelytrum roseum* (Nees) Stapf & C.E. Hubb. (1930); *Rhynchelytrum repens* (Willd.) C.E. Hubb. var. *roseum* (Nees) Chiov., *Miss. Biol. Borana, Racc. Bot.*: 275 (1939).

Tricholaena tonsa Nees (1836); *Monachyron tonsum* (Nees) Parl. (1850); *Panicum tonsum* (Nees) Steud. (1854); *Rhynchelytrum tonsum* (Nees) Lanza & Mattei (1910).

Tricholaena fragilis A. Braun (1841); *Panicum braunii* Steud. (1854) non *Panicum fragile* Kunth (1829) - type: cultivated at Karlsruhe from seed collected in Ethiopia by Schimper (K iso.).

Tricholaena sphacelata Benth. in Hook. (1849); *Saccharum sphacelatum* (Benth.) Walp. (1852).

Tricholaena tonsa Nees var. *submutica* Schweinf. in *Bull. Herb. Boiss.* 2, App. 2: 96 (1894) - type: Eritrea, Ambelaco near Maldi, Schweinfurth 24 (K iso.).

Tufted annual or short-lived perennial; culms 20–150 cm high, geniculately ascending and often rooting at the lower nodes. Leaf-blades 4–20(–27) cm long, 2–12(–14) mm wide, flat. Panicle (6–)8–20 cm long, broadly ovate; pedicels with a few long hairs. Spikelets 2–12 mm long, ovate; lower glume (0.3–)0.6–3(–4.3) mm long, 0–1-nerved, narrowly ovate, separated from the upper by an internode (0.1–)0.2–1.7(–2) mm long; upper glume 5-nerved, membranous to subcoriaceous, usually gibbous on the back, hairy or glabrous, often tapering to a glabrous beak, emarginate, mucronate or awned; lower floret male, its lemma 5-nerved, resembling the upper glume but less gibbous, the palea-keels ciliate.

A very variable species formerly divided into 2–4 species according to hairiness of the spikelet, growth-

form and the length of the internode between the glumes. Hairiness and colour of the spikelet as well as growth form have proved to be of no taxonomic value. Four weakly separated infraspecific groups (two in the Flora area) are recognized. Typical specimens can be identified easily, but there is frequent intergradation between the groups. The length of the internode between the glumes varies continuously but, together with spikelet length, is nevertheless the best character to separate the following 2 subspecies.

M. repens may be confused with *Tricholaena teneriffae* (L.f.) Link, but can be separated from the latter by its hairy pedicels and laterally compressed upper floret of different texture.

1. Spikelets 2–4(–4.5) mm long; glumes separated by an internode 0.1–0.5(–0.6) mm long.

subsp. *repens*

- Spikelets (4–)5–12 mm long; glumes separated by an internode (0.5–)0.7–1.7(–2) mm long.

subsp. *grandiflora*

subsp. *repens*

Tufted short-lived perennial, or sometimes annual; culms 25–120(–150) cm high and 1–3 mm in diam.; spikelets 2–4(–4.5) mm long, slightly laterally compressed, usually densely hairy; lower glume (0.3–) 0.6–1.3(–1.5) mm long, separated from the upper by an internode 0.1–0.5(–0.6) mm long; upper glume and lower lemma membranous.

A weed on anthropogenic and otherwise disturbed sites, often forming extensive stands; sea level–2500 m. EE EW TU GD WU GJ WG SU KF GG SD HA; tropical and southern Africa, nowadays established throughout the tropics and subtropics. Gillett 5042; Mooney 5522; M.G. & S.B. Gilbert 1317.

subsp. *grandiflora* (Hochst.) Zizka in *Bibl. Bot.* 138: 60 (1988);

Rhynchelytrum grandiflorum Hochst. (1844); *Melinis grandiflora* (Hochst.) Hack. (1901) - type: Sudan, Kotschy 370 (TUB lecto., K isolecto.).

Monachyron villosum Parl. in Hook. (1849); *Tricholaena villosa* (Parl.) Th. Dur. & Schinz (1894); *Tricholaena monachyron* Oliv. in Hook. (1895), nom. superfl.; *Melinis villosa* (Parl.) Hack. (1901); *Rhynchelytrum villosum* (Parl.) Chiov. (1907).

Tricholaena grandiflora Hochst. ex A. Rich. (1850); *Saccharum grandiflorum* (A. Rich.) Walp. (1852); *Panicum insigne* Steud. (1854), non *Panicum grandiflorum* Nees (1829); *Monachyron grandiflorum* (A. Rich.) Martelli (1886) - types: Ethiopia, TU, Selleuda, Schimper 205 (BR K M syn.) & SU, Choa, Petit s.n. (P syn.).

Tricholaena brevipila Hack. (1888); *Melinis brevipila* (Hack.) Hack. (1901); *Rhynchelytrum brevipilum* (Hack.) Chiov. (1907).

Melinis barbeyana Mez (1921).

Tufted annual or rarely a short-lived perennial; culms 25–90 cm high, 0.9–1.6(–2) mm in diameter; spikelets (4–)5–12 mm long, glabrous or hairy, conspicuously laterally compressed; lower glume (0.6–)1.5–3(–4.3) mm long, separated from the upper by an internode (0.5–)0.7–1.7(–2) mm long; upper glume and lower lemma membranous to coriaceous, often drawn out into a narrow glabrous beak.

Dry sunny places on sandy soils or between boulders in grassland and savanna woodland, rarely on disturbed sites; 200–1600 m. EW TU GJ SU SD BA HA; tropical and South Africa; Saudi Arabia, Yemen; India. *De Wilde* 4166 (BR); *Gilbert* 2088; *Kuls* 342 (FR).

2. *M. longiseta* (A. Rich.) Zizka (1988);

Tricholaena longiseta A. Rich. (1850); *Saccharum longisetum* (A. Rich.) Walp. (1852); *Panicum macrotrichum* Steud. (1854), non *Panicum longisetum* Poir. (1816); *Rhynchelytrum longisetum* (A. Rich.) Stapf & C.E. Hubb. (1930) - types: Ethiopia, TU, Chiré, *Quartin Dillon* s.n. (P lecto., W isolecto.) & *Schimper* 1803 (B K W).

Tufted to loosely caespitose perennial; culms 20–100 cm high, erect or geniculately ascending. Leaf-blades 4–12 cm long, 4–9 mm wide, flat. Panicle 4–17 cm long, narrowly oblong to linear; pedicels with a few long hairs. Spikelets 2.3–3.8(–4.2) mm long, usually ovate; lower glume 0.6–1.4 mm long, inconspicuously 1-nerved, ovate, separated from the upper by an internode 0.3–0.5 mm long; upper glume 5-nerved, subcoriaceous to coriaceous, emarginate to bilobed, awned, densely hairy on the keel, glabrous on the sides; lower floret male, its lemma 5-nerved, similar to the upper glume but glabrous on the keel and hairy on the sides; palea scaberulous on the keels.

Open woodland on sandy soils; 1000–2000 m. TU; Sudan, eastern and southern tropical Africa. *Schimper* 1803; *Quartin Dillon* s.n. (P W).

The species is easily recognized by its characteristic pattern of hairiness of the upper glume and lower lemma, 5-nerved upper glume and scaberulous keels of the lower palea.

The above description applies to subsp. *longiseta*, the only subspecies in the Flora area. The second subspecies, subsp. *bellespicata* (Rendle) Zizka, occurs in Nigeria, Cameroon, southern and South Africa. It differs by its longer, narrower, less strongly indurated spikelets (4–8.5 mm long) and narrower leaf-blades (1.5–6 mm wide). Until recently it was treated as a distinct species, but is insufficiently distinct from *M. longiseta* to merit separate specific status.

3. *M. ambigua* Hack. (1901);

- type: Ethiopia, TU, Amba Harres Mt., *Schimper* 800 (W lecto., B K isolecto.).

Melinis pallida Stapf & C.E. Hubb. (1926).

Caespitose or rarely tufted perennial; culms (30–)60–

120(–150) cm high, erect or rarely geniculately ascending. Leaf-blades (3.5–)5–30 cm long, 2–8(–11) mm wide, flat or involute. Panicle 9–25 cm long, narrowly ovate; pedicels with a few long hairs. Spikelets 2–3(–3.4) mm long, narrowly ovate; lower glume 0.4–1.0 mm long, ovate, 0–1-nerved, inserted close to the upper; upper glume 7-nerved, usually hairy, emarginate to bilobed with an awn up to 4.5 mm long; lower floret male or sterile, its lemma 5-nerved with an awn (0.3–)2–12 mm long, equalling the upper glume, the palea often absent or when present scaberulous on the keels. Fig. 78.

Sandy or stony soils, often by streamsides or on disturbed ground; 1000–2500 m. TU GD SU; central and southern tropical Africa. *Gilbert & Thulin* 909; *Chiovenda* 2724; *Minta* 24 (ETH).

M. ambigua is very variable and forms, together with *M. minutiflora*, *M. tenuissima* and *M. effusa*, a group of similar species with rare intermediate forms occurring between them. *M. minutiflora* is the least clearly defined of this group.

The above description applies to subsp. *ambigua*. Subspecies *longicauda* (Mez) Zizka, occurring from Tanzania southwards to Zimbabwe and Mozambique, differs by its longer spikelets (2.7–5.2 mm long), longer awn on the upper glume (3.5–8.3 mm) and the presence of a lower palea.

4. *M. tenuissima* Stapf (1900);

- type: Malawi, *Cameron* 33 (K holo.).

Melinis tenuissima Stapf var. *abyssinica* Stapf in Hook., *lc. Pl.* 27, t. 2660 (1900) - type: Ethiopia, GD, *Schimper* 1410 (K holo., B iso.).

Straggling perennial; culms (28–)50–110(–140) cm high, ascending. Leaf-blades (1.5–)2–8(–10) cm long, 3–6 mm wide, glabrous or rarely pubescent. Panicle 10–20 cm long, broadly ovate, delicately branched; pedicels smooth with a few long hairs towards the apex. Spikelets 1.1–1.5 mm long, narrowly ovate to oblong; lower glume an obscure rim up to 0.1 mm long, inserted close to the upper; upper glume 5-nerved, thinly membranous, glabrous to sparsely hairy, irregularly dentate, awnless; lower floret sterile without a palea, its lemma 3–5-nerved, emarginate or irregularly dentate, equalling the upper glume but narrower and with an awn (1.5–)4–10 mm long.

Grassland and woodland, frequently in disturbed sites or near river banks; 1000–2000 m. GD WU WJ SU IL KF GG SD; tropical Africa. *Friis* et al. 454; *Gilbert* 4134; *De Wilde & De Wilde-Duyffes* 8803.

The most reliable characters for recognition are the smooth pedicels and 5-nerved upper glume. The delicate ovate panicle is also characteristic.

5. *M. effusa* (Rendle) Stapf (1926);

Melinis minutiflora P. Beauv. var. *effusa* Rendle in Hiern, *Cat. Afr. Pl. Welw.* 2: 200 (1899); *M. effusa*

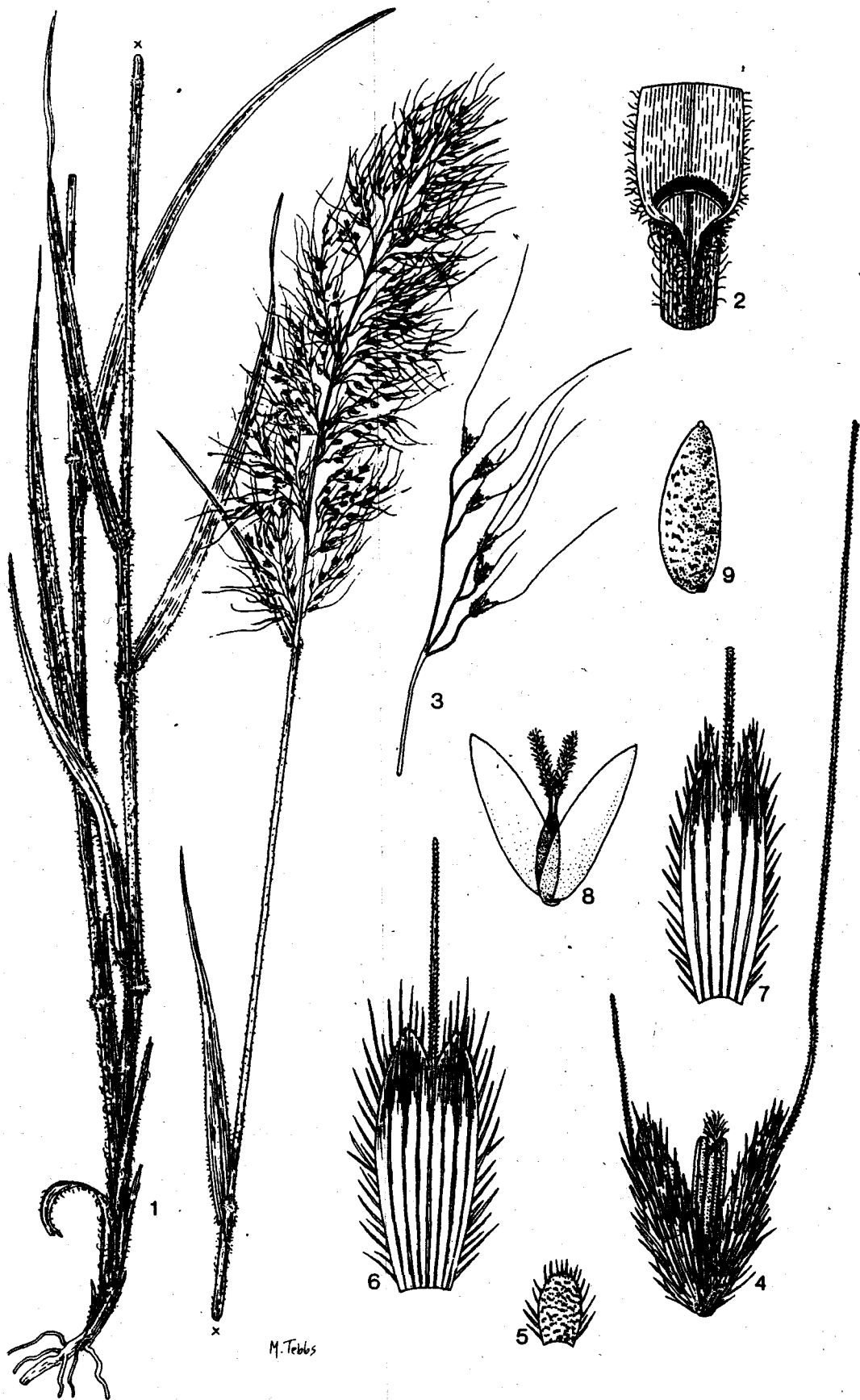


Figure 78. *MELINIS AMBIGUA* subsp. *AMBIGUA*: 1 - habit x 2/3; 2 - ligule x 8; 3 - group of spikelets x 4; 4 - spikelet x 14; 5 - lower glume x 20; 6 - upper glume x 20; 7 - lower lemma x 20; 8 - upper floret with ovary x 20; 9 - grain x 20. 1 from Biegel 1152; 2-9 from Schimper 800. Drawn by Margaret Tebbs. (Reproduced from *Fl. Zamb.* (10)3: Fig. 32, with permission of the Editors).

Stapf (1922) nom. nud. - type: Angola, *Welwitsch* 2958 (LISU lecto., BM K isolecto.).

Tufted perennial; culms (50-)70-130(-160) cm high, ascending, rarely erect. Leaf-blades (1.5-)3-11(-14) cm long, (2-)3-8(-11) mm wide, flat, often densely tomentose. Panicle (6-)8-20(-27) mm long, ovate to narrowly ovate; pedicels with a few long hairs towards the apex, scaberulous. Spikelets 1.4-1.8 mm long, narrowly ovate to oblong; lower glume 0.2-0.4(-0.5) mm long, ovate, inserted close to the upper; upper glume 7-nerved, awnless or mucronate, membranous, glabrous to sparsely hairy, obtusely bilobed; lower floret sterile without a palea, its lemma 5-nerved, acutely bilobed, equalling the upper glume but narrower with an awn 2-10 mm long, rarely awnless.

Grassland, often in disturbed places; 1000-2200 m. KF; scattered records throughout tropical Africa. *Friis* et al. 453B (ETH).

M. effusa is intermediate between *M. minutiflora* and *M. tenuissima*, and its specific rank is doubtful. It seems to be quite rare and more collections are needed. Morphology and distribution support the suggestion by Clayton & Renvoize (*Fl. Trop. E. Afr.*, Gramineae: 509, 1982) that it may be of hybrid origin.

6. *M. minutiflora* P. Beauv. (1812);

- type: Brazil, *De Jussieu* (G holo.).

Melinis minutiflora P. Beauv. var. *pilosa* Stapf in *Fl. Cap.* 7: 447 (1899); *M. tenuinervis* Stapf (1922).

Melinis maitlandii Stapf & C.E. Hubb. (1926).

Tufted perennial; culms (50-)80-150 cm high, geniculately ascending; leaf-blades (2-)4-20 cm long, (2.5-)5-11(-19) mm wide, flat, blades and sheaths densely tomentose and usually sticky with a strong smell. Panicle (8-)10-20(-36) cm long, narrowly ovate; pedicels glabrous, rarely with a few hairs towards the apex, scaberulous. Spikelets (1.5-)1.7-2.2(-2.4) mm long, narrowly ovate to narrowly oblong; lower glume 0.1-0.4 mm long, ovate, 0-1-nerved, inserted close to the upper; upper glume prominently 7-nerved, awnless or with a short mucro (rarely conspicuously awned), membranous, glabrous or rarely hairy, obtusely bilobed; lower floret sterile without a palea, its lemma prominently 5-nerved, acutely bilobed, equalling the upper glume but narrower, awnless or with an awn up to 14 mm long.

Grassland or woodland, often on disturbed sites; 1000-2300 m. SU AR KF; tropical and South Africa; introduced into many tropical countries as a fodder grass ("Molasses Grass"). *Ash* 2758; *Friis* et al. 1594; *Thulin* 1684.

M. minutiflora is very variable, especially in hairiness of the spikelets and in awn length, but can usually be recognized by the prominently nerved upper glume and lower lemma together with the scaberulous glabrous pedicels. Intergradation with *M. ambigua* subsp.

ambigua (spikelets hairy, upper glume and lower lemma awned) and *M. effusa* (pedicels with a few long hairs) occurs rarely. Investigation of some common variants showed that cross-fertilization between them is rare and the species is probably apomictic (*Bogdan* in *E. Afr. Agric. Journ.* 26: 49, 1960).

7. *M. macrochaeta* Stapf & C.E. Hubb. (1926);

- type: Nigeria, *Lely* 785 (K holo.).

Tufted annual or short-lived perennial; culms (35-)50-100(-150) cm high, geniculately ascending and often rooting at the lower nodes. Leaf-blades (3-)5-15(-20) cm long and (3-)5-10(-13) mm wide, flat, thin, softly pilose. Panicle 10-25 cm long, narrowly ovate; pedicels glabrous, rarely with a few long hairs towards the apex, scaberulous. Spikelets 1.5-2 mm long, narrowly oblong; lower glume an obscure rim up to 0.1 mm long, inserted close to the upper; upper glume 7-nerved, delicately membranous, bilobed, the lobes irregularly dentate, awnless or mucronate; lower floret sterile without a palea, its lemma 3-5-nerved, acutely bilobed, equalling the upper glume but narrower and with an awn (5-)8-20 mm long, Fig. 79.

Grassland, often at streamsides or in disturbed places; 800-1800 m. IL; tropical Africa. *Friis* et al. 586.

Typical members of *M. macrochaeta* are well characterized by the glabrous pedicels and the annual habit. The number of culm-nodes provides an additional aid to recognition: less than 10 in *M. macrochaeta*; more than 10 in *M. minutiflora* and *M. effusa*.

96. TRICHOLAENA Schrader ex Schultes (1824)*

Tufted or loosely caespitose annuals or short-lived perennials; leaf-blades linear; ligule a ciliate rim. Inflorescence a panicle, the pedicels slender, glabrous. Spikelets oblong in profile, slightly laterally compressed, mostly hairy; lower glume small or suppressed; upper glume as long as the spikelet, 5-nerved, membranous, not gibbous, emarginate to acute, awnless to mucronate; lower floret male, its lemma resembling the upper glume, the palea-keels ciliate; upper floret dorsally compressed, readily deciduous, its lemma cartilaginous, smooth, glabrous; caryopsis oblong-ovate.

4 species; mainly in arid regions of Africa, and from the Mediterranean to India; 1 species endemic to Socotra.

Easily visible characters for separation from the genus *Melinis* are the dorsally (not laterally) compressed, more cartilaginous upper floret. *Melinis repens*, which is sometimes mistaken for *Tricholaena*, differs additionally in having pedicels with several long hairs.

* by G. Zizka, Palmengarten, Siesmayerstrasse 61, 60323 Frankfurt am Main, Germany.



Figure 79. *MELINIS MACROCHAETA*: 1 - habit x 3/4; 2 - spikelet x 15; 3 - upper glume x 25; 4 - lower lemma x 25. All from Mitchell 14/35. Drawn by Eleanor Catherine. (Reproduced from *FL. Zamb.* 10(3): Fig. 33, with permission of the Editors).

T. teneriffae (L.f.) Link (1829);

Saccharum teneriffae L.f. (1781); *Panicum teneriffae* (L.f.) Spreng. (1825); *Melinis teneriffae* (L.f.) Hack. (1901) - type: Canary Is., Tenerife, Masson (LINN lecto.). *Tricholaena micrantha* Schrad. ex Schultes (1824).

Panicum leucanthum Hochst. ex A. Rich. (1850); *Melinis leucantha* (A. Rich.) Chiov. (1907); *Tricholaena leucantha* (A. Rich.) Stapf & C.E. Hubb. (1930) - types: Ethiopia, TU, Djeladjeranne, Schimper 1818 (B K W syn.) & Chiré, *Quartin Dillon* s.n. (P syn.).

Tricholaena mascatensis Gand. (1920).

Melinis somalensis Mez (1921).

Tricholaena gillettii C.E. Hubb. (1941).

Tricholaena setacea C.E. Hubb. (1941).

Loosely caespitose or rarely tufted perennial; culms 15–90 cm high, erect or geniculately ascending. Leaf-blades 2–11 cm long and 1.5–4 mm wide. Panicle 6–12 cm long and 1–4 cm wide. Spikelets (2–)2.5–3.4 mm long, hairy, lower glume a tiny scale, 0–1-nerved; upper glume 5-nerved, hairy; lower lemma resembling the upper glume, 5-nerved, hairy.

1. Spikelets hairy, the hairs exceeding the tip by 1.3–5.5(–7) mm; leaf-sheaths ± glabrous, never with tubercle-based hairs; base of culm not thickened. subsp. *teneriffae*
- Spikelets shortly hairy, the hairs exceeding the tip up to 1.3 mm; leaf-sheaths with tubercle-based hairs; base of culm thickened. subsp. *eichingeri*

subsp. *teneriffae*

Culms 15–80(–90) cm high, geniculately ascending; leaf-sheaths glabrous; spikelets (2–)2.5–3(–3.4) mm long, hairy, the hairs exceeding the spikelet-tip by 1.3–5.5(–7) mm.

Stony hills or sandy ground in dry *Acacia* bushland; sea level–1900 m. EE TU SU AR HA; Sudan, Somalia, Uganda; Canary & Cape Verde Is. through the Mediterranean to Arabia and eastwards to India. *Gilbert* 2125; *De Wilde* 5757 (BR); *Pappi* 30.

T. leucantha has been separated from *T. teneriffae* by the length of the spikelet hairs, but this character is unworkable and there are no other distinguishing features.

subsp. *eichingeri* (Mez) Zizka in *Bibl. Bot.* 138: 46 (1988);

Melinis eichingeri Mez (1921); *Tricholaena eichingeri* (Mez) Stapf & C.E. Hubb. (1930) - type: Tanzania, *Eichinger* 3332 (B hol., K iso.).

Culms (20–)30–60(–80) cm high, ± erect, the base thickened and mostly covered by the leaf-sheaths; leaf-sheaths hairy, the hairs tubercle-based; spikelets 2.5–

3.4 mm long, shortly hairy, the hairs exceeding the spikelet-tip by up to 1.3 mm.

Grassland and bushland on sandy soil, often in crevices; 1000–2300 m. SU; Somalia, Kenya, Uganda, Tanzania. *Gilbert* 527; *Semple* 16.

97. **OPLISMENUS** P. Beauv. (1810), *nom. conserv.*

Davey & Clayton in *Kew Bull.* 33: 147–157 (1978); U. Scholz, *Monogr. Oplis.* (1981).

Trailing annuals or perennials; culm-internodes mostly with a villous line adaxial to the subtending leaf, leaf-blades lanceolate to ovate, often with cross-veins; ligule a ciliate membrane. Inflorescence composed of several racemes spaced along a central axis; racemes elongate or reduced to fascicles of a few spikelets, the spikelets paired on short pedicels, the lowermost sometimes reduced. Spikelets lanceolate to oblong, weakly dorsally or laterally compressed; glumes subequal, herbaceous to cartilaginous, subequalling or somewhat shorter than the spikelet, awned, often pilose; lower lemma similar, equalling the spikelet, clasping the upper floret, mucronate or awned, sterile, its palea absent or much reduced; upper lemma subcoriaceous, pale, smooth and shiny, its margins inrolled but covering much of the palea, tip slightly crested.

5 species throughout the tropics (one endemic to Sri Lanka), extending into warm temperate regions.

O. burmannii (Retz.) P. Beauv. is a distinct species, but the remaining entities form part of a single pantropical polymorphic complex. The core of each entity is easily recognizable and these show some geographical separation; they are best retained as species to bring a degree of order to variation in the genus, but are fully intergrading so intermediates are commonplace. Morphological variation in this complex is discussed in detail in Davey & Clayton (1978). A cytogenetic study is now required before a definitive taxonomy can be attempted.

The descriptions encompass variation in Ethiopian material only, and measurements refer to the lowest raceme in an inflorescence.

1. Awns scaberulous, slender; lower lemma often transversely fringed; racemes pale silvery-green. 1. *O. burmannii*
- Awns smooth and viscid, stout; lower lemma not fringed. 2
2. Spikelet-pairs distant, 4 mm or more apart; lowest raceme 2.5–10 cm long. 2. *O. compositus*
- Spikelet-pairs contiguous, less than 4 mm apart; lowest raceme 0.5–3 cm long. 3
3. Racemes elongate with up to 15 spikelet-pairs; awns 5–12 mm long. 3. *O. hirtellus*
- Racemes reduced to cuneate fascicles of 2–4 spikelet-pairs; awns 7–14 mm long. 4. *O. undulatifolius*

1. *O. burmannii* (Retz.) P. Beauv. (1812);

Panicum burmannii Retz. (1783) - type: India, König (LD hol.).

Oplismenus multisetus A. Rich. (1850); *Panicum multisetum* (A. Rich.) Steud. (1854); *Oplismenus burmannii* var. *multisetus* (A. Rich.) U. Scholz, *Monogr. Oplis.*: 71 (1981) - type: TU, Djeladjeranne, Schimper 1469 (FT K iso.).

Slender annual; culms stoloniferous, branching and rooting at the nodes, up to 35 cm high. Leaf-blades lanceolate, 1.5–8 cm long and 5–15 mm wide, thinly appressed-pilose, acute. Inflorescence composed of 4–6 pale green racemes spaced along an axis 5–11 cm long; racemes 1–2.5 cm long, rhachis and pedicels silky-hairy with hairs 2.4–4 mm long, the spikelet-pairs slightly imbricate. Spikelets lanceolate, 2.5–3.2 mm long, the awns fine, scaberulous; glumes appressed-pilose becoming villous near the margins, the lower c 1/2 spikelet length, its awn 4–13 mm long, the upper 3/4 spikelet length, its awn somewhat shorter, lower lemma lacking a palea, usually with a transverse fringe about 2/3 up (this sometimes short or incomplete), subapically awned, the awn 1.3–2.2 mm long; upper lemma 2 mm long.

Shady, often moist places; 550–1500 m. TU WG IL; throughout the tropics. Friis et al. 1904, 2457; Parker 454.

A more delicate species than *O. hirtellus* and its allies, with an annual habit and awns which are rough to the touch.

2. *O. compositus* (L.) P. Beauv. (1812);

Panicum compositum L. (1753) - type: Sri Lanka, Hermann (BM hol.).

Stoloniferous perennial with straggling culms up to 1 m long. Leaf-blades lanceolate to narrowly ovate, 3.5–8 cm long and 10–16 mm wide, thinly hispid, sharply acuminate. Inflorescence composed of 3–6 racemes spaced along an axis 5–15 cm long; racemes ascending to erect, the lowest 3–11 cm long, bearing 7–14 \pm distant, sometimes patent spikelet-pairs. Spikelets lanceolate, 3–4 mm long, the awns stout, viscid, green or purple; glumes glabrous to thinly pilose, lower glume awn 5–10 mm long; upper glume awn shorter; lower lemma similar, tipped by a stout mucro 0.3–1 mm long, its palea much reduced; upper lemma 2.2–3 mm long.

Forest shade; 2000–2190 m. EE EW KF SD HA; tropical Asia, Australia and Polynesia, extending westwards to the eastern side of Africa; also in Mexico, Venezuela and Ecuador. E.F. Gilbert 384; Gillett 14260.

3. *O. hirtellus* (L.) P. Beauv. (1812);

Panicum hirtellum L. (1759) - type: Jamaica, Browne (LINN hol.).

O. hirtellus subsp. *fasciculatus* U. Scholz, *Monogr. Oplis.*: 118 (1981) - type: Zaire, Humbert 8993 (B hol.).

Slender, stoloniferous perennial; culms decumbent and rooting at the nodes, ascending to 60 cm high. Leaf-blades narrowly lanceolate to narrowly ovate, 5–10 cm long and 10–18 mm wide, thinly hispid to subglabrous, sharply acuminate. Inflorescence composed of 3–7 racemes spaced along an axis 5–15 cm long; racemes ascending to erect, the lowest 1–3 cm long, bearing 6–15 contiguous or imbricate spikelet-pairs. Spikelets lanceolate, 3–3.6(–4) mm long, the awns stout and viscid; glumes herbaceous, half as long to almost equalling the spikelet, thinly pilose especially near the margins, lower glume awn 5–12 mm long, upper glume awn shorter; lower lemma similar, tipped by a stout mucro 0.3–0.8 mm long, its palea much reduced; upper lemma 2.2–3 mm long. Fig. 80:1, 2.

In the shade of forests and coffee plantations; 950–2300 m. EE EW GJ WG SU KF IL GG SD BA; throughout the tropics (except India and Indo-China where it is replaced by *O. compositus*). Friis, Hounde & Jakobsen 137; M.G. & S.B. Gilbert 1326; Mooney 5915.

O. hirtellus is extremely polymorphic and is the commonest species of *Oplismenus* in Africa. The upper racemes are often reduced to short fascicles of spikelets, and occasional depauperate forms with the entire inflorescence composed of fascicles may be confused with *O. undulatifolius*. Such specimens have shorter awns (<7 mm) than is usual in *O. undulatifolius*. *O. hirtellus* in Ethiopia also tends to have smaller, hairier spikelets than *O. undulatifolius*, often (but not invariably) with pale green or yellowish rather than purple awns.

4. *O. undulatifolius* (Ard.) Roem. & Schult. (1817),

non P. Beauv. (1812), nom. nud.;

Panicum undulatifolium Ard. (1764); *O. hirtellus* subsp. *undulatifolius* (Ard.) U. Scholz, *Monogr. Oplis.*: 147 (1981) - type: Italy, Arduino (M hol., C iso.).

Slender, straggling perennial; culms prostrate, branching and rooting at the nodes, up to 1 m long. Leaf-blades narrowly lanceolate, 6–11 cm long and 9–14 mm wide, thinly hispid to subglabrous, acuminate. Inflorescence composed of 4–9 short racemes distant along an axis 9–13 cm long; racemes cuneate, with only 3–5 clustered spikelet-pairs on an often setose rhachis up to 1 cm long. Spikelets lanceolate, (3.7–)4–4.7 mm long, green, essentially glabrous, the awns stout, purple, viscid; glumes cartilaginous, the lower 2/3 to almost as long as the spikelet, its awn (6.3–)7.8–12.2 mm long, the upper slightly shorter with a shorter, more slender awn; lower lemma tipped by a stout mucro 0.2–0.8 mm long, its palea much reduced; upper lemma c 3.5 mm long.

Forest shade; 900–2200 m. AR IL KF GG; warm temperate regions of the northern hemisphere, extending southwards on the uplands of Africa and India. De Wilde 7783; Friis et al. 1662; M. G. & S. B. Gilbert 1761.



Figure 80. *OPLISMENUS HIRTELLUS*: 1 - habit x 1/2; 2 - spikelet x 9. *PSEUDECHINOLAENA POLYSTACHYA*: 3 - inflorescence x 3/4; 4 - spikelet x 9. *POECILOSTACHYS OPLISMENOIDES*: 5 - inflorescence x 3/4; 6 - spikelet x 9. 1 from Friis et al. 137; 2 from Mooney 5915; 3 from Siegenthaler 1488; 4 from Stewart 57; 5 from Friis et al. 319; 6 from De Wilde 7037. Drawn by Eleanor Catherine.

O. undulatifolius is distinguished by its short spikelet-clusters coupled with long, stout awns. The spikelets are often bright green with purple awns. In Ethiopia and East Africa the leaf-blades are usually relatively long and narrowly lanceolate, but elsewhere in its range they are more variable, ranging through to forms with shorter, ovate leaves. In intermediates with *O. hirtellus* the lower fascicle is extended into a short raceme.

98. **POECILOSTACHYS** Hack. (1884)
Chloachne Stapf (1916)

Trailing perennials; leaf-blades linear to lanceolate. Inflorescence composed of several lax, 1-sided racemes spaced along a central axis, bearing paired spikelets (or often compound with short side branches in *P. oplismenoides*). Spikelets laterally compressed; glumes unequal, 1/3–3/4 the length of the spikelet, acute to mucronate or awned; lower lemma similar, equalling the spikelet; upper lemma laterally compressed, membranous to cartilaginous, the margins flat or inrolled.

About 20 species of forest grasses; one in tropical Africa, the remainder endemic to Madagascar.

P. oplismenoides (Hack.) W. D. Clayton (1987);
Panicum oplismenoides Hack. (1888);
Chloachne oplismenoides (Hack.) Robyns (1932) - type: Mozambique, *Rodrigues de Carvalho* (W. holo.).

Straggling perennial; culms stoloniferous, rooting at the lower nodes, 70 cm to 1 m or more long. Leaf-blades narrowly lanceolate, thin and flaccid, 8–14 cm long, 10–20 mm wide, cross-veined, acuminate; ligule a long-ciliate membrane, *c* 3 mm long. Inflorescence composed of 4–10 loose, ascending racemes along an axis 10–20 cm long; lower racemes compound with short racemelets of spikelet-pairs, becoming simple towards their tips, lowest raceme 4–7 cm long, upper racemes shorter, consisting of a few clustered spikelet-pairs. Spikelets narrowly lanceolate-oblong, 6.5–8 mm long, pale green; glumes and lower lemma coarsely tuberculate-hispid with bristles to 2 mm long, keeled and acuminate at the tip; upper lemma narrowly ellipsoid, pale, glossy, the tip keeled, sharply acute. Fig. 80:5, 6.

Damp places in deep shade of evergreen forest; 1700–2000 m. AR BA IL KF; Tropical Africa. *Friis* et al. 319; *Mooney* 8486; *W. de Wilde* 7037.

99. **PSEUDECHINOLAENA** Stapf (1919)

Trailing annuals; leaf-blades lanceolate, sometimes with cross-veins; ligule membranous, truncate. Inflorescence composed of several loosely spiculate racemes spaced along a central axis; raceme-rhachis slender, bearing paired spikelets, the sessile spikelets often reduced. Spikelets laterally compressed, obliquely ovoid; glumes equalling the spikelet or slightly shorter, herbaceous, the lower almost flat, acute to awned, the upper

boat-shaped, gibbous, armed at maturity with coarse, hooked bristles, truncate to acute; lower lemma equalling the spikelet, male or sterile, ovate-oblong, chartaceous to subcoriaceous with a median hyaline patch at the base and a green, herbaceous tip; lower palea narrow, its keels rounded; upper lemma smooth, cartilaginous to coriaceous, obliquely ellipsoid, the margins flat or inrolled.

6 species; one pantropical, the remainder endemic to Madagascar.

A small genus of broad-leaved forest grasses related to *Oplismenus* and *Poecilostachys*.

P. polystachya (Kunth) Stapf (1919);
Echinolaena polystachya Kunth (1816); *Panicum polystachyum* (Kunth) K. Schum. (1895), non L. (1759); *Echinochloa polystachya* (Kunth) Roberty (1955), non (Kunth) Hitchc. (1920) - type: Colombia, *Humboldt & Bonpland* (P. holo.).

Slender, spreading annual; culms stoloniferous and rooting at the nodes, ascending to 10–40 cm. Leaf-blades 3–6 cm long and 5–15 mm wide, thinly pilose, acute. Inflorescence 6–15 cm long, bearing 4–5 loosely ascending racemes with distant spikelet-pairs; lowest raceme 1–4 cm long. Spikelets 4–5 mm long; lower glume green, lanceolate-oblong, sharply acute; upper glume pallid with a green herbaceous tip; upper lemma pale, glossy. Fig. 80:3, 4.

Forest shade, often as a ground-cover below coffee; 900–2000 m. WG IL KF BA; throughout the tropics. *Mesfin & Kagnew* 2168; *Mooney* 6060, 8463.

The coarse, hooked bristles on the gibbous upper glume are an unmistakable feature of this grass, but only develop after fertilization. In the immature spikelet the upper glume bears colourless pointed hairs appressed to its surface. As the spikelet matures, each becomes raised up on a stout green stalk with a hollow base, to form a bristle with a right-angle bend.

The spikelets often appear single to the casual glance, as the sessile spikelet is frequently only poorly developed when the pedicelled spikelet is mature. It may remain vestigial or develop later to maturity when the pedicelled spikelet has been shed, hence extending the flowering period. Both the hooked bristles and long flowering period are adaptations to animal dispersal in a forest environment [*Lucas* in *Isleya* 1: 115–139 (1977)].

100. **SACCIOLEPIS** Nash (1901)

Simon in *Kew Bull.* 27: 387–406 (1972).

Annual or perennial; leaf-blades linear to convolute; ligule membranous. Inflorescence a narrowly cylindrical, densely spiciform panicle (rarely open; always spiciform in Ethiopia). Spikelets lanceolate-oblong to ovate, asymmetrical, plump, usually laterally but sometimes lightly dorsally compressed, prominently ribbed, of variable length within the panicle with some spike-

lets reduced, basal spikelets sometimes sterile; lower glume broad, loose and slightly inflated, 1/3–2/3 spikelet length; upper glume as long as the spikelet, deeply concave and gibbous on the back, membranous to firmly herbaceous; lower lemma similar but a little narrower and flatter, male or sterile, its palea narrow, shorter than the lemma and often much reduced; upper lemma cartilaginous, dorsally compressed, smooth and shiny, often much shorter than the spikelet, the margins clasping the edges of the palea; mature floret readily deciduous.

30 species in the tropics, predominantly in Africa.

A genus of marshland and aquatic plants, probably undercollected in Ethiopia. Recognized by its spiciform inflorescence of asymmetrical, ribbed spikelets.

1. Spikelets dorsally compressed; stems spongy and succulent, often floating. 1. *S. africana*
- Spikelets laterally compressed; stems hard, not floating. 2
2. Spikelets 3–4.5 mm long; rhizomatous perennial. 2. *S. rigens*
- Spikelets 1–3.2 mm long; slender annuals. 3
3. Spikelets 2–3.2 mm long; culm-base decumbent with aerial roots; leaf-blades 2–6 mm wide, not ribbed and papillose, often pilose. 3. *S. indica*
- Spikelets 1–2 mm long; culm-base erect; leaf-blades 1–3 mm wide, upper surface ribbed and papillose, glabrous. 4. *S. spiciformis*

1. *S. africana* C. E. Hubb. & Snowden (1936);
– type: Nigeria, Dalziel 478 (K holo.), not Graham s.n. as in Cufodontis, Enum: 1322 (1969).
S. interrupta auct., non (Willd.) Stapf (1920).

Vigorous aquatic grass (perennial?), completely glabrous; culms often floating, procumbent and rooting below, spongy and succulent, ascending up to 1 m or more above the water. Leaf-blades linear, flat, 15–50 cm long, 4–12 mm wide, closely nerved without an obvious midrib on the upper surface, long-acuminate; leaf-sheaths loose and papery. Panicle spiciform, 6–30 cm long, the pedicels smooth. Spikelets asymmetrically elliptic-oblong, lightly dorsally compressed, 2.7–3.5(–4.1) mm long, thinly membranous, obtuse to subacute, yellowish-green with darker tips; lower glume broadly rounded, 5–7-nerved, 1/3 to almost 1/2 spikelet length; upper glume narrowly obovate, 9–11-nerved, hooded, broadly obtuse when flattened; lower lemma similar but flat, sterile with a palea 1.8–2.1 mm long; upper lemma only slightly shorter than the spikelet; white or pale brown. Fig. 81:1, 2.

Wet pasture and floating in shallow water; 1700–1800 m. GD GJ KF; throughout tropical Africa, extending to Natal and Madagascar. Friis et al. 2064; Mesfin & Kagnew 1768; Stewart 88.

S. interrupta (Willd.) Stapf, with a mainly Asian distribution from India to SE Asia, differs only in its longer (4–4.5 mm), more acute spikelets. A few specimens with the dimensions of *S. interrupta* do occur in

eastern Africa (although apparently not in Ethiopia) and there is no sharp morphological demarcation between the two taxa. However, *S. africana* is reported to be diploid ($2n=18$) and *S. interrupta* tetraploid ($2n=36$).

2. *S. rigens* (Mez) A. Chev. (1934);
Panicum rigens Mez (1904) – type: Togo, Kersting 595 (K iso.).

Shortly rhizomatous perennial; culms usually single, laxly ascending, leafy and branching, 1–2 m high. Leaf-blades linear, flat, 10–40 cm long, 5–7 mm wide, glabrous or shortly hispid, acuminate; leaf-sheaths extended into auricles 1–4 mm long at the mouth. Panicle spiciform, 6–20 cm long; pedicels smooth. Spikelets narrowly lanceolate, 3–4.5 mm long, subacute, laterally compressed, glabrous or hispidulous, tinged grey-purple; lower glume ovate, c 1/2 spikelet length, 3–7-nerved with broad hyaline margins and obtuse tip; upper glume ovate, 9-nerved, membranous to firm, tip broadly obtuse when flattened; lower lemma similar, firm, male, its palea 2–2.5 mm long; upper lemma 1/2 spikelet length, pallid.

Marshes; 1900 m. KF; infrequent from scattered localities in tropical Africa from Ghana to East Africa and Zambia. De Wilde 7570; Stewart C-21b.

S. rigens is sometimes confused with the annual *S. indica*, which also has auriculate leaf-sheaths. *S. rigens* is a more vigorous species with a perennial rhizomatous base, longer, proportionately narrower leaf-blades and longer spikelets.

3. *S. indica* (L.) A. Chase (1908);
Aira indica L. (1753) – type: India, König (LINN holo.).
Sacciolepis auriculata Stapf (1920).
Sacciolepis pergracilis Chiov. (1928) – types: Ethiopia, GD, near Gondar, Chiovenda 1736 (FT syn.) & 2342 (K isosyn.) & Asoso, Chiovenda 2576 (K isosyn.).
Sacciolepis gracilis Stent & Rattray (1933).

Delicate annual; culms very slender, 10–70 cm high, weakly ascending from a branching, decumbent or shortly stoloniferous base anchored by aerial roots. Leaf-blades broadly linear, flat, 2–12 cm long, 2–6 mm wide, glabrous or stiffly pilose, not papillose, acute; leaf-sheaths often with auricles up to 2 mm long. Panicle spiciform, 1–10 cm long; pedicels smooth. Spikelets broadly lanceolate to ovate, 2–3.2 mm long, obtuse, laterally compressed, hispidulous or glabrous, often purple-tinged; lower glume ovate, 3(–5)-nerved, 1/3–2/3 spikelet length, herbaceous with broad hyaline margins and tip; upper glume gibbously ovate, 7–9-nerved, herbaceous with a hyaline, broadly obtuse tip; lower lemma similar, male or sterile, its palea 1–2 mm long; upper lemma 1/2–2/3 spikelet length, pallid.

Swampy grassland and stream margins. GD KF; Old World tropics. Stewart C-21a; Friis et al. 611 (ETH).

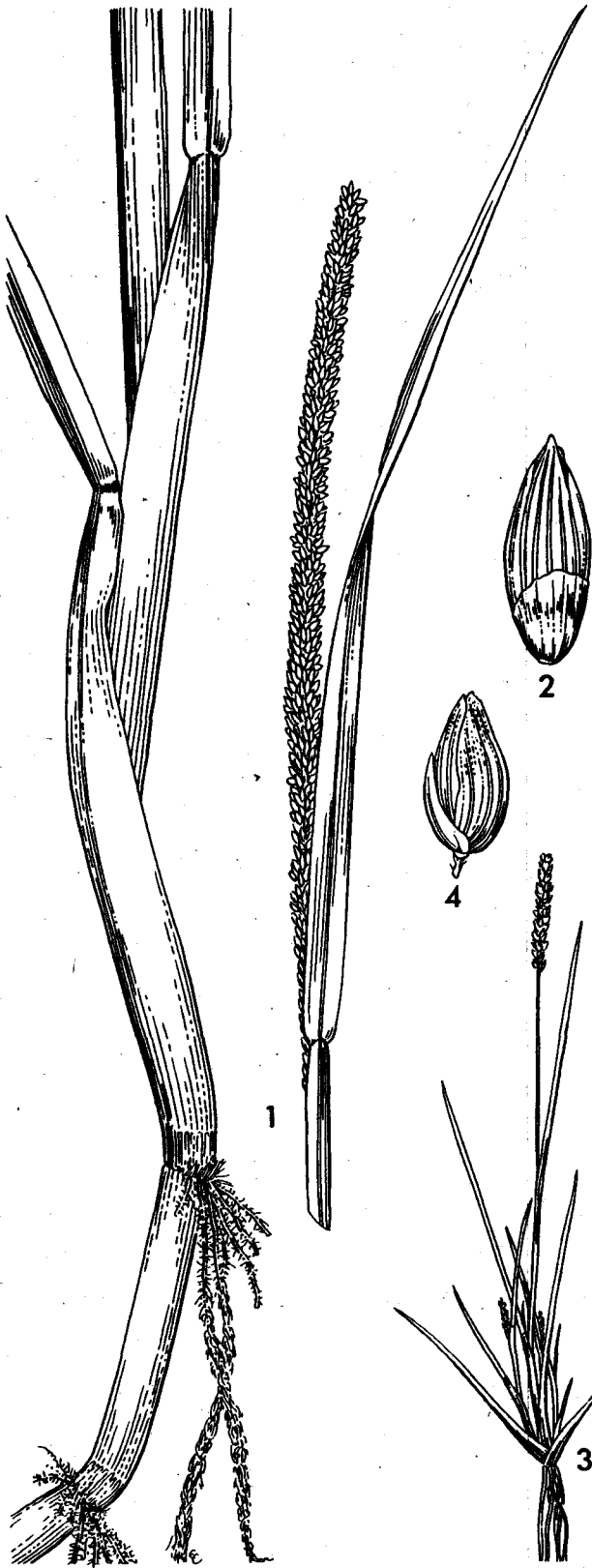


Figure 81. *SACCIOLEPIS* spp.: *S. AFRICANA*: 1 - base of plant and inflorescence x 2/3; 2 - spikelet x 10. *S. SPICIFORMIS*: 3 - habit x 2/3; 4 - spikelet x 10. 1 from Schimper 1367; 2 from Mesfin & Kagnew 1768; 3 & 4 from Chiovenda 2246. Drawn by Eleanor Catherine.

4. *S. spiciformis* (Hochst. ex A. Rich.) Stapf (1920);
Panicum spiciforme Hochst. ex A. Rich. (1850);
P. myosuroides R. Br. var. *spiciforme* (Hochst. ex A. Rich.) Engler, *Hochgebirgs. Fl. trop. Afr.*: 118 (1892) - type: Ethiopia, TU, Shire [Chiré], Schimper 1825 (P holo.).

Sacciolepis huillensis (Rendle) Stapf (1920).

Slender annual; culms erect, solitary or tufted, 5–80 cm high. Leaf-blades linear, flat, 3–13 cm long, 1–3 mm wide, glabrous, the upper surface with spaced prominent ribs covered in papillae, acute. Panicle spiciform, 1–20 cm long; pedicels thinly spinulose. Spikelets ovate-oblong, 1–2 mm long, laterally compressed, glabrous or hispidulous, obtuse, tinged purplish-grey; lower glume ovate, 3–5-nerved, 1/2–2/3 spikelet length, thin; upper glume gibbously ovate, 7–9-nerved, herbaceous, obtuse; lower lemma similar, sterile, its palea up to 0.9 mm long; upper lemma 2/3 spikelet length, pallid or light brown. Fig. 81:3, 4.

Swampy grassland; 1800–2600 m. TU GD GJ; southwards to Natal, Cameroon, Madagascar. *Chiovenda* 2193; *Mesfin & Kagnew* 1784.

S. spiciformis is closely related to *S. indica*, but can generally be separated by its smaller spikelets and more erect habit. The papillose upper leaf-epidermis is a good diagnostic character, although difficult to see without good magnification. Ethiopian specimens tend to have larger spikelets (1.7–2 mm) than elsewhere in Africa, where the spikelets seldom exceed 1.7 mm.

S. micrococca Mez, mainly occurring from Senegal to Sudan, also has a papillose upper leaf-epidermis but is distinguished by its smaller, glabrous spikelets (0.7–1 mm long).

101. *PANICUM* L. (1753)

Delicate to robust annuals or perennials, rarely suffrutescens. Leaf-blades very variable, linear or inrolled and pungent to lanceolate or ovate, sometimes cross-veined; ligule membranous or ciliate. Inflorescence a panicle, sometimes the spikelets contracted along the primary branches. Spikelets elliptic or oblong, dorsally or weakly laterally compressed, glabrous or occasionally hairy, membranous to chartaceous, obtuse to acuminate; lower glume usually shorter than the spikelet but varying from a small hyaline scale to a well developed glume equaling the spikelet, sometimes sheathing at the base or separated by a short internode; upper glume as long as the spikelet; lower lemma resembling upper glume, sterile with its palea absent or reduced, or male with a fully developed palea; upper lemma crustaceous to coriaceous, usually smooth and glossy, occasionally rugose or verruculose.

About 470 species throughout the tropics; extending into temperate North America. *Panicum* species occur in all habitat types from desert to forest and swamp, the forest species often having thin, lanceolate or ovate, cross-veined leaf-blades.

Panicum is one of the largest genera of Gramineae and encompasses an enormous range of vegetative variation, but is held together by its paniculate inflorescence and the relatively uniform structure of its spikelets. Incipient trends towards characters typical of related genera are often found within the genus, sometimes leading to difficulties in determining generic limits. The most obvious of these in Ethiopia is the boundary between *Panicum* and *Brachiaria*, with *B. comata* and *B. deflexa* lying on the borderline.

A number of species are useful for grazing and fodder, especially *P. maximum* Jacq. (Guinea Grass) and *P. coloratum* L. (Buffalo Grass). *P. miliaceum* L. (Proso Millet) is cultivated as a grain crop, especially in India.

1. Upper floret transversely rugose; perennials, often robust. 2
- Upper floret usually smooth, not obviously rugose. 3
2. Lowermost panicle branches whorled; lower lemma not grooved. 1. *P. maximum*
- Panicle branches inserted singly; lower lemma with a longitudinal median groove. 2. *P. infestum*
3. Suffrutescent desert grass forming mounds; culms woody and glaucous; leaf-blades hard, pungent; lower glume 2/3 to almost as long as spikelet. 3. *P. turgidum*
- Herbaceous annuals or perennials. 4
4. Spikelets permanently gaping open; tips of glumes sharply acuminate, slightly recurving; perennials. 5
- Spikelets not gaping (or only at maturity); tips of glumes straight or incurving. 7
5. Spikelets 3.5-4.5 mm long; lower glume 2/3-7/8 spikelet length; rhizomatous. 4. *P. ruspolii*
- Spikelets 2-3 mm long; lower glume 1/3-1/2 spikelet length; tufted. 6
6. Dense tussocky perennial with erect culms; basal leaf-sheaths silky-hairy; lower lemma faintly 5-nerved. 5. *P. dregeanum*
- Tufted perennial with ascending culms; basal leaf-sheaths glabrous; lower lemma prominently 7-9-nerved. 6. *P. poaeoides*
7. Lower glume very broad, clasping the spikelet base, 1/3 as long as the spikelet or less. 8
- Lower glume 1/2 to equal the spikelet length, or if less scale-like, not clasping. KEY 2 15
8. Slender, straggling grasses of forest shade; leaf-blades narrowly to broadly lanceolate; lower lemma 5-nerved. 9
- Tufted or creeping, often robust grasses of open (sometimes aquatic) habitats; leaf-blades linear; lower lemma 7-9-nerved. 11
9. Spikelets obtuse, 2-2.2 mm long; upper glume 3-nerved; ligule triangular, 2-3 mm long. 24. *P. comorense*
- Spikelets acute, 2.5-3 mm long; upper glume 5-nerved; ligule <1 mm long. 10

10. Panicle-axis and pedicels glabrous; spikelets clustered along the panicle-branches. 29. *P. monticola*
- Lower part of panicle-axis hairy; spikelets usually overtopped by fine hairs from the pedicel-tips; spikelets distant on slender pedicels. 28. *P. trichocladum*
11. Tufted perennial from a knotty base, culms erect; lower floret male with a well developed palea. 7. *P. coloratum*
- Robust annuals or creeping perennials; lower floret male or sterile. 12
12. Coarse, robust, mostly annual grasses up to 2 m high; panicles large, 15-50 cm long; leaf-blades soft and lush, 4-12 mm wide, up to 35 cm long. 13
- Creeping perennials up to 1 m high; panicles 5-20 cm long; leaf-blades 3-6 mm wide, often shorter than 15 cm long (if longer, then tough and glaucous). 14
13. Robust tussock grass; culms tough, 2-3 mm wide, erect or ascending; lower palea well developed. 8. *P. porphyrrhizos*
- Stout aquatic grass; culms spongy and succulent, 3-7 mm wide, often stoloniferous; lower palea absent or much reduced. 9. *P. subalbidum*
14. Culms erect from long, spreading rhizomes; leaf-blades tough, pungent; leaf-sheaths tough, woolly on the margins (at least when young). 10. *P. repens*
- Culms stoloniferous from a basal tuft; leaf-blades soft; leaf-sheaths loose, papery, margins glabrous; aquatic grass. 11. *P. hygrocharis*

KEY 2

15. Leaf-blades lanceolate to ovate; plants of forest shade. KEY 3 26
- Leaf-blades linear to lanceolate; plants usually of open habitats. 16
16. Culms much branched with fascicles of short shoots at the nodes; spikelets prominently striate, the nerves forming raised ribs. 27. *P. vatovae*
- Culms and spikelets not as above. 17
17. Spikelets 4-6.5 mm long. 18
- Spikelets 1.5-3 mm long. 19
18. Annual; spikelets acuminate; pedicels to 20 mm long; panicle glabrous. 14. *P. callosum*
- Perennial; spikelets obtuse; pedicels 1-2 mm long; panicle clavellate-hairy. 12. *P. deustum*
19. Spikelets oblong; panicle sometimes clavellate-hairy; lower glume 0-1-nerved. 13. *P. hymenochilum*
- Spikelets plumply elliptic to ovate, acute; panicle not clavellate-hairy; lower glume 3-7-nerved. 20
20. Perennial from a knotty base; upper floret verruculose. 22. *P. nervatum*
- Annuals; upper floret smooth. 21
21. Delicate decumbent annuals; leaf-blades lanceolate, 1-3 cm long; panicle up to 5 cm long. 22

- Tufted annuals; leaf-blades 3–30 cm long; panicle 5–40 cm long, many-spiculate. 23
- 22. Panicle few-spiculate, branches and pedicels divaricate; lower floret sterile with a reduced palea; leaf-blades narrowed at base.
 - 19. *P. pusillum*
- Panicle many-spiculate, branches and pedicels ascending; lower floret male with a well developed palea; leaf-blades cordate at base.
 - 20. *P. dorsense*
- 23. Spikelets in contiguous pairs at the branchlet tips.
 - 15. *P. pansum*
- Spikelets evenly spaced. 24
- 24. Fertile floret pale; lower palea subequalling lower lemma.
 - 16. *P. laetum*
 Fertile floret dark brown or blackish; lower palea clearly shorter than lower lemma. 25
- 25. Leaves hairy; culms ascending or spreading; lower palea 2/3 length of lower lemma.
 - 17. *P. atrosanguineum*
- Leaves glabrous; culms erect; lower palea absent.
 - 18. *P. haplocaulos*

KEY 3

- 26. Spikelets oblique to gibbous, 1.3–1.5 mm long, diffusely scattered in delicate open panicles. 27
 - Spikelets symmetrical. 28
- 27. Panicle branches with glandular patches; upper lemma verruculose.
 - 21. *P. heterostachyum*
- Panicle branches eglandular; upper lemma smooth. *P. brevifolium* (see note under no. 21)
- 28. Spikelets acuminate-subulate; delicate erect annual; leaf-blades narrowly ovate.
 - 23. *P. delicatulum*
- Spikelets obtuse to acute; culms straggling or scandent; mostly perennial. 29
- 29. Spikelets obscurely to obviously nerved but not conspicuously striate; lower glume up to 2/3 spikelet length (usually much less). 30
 - Spikelets prominently nerved with the nerves forming raised ribs; lower glume 2/3 to as long as the spikelet. 31
- 30. Upper glume 3-nerved; ligule 2–3 mm long.
 - 24. *P. comorense*
- Upper glume 5–7-nerved; ligule a narrow rim. 32
- 31. Spikelets obtuse to acute, 2–2.5 mm long; lower glume 2/3–3/4 spikelet length; lower floret male.
 - 25. *P. hochstetteri*
- Spikelets acuminate, 3–3.5 mm long; lower glume equalling spikelet; lower floret sterile.
 - 26. *P. aequinerve*
- 32. Lower part of panicle-axis hairy; spikelets usually overtopped by fine hairs from pedicel-tip.
 - 28. *P. trichocladum*
- Panicle-axis and pedicels glabrous. 33
- 33. Lower glume ovate, 1/4–1/3 spikelet length, 0–1-nerved; spikelets *c* 3 mm long; panicle branches scabrid.
 - 29. *P. monticola*

- Lower glume lanceolate; 1/2–3/4 spikelet length; spikelets 2–2.4 mm long; panicle branches smooth. 30. *P. calvum*

1. *P. maximum* Jacq. (1781);

Urochloa maxima (Jacq.) Webster (1987) - type: Lesser Antilles, Gouadeloupe, *Jacquin* (BM iso.).

P. polygamum Sw. (1788), non Forssk. (1775); *P. jumentorum* Pers. (1805) - type: Jamaica, *Browne* 366 (whereabouts uncertain).

P. teff Desv. (1831) - type: Ethiopia (P-LAM holo., K microfiche).

P. confine Hochst. ex A. Rich. (1850) as syn. of *P. jumentorum*; *P. maximum* var. *confine* (Hochst. ex A. Rich.) Chiov. in *Ann. Ist. Bot. Roma* 8: 33 (1903).

Loosely to densely tufted perennial from a stout root-stock; culms slender to robust, (0.5–)1–3 m high, usually erect, branching, nodes often villous. Leaf-blades linear to linear-lanceolate, flat, 15–55 cm long, up to 25 mm wide, glabrous to pubescent or hispid, margins scaberulous to sharply scabrid, tip acuminate. Panicle 15–45 cm long, loose, many-spiculate, primary branches ascending or spreading, the lowermost whorled; pedicels slender, 1–5 mm long, occasionally setose. Spikelets narrowly elliptic-oblong, (2.5–)3–4 mm long, acute, usually glabrous, occasionally pubescent, firmly membranous to papyraceous; lower glume sheathing, *c* 1/3 spikelet length, 3-nerved, broadly obtuse; upper glume 5-nerved, subacute; lower lemma 5-nerved, usually male with a well-developed palea; upper floret pale, rugose. Fig. 82:1, 2.

Woodland, grassland with scattered trees, and in old cultivations, often in light shade on damp, sandy or alluvial soils near streams; 500–2000 m. EW TU GD WG WU SU AR IL KF GG SD BA HA; tropical Africa; introduced throughout the tropics as a herbage grass (Guinea Grass). *Burger* 3184; *Friis* et al. 980; *M.G. & S.B. Gilbert* 1598.

P. maximum is a valuable pasture and forage species, and many strains have been selected as agricultural cultivars from the large pool of variation found in the wild. There is wide variation in habit, robustness of the culms and in general indumentum. Specimens with pubescent spikelets are sometimes separated as var. *pubiglume* Peter or var. *trichoglume* Robyns.

2. *P. infestum* Peters (1865);

Urochloa maxima (Jacq.) Webster subsp. *infestum* (Peters) Scholz in *Adansonia* 4: 443 (1989) - type: Mozambique, *Peters* (K iso.).

Tussock-forming perennial; culms erect, 0.7–1.2(–2) m high, sometimes branched. Leaf-blades and especially leaf-sheaths usually hirsute with tubercle-based hairs; blades linear, flat, 15–30 cm long, 2–5 mm wide, acuminate. Panicle 10–25 cm long, the primary branches inserted singly, loosely ascending, bearded at point of insertion, spiciform, the spikelets clustered directly

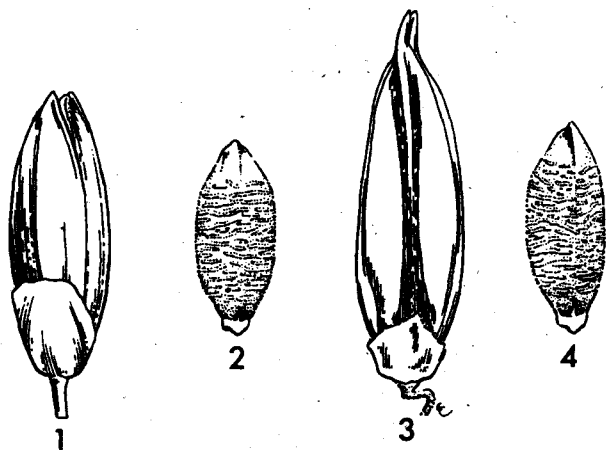


Figure 82. *PANICUM* spp.: *P. MAXIMUM*: 1 - spikelet x 11; 2 - fertile floret x 11. *P. INFESTUM*: 3 - spikelet x 11; 4 - fertile floret x 11. 1 & 2 from Friis et al. 833; 3 & 4 from McLeish 888. Drawn by Eleanor Catherine.

along their length or on short secondary branchlets. Spikelets narrowly oblong, 2.8–4.3 mm long, thinly cartilaginous, apiculate, green tinged with purple; lower glume sheathing, 1/4–1/3 spikelet length, 3-nerved, obtuse; upper glume 5-nerved; lower lemma 5-nerved, the midnerve sunk in a median groove, male with a well developed palea; upper floret pale, rugose. Fig. 82:3, 4.

Acacia woodland and bushland on sandy soils; 600–1600 m. GG SD HA; southwards to South Africa. Gilbert & Jefford 4395, 4660; Glover & Gilliland 1038; Gilbert & Phillips 8968.

P. infestum is the only species of *Panicum* besides *P. maximum* to have a rugose upper floret, but is easily distinguished by the characters given in the key, and in Ethiopia is of only limited distribution in the southern lowlands.

3. *P. turgidum* Forssk. (1775);

- type: Egypt, Forsskål (C holo.).

Suffrutescent glaucous perennial; culms hard, stout and woody below, much-branched, forming rounded bushes up to 1(–1.5) m high and wide. Leaf-blades linear, hard and pungent, 2–15 cm long, 1–6 mm wide, often much shorter than their sheath. Panicle moderately branched, 2.5–15 cm long, primary branches well spaced, eventually spreading, spiculate to the base. Spikelets ovate, turgid, 3.4–4.4 mm long, papery, soon gaping; glumes broadly ovate, acute to acuminate; lower glume slightly shorter than the spikelet, 5–9-nerved; upper glume 7–9-nerved; lower lemma 9–11-nerved, male, its palea well developed; upper floret pallid or yellowish, smooth, glossy.

Sandy deserts and subdeserts with *Acacia*; sea level–900 m. EE AF; N Somalia; northern tropical and subtropical Africa; Arabia and eastwards to Pakistan. Bally 6892; Burger 3515; Pappi 5892.

P. turgidum is common throughout the coastal plains of Eritrea, where it is dominant on some sand dunes. It forms an important constituent of the Saharan and Arabian desert, its twiggy bushes catching sand and forming hummocks, or sometimes breaking off and blowing in the wind like tumbleweeds. It provides grazing for camels and other animals, and is also a useful sand-binder.

4. *P. ruspolii* Chiòv. (1897);

- type: Ethiopia, SD, Surro, Riva 1444 (FT holo.).

Rhizomatous perennial forming loose tussocks; culms ascending, hard, 20–90 cm high, branched. Leaf-blades linear, flat, 7–18 cm long, 4–5 mm wide, pilose with tubercle-based setae along the margins, acuminate. Panicle 5–13 cm long, composed of 4–7 solitary distant primary branches, these ascending, sometimes at a narrow angle, the spikelets scattered along the secondary branches (or directly on the primary branches in small specimens). Spikelets gaping, ovate, 3.5–4.5 mm long, firmly membranous with prominent nerves; glumes ovate with sharply acuminate recurving tips, the lower 2/3–7/8 spikelet length, 5-nerved, the upper 7–9-nerved; lower lemma 9-nerved, acute to shortly acuminate, male with a well developed palea; upper floret narrowly oblong, obtuse, pale, smooth and glossy. Fig. 83:4, 5.

Open deciduous low woodland or bushland, usually in light shade on sandy soils; 1300–1900 m. BA SD; unknown elsewhere. Gilbert & Ermias 8447; Gilbert & Jefford 4679; Gilbert 3320.

Panicum anabaptistum Steud. is a closely related species occurring in swamps and on seasonally flooded grassland from Mauretania to southern Sudan. It is a tough tussock grass with glabrous leaves and larger, more ample panicles to 30 cm long of similar, but narrower spikelets.

5. *P. dregeanum* Nees (1841);

- type: South Africa, Drège s.n. (K iso.).

Densely tufted perennial, closely surrounded at the base by old leaf-sheaths; basal sheaths silky-tomentose; culms erect, slender, 60–100 cm high, flushed purple above each node. Leaf-blades linear, flat or inrolled, 15–40 cm long, 1.5–3 mm wide, glabrous to hirsute, acuminate; leaf-sheaths often ciliate on the margins and tomentose at junction with blade. Panicle ovate or elliptic, 10–20 cm long, much-branched and many-spiculate, branches and pedicels scabrid, slender and often flexuous. Spikelets ovate, gaping, 2–2.8 mm long, purplish; glumes ovate with sharply acuminate recurving tips; the lower 1/2 spikelet length, 5-nerved, the upper 5–7-nerved; lower lemma 5-nerved, acuminate, male with a well developed palea; upper floret narrowly elliptic, pale, smooth and glossy. Fig. 83:6.

Seasonally wet grassland; 1400 m. WG; tropical and South Africa. W. de Wilde 10820.



Figure 83. *PANICUM* spp.: *P. SUBALBIDUM*: 1 - base of plant x 3/4; 2 - panicle x 3/4; 3 - spikelet x 11. *P. RUSPOLII*: 4 - base of plant and panicle x 3/4; 5 - spikelet x 11. *P. DREGEANUM*: 6 - spikelet x 11. 1 from *Frits et al.* 1126; 2 & 3 from *Frits et al.* 49; 4 from *Gilbert et al.* 7889; 5 from *Gilbert & Jefford* 4370; 6 from *De Wilde* 10820. Drawn by Eleanor Catherine.

P. dregeanum can be distinguished from the other *Panicum* species with gaping spikelets by its dense tussocky habit and silky-hairy basal leaf-sheaths. It has only been collected once in Ethiopia, but is widespread elsewhere in Africa.

6. *P. poaeoides* Stapf (1920);

- types: Kenya, Lindon 213 & Dowson 256 (both K syn.).

Hairy tufted perennial from a knotty rootstock; culms slender, ascending, 30–70 cm high, several-noded, mostly unbranched. Leaf-blades linear, flat, 10–16 cm long, 4–8 mm wide, hirsute, tubercle-based setae spaced along the margins, especially near the sheath, acuminate. Panicle elliptic, 8–17 cm long, compact, much-branched and many-spiculate; pedicels filiform. Spikelets 2.1–3 mm long, gaping, prominently nerved, usually purplish; lower glume 1/3–1/2 spikelet length, broadly ovate, 1(–sub 5)-nerved, acute to cuspidate; upper glume ovate, 7-nerved, tip acuminate-cuspidate, sometimes recurved; lower lemma 7–9-nerved, acute, male with a well developed palea; upper floret whitish, smooth and glossy.

Seasonally wet grassland on black cotton soil; 1300 m. SD; East Africa, Mozambique and Zimbabwe. Friis et al. 978; Rippstein 782.

Recognized by its much-branched, many-spiculate, rather dense panicle of small, gaping, purplish spikelets.

7. *P. coloratum* L. (1767);

- type: Egypt, Forsskål (LINN holo.).

P. subalbidum Kunth var. *tuberculosum* Chiov. in *Ann. Ist. Bot. Roma* 8: 307 (1908) - types: Eritrea, Pappi 5948, 6281, 6503, 6927 (FT syn.).

P. coloratum L. var. *minus* Chiov. in *Result. Sci. Miss. Stef.-Paoli, Coll. Bot.* 1: 183 (1916) - type: Somalia, Paoli 1270 (FT holo.).

Tufted perennial from a knotty rootstock; culms usually erect, branching, (15–)30–120 cm high. Leaf-blades linear, flat, green or glaucous, 5–26 cm long, 4–10 mm wide, glabrous to pilose, acute to acuminate; leaf-sheaths often tuberculate-pilose. Panicle (4–)10–25 cm long, open to contracted, the primary branches loosely ascending, many-spiculate with the spikelets evenly dispersed or clustered along the secondary branchlets. Spikelets elliptic, plump, 2–3 mm long, prominently nerved, acute to acuminate, green or purple; lower glume broadly ovate and sheathing, 1/3 spikelet length, 1–5-nerved, abruptly acuminate; upper glume elliptic, 7–9-nerved; lower lemma 7–9-nerved, male with a well developed palea; upper floret pale yellow to light brown, smooth, glossy.

Grassland or *Acacia* bushland, roadsides and field margins; 900–1800 m. EE AF EW GJ SU KF SD BA HA; eastern and southern tropical Africa; introduced to West Africa and other tropical countries as a fodder

grass. Edwards 3647; Gilbert, Ensermu & Vollesen 7712; M. G. & S. B. Gilbert 2066.

P. coloratum is a polymorphic species known to include diploid, tetraploid and hexaploid forms, and selected leafy variants are in use as agricultural cultivars for pasture and forage purposes. The habit is mostly tufted with erect culms, but plants vary greatly in height, vigour, leaf length and hairiness, and in panicle size. Agricultural strains are discussed by Bogdan [*Tropical Pasture and Fodder Plants* (1977)].

Small plants with short culms (up to 30 cm), short panicles (4–10 cm) and small spikelets (2–2.3 mm) from eastern and northeastern Africa are sometimes separated as var. *minus* Chiov. However, in Ethiopia such plants are not distinguishable from the rest of the variation range found within the species.

8. *P. porphyrrhizos* Steud. (1854);

- type: Ethiopia, TU, Gafta, Schimper 1230 (K iso.).

Robust annual or short-lived perennial tussock grass; culms erect or ascending, tough, 2–3 mm wide at the base, 0.5–1(–2) m high. Leaf-blades linear, flat, 12–30 cm long, 4–10 mm wide, glabrous or thinly tuberculate-hispid, acute to acuminate. Panicle large and open, 15–40 cm long, moderately to many spiculate, the branches often stiffly divaricate with the spikelets gathered in the distal portions. Spikelets lanceolate, 3–4 mm long, prominently nerved, acuminate to cuspidate; lower glume broadly ovate and sheathing, 1/3 spikelet length, 1(–3)-nerved, obtuse to sharply acute; upper glume narrowly ovate, 7–9-nerved; lower lemma 7–9-nerved, its palea well developed, sometimes including anthers; upper floret pallid or light brown, smooth and glossy.

Seasonally swampy black clay soils; 1200–1700 m. TU GD SU IL KF GG SD; Sudan, West Africa, and southwards through East Africa to Malawi and Zambia. Gilbert & Thulin 349; Gilbert & Jefford 4505; Stewart 59.

P. porphyrrhizos is very closely related to both *P. coloratum* and *P. subalbidum*, and is not completely separated from either. The main differences between the three species are vegetative. *P. subalbidum* is an aquatic with thick spongy culms, usually decumbent and rooting at the nodes, whilst *P. porphyrrhizos* has tougher, rather thinner, non-spongy culms forming loose tussocks on moist ground, but not actually growing in water. In Ethiopia, at least, *P. porphyrrhizos* is also distinguished by the presence of a well developed lower palea. *P. porphyrrhizos* has a less obviously perennial rootstock than *P. coloratum*, and also usually has a more ample panicle with stiffly divaricate branches and slightly longer spikelets.

9. *P. subalbidum* Kunth (1831);

- type: Senegal, Leprieur (P holo.).

P. glabrescens Steud. (1854) - type: Senegal, Leprieur (whereabouts uncertain, not P).

Aquatic grass, probably annual; culms stout and spongy, 3–7 mm wide at the base, erect or more usually decumbent to stoloniferous, rooting and branching at the lower nodes, 0.6–2 m high. Leaf-blades linear, flat, 20–35 cm long, 6–12 mm wide, lush, smooth or scabrid, acute to acuminate; leaf-sheaths papery, loose. Panicle large, ovate, 18–50 cm long, moderately branched, primary branches stiffly ascending, often bare below, the spikelets clustered on the appressed secondary branchlets. Spikelets lanceolate, 2.5–3.5(–4.5) mm long, prominently nerved, acuminate to cuspidate; lower glume broadly ovate and sheathing, 1/4–1/3 spikelet length, 1–3-nerved, truncate to subacute; upper glume narrowly ovate, 7–9(–11)-nerved; lower lemma 9(–11)-nerved, sterile, its palea absent or much reduced; upper floret pale, smooth and glossy. Fig. 83:1–3.

Swamps and shallow open water, 500–2500 m. TU GD GJ SU WG IL KF SD BA; tropical Africa. *Friis* et al. 1126; *Gilbert & Getachew* 2929; *Mooney* 8537.

P. subalbidum varies considerably, and at least two ill-defined and intergrading forms can be distinguished. In Ethiopia most plants are distinctly stoloniferous, with scabrid leaf-blades and a ciliate ligule. In West Africa the commonest form is erect, with smooth leaf-blades and a ciliolate ligule, and such forms also occur in Ethiopia e.g. *Gilbert & Getachew* 2944. However, there are intermediates e.g. *W. de Wilde* 7848 with smooth leaf-blades and a stoloniferous base, and *Stewart* C-15 with scabrid leaf-blades and an erect habit. In West Africa the erect, smooth-leaved characters are correlated with the absence of a lower palea, but this correlation breaks down in Ethiopia, where the presence or absence of a small lower palea varies independently of leaf scabridity.

10. *P. repens* L. (1762);

- type: Spain, *Alstroemer* (LINN holo.).

Tough perennial with elongate rhizomes; culms erect, 15–100 cm high, often from a knotty, tuberous base. Leaf-blades linear, tough and glaucous, distichous, 7–25 cm long, 3–6 mm wide, pungent; ligule a ciliolate rim 0.3–0.5 mm long; leaf-sheaths tough, usually woolly on the margins (at least when young). Panicle moderately branched with ascending branches, 5–20 cm long, the spikelets clustered about the secondary branchlets. Spikelets elliptic, 2.5–3 mm long, pallid or purple-tinged, acute; lower glume broadly ovate and sheathing, 1(–3)-nerved, subacute to obtuse or truncate, usually c 1/3 spikelet length (but sometimes less); upper glume ovate, 9-nerved; lower lemma 9-nerved, male with a well developed palea; upper floret elliptic, pale, smooth and glossy.

Marshes and river and lake margins, usually in sandy soil, sometimes dominant; 1100–2000 m. WU SU AR GG SD; throughout the tropics and subtropics. *Ash* 301; *Parker* 386 & 600; *Gilbert & Phillips* 8868.

P. repens often appears as a pioneer grass, rapidly spreading by means of its long, tough rhizomes.

11. *P. hydrocharis* Steud. (1854);

P. aquaticum A. Rich. (1850), non Poir. (1816) - types: Ethiopia, TU, Ferras-Mai, *Schimper* 1786 (K syn.) & TU, Assai, *Quartin Dillon* (P syn.).

P. repentellum Napper (1963).

Tufted aquatic perennial; culms up to 1 m long, stoloniferous and rooting at the nodes, spongy. Leaf-blades linear, distichous, 6–12 cm long, 3–5 mm wide, soft, acute; ligule ciliate from a membranous base, 0.8–2 mm long; leaf-sheaths thin and papery, rather loose. Panicle moderately branched, ovate with loosely spreading branches or narrower with ascending branches, 6–14 cm long, the spikelets clustered about the secondary branchlets. Spikelets elliptic, 2.2–3 mm long, pale with prominent green nerves in the upper half, acuminate; lower glume a broadly rounded to truncate sheathing scale $<1/3$ spikelet length, 0(–3)-nerved; upper glume ovate, 7(–9)-nerved; lower lemma 7–9-nerved, male with a well developed palea; upper floret elliptic, pale, smooth and glossy.

Shallow water of lake margins and irrigation channels, sometimes forming floating mats, or rooting in marshland and damp gravel of the shore; 1300–2000 m. EW TU WU SU AR SD HA; Sudan and southwards to southern tropical Africa. *Ash* 2167; *Glover & Gilliland* 417; *Thulin* 1349; *Pappi* 106.

P. hydrocharis is distinguished from *P. repens* mainly by its stoloniferous culms from a basal tuft, softer shorter leaf-blades and loose thin leaf-sheaths lacking woolly hairs along the margin. The ciliate ligule and often nerveless truncate lower glume are additional, but less reliable characters.

12. *P. deustum* Thunb. (1794);

- type: South Africa, *Thunberg* (UPS-Thunb. 1844 holo.).

P. arundinifolium Schweinf. (1894) - type: Eritrea, *Schweinfurth* 435 (B holo.).

Tufted perennial from a stout rhizome; culms erect, slender to robust, 1–2 m high, clavellate-pilose below the panicle. Leaf-blades broadly linear, flat, 15–45 cm long, 10–30 mm wide, glabrous to softly pilose, rounded to amplexicaul at the base, acuminate. Panicle 15–40 cm long, the primary branches stiffly ascending or spreading, scabrid, clavellate-hairy, secondary branches usually short and few-spiculate (often 2-spiculate), pedicels 1–2 mm long. Spikelets oblong, pale green, papyraceous, obtuse; lower glume ovate, sheathing, 1/2–3/4 spikelet length, 5–7-nerved, separated by a short internode; upper glume oblong, 7-nerved; lower lemma 5-nerved, male, its palea well developed with winged keels; upper floret narrowly elliptic-oblong, pale. Fig. 84:1.

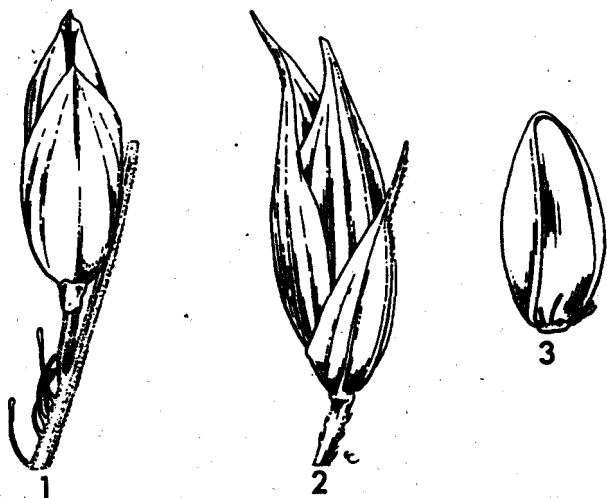


Figure 84. *PANICUM* spp.: *P. DEUSTUM*: 1 - spikelet and part of branch x 9. *P. CALLOSUM*: 2 - spikelet x 9; 3 - fertile floret x 9. 1 from Fukui 1136; 2 & 3 from Jackson 2396. Drawn by Eleanor Catherine.

Deciduous woodland, grassland and in thickets; 700–1600 m. EW GJ GG SD; E Sudan and southwards to South Africa. Friis et al. 975; Fukui 1190; M. G. & S. B. Gilbert 1601.

13. *P. hymeniocentrum* Nees (1841);

- type: South Africa, Natal, Drège s.n. (K iso.).

Sacciolepis semienensis Chiov. (1928) - type: Ethiopia, TU, Debarek, Chiovenda 937 ("137" in protologue in error) (FT holo.).

P. snowdenii C. E. Hubb. (1928) - type: Uganda, Snowden 1188 (K holo.).

Semi-aquatic stoloniferous annual or short-lived perennial, culms slender, weak, rooting at the lower nodes, up to 1 m long. Leaf-blades narrowly lanceolate, thin, divaricate or deflexed, 1.2–7 cm long, 1.5–7 mm wide, subacute. Panicle oblong to pyramidal, 2–9 cm long, sometimes clavellate-hairy, sparsely branched, the primary branches stiffly divergent or the lower often deflexed, the secondary branchlets appressed along their length. Spikelets narrowly elliptic-oblong, 2.2–3 mm long, membranous with a scarious obtuse tip, green tinged with purple; lower glume lanceolate, 1-nerved, 1/2–2/3 spikelet length; upper glume lanceolate-oblong, 7–9-nerved; lower lemma 7–9-nerved, usually sterile with a somewhat reduced palea, occasionally male; upper floret pale, glossy. Fig. 85:6.

Streamsides, swamps and wet grassland, often scrambling through other vegetation; 1800–2400 m. TU SU KF; tropical Africa and Madagascar. Friis et al. 396, 2234; Mooney 8862.

P. hymeniocentrum has very variable indumentum. The clavellate hairs found on the panicle branches and sometimes also on the leaf-sheaths are characteristic, but may be very sparse or even completely absent. The leaves and panicles may likewise also be densely to sparsely pilose with slender tapering hairs, or glabrous.

14. *P. callosum* Hochst. (1844);

- type: Ethiopia, TU, Djeladgeranne, Schimper 1713 (K iso.).

Coarse annual; culms erect, solitary or tufted, 75–115 cm high. Leaf-blades linear, flat, 40–45 cm long, 5–9 mm wide, glabrous or sparsely hispid, narrowed towards the ligule, tip setaceously acuminate. Panicle narrowly elliptic to ovate, 20–35 cm long, scabrid, primary branches stiffly ascending, glabrous in the axils, the spikelets distant on long stiff pedicels. Spikelets narrowly ovate, 5–6.5 mm long, acuminate to cuspidate, prominently nerved; lower glume separated by a short internode, lanceolate, 3/4 spikelet length, 7–9-nerved (outermost nerves sometimes faint), tip keeled, scabrid, acuminate-mucronate; upper glume narrowly ovate, 9-nerved, acuminate; lower lemma 9–11-nerved, acuminate, sterile but with well developed palea, abortive anthers sometimes present; upper floret obtuse, pale, smooth and glossy, a tuft of swollen hairs at the base of the lemma margins. Fig. 84:2, 3.

Shallow soils among rocks. TU GD; Sudan, Cameroon. Schweinfurth 1081; Schimper 693.

A seldom collected annual, with long leaves and a large stiff panicle of big, pointed spikelets on long scabrid pedicels. The tufts of swollen hairs at the base of the lemma, although inconspicuous, are a most unusual feature of this species. These hairs are also found in the very similar perennial South American species, *P. ohyroides* Kunth.

P. nigerense Hitchc. from West Africa is a closely related species differing by its often stouter culms, more ample panicle bearded in the lower axils, narrower lanceolate spikelets, shorter 3–5-nerved acuminate lower glume about half the spikelet length, and narrower upper floret lacking basal tufts of swollen hairs. Two other African annuals belong to this group: *P. hippothrix* K. Schum. from S Somalia and lowland Kenya and Tanzania with spikelets only 3.5–4.5 mm long, and *P. volutans* J. G. Anderson from South Africa with tuberculate-hispid leaves, narrow lanceolate spikelets c 6 mm long and a blackish, striped fertile floret.

15. *P. pansum* Rendle (1899);

- types: Angola, Welwitsch 7261, 2832 (both K isosyn.).

Slender to moderately robust tufted annual; culms branched, 50–100 cm high. Leaf-blades and sheaths pilose to hispid with tubercle-based, spreading hairs, blades broadly linear, 8–30 cm long, 5–7 mm wide, flat, acute. Panicle 15–40 cm long, open and delicate with many spreading branches, the spikelets mostly in contiguous pairs at the tips of long, fine branchlets. Spikelets narrowly ovate, 2.5–3 mm long, prominently nerved, shortly acuminate; lower glume ovate with a clasping base, separated by a short internode, 1/2–2/3 spikelet length, 5-nerved, sharply acute; upper glume narrowly ovate, 7-nerved; lower lemma 7-nerved, sterile

with a reduced palea 1/3–1/2 its length; upper floret obtuse, glossy, usually pale, occasionally flushed darker. Fig. 85:5.

Weedy places; 700 m. GG; westwards to Senegal and southwards through Zaire and Tanzania to Angola, Zambia and Malawi. *Fukai* 1417.

16. *P. laetum* Kunth (1831);

- type: Senegal, *Perrottet* (2 collections, whereabouts uncertain).

P. albidulum Steud. (1854) - type: Sudan, *Kotschy* 42 (K iso.).

Tufted annual; culms slender, erect or geniculately ascending, branching, 20–75 cm high. Leaf-blades linear, flat, 5–23 cm long, 5–10 mm wide, usually glabrous, rarely the undersides hispid near the base, margins smooth or pectinate-setose below, acuminate; leaf-sheaths glabrous or tuberculate-hispid. Panicle 6–20 cm long, untidily much-branched, primary branches ascending or spreading, branchlets and pedicels slender. Spikelets narrowly elliptic, 2.5–2 mm long, prominently nerved, acute, usually pale green; lower glume ovate, 1/2 spikelet length or slightly less, 5–7-nerved, subacute; upper glume elliptic, 7–11-nerved, acute; lower lemma 9–11-nerved, sterile, its palea almost as long; upper floret narrowly ovate, acute, smooth, glossy, pallid or light greyish-brown.

Seasonally damp places in short grassland, ditches, pond and river margins, often on black clay soils. EW; westwards to Mauretania and Senegal; also in Tanzania. *Pappi* 6045.

17. *P. atrosanguineum* A. Rich. (1850);

- type: Ethiopia, TU, Djeladjeranne, *Schimper* 1709 (K iso.).

P. sociale Stapf (1920) - types: Sudan/Gonder border, Matamma, *Schweinfurth* 1585 (K syn.) & Sudan, *Penton* (whereabouts uncertain, not K or BM).

Slender, tufted annual; culms ascending or spreading, 10–70 cm high. Leaf-blades and sheaths (sometimes also the culms) pilose to hispid with tubercle-based hairs; leaf-blades broadly linear, flat, 3–14 cm long, 3–10 mm wide, margins pectinate-hispid, tip acute. Panicle delicate, ovate, 5–20 cm long, the spikelets symmetrically spaced on slender pedicels. Spikelets elliptic, 1.8–2.3 mm long, acute, purplish; lower glume broadly ovate with a sheathing base, 1/2–3/4 spikelet length, 3–5-nerved, acute; upper glume ovate, 5–7-nerved, acute, often falling early; lower lemma 7-nerved, sterile with a reduced palea; upper floret broadly elliptic, acute, smooth and glossy, brownish-black at maturity.

Fig. 85:1, 2.

A weed of disturbed situations, pathsides and arable land; 400–2000 m. EE EW TU GD WU SU AR KF GG

SD BA HA; Sudan, Somalia and southwards to Zimbabwe; also in Arabia, Pakistan and NW India. *Ash* 2637; *Burger* 1117; *Gilbert & Thulin* 201.

The syntype specimen of *P. sociale*, *Schweinfurth* 1585, has rather large spikelets (2.5–3 mm) and a 9-nerved lower lemma, but in other spikelet characters and in general facies fits well into *P. atrosanguineum*.

18. *P. haplocaulos* Pilger (1902);

- type: Sudan, *Schweinfurth* 2003 (K iso.).

Slender annual; culms erect, solitary or tufted, 30–60 cm high. Leaf-blades erect, pale green, linear and flat or inrolled and filiform, 7–25 cm long, 2–6 mm wide, papillose on the upper surface, often pectinate-setose on the lower margins, acute. Panicle delicate and open, 5–20 cm long, the branches filiform, loosely ascending to widely spreading, spikelets distant on slender pedicels. Spikelets elliptic-oblong, 2–3 mm long, pale green with purple tips, acute; lower glume broadly ovate, 1/3–1/2 spikelet length, 3–5-nerved, base sheathing, acute; upper glume 7-nerved, acute; lower lemma 7-nerved, sterile, lacking a palea; upper floret smooth and glossy, acute, golden-brown or brownish-black at maturity.

Marshy ground; 1300 m. WG; westwards to Senegal and in Tanzania, Zambia and Malawi. *Gilbert & Thulin* 645.

A slender, semi-aquatic, probably under-collected species from a few widely scattered localities across tropical Africa. The spikelet scales tend to break away at maturity, exposing the shiny, dark, rather tardily deciduous fertile floret.

19. *P. pusillum* Hook. f. (1864);

- type: Cameroon, Cameroon Mt., *Mann* 2090 (K holo.).

P. tylanthum Hackel (1891) - type: Ethiopia, TU, Hedscha, *Schimper* 1095 (K iso.).

Small decumbent annual; culms delicate, reddish, pilose, 8–30 cm high, much-branched and forming loose mats. Leaf-blades lanceolate, 1–3 cm long, 2–7 mm wide, divaricate or deflexed, pilose, base rounded, tip acute; leaf-sheaths loose, slightly inflated. Panicle ovate, 1.5–3.5 cm long, sparsely branched, branches and pedicels divaricate. Spikelets narrowly elliptic, 1.8–2.2 mm long, green, tuberculate-pilose with stiff, spreading hairs or glabrous, acute; lower glume lanceolate, 3-nerved, 3/4 spikelet length; upper glume narrowly ovate, 7-nerved; lower lemma 5-nerved, sterile with a reduced palea; upper floret pale, smooth and glossy, readily deciduous. Fig. 85:3, 4.

Open patches of moist soil on banks, among rocks and in short grassland, in the open or in shade; 1700–3100 m. TU WG, SU AR IL KF GG SD BA; upland areas westwards to Sierra Leone, and southwards through East Africa to Malawi. *Friis* et al. 1859; *Gilbert & Ermias* 8477; *Mooney* 5819A.



Figure 85. *PANICUM* spp.: *P. ATROSANGUINEUM*: 1 - habit x 3/4; 2 - spikelet x 17. *P. PUSILLUM*: 3 - habit x 3/4; 4 - spikelet x 17. *P. PANSUM*: 5 - pair of spikelets x 17. *P. HYMENIOCHILUM*: 6 - spikelet x 17. 1 & 2 from *Frits et al.* 3079; 3 from *Thulin* 1353; 4 from *Frits et al.* 1057; 5 from *Fukui* 1417; 6 from *Frits et al.* 396. Drawn by Eleanor Catherine.

20. *P. dorsense* S. M. Phillips (1991);

- type: Ethiopia, GG, Dorse, *Gilbert & Phillips* 9262 (K holo., ETH UPS iso.).

Delicate decumbent annual forming loose mats; culms slender, much-branched and rooting at the nodes, reddish, up to 25 cm high. Leaf-blades lanceolate, 0.8–2 cm long, 3–4 mm wide, divaricate, firm, pubescent, base cordate, setose on the margins, tip acute. Panicle elliptic, fairly compact, 3–5 cm long, primary branches ascending, the spikelets evenly dispersed on capillary branchlets and pedicels. Spikelets elliptic, 1.8–2 mm long, pilose, acute; lower glume lanceolate, 1/2–2/3 spikelet length, 3-nerved, acute; upper glume ovate, 7-nerved; lower lemma 5–7-nerved, male with a well de-

veloped palea; upper floret pallid to greyish, smooth, glossy.

Loose stony soil on dry, open banks; 2150 m. GG; unknown elsewhere.

P. dorsense closely resembles *P. pusillum*, but has a fuller panicle of many purplish spikelets on fine ascending branches, in contrast to the sparse panicle with a few green spikelets on stiffly divaricate branches typical of *P. pusillum*.

21. *P. heterostachyum* Hackel (1901);

- type: Eritrea, Keren, *Steudner* 1009 (W holo., K iso.).

Slender annual; culms erect to weakly ascending, many-

noded, up to 80 cm high. Leaf-blades broadly lanceolate to ovate, thin with cross-veins, 8–12 cm long, 10–25 mm wide, pubescent, constricted to an amplexicaul base, margins pectinate-ciliate especially round the base, shortly acuminate. Panicle ovate, delicate, 7–15 cm long, diffuse with many capillary branches, the numerous spikelets spread throughout, often set at an angle to the pedicels; branches with brown glandular patches. Spikelets plump, gibbous, 1.3–1.5 mm long; glumes thinly membranous, pubescent (sometimes glumes of peripheral spikelets hirsute), acute; lower glume narrowly oblong, flat, 3-nerved, equalling the spikelet; upper glume ovate, strongly convex, 5-nerved; lower lemma hyaline, flat, 5-nerved with the lateral nerves marginal, sterile; lower palea equalling lower lemma; upper floret pale, verruculose. Fig. 86:5.

In shade on sandy soils; c 1000 m. EW IL; eastern and southern tropical Africa; also recorded from Sudan and Niger. *Sato* 35 (ETH).

P. brevifolium L. is another very similar annual species from forest shade, occurring throughout the Old World tropics, but not so far found in Ethiopia, although it is quite frequent in East Africa. It is distinguished from *P. heterostachyum* by the absence of glandular patches in the panicle, by its smooth, glossy upper floret and by a short swollen internode separating the glumes.

22. *P. nervatum* (Franch.) Stapf (1920);

Isachne nervata Franch. (1895) - type: Congo, Brazzaville, de Brazza & Thollon 390 (K iso.).

Panicum baumannii K. Schum. (1898) - type: Togo, Baumann 354 (K iso.).

P. fulgens Stapf (1920) - types: Uganda, *Dummer* 593 (K syn.) and several other syntypes.

P. fulgens Stapf var. *pubescens* Robyns in Mém. Inst. Roy. Col. Belge, Sec. Sci. Nat. & Méd. 1: 41 (1932) - types from Zaire.

Slender perennial from a knotty base; culms wiry, scrambling, c 1 mm wide at the base, up to 130 cm long. Leaf-blades cauline, linear-lanceolate, flat, 5–15 cm long, 1.5–6 mm wide, glabrous or tuberculate-pilose, acute to acuminate. Panicle ovate-oblong with loosely ascending branches, 6–18 cm long. Spikelets plumply elliptic to orbicular, 1.5–2.3 mm long, pale green often tinged with purple and gold, glabrous or pubescent, minutely asperulous; glumes obtuse to acute; lower glume 2/3–4/5 the length of the spikelet, oblong, 3-nerved; upper glume as long as the spikelet, broadly elliptic, deeply concave, 5-nerved; lower lemma 5-nerved, male with a well developed palea; upper floret shorter than the lower, thinly cartilaginous, pallid, verruculose.

Wooded grassland; 1350 m. KF; through Sudan to W Africa and southwards to southern tropical Africa. *Tewelde* B.G.E. 440 & 441 (ETH).

23. *P. delicatulum* Fig. & De Not. (1854);

- type: Sudan, Blue Nile, *Figari* (whereabouts unknown, not FT).

P. lepidum Hochst. ex Chiov. (1906) - type: Ethiopia, TU, Djeladgeranne, *Schimper* 2020 (P iso.).

P. figarianum Chiov. (1917) - type: Ethiopia, TU, Djeladgeranne, *Schimper* (FT holo.).

Delicate annual; culms erect, 10–40 cm high. Leaf-blades lanceolate to ovate, thin, 3–8 cm long, 5–12 mm wide, asymmetrical, pilose especially on the lower surface, abruptly narrowed at the base, acuminate. Panicle ovate, 3–8 cm long, delicate with capillary branches, moderately to much branched, primary branches branched from the base, often pilose. Spikelets elliptic with a subulate tip, 2–2.5 mm long, scaberulous on the nerves, often pilose; lower glume a broad, hyaline, nerveless scale c 1/4 spikelet length; upper glume ovate, 3(-sub 5)-nerved, its tip attenuate, extended into a subulate point; lower lemma 3-nerved, sterile, its palea moderately developed; upper floret pallid to light brown, smooth, glossy. Fig. 86:8.

Open patches of damp soil in shade, especially on rocky banks; 1300–2000 m. TU GD GJ SU; Sudan (Blue Nile Province), Tanzania, Zambia and Malawi. *Bigazzi & Tardelli* 241; *De Wilde & Gilbert* 303; *M. G. & S. B. Gilbert* 1888.

P. delicatulum can be easily distinguished from other slender, broad-leaved shade species of *Panicum* by its distinctive sharp-pointed spikelets.

24. *P. comorense* Mez (1921);

- types: Tanzania, *Holst* 549 & Comoros, *Boivin* (both B syn.).

Annual; culms lax, procumbent and rooting at the lower nodes, ascending to 45–100 cm. Leaf-blades narrowly lanceolate, thin with many cross-veins, 10–15 cm long, 10–18 mm wide, tapering at the base, acuminate with a setaceous tip; ligule membranous, 2–3 mm long. Panicle large and open, 15–25 cm long, primary branches few, widely spaced and divaricate, the short secondary branchlets appressed along their length. Spikelets narrowly elliptic-oblong, 2–2.2 mm long, glabrous, chartaceous, obtuse; lower glume c 1/4 spikelet length, broadly ovate, sheathing, 1-nerved, subacute; upper glume ovate-oblong, 3-nerved; lower lemma 5-nerved, sterile, its palea absent or vestigial; upper floret smooth, glossy, straw-coloured with a minute roughened green patch at the tip.

Forest shade; 900–1500 m. SU IL; throughout tropical Africa; Madagascar and Comoro Is. *Friis* et al. 1903; *Gereau* 1232; *Pavlov* 240 (ETH).

P. comorense bears some resemblance to *P. monticola*, but this is a perennial species with longer culms, a much shorter ciliate ligule, and longer acute spikelets (c 3 mm long) with a 5-nerved upper glume.

25. *P. hochstetteri* Steud. (1854);

P. trichanthum A. Rich. (1850) non Nees (1830);
P. hochstetteri var. *trichanthum* (A. Rich.) Chiov. in
Ann. Ist. Bot. Roma 8: 308 (1908) - types: Ethiopia,
 TU, Mt. Scholoda, *Schimper* 115 (K isosyn.) & Am-
 baetcha, *Quartin Dillon* (P syn.). *P. hochstetteri* var.
gracile Chiov. in *Ann. di Bot.* 5: 61 (1906) - type:
 Ethiopia, SD, Burgi (Hamara), *Riva* 1519 (1641)
 (FT holo.).

P. hochstetteri var. *glaberrimum* Chiov., l.c. 308
 (1908) - types: Eritrea, Amasen, *Tellini* 350 & Sara,
Pappi 129 (FT syn.).

P. cooperi C. E. Hubb. (1928) - type: Ethiopia,
 SU, Addis Alem, *Cooper* (K holo.).

Diffuse, slender perennial; culms scandent, wiry, 40–
 150 cm long. Leaf-blades lanceolate, 4–10 cm long, 4–
 11 mm wide, divaricate or reflexed, cross-veined, glab-
 rous or pubescent, base subcordate, tip acuminate. Pani-
 cle ovate, 5–10(–13) cm long, the spikelets evenly
 spaced on fine, smooth branches. Spikelets oblong,
 (1.8–)2–2.5 mm long, glabrous or thinly pubescent,
 prominently nerved, the nerves forming raised ribs,
 acute; lower glume ovate to lanceolate-oblong, 3–5-
 nerved, 2/3–3/4 spikelet length; upper glume oblong, 7-
 nerved; lower lemma 5–7-nerved, male with a well de-
 veloped palea; upper floret pale, smooth, glossy.

Fig. 86: 1, 2.

Light shade of bushland and forest margins, scram-
 bling through shrubs; 1700–2700 m. EW TU GJ WU
 SU AR IL KF GG SD HA; westwards to Sierra Leone,
 Zaire, Uganda and southwards to Tanzania. *Burger*
 3257; *Mooney* 6033; *Thulin* 1557.

P. hochstetteri is characterized by its scandent habit
 and open panicle of oblong, striate spikelets with very
 prominent nerves.

P. chionachne Mez from East Africa is a closely re-
 lated species differing by its longer panicle (10–23 cm
 long) of ovate spikelets, and a preference for marshy
 ground and damp stream banks.

26. *P. aequinerve* Nees (1841);

- type: South Africa, *Drège* s.n. (whereabouts
 uncertain).

Annual or short-lived perennial; culms slender, ram-
 bling, often decumbent and rooting at the lower nodes,
 15–70(–100) cm long. Leaf-blades narrowly lanceolate,
 3–11 cm long, 3–10 mm wide, divaricate, glabrous to
 pilose, acute or acuminate. Panicle broadly ovate, 6–18
 cm long, sparsely branched. Spikelets lanceolate to
 ovate, (2.5–)3–3.5 mm long, glabrous or thinly pilose,
 prominently nerved, sharply acuminate; lower glume
 equalling the spikelet, lanceolate, 3–7-nerved; upper
 glume 7-nerved; lower lemma 5-nerved, usually sterile
 with a reduced palea, rarely male; upper floret pale,
 smooth, glossy.

Shade of forest margins or bushes in grassland on
 clay or sandy soils; 2000 m. KF; Uganda, Malawi,
 South Africa, Madagascar. *Stewart* 172.

P. aequinerve is a predominantly South African
 species with only a few records extending northwards
 into East Africa, whereas *P. hochstetteri* occurs mainly
 in northeastern and eastern tropical Africa. Typical *P.*
aequinerve is easy to distinguish from *P. hochstetteri*,
 having a sparser panicle of larger (c 3 mm), ovate,
 sharply pointed spikelets with a very long lower glume
 equalling the spikelet and a sterile lower floret. How-
 ever, where the distributions overlap it seems that in-
 trogression occurs as the distinguishing characters be-
 come less clear cut. No unequivocal specimens of *P.*
aequinerve have so far been found in Ethiopia. *Stewart*
 172 is assigned to this species here on account of its
 large spikelets and long lower glume, but the spikelets
 are not distinctly acuminate and the lower floret is
 male.

A few other Ethiopian specimens with exceptionally
 large spikelets for *P. hochstetteri*, and a rather long
 lower glume only slightly shorter than the spikelet ap-
 pear to be intermediate e.g. *Friis* et al. 1443.

27. *P. vatovae* Chiov. (1951);

- type: Ethiopia, SD, Neghelle, *Vatova* 201 (FT
 holo.).

Slender perennial from a tough, knotty rootstock; culms
 ascending, 50–70 cm high, hard, wiry, fasciculately
 branching at the nodes forming clusters of short, leafy
 shoots. Leaf-blades linear-lanceolate, 3–10 cm long, 3–
 8 mm wide, divaricate or deflexed, pubescent especially
 on the undersurface, acuminate; leaf-sheaths imbricate
 on the lateral shoots, tomentose abaxially at the junction
 with the blade and the blades finally disarticulating.
 Panicle ovate, 3–8 cm long, sparsely branched. Spike-
 lets oblong, 3–3.8 mm long, pubescent, prominently
 nerved, olive-green, obtuse; lower glume lanceolate-
 oblong, 3(–5)-nerved, subequalling the spikelet; upper
 glume oblong, 7(–9)-nerved; lower lemma 7-nerved,
 male with a well developed palea; upper floret pale,
 smooth, glossy.

Rocky limestone slopes; 1600 m. SD; unknown else-
 where. *Boudet* 7793; *Corradi* 932, 940, 941, 942, 960.

P. vatovae is closely related to *P. hochstetteri* with
 similar but larger, prominently nerved spikelets. How-
 ever, its fasciculately branching culms and deciduous
 leaf-blades are not found in *P. hochstetteri*, which has a
 loosely branching, scandent habit. It is known at pre-
 sent only from an area within 50 km of Neghelle.

28. *P. trichocladum* K. Schum. (1895);

- types: Tanzania, *Volkens* 69 & *Meyer* 140
 (both B syn.).

Straggling perennial; culms slender, stoloniferous,
 much branched, up to 2.5 m long. Leaf-blades narrowly
 lanceolate, 6–18 cm long, 5–11 mm wide with a con-



Figure 86. *PANICUM* spp.: *P. HOCHSTETTERI*: 1 - panicle and leaves x 3/4; 2 - spikelet x 17. *P. MONTICOLA*: 3 - panicle and leaves x 3/4; 4 - spikelet x 17. *P. HETEROSTACHYUM*: 5 - spikelet x 17. *P. CALVUM*: 6 - spikelet x 17. *P. TRICHOCLADUM*: 7 - spikelet x 17. *P. DELICATULUM*: 8 - spikelet x 17. 1 & 2 from *Mulvany* 58; 3 from *Friis et al.* 2105; 4 from *Mooney* 6061; 5 from *Vollesen* 3604; 6 from *Fröman* 3401; 7 from *M.G. & S.B. Gilbert* 1615; 8 from *De Wilde & Gilbert* 303. Drawn by Eleanor Catherine.

spicuous white midrib, pilose or occasionally glabrous, constricted at the base, acuminate. Panicle ovate, 7–20 cm long, the primary branches divaricate, the spikelets widely spaced on capillary pedicels; lower part of rachis hispid. Spikelets narrowly elliptic, 2.5–3 mm long, plano-convex, obtuse or apiculate, usually overtopped by fine hairs from the pedicel tip; lower glume ovate, 1/6–1/4 spikelet length, 0–1-nerved, obtuse; upper glume convex, 5-nerved, apiculate; lower lemma flat, 5(–7)-nerved, male with a well developed palea; upper floret elliptic, pale, faintly rugulose. Fig. 86:7.

Scrambling through undergrowth at forest margins and edges of clearings, forming colonies; 1200 m. GG SD; S Sudan and southwards to Mozambique. *M. G. & S. B. Gilbert* 1615.

29. *P. monticola* Hook. f. (1864);

- type: Cameroon Mt., *Mann* 1353 (K holo.).

P. umbratile Mez (1904); *P. meyeranum* Nees var. *umbratile* (Mez) Chiov. in *Webbia* 8: 77 (1951)

- type: Ethiopia, Tigre(?), Lótho, *Schimper* 1554 (B holo.).

P. transvenulosum Stapf (1920) - type: Kenya, *Scott Elliot* 6922 (K holo.).

Perennial; culms rambling or climbing, to 3 m long, stoloniferous and rooting at the nodes below. Leaf-blades lanceolate, 9–15 cm long, 10–27 mm wide, thin and cross-veined, usually ± glabrous, occasionally pubescent or thinly hispid, base rounded, tip acuminate; leaf-sheaths hairy along one margin. Panicle 10–18 cm long, moderately branched, the primary branches ascending to widely spreading, the spikelets appressed on secondary branchlets along their length; branches and pedicels scabrid. Spikelets lanceolate to narrowly elliptic, c 3 mm long, glabrous, acuminate to apiculate; lower glume 1/4–1/3 spikelet length, 0–1-nerved, ovate and broadly rounded but its base not sheathing; upper glume elliptic, 5-nerved; lower lemma 5-nerved, usually sterile, its palea variable, much reduced to subequalling spikelet; upper floret pallid or light brown, slightly roughened, glossy. Fig. 86:3, 4.

Damp places in forest shade; 1200–2100 m. TU? WG SU AR IL KF BA; throughout tropical Africa. *Friis* et al. 1688, 1754; *Mooney* 6061.

The lower palea in *P. monticola* is often described as being absent or vestigial, but is in fact very variable, frequently subequalling the spikelet and sometimes even including well-developed anthers (e.g. *Friis* et al. 1754).

30. *P. calvum* Stapf (1920);

- types: Kenya, *Battiscombe* 685 & Uganda, *Dummer* 3727 & *Scott Elliot* 7647, 7686 (all K syn.).

Slender straggling perennial; culms weak, stoloniferous, to 1 m or more long. Leaf-blades lanceolate, 5–15 cm long, 8–20 mm wide, thin, cross-veined, pilose, especially on the upper surface, with stiff hairs (some-

times sparsely), base rounded, tip acute to shortly acuminate. Panicle 10–20 cm long, moderately branched, the primary branches fine, ascending to widely spreading, bare in their lower parts; branches and pedicels smooth. Spikelets elliptic, 2–2.4 mm long, glabrous, apiculate; lower glume narrowly lanceolate, 1–3-nerved, 1/2–3/4 spikelet length; upper glume elliptic, 7-nerved; lower lemma 5(–7)-nerved, sterile, its palea usually absent; upper floret pale, smooth, glossy. Fig. 86:6.

Forest floor, forming extensive colonies; 1500–2000 m. IL KF BA; West Africa and southwards to Zaire and Tanzania. *Friis* et al. 1841; *Jimma ATS* A105; *Phillips* 18.

P. calvum is best distinguished from other *Panicum* species of similar facies by its lanceolate lower glume, which is clearly narrower in width than the spikelet. *P. hochstetteri* is quite similar, but this is a scandent grass with oblong striate spikelets and a broader, prominently 3–5-nerved lower glume.

102. ACROCERAS Stapf (1920)

Annuals or perennials; culms slender, trailing and often rooting below; leaf-blades linear to lanceolate or ovate, sometimes with cross-veins; ligule a narrow membranous rim. Inflorescence of several loose racemes along a central axis, sometimes subpaniculate due to secondary branching; raceme rachis triquetrous, the spikelets paired, pedicels of each pair connate at the base. Spikelets lanceolate to oblong, plump, the upper glume and lower lemma sharply laterally compressed and keeled at the tip to form a thickened green crest (often both glumes and lemmas crested); lower glume 1/2 – 3/4 spikelet length; upper glume equalling spikelet; lower lemma resembling upper glume, male or sterile with a palea; upper lemma dorsally compressed, crustaceous, smooth or finely striate, margins inrolled; tip of upper palea briefly reflexed and protruding from the lemma.

19 species throughout the tropics (including 12 Madagascan endemics).

A genus of mainly semi-aquatic grasses, recognizable by the thickened green crests at the tips of the spikelet scales.

1. Leaf-blades linear, 3–6 mm wide; racemes erect, appressed to the main axis. 1. *A. macrum*
- Leaf-blades lanceolate, 6–26 mm wide; racemes divergent. 2. *A. zizanioides*

1. *A. macrum* Stapf (1920);

- types: Mozambique, *Swynnerton* 1596 (BM syn) & Zimbabwe, *Craster* 22 & 81 (both K syn.) & Angola, *Pearson* 2024 (K syn.).

Panicum (*Brachiaria*) *gimmae* Fiori (1941) - type: Ethiopia, KF, Jimma [Gimma], *Ufficio Agrario* (FT holo.).

Rhizomatous perennial; culms decumbent and rooting at the lower nodes; 60–130 cm high. Leaf-blades linear, 3–6 mm wide, glabrous or pubescent, not cross-veined, rounded at the base, acuminate. Inflorescence narrow, composed of 3–6 erect appressed racemes spaced along the central axis; racemes 3–8 cm long, the spikelet-pairs loosely contiguous. Spikelets oblong, 4.2–5.5 mm long, slightly laterally compressed, green; glumes chartaceous, the lower 2/3–3/4 spikelet length, 3-nerved, the upper equalling the spikelet, 5-nerved; lower lemma male; upper lemma pale, finely striate, shiny. Fig. 87:1–3.

Marshy grassland and shallow water at stream and lake margins, sometimes forming floating mats; 1600–2400 m. GJ SU KF; southwards to South Africa. *Aweke & Gilbert* 994; *De Wilde* 6967; *Mooney* 7598.

2. *A. zizanioides* (*Kunth*) *Dandy* (1931);

- type: Colombia, *Humboldt* (B holo.).

Rhizomatous perennial; culms decumbent and rooting at the lower nodes, 30–100 cm high. Leaf-blades lanceolate, 6–26 mm wide, faintly cross-veined, the base constricted, rounded or subcordate, tip acuminate. Inflorescence composed of 4–8 divergent racemes spaced along a central axis; racemes 4–12 cm long, sometimes with secondary branching. Spikelets narrowly oblong, 4.5–6.5 mm long, purple; glumes chartaceous, the lower 3/4 spikelet length, 3-nerved, the upper equalling the spikelet, 5-nerved; lower lemma sterile; upper lemma pale, ± smooth, shiny. Fig. 87:4–6.

Swampy ground in forest; 1200 m. KF; western Africa from Guinea to Angola; Uganda and W Tanzania; also in India and tropical America. *Friis* 4508.

A. amplexans *Stapf*, which occurs from Senegal eastwards to Upper Nile Province, Sudan, is to be expected in marshy lowland areas of western Ethiopia. It is similar to *A. zizanioides*, but has a straggling annual habit and thinner, linear-lanceolate leaf-blades with amplexicaul bases.

103. *ECHINOCHLOA* *P. Beauv.* (1812),

nom. conserv.

Tufted annuals or tufted to rhizomatous perennials; culms often coarse and robust; leaf-blades linear, flat; ligule ciliate or absent. Inflorescence composed of racemes along a central axis; racemes simple or compound, densely spiculate throughout; rachis triquetrous, often setose; spikelets congested into pairs or fascicles, or on short secondary branchlets. Spikelets plump, plano-convex, usually pubescent to hispid or spinulose and acute to awned, rarely smooth, glabrous and obtuse; lower glume 1/3–1/2 (rarely more) spikelet length, sheathing, occasionally extended downwards into a stipe; upper glume and lower lemma equalling spikelet, usually prominently 5–7-nerved, acute to rostrate or the lower lemma extended into a stout awn; upper lemma crustaceous, smooth, glossy, margins clasp-

ing edges of the palea, tip usually extended into a short green incurving beak; upper palea tip briefly reflexed.

30–40 species in tropical and warm temperate regions of the world, mostly in aquatic or moist situations. Several species are widespread arable weeds, especially of irrigated crops.

Echinochloa is a difficult genus taxonomically as there are seldom clear-cut boundaries between the species. The species themselves are also very variable, reacting strongly to differences in environment and apparently readily developing local variants. Most species are known to include several different chromosome numbers and introgression between species is commonplace. It is therefore often impossible to find unequivocal key characters for separating the species. *Yabuno* [*Cytologia* 38: 134 (1973)] considers tropical East Africa to be one of the centres of origin of the genus.

The reflexed upper palea-tip, although a very tiny character, is nevertheless one of the most important for distinguishing *Echinochloa* from neighbouring genera in the *Panicaceae*, especially from *Brachiaria* (see note under *E. rotundiflora*).

Two cultivated species of *Echinochloa* are sometimes grown as minor crops for grain or forage. Although neither is used in Ethiopia, they are likely to occur as adventives. *E. frumentacea* *Link* is mainly grown in India, but also rarely in Australia and in Africa from Tanzania southwards to Zimbabwe. It is regarded as a cultivated derivative of *E. colona*, and is a robust erect annual with a dense lanceolate head of plump, pallid, tardily deciduous spikelets with a sterile lower floret and whitish grain. *E. utilis* *Ohwi & Yabuno* is cultivated mainly in warm temperate E Asia, but has been introduced to most warm temperate areas and is occasionally adventive in Africa. It is derived from *E. crus-galli*, and resembles *E. frumentacea* but has purplish, more acute spikelets with a brownish grain.

1. Spikelets obtuse, smooth and glabrous; supported by a basal stipe 0.5 mm long. 1. *E. rotundiflora*
- Spikelets acute, rostrate or awned, pubescent to spinulose. 2
2. Ligule absent or inconspicuous with hairs <1 mm long (if longer, spikelets <3 mm). 3
- Ligule densely ciliate with stiff hairs 2–4 mm long (sometimes absent on uppermost leaf-blades). 7
3. Racemes essentially unbranched (a few basal branchlets sometimes present); spikelets in pairs or clusters on the raceme-rachis. 4
- Racemes obviously branched; most spikelets borne on secondary branchlets. 6. *E. crus-pavonis*
4. Tussocky perennial; spikelets typically purple, 2–3 mm long, acuminate to shortly awned; racemes setose. 2. *E. haploclada*
- Weedy annuals. 5
5. Spikelets 2–3 mm long, pubescent, acute, un-awned; racemes 1–3 cm long, the spikelets



Figure 87. *ACROCERAS* spp.: *A. MACRUM*: 1 - habit x 3/4; 2 - inflorescence x 3/4; 3 - spikelet pair x 9. *A. ZIZANOIDES*: 4 - habit x 3/4; 5 - inflorescence x 3/4; 6 - spikelet x 9. 1 from Friis et al. 2059; 2 from Friis et al. 52; 3 from Stewart 80; 4-6 from Friis et al. 4508. Drawn by Eleanor Catherine.

congested into 4 neat rows; fertile floret whitish at maturity.

3. *E. colona*

– Spikelets 2.8–4 mm long, acuminate to awned; fertile floret brownish at maturity.

6

6. Ligule shortly ciliate (<0.5 mm); leaf-blades 4–6 mm wide.

4. *E. ugandensis*

– Ligule absent; plant often coarse, leaf-blades up to 20 mm wide.

5. *E. crus-galli*

7. Culms reed-like, hard, unbranched, up to 4 m high; spikelets 3–4 mm long, acute to cuspidate; lower glume <1/2 spikelet length.

7. *E. pyramidalis*

– Culms decumbent, often floating, spongy with papery leaf-sheaths, ascending to 2 m high; spikelets 4–6 mm long, rostrate to awned; lower glume >1/2 spikelet length.

8. *E. stagnina*

1. *E. rotundiflora* Clayton (1980);

Panicum obtusiflorum A. Rich. (1850), non *Echinochloa obtusiflora* Stapf (1920); *Brachiaria obtusiflora* (A. Rich.) Stapf (1919) - type: Ethiopia, TU, Mt. Walcha, Schimper 1553 (K iso.).

Coarse annual; culms solitary or tufted, stout, 45 cm to 1.3 m high, the leaf-sheaths loose and papery. Leaf-blades linear, flat, 15–30 cm long, 5–10 mm wide, margins cartilaginous, serrate, tip acute; ligule absent. Inflorescence yellowish-green, 9–30 cm long, contracted with the racemes loosely erect and overlapping by much of their length, or the lower somewhat spreading; racemes 3–12 cm long, compound, scabrid-hispid, the spikelets borne loosely on secondary branchlets at least near the base. Spikelets plumply elliptic or obovate, 3.5–4.5 mm long, smooth, glossy, obtuse, supported by a cylindrical basal stipe 0.5 mm long; lower glume 1/3 spikelet length, broadly rounded; upper glume and lower lemma cartilaginous; lower lemma male; upper lemma broadly elliptic, without a green herbaceous tip. Fig. 88:7, 8.

Marshy grassland, *Acacia seyal* woodland, or occasional weed of roadsides and arable land, favouring clay soils; 1000–2000 m. EW TU GD SU KF; Sudan, Nigeria. Ash 2240; Fröman 3318; Parker E48.

E. rotundiflora, with its plump obtuse spikelets supported by a stipe, superficially resembles *Brachiaria* much more than *Echinochloa*. It is placed in *Echinochloa* mainly on the strength of its reflexed upper palea-tip, a typical *Echinochloa* feature never occurring in *Brachiaria*. The absence of a ligule is also characteristic of *Echinochloa*.

E. obtusiflora Stapf, known from Niger, Nigeria, Cameroon and Sudan (Kordofan Province), has similar plump stipitate spikelets. However, the spikelets are smaller (2.2–3.5 mm) on neatly 4-rowed racemes and this species also has a ciliate ligule.

2. *E. haploclada* (Stapf) Stapf (1920);

Panicum haplocladum Stapf (1908) - types:

Kenya, Hildebrandt 2022 (K syn.) & Tanzania, Grant (K syn.) and several other syntypes.

Perennial forming tough tussocks; culms erect, (40–)75 cm to 2.5 m high, hard, branching. Leaf-blades linear, 10–30 cm long, 2–10(–15) mm wide, often rather glaucous, occasionally with horizontal purple bands, tip filiform; ligule usually absent, sometimes a ciliate fringe of short hairs to 1 mm long on lower leaves. Inflorescence 7–15 cm long, usually purple, often lanceolate with crowded ascending racemes (occasionally linear with the racemes more spaced and erect); racemes 1–4(–5.5) cm long, bearing the spikelets in congested clusters surrounded by tubercle-based setae 2–5 mm long. Spikelets elliptic, 2–3 mm long, spinulose on the nerves, sometimes also puberulous; lower glume 1/3–1/2 spikelet length, cuspidate or mucronate; upper glume and lower lemma abruptly acuminate to rostrate or lower lemma tip extended into a stout curved awn to 2(–5) mm long; lower lemma male; upper lemma 1.5–2.3 mm long. Fig. 88:5, 6.

Damp depressions on black clay soils, often in *Acacia-Commiphora* bushland, and in the wet mud of river margins; 180–1700 m. GG SD HA; S Sudan, Somalia and southwards through East Africa to Zimbabwe and Mozambique. Friis et al. 3258; Gilbert & Sebsebe 8730; M.G. & S.B. Gilbert 1603.

E. haploclada has similar short racemes of small spikelets to *E. colona*, but the racemes typically arise closer together on the main axis, and bear the purplish, somewhat narrower, more acuminate spikelets in clusters rather than pairs; the branch- and spikelet-nodes also bear setae which may be numerous and conspicuous. However, the boundary with *E. colona* is very indistinct and difficulties can arise, especially when the habit is unknown. Plants from the banks of the Wabi Shebele river have pale-green spikelets on short racemes very similar to *E. colona*, but the spikelets are in clusters supported by a few setae and the vigorous habit and glaucous leaves are more characteristic of *E. haploclada* (e.g. Taddesse Ebba 808; Sandford 12). These two species are known to hybridize [Yabuno in *Cytologia* 38: 131–135 (1973)].

E. haploclada is distinguished from *E. pyramidalis* by its more compact tussock, generally less vigorous branching habit, ligule either absent or represented only by short silky hairs, and shorter racemes of smaller spikelets with more elongate acuminate tips.

3. *E. colona* (L.) Link (1833);

Panicum colonum L. (1759) - type: Jamaica, Browne (LINN, holo.).

Panicum equitans A. Rich. (1850); *P. colonum* var. *equitans* (A. Rich.) Th. Dur. & Schinz, *Consp. Fl. Afr.* 5: 743 (1895); *Echinochloa equitans* (A. Rich.) C. E. Hubb. (1956); *E. colonum* var. *equitans* (A. Rich.) Cuf., *Enum.* 39, Suppl.: 1320 (1969) - types: Ethiopia, TU, Chiré, Quartin Dillon (P syn.) & Sana, Walcha, Schimper 1608 (K iso.).

Loosely tufted annual; culms prostrate or ascending, up to 1 m high. Leaf-blades linear, flat, 7–25 cm long, 3–6 mm wide, glabrous, minutely granular, sometimes with horizontal purple banding, acute; ligule absent. Inflorescence 6–12 cm long, the racemes simple, 1–3 cm long, spaced or overlapping by up to half their length or more, erect and lying against the main axis or sometimes stiffly diverging from it, bearing the spikelets usually in pairs tightly congested into 4 neat rows. Spikelets plumply ovate-elliptic, 2–3(–3.3) mm long, green or purple-tinged, pubescent (rarely glabrous) and subspinulose upwards along the nerves, sharply acute to cuspidate (lower lemma rarely with a subulate point to 1 mm long); lower glume 1/3–1/2 spikelet length; lower lemma male or sterile; upper lemma 2–3 mm long, 1.1–1.2 mm wide, whitish at maturity. Fig. 88:9, 10.

Weed of irrigated fields, streamsides and disturbed places on seasonally waterlogged soils; sea level–2400 m. EE AF EW TU GD GJ WU SU AR IL KF GG SD HA; throughout the tropics and subtropics. *Aweke & Gilbert* 798; *M.G. & S.B. Gilbert* 1306; *Hemming* 1083.

E. colona is best recognized by its weedy annual habit and inflorescence of short, neat, usually rather openly spaced racemes of round, unawned, pubescent spikelets. The racemes typically lack long setae (in contrast to *E. haploclada*), although a few setae may occur in some specimens.

The specific epithet has usually in the past been regarded as the reduced genitive plural form "colonom", but nowadays the more straightforward adjectival form "colona" is generally accepted.

4. *E. ugandensis* *Snowden & C.E. Hubb.* (1936);

- type: Uganda, *Liebenberg* 851 (K holo.).

Loosely tufted annual; culms somewhat spongy, often rooting at the lower nodes, 30–100 cm high. Leaf-blades linear, flat, 10–25 cm long, 4–6 mm wide, minutely granular, acute; ligule <0.5 mm, a thin line of hairs or merely a sparse diffuse pubescence at the ligular area. Inflorescence contracted, 8–10(–20) cm long, the racemes simple or with inconspicuous basal branchlets, suberect or the lower spreading, 2–4 cm long, overlapping by half their length or more, densely spiculate with the spikelets in pairs or threes. Spikelets plumply elliptic, 2.8–3.5 cm long, pubescent and spinulose upwards on the nerves, rostrate or awned; lower glume 1/3 spikelet length; lower lemma male (in Ethiopia), rostrate or extended into a stout awnlet to 2 mm long; upper lemma 2.8–3 mm long, 1.5–1.8 mm wide, pale brownish at maturity.

Marshy pond and stream margins; 1500–2600 m. TU GD GJ WU SU; southwards through eastern Africa to Transvaal. *Gilbert & Getachew* 2805; *Parker* E27; *Thulin & Hunde* 3901.

E. ugandensis is similar to *E. colona*, but has a shortly ciliate ligule at least on the lower leaves, and a tendency to awned spikelets.

5. *E. crus-galli* (*L.*) *P. Beauv.* (1812);

Panicum crus-galli *L.* (1753) - type: Europe (LINN holo.).

Tufted annual; culms variable, often rather coarse, erect or geniculately ascending, 25–100 cm high. Leaf-blades linear, flat, 7–35 cm long, 6–20 mm wide, acute; ligule absent. Inflorescence lanceolate to ovate or pyramidal, 6–22 cm long, the racemes stiffly ascending, 2–10 cm long, simple or the longest with inconspicuous branchlets near the base, the spikelets loosely to densely crowded and usually interspersed with tubercle-based setae. Spikelets ovate-elliptic, mostly 3–4 mm long, green or purple-tinged, spinulose; lower glume 1/3–1/2 spikelet length; lower lemma acuminate or extended into an awn up to 5 cm long, sterile; upper lemma 2–3 mm long, 1.2–1.6 mm wide, pale brownish at maturity.

Warm temperate and subtropical regions of the world (a rare adventive in tropical Africa). Barnyard Millet.

E. crus-galli is a polymorphic weed widespread in North Africa, Arabia and South Africa, but occurring only as a rare adventive in tropical Africa. There are no confirmed reports yet for Ethiopia, but it is to be expected as an arable weed.

6. *E. crus-pavonis* (*Kunth*) *Schult.* (1824);

Oplismenus crus-pavonis *Kunth* (1816); *Panicum crus-pavonis* (*Kunth*) *Nees* (1829) - type: Venezuela, *Humboldt* (whereabouts uncertain).

Panicum crus-pavonis (*Kunth*) *Nees* var. *rostratum* *Stapf* in *Fl. Cap.* 7: 396 (1898).

Robust grass (annual or perennial) forming a large clump; culms stout, rooting at the lower nodes, (0.5–) 1–2 m high; lower leaf-sheaths loose and papery. Leaf-blades flat, lush, up to 35 cm long, 7–20 mm wide with a broad white midrib, margins harshly scabrid, tip acuminate; ligule absent. Inflorescence 12–30 cm long, elliptic, yellowish-green or purple-tinged, primary branches mostly compound, bearing numerous spikelets crowded on secondary branchlets, the lowest 3–12 cm long. Spikelets elliptic, c 3 mm long, hispid on the nerves; lower glume 1/3 spikelet length; upper glume shortly rostrate; lower lemma sterile, its tip extended into a stout subulate awnlet 0.8–2.5 mm long; upper lemma 2–2.5(–3) mm long. Fig. 88: 3, 4.

Marshy grassland, ditches and river banks. 1000–2000 m. WG SU (Gibe R.), IL KF; tropical and South Africa; tropical America. *Ash* 2217; *Friis et al.* 1969; *Gilbert & Thulin* 799.

7. *E. pyramidalis* (*Lam.*) *Hitchc. & Chase* (1917);

Panicum pyramidale *Lam.* (1791) - type: Senegal, *Roussillon* (P holo.).

Panicum quadrifarium *A. Rich.* (1850); *P. pyramidale* *Lam.* var. *quadrifarium* (*A. Rich.*) *Chiov.* in



Figure 88. *ECHINOCHLOA* spp.: *E. STAGNINA*: 1 - inflorescence x 3/4; 2 - spikelet x 11. *E. CRUS-PAVONIS*: 3 - inflorescence x 3/4; 4 - spikelet x 11. *E. HAPLOCLADA*: 5 - inflorescence x 3/4; 6 - spikelet x 11. *E. ROTUNDIFLORA*: 7 - inflorescence x 3/4; 8 - spikelet x 11. *E. COLONA*: 9 - inflorescence x 3/4; 10 - spikelet x 11. *E. PYRAMIDALIS*: 11 - inflorescence x 3/4; 12 - spikelet x 11. 1 from Tadesse & Kagnev 1758; 2 from Thulin 1537; 3 & 4 from Friis et al. 560; 5 & 6 from Gilbert & Jefford 4501; 7 & 8 from Ash 2240; 9 & 10 from Mooney 7971; 11 & 12 from Mooney 6098. Drawn by Eleanor Catherine.

Ann. Ist. Bot. Roma 8: 298 (1908); *Echinochloa quadrifaria* (A. Rich.) Chiov. (1937) - types: Ethiopia, TU, Adoa, *Schimper* 206 (K isosyn.) & *Quartin Dillon* (P syn.).

Panicum atrovioleaceum A. Rich. (1850); *Echinochloa quadrifaria* (A. Rich.) Chiov. var. *atrovioleacea* (A. Rich.) Chiov. in *Miss. Biol. Borana, Racc. Bot.*: 275 (1939) - type: Ethiopia, without locality, *Petit* (P holo.).

Robust perennial from a scaly rhizome; culms 1–2.5(–4) m high, hard and reed-like, unbranched, erect or the basal portion and young shoots sometimes spongy and rooting at the nodes. Leaf-blades linear, 25–60 cm long, 6–20 mm wide, tough with a broad white midrib and filiform tip; ligule coarsely ciliate with stiff hairs 2–4 mm long. Inflorescence narrowly lanceolate to pyramidal, often flushed with purple, 9–30 cm long; racemes ascending and usually rather crowded, 2–10 cm long, simple or compound, usually tuberculate-setose, densely spiculate with the spikelets congested into groups or on secondary branchlets. Spikelets broadly elliptic, plump, 3–4 mm long, smooth or scaberulous to hispid on the nerves upwards, acute to cuspidate; lower glume 1/4–1/2 spikelet length, acute, constricted into a short stipe-like base; lower lemma male; upper lemma 2–3.5 mm long. Fig. 88: 11, 12.

Marshland and the shallow water of ditches, pond and river margins; occasional arable weed; 600–2400 m. AF EW TU GD GJ WU SU IL KF GG SD HA; tropical and South Africa; Madagascar. *Friis* et al. 202; *Mesfin & Kagnew* 1762; *Ryding* et al. 1583.

E. pyramidalis may form extensive colonies in seasonal swamps, and the young shoots provide good grazing (Antelope Grass). It is best recognized by its vigorous habit with unbranched tall canes, coarsely hairy ligule and stout, congested racemes of plump unawned spikelets.

8. *E. stagnina* (Retz.) P. Beauv. (1812);

Panicum stagninum Retz. (1789) - type: India, König (LD holo.).

Aquatic grass (annual or perennial); culms decumbent, thick and spongy, rooting and branching at the nodes to form extensive mats, lower leaf-sheaths loose and papery, flowering shoots 0.8–2 m high. Leaf-blades 20–40 cm long, 7–15 mm wide, firm with scabrid margins and filiform tip; ligule long-ciliate (sometimes absent on uppermost leaf). Inflorescence lanceolate, erect or nodding, 10–35 cm long; racemes ascending, up to 15 cm long, secund with a flattened rhachis, simple or the lowermost compound, coarsely spiculate, the spikelets paired. Spikelets narrowly ovate, 4–6 mm long, puberulous, spinulose on the nerves (spicules often tubercle-based); lower glume (<1/2–)1/2–3/4 spikelet length, sharply acuminate to mucronate; upper glume rostrate or shortly awned; lower lemma male or sterile, gradually acuminate into a stout awn 1.5–20 mm long; upper lemma 3–5 mm long. Fig. 88: 1, 2.

Shallow water of marshy lake shores, forming spreading colonies rooting in the mud, the spongy stems forming floating rafts where there is sufficient depth of water; 500–2300 m. TU GD GJ WU SU AR IL KF; tropical Africa; Madagascar; Assam to Indo-China. *Ash* 2753; *Friis* et al. 11; *Thulin* 1537.

A floating species, characterized by its soft, spongy culms, tapering awned spikelets and long lower glume. *E. pyramidalis* is the only other Ethiopian species with a conspicuous ciliate ligule, but this has tall hard canes arising from a scaly rhizome and smaller, unawned spikelets.

104. *ALLOTEROPSIS* Presl (1830) emend. Hitchc. (1909)

Butzin in *Willdenowia* 5: 123–143 (1968).

Annuals or perennials; leaf-blades convolute, linear or lanceolate; ligule membranous or ciliate. Inflorescence composed of slender racemes, these digitate or in whorls along a short central axis; rhachis narrowly triquetrous, bearing the spikelets in pairs or clusters. Spikelets ovate to elliptic, dorsally compressed; glumes unequal, acute to awn-pointed, the lower about half the spikelet length, the upper subequalling the spikelet and ciliate on the margins; lower lemma chartaceous, male, acute, its palea short (much shorter than the anthers) and bifid; upper lemma cartilaginous, shortly awned, the narrow inrolled margins clasping the edges of the acute palea; palea-flaps basally auriculate. Grain elliptic-oblong.

5 species in tropical and South Africa, India, the Philippines and Australia.

Alloteropsis is best distinguished from other Panicoid genera by its awned spikelets and ciliate upper glume.

1. Tussocky perennial; leaves convolute to linear.

1. *A. semialata*

– Annual; leaves lanceolate, amplexicaul, pectinate on the margins.

2. *A. cimicina*

1. *A. semialata* (R. Br.) Hitchc. (1909);

Panicum semialatum R. Br. (1810); *Urochloa semialata* (R. Br.) Kunth (1829); *Oplismenus semialatus* (R. Br.) Desv. (1831); *Coridochloa semialata* (R. Br.) Nees (1833); *Paspalum semialatum* (R. Br.) Eyles (1916) - type: Australia, *Brown* 6101 (BM holo., K iso.).

Tussocky perennial, the swollen base clothed in sericeous to tomentose old sheaths; culms slender, erect, 35–90 cm high, the nodes bearded. Leaf-blades linear to convolute, 7–50 cm long, 2–6 mm wide, glabrous or hairy, acute. Inflorescence digitate, composed of 2–5 ascending, hirsute racemes 4–12 cm long; spikelets arranged in groups on pedicels of varying length, often on racemelets towards the raceme base and in pairs towards the tip. Spikelets lanceolate, 4.5–5.2 mm long (excluding awn), pallid to dark brown, often with hori-

zonal banding; glumes chartaceous with scarious margins, sharply acute or tipped with a mucro to 1 mm long; lower glume ovate, 3-nerved; upper glume elliptic, 7-nerved, the margins ciliate; lemmas both equaling the spikelet, 7-nerved; lower lemma with a small palea corresponding to a thin triangular basal patch on the lemma; upper lemma tip excurrent into a rigid awn-point to 2 mm long. Fig. 89:1-3.

Grassland on clay soils; 1300-2200 m. SU IL KF; tropical Africa, Asia and Australia. *De Wilde* 10185; *Friis et al.* 2401; *Stewart* 186.

A. semialata is a polymorphic species and is unique among grasses in possessing leaf anatomy corresponding to both C3 and C4 photosynthetic types [Ellis in *S. Afr. J. Sci.* 70: 169-173 (1974)]. Gibbs Russell [in *Bothalia* 14: 205-213 (1983)] could distinguish these two types morphologically in South Africa and in southern tropical Africa, creating two subspecies distinguished as follows:

subsp. *semialata*

Veins on the hairy basal sheaths 0.5-1.1 mm wide; leaf-blades convolute, gradually tapered to the tip (< 2 mm wide at 2 cm from tip), hard, sparsely hairy; racemes often >8 cm long with loosely arranged, pale spikelets. C4 leaf anatomy.

subsp. *eckloniana* (Nees) Gibbs Russell in *Bothalia* 14: 211 (1983);

Bluffia eckloniana Nees (1834).

Veins on the hairy basal sheaths up to 0.3 mm wide; leaf-blades flat, broader, abruptly tapering to the tip (2-6 mm wide at 2 cm from tip), soft, usually densely hairy; racemes often <8 cm long with dark congested spikelets. C3 leaf anatomy.

The available Ethiopian specimens do not fit neatly into either of these subspecies. They approach subsp. *semialata* more closely, but have basal veins of intermediate width (0.4-0.5 mm), leaf-blade tips 2.5-3 mm wide and dark coloured spikelets. Leaf anatomy of the species in Ethiopia is unknown.

2. *A. cimicina* (L.) Stapf (1919);

Milium cimicinum L. (1771); *Panicum cimicinum* (L.) Retz. (1783); *Axonopus cimicinus* (L.) P. Beauv. (1812); *Urochloa cimicina* (L.) Kunth (1829); *Coridochloa cimicina* (L.) Nees (1833) - type: India, König (LINN holo.).

Tufted annual; culms ascending, up to 1 m high. Leaf-blades lanceolate, amplexicaul, 4-10 cm long, 10-20 mm wide, pectinate-setose along the margins, glabrous above, tuberculate-hispid on the lower surface and on the leaf-sheaths. Inflorescence composed of 4-11 digitate racemes (1 or 2 sometimes set above the rest) 7-25 cm long, narrowly ascending, bare of spikelets in the lower 1/5-1/2 of their length, the spikelets mostly in pairs. Spikelets elliptic, 3.5-5.5 mm long, pale green; lower glume scarious, ovate, 3-nerved, acuminate or

mucronate; upper glume thinly cartilaginous and shiny, elliptic, 5-nerved, caudate, silky-hairy on the margins with white or pinkish hairs; lemmas 5-nerved, the lower narrowly oblong, subequalling the spikelet; upper lemma elliptic, 3/5 as long as the spikelet, obtuse, tipped with a fine scabrid awn 2-5 mm long; upper palea papillose with swollen lacrimiform hairs. Fig. 89: 4-7.

Sandy soil among rocks; 1300-1500 m. SU SD; throughout the Old World tropics. *Friis et al.* 3302; *M.G. & S.B. Gilbert* 2175; *Tewelde Berhan* 471 (ETH).

105. *ERIOCHLOA* Kunth (1816)

Clayton in *Kew Bull.* 30: 107 (1975).

Annuals or perennials. Leaf-blades linear, flat, acuminate; ligule ciliate. Inflorescence composed of racemes along a central axis (subpaniculate in *E. meyeriana*), the spikelets pedicellate, single, paired or clustered on a narrow rachis, adaxial (back of upper lemma facing away from rachis). Spikelets lanceolate to elliptic, dorsally compressed, thinly cartilaginous, acute to aristate, a bead-like swelling at the base formed by the swollen lowest rhachilla internode and adnate vestige of the lower glume (rarely lower glume well developed); upper glume equalling the spikelet, often awn-pointed; lower lemma similar but usually slightly shorter, male or barren; upper lemma crustaceous, papillose, obtuse and mucronate, its margins inrolled and clasping the edges of the palea.

About 30 species throughout the tropics.

The main diagnostic feature of *Eriochloa* is the bead-like swelling at the spikelet base, in place of the lower glume, usually coupled with lanceolate awn-pointed spikelets. This bead appears to be a development from the basal stipe, formed by the downward extension of the lower glume, often found in *Brachiaria*, to which *Eriochloa* is very closely related. *Brachiaria*, however, has plumper awnless spikelets and a well-developed lower glume. *Eriochloa meyeriana* lies on the boundary between these two genera and *Panicum*.

1. Perennial; inflorescence subpaniculate, the racemes often compound; lower lemma with a palea. 1. *E. meyeriana*
- Annual; inflorescence strictly racemose, the spikelets paired; lower lemma without a palea. 2
2. Tip of spikelet with an awn-point 0.5-4 mm long; pedicel usually setose. 2. *E. fatmensis*
- Tip of spikelet acute to acuminate; pedicels usually glabrous. 3. *E. procera*

1. *E. meyeriana* (Nees) Pilg. (1940);

Panicum meyerianum Nees (1841) - type: South Africa, Drège s.n. (K iso.).

Panicum schimperianum A. Rich. (1850) - types: Ethiopia, TU, Chiré, *Quartin Dillon* (P syn.) & without locality, *Schimper* 1853 (K isosyn.).



Figure 89. *ALLOTEROPSIS* spp.: *A. SEMIALATA*: 1 - habit and inflorescence x 3/4; 2 - spikelet x 9; 3 - upper lemma x 9. *A. CIMICINA*: 4 - habit x 3/4; 5 - inflorescence x 3/4; 6 - spikelet x 9; 7 - upper lemma x 9. 1 from *De Wilde* 10185 & *Stewart* 186; 2 from *Stewart* 186; 3 from *De Wilde* 10185; 4-7 from *Gilbert* 2175. Drawn by Eleanor Catherine.

Panicum mite Steud. (1854) - type: Sudan, *Kotschy* 442 (K iso.).

Robust tussocky perennial; culms erect and woody below, up to 1.3(-2) m high, fasciculately branched, nodes villous, sometimes scandent or arching down and rooting to form long stolons. Leaf-blades 7-20 cm long, 4-12 mm wide, glabrous or pubescent; leaf-sheaths glabrous to hirsute. Inflorescence subpaniculate, 8-16 cm long, branches incanate, the spikelets contracted around the primary branches, lower branches bearing short secondary racemelets, upper branches often racemose with paired spikelets; pedicels setose. Spikelets lanceolate to narrowly elliptic, 2.3-3 mm long, glabrous, acute to cuspidate; lower glume triangular to truncate, sheathing, up to 1/3 spikelet length, an inconspicuous swelling at its base; upper glume 5(-7)-nerved; lower lemma male with a well-developed palea; upper lemma elliptic, tipped by a tiny recurved mucro. Fig. 90:1-3.

Marshy or seasonally flooded ground in dry scrubland; 300-1400 m. AF TU SU (Awash) GG SD HA; tropical and South Africa; N Yemen. *Burger* 2879; *M.G. & S.B. Gilbert* 1604; *Gillett* 14751.

E. meyeriana is difficult to place generically, lying on the boundary between *Panicum*, *Brachiaria* and *Eriochloa*, and consequently is not easy to name from keys. It is very similar to *Brachiaria mutica* (Forssk.) Stapf, to which it is undoubtedly closely related. *B. mutica* differs by its plumper elliptic spikelets lacking a basal swelling and borne upon a flattened rhachis.

2. *E. fatmensis* (Hochst. & Steud.) W. D. Clayton (1975);

Panicum fatmense Hochst. & Steud. (1837); *Helopus acrotrichus* Steud. (1854), *nom. supersfl.*, *Eriochloa acrotricha* (Steud.) Thell. (1907), *nom. illegit.* - type: Saudi Arabia, *Schimper* 806 (K iso.).

Panicum annulatum A. Rich. (1850), non *Eriochloa annulata* (Fluegge) Kunth (1829) nec *Helopus annulatus* (Fluegge) Nees (1829) - types: Sudan, *Kotschy* 382 & Eritrea, Modat, *Schimper* 1748 (both K isosyn.).

Helopus nubicus Steud. (1854); *Eriochloa nubica* (Steud.) Thell. (1919) - type: Sudan, *Kotschy* 382 (K iso.).

Loosely tufted annual; culms ascending, 25-100 cm high. Leaf-blades glabrous or pubescent, 9-20 cm long, c 5 mm wide. Inflorescence composed of 4-12 suberect or slightly spreading racemes 2-6 cm long, usually bearing paired spikelets on a narrowly winged, triquetrous rhachis, spikelets single towards raceme-tips, occasionally all single or the second spikelet vestigial; pedicel-tips setose. Spikelets lanceolate-aristate, pale green, 2.8-4.3 mm long (excluding awn), appressed-pilose; lower glume apparently absent but basal bead-like swelling well-developed, often purplish; upper glume 5-nerved, acuminate-aristate, the awn-point (0.3-)0.5-2 mm long; lower lemma acuminate or briefly mucronate, barren and lacking a palea; upper lemma

shorter than the spikelet, tipped with a mucro 0.3-0.6 mm long. Fig. 90: 4-6.

Seasonally damp areas in bushland and open woodland, and in disturbed weedy places; sea level-2200 m. EE AF EW TU SU AR IL KF GG SD BA HA; tropical and South Africa; Arabian Peninsula and a few records from India. *Burger* 806; *Mooney* 7973; *Thulin* 1321.

E. fatmensis is readily distinguished from other racemose Paniceae in Ethiopia by its pale green, pointed spikelets with a bead-like swelling at the base. The upper margin of the lower glume is free, forming a narrow incurving frill around the top of the 'bead'.

An unusual aberrant form of *E. fatmensis* has 3-flowered spikelets with an extra indurated empty lemma (*Burger* 741; *IECAMA* I-13). This form is also known from Tanzania.

3. *E. procera* (Retz.) C. E. Hubb. (1930);

Agrostis procera Retz. (1786) - type: India, *König* (LD holo.).

Annual; culms 20-100 cm high, erect or geniculately ascending. Leaf-blades 2-30 cm long, 2-4 mm wide. Inflorescence 4-20 cm long, the racemes bearing paired spikelets on a triquetrous, puberulous rhachis; pedicels usually glabrous, those of a pair often connate below. Spikelets lanceolate, (2.5-)3-4 mm long, thinly pubescent; lower glume absent; upper glume acute to acuminate; lower lemma barren and lacking a palea; upper lemma shorter than the spikelet, tipped with a mucro 0.3-0.5 mm long.

E. procera is widespread in southeast Asia, and is present (probably introduced) in East Africa, Zaire and Mozambique, and also in tropical America. It has been reported from river banks and dams up to 1400 m in Ethiopia [Fröman & Persson, *III. Guide Grasses Eth.*: 64 (1974)]. It intergrades with *E. fatmensis* where both species occur together.

106. BRACHIARIA (Trin.) Griseb. (1853)

Tufted or rhizomatous annuals or perennials; leaf-blades linear to lanceolate, often with cartilaginous margins; ligule ciliate or a ciliate membrane. Inflorescence composed of racemes along a central axis; raceme rhachis triquetrous or flattened and sometimes winged; spikelets loosely to densely arranged singly or in pairs, often with short branch racemelets near the base, rarely most racemes compound and the inflorescence resembling a panicle. Spikelets plump, usually elliptic, lower glume adaxial (upper lemma with its back facing away from rhachis), lower floret male or sterile; lower glume varying from very small and nerveless to many-nerved and almost equalling the spikelet, its base sheathing, sometimes extended downwards as a short stipe; upper glume and lower lemma similar, equalling the spikelet, membranous or cartilaginous; upper lemma crustaceous to coriaceous, smooth, striate or rugose, margins in-rolled, obtuse to acute, rarely mucronulate; tip of upper palea tucked within the lemma.



Figure 90. *ERIOCHLOA* spp.: *E. MEYERIANA*: 1 - habit x 3/4; 2 - inflorescence x 3/4; 3 - spikelet x 11. *E. FATMENSIS*: 4 - habit x 3/4; 5 - portion of raceme x 3; 6 - spikelet x 11. 1 from Sheldrick TNP E85; 2 & 3 from Bogdan 1125; 4-6 from Mooney 7973. Drawn by Eleanor Catherine.

About 100 species in the tropics and subtropics, concentrated in Africa.

The genus *Brachiaria* encompasses a great deal of variation, bordering on other genera through a number of intermediates, in particular *Panicum* (*B. deflexa*) and *Urochloa* (*B. lata*). The plump spikelets are characteristic and the adaxial spikelet orientation is an important diagnostic feature, although this often becomes obscure in species with paired spikelets where the lower glume always lies against the pedicel rather than the main raceme rhachis. However, in most cases single spikelets with normal orientation can be found towards the raceme tips.

The genus also occurs over a very wide habitat range from semi-desert to swamp. Several species are grown for pasture and forage including *B. brizantha* (Palisade Grass), *B. decumbens* (Surinam Grass), *B. mutica* (Para Grass) and *B. arrecta* (Tanner Grass).

Webster [The Australian Paniceae (1987)] limits *Brachiaria* to the type species *B. eruciformis* and its allies, which differ from the other species by their deciduous, obtuse upper floret. He places many other species in *Urochloa*, but the traditional separation of these two is maintained here until a general consensus on their classification has been reached.

Echinochloa rotundiflora Clayton, a coarse annual with compound racemes, has plump, stipitate, *Brachiaria*-like spikelets. It is most easily distinguished by the absence of a ligule.

1. Lower glume 2/3 the length of the spikelet or more with many parallel nerves; upper glume conspicuously cross-veined. 2
- Lower glume up to 1/2 the length of the spikelet, usually with incurving and anastomosing nerves; upper glume not or only inconspicuously cross-veined near the tip. 5
2. Rhachis of racemes winged, flat and ribbon-like, ciliate with orange-yellow hairs. 1. *B. jubata*
- Rhachis of racemes triquetrous, sometimes narrowly winged. 3
3. Spikelets 3.2-4.5 mm long, glumes not separated by an internode. 2. *B. bovonei*
- Spikelets 4-6 mm long; glumes separated by a short internode. 4
4. Tufted, culms ascending, not rooting at nodes; inflorescence of 3-12 racemes. 3. *B. dictyoneura*
- Stoloniferous, culms procumbent and rooting at lower nodes; inflorescence of 2-3 racemes. 4. *B. humidicola*
5. Rhachis of racemes flat, winged and ribbon-like; stoloniferous perennials. 6
- Rhachis triquetrous (or at least not obviously flattened); tufted annuals or perennials. 7
6. Racemes unbranched; spikelets arranged singly in 2 neat rows. 5. *B. arrecta*
- Racemes branched towards base; spikelets mostly untidily arranged in pairs. *B. mutica* (see note under no. 5)
7. Perennials from a tough rootstock. 8
- Annuals (rarely short-lived perennial). 13
8. Spikelets glabrous or thinly pubescent. 9
- Spikelets pilose, sometimes with a subapical transverse fringe or hairy margins. 11
9. Racemes densely spiculate, the spikelets borne singly in one row on a crescentic rhachis. 6. *B. brizantha*
- Racemes few-spiculate, the spikelets loosely arranged on a triquetrous rhachis. 10
10. Spikelets 6.5-8.5 mm long; upper lemma smooth. 7. *B. longiflora*
- Spikelets 3-5.5 mm long; upper lemma rugose. 8. *B. chusqueoides*
11. Spikelets with a transverse subapical fringe. 9. *B. serrata*
- Spikelets not transversely fringed. 12
12. Upper lemma faintly striate; lower lemma evenly hairy. 10. *B. lachnantha*
- Upper lemma rugose; lower lemma usually fringed along the margins. 11. *B. ambigens*
13. Racemes compound, bearing the spikelets on short side-branches or in fascicles. 14
- Racemes simple, bearing the spikelets singly or in pairs (side-branches if present confined to base of inflorescence). 15
14. Spikelets 1.5-2.5 mm long, mostly clustered in fascicles. 17. *B. comata*
- Spikelets 2.5-3 mm long; inflorescence open, resembling a panicle, some spikelets on slender pedicels to 10 mm long. 22. *B. deflexa*
15. Lower glume tiny (up to 1/4 length of spikelet). 16
- Lower glume 1/3-1/2 length of spikelet. 18
16. Spikelets hairy, borne singly; imbricate on short erect racemes 0.5-3 cm long (if spikelets gibbous, see 19. *B. semiundulata*). 17
- Spikelets glabrous, borne in pairs. 14. *B. reptans*
17. Spikelets narrowly elliptic, pilose; upper floret smooth, shiny, readily deciduous. 12. *B. eruciformis*
- Spikelets broadly elliptic, silky-villous with hairs extending beyond spikelet-tip; upper floret rugulose, retained within the spikelet. 13. *B. breviglumis*
18. Glumes separated by a short internode; plant often glaucous with waxy deposits especially on inflorescence. 15. *B. leersioides*
- Glumes adjacent, the lower often narrowed below into a stipe. 19
19. Spikelets 1.6-2(-2.7) mm long, estipitate. 20
- Spikelets 2.5-5 mm long, often with a basal stipe. 22
20. Spikelets broadly elliptic, strongly gibbous, borne singly in 2 compact neat rows. 19. *B. semiundulata*
- Spikelets elliptic to narrowly elliptic, borne loosely mostly in pairs. 21
21. Spikelets 1.5-2 mm long, acute. 18. *B. scalaris*

- Spikelets 2–2.7 mm long, sharply acute to shortly cuspidate. *B. villosa* (see note under no. 18)
- 22. Spikelets 4–5 mm long, glabrous, obovate-oblong; leaf-margins cartilaginous, crinkled-serate. 16. *B. serrifolia*
- Spikelets 2.5–4.2 mm long, glabrous or pubescent, elliptic to narrowly ovate. 23
- 23. Spikelets thinly cartilaginous, smooth and shiny. 20. *B. ovalis*
- Spikelets membranous, not shiny. 24
- 24. Spikelets mostly paired. 25
- Spikelets mostly single, overlapping in 2 neat rows. 28
- 25. Spikelets 2–2.7 mm long; glumes separated by a slight internode; leaf-blades up to 7 cm long. *B. villosa* (see note under no. 18)
- Spikelets 2.5–4.2 mm long; glumes not separated; leaf-blades up to 25 cm long. 26
- 26. Short-lived perennial with basal buds; spikelets 3.8–4.2 mm long, ovate, shortly acuminate; upper lemma papillose-rugulose. 21. *B. pubescens*
- Annuals; spikelets 2.5–3.5 mm long, elliptic, acute; upper lemma rugose. 27
- 27. Racemes loosely spiculate, one spikelet of each pair pedicellate (primary pedicels 1–3 mm long); spikelets usually pubescent, stipitate; leaf-blades velvety-pubescent, not marginally ciliate. 23. *B. ramosa*
- Racemes densely spiculate, spikelet-pairs subsessile (primary pedicels <0.8 mm); spikelets usually glabrous, estipitate; leaf-blades glabrous to hispidulous, pectinate-ciliate on margins above ligule. 24. *B. lata*
- 28. Spikelets 2.7–4.2 mm long, acute to cuspidate, evenly hispidulous. 25. *B. xantholeuca*
- Spikelets 4–5 mm long, caudate-acuminate, pilose above with tufts of hair on either side of midnerve. 26. *B. leucacrantha*

1. *B. jubata* (Fig. & De Not.) Stapf (1919);

Panicum jubatum Fig. & De Not. (1854) - type: Sudan, Figari (FT holo.).

Brachiaria soluta Stapf (1919).

Slender tufted perennial; culms often decumbent at the base, 35–100 cm high. Leaf-blades broadly linear, 5–8 mm wide, glabrous to pilose with cartilaginous margins, acute. Inflorescence of 3–7(–10) racemes on a filiform axis 3–10 cm long; racemes 1–3(–6) cm long, often curved, the spikelets borne singly in 2 dense rows on a flat, ribbon-like, purplish rhachis 1–1.5 mm wide, its margins ciliate with orange-yellow hairs surrounding the spikelets. Spikelets 2.5–3.5 mm long, elliptic-oblong, pilose, subacute; lower glume 2/3–3/4 as long as the spikelet, 7–11-nerved, truncate; upper glume 5–7-nerved with cross-veins; lower lemma 5-nerved with the lateral nerves marginal, otherwise like the lower glume; upper lemma crustaceous, shiny, almost smooth, subacute. Fig. 91:3, 4.

Grassland and scrubland, often in seasonally waterlogged places; 1400–2200 m. KF GG SD; tropical Africa. Gilbert & Thulin 582; Mooney 9263; Gilbert & Phillips 8847.

2. *B. bovonei* (Chiov.) Robyns (1932);

Panicum bovonei Chiov. (1914) - type: Zaire, Bovone 89 (TO holo.).

Densely tufted perennial; culms 25–100 cm high. Leaf-blades flat (or sometimes convolute), 3–30 cm long, 2–6 mm wide, stiffly pilose to conspicuously villous. Inflorescence of (1–)3–5 racemes on an axis 3–10 cm long; racemes 1–5 cm long, bearing the spikelets singly on a triquetrous rhachis, its margins sparsely ciliate with white or yellow hairs 1–2 mm long. Spikelets elliptic, 3.2–4.5 mm long, pubescent, subacute; lower glume 2/3 to almost as long as the spikelet, 5–11-nerved, obtuse; upper glume 5–7-nerved, with cross-veins, not separated from the lower; lower lemma 5-nerved, the laterals near the margin, connected by cross-veins; upper lemma faintly rugulose, subacute.

Damp places in deciduous bushland; 1800 m. SD; East Africa, Rwanda, Zaire and southwards to Zimbabwe. Keller-Grein & Ahmed ILCA13451.

3. *B. dictyoneura* (Fig. & De Not.) Stapf (1919);

Panicum dictyoneurum Fig. & De Not. (1854) - type: Sudan, Figari (FT holo.).

Tufted perennial; culms ascending, 55–130 cm high. Leaf-blades coarse, broadly linear, 6–20 mm wide, often softly pilose. Inflorescence composed of 3–12 racemes 2–7 cm long on an axis 5–15 cm long; spikelets borne singly in 2 rows on a triquetrous rhachis 0.5 mm wide, its margins setose with hairs 1.5–2 mm long. Spikelets narrowly elliptic, 4.5–6.5 mm long, silky-hairy, acute; lower glume 3/4 to as long as the spikelet, flushed reddish, 9–11-nerved, its sheathing base separated from the upper glume by a short internode; upper glume 7–9-nerved with conspicuous cross-veins; lower lemma 5–7-nerved with the lateral nerves marginal; upper lemma narrowly elliptic to elliptic, shiny, almost smooth, apiculate.

Bushland and open woodland; 1400–1900 m. SD GG; Sudan and southwards through East Africa to Zambia and Mozambique; also in South Africa. Gilbert & Jefford 4422; Friis et al. 784; Gilbert & Phillips 8965.

4. *B. humidicola* (Rendle) Schweick. (1936);

Panicum humidicola Rendle (1899) - type: Angola, Welwitsch 2678 (K iso.).

Stoloniferous perennial; culms slender, procumbent at the base and rooting at the nodes, 35–80 cm high. Leaf-blades broadly linear, 5–8 mm wide, acute; leaf-sheaths villous along the margins. Inflorescence composed of 2–3(–4) racemes 3–6 cm long on an axis 2.5–10 cm long; spikelets borne singly in 2 rows on a triquetrous rhachis 0.5 mm wide, its margins with scattered setae. Spikelets

elliptic to broadly elliptic, 4–4.8(–5.8) mm long, silky-hairy, subacute; lower glume 3/4–7/8 as long as the spikelet, 11-nerved, its sheathing base separated from the upper glume by a short internode; upper glume 7–9-nerved with conspicuous cross-veins; lower lemma 5–7-nerved with the lateral nerves marginal, otherwise like the lower glume; upper lemma elliptic, shiny, almost smooth, obtuse, apiculate.

Damp grassland; 1700–2000 m. SD; Sudan and southwards through Kenya and Tanzania to South Africa. *M.G. & S.B. Gilbert* 1348; *Parker* 389; *Yoseph* S.3 (ETH).

The spikelets of *B. humidicola* are on average a little shorter and broader than those of *B. dicyoneura*, but are otherwise identical. The main difference between the 2 species lies in the more slender, stoloniferous habit of *B. humidicola*, which also usually has fewer racemes in its inflorescence and narrower, more or less glabrous leaf-blades.

5. *B. arrecta* (*Th. Dur. & Schinz*) *Stent* (1924);
Panicum arrectum *Th. Dur. & Schinz* (1894) -
 types: South Africa, *Drège* s.n. (K isosyn.).
Brachiaria radicans *Napper* (1963).

Straggling perennial; culms prostrate, stoloniferous and rooting at the lower nodes, eventually ascending to 60–120 cm. Leaf-blades narrowly lanceolate, 6–15 mm wide, glabrous. Inflorescence of 4–10 racemes spaced singly (or rarely paired) along an axis 8–20 cm long; racemes 2–8 cm long, the spikelets borne singly in 2 neat rows on a flattened, ribbon-like, winged rhachis 1–1.5 mm wide, its margins scabrid (pedicels sometimes setose). Spikelets glabrous, narrowly elliptic, 3–4 mm long, acute; lower glume 1/3–1/2 as long as the spikelet; upper glume 7-nerved, a few cross-veins in the upper half; upper lemma rugulose, coriaceous, obtuse.

In seasonal swamps and along lake and stream margins; 1700 m. KF; tropical and South Africa; introduced into tropical America. *Fröman* 3357.

The cultivated form of this grass is sometimes grown for pasture and forage under the name "Tanner Grass".

Brachiaria mutica (Forssk.) *Stapf* [syn. *B. purpurascens* (Raddi) *Henr.*; *Urochloa mutica* (Forssk.) *Webster*], a pasture grass widely cultivated in the moist tropics (Para Grass), is very closely related to *B. arrecta*, having almost identical glabrous, acute spikelets on a similar flattened rhachis. The main difference between the two lies in the inflorescence. *B. mutica* has longer, more numerous racemes of untidily arranged spikelets borne on side branches towards the base of the raceme, paired over the central portion, and arranged singly in 2 rows only towards the raceme tips.

6. *B. brizantha* (*A. Rich.*) *Stapf* (1919);
Panicum brizanthum *A. Rich.* (1850); *Urochloa brizantha* (*A. Rich.*) *Webster* (1987) -types: Ethio-

pia, TU, Shire [Chiré], *Quartin Dillon* (P syn.) & *Adua* [Adoua], *Schimper* 89 (K isosyn.).

Tough, tussocky perennial; culms erect or loosely ascending, 50–200 cm high. Leaf-blades linear, flat, 7–15 mm wide, glabrous or pilose, margins scabrid. Inflorescence of (1–)3–10 often gently nodding racemes on an axis 5–12 cm long; racemes 4–15 cm long, the spikelets borne singly in an apparently single row (actually 2 scarcely staggered rows) on a crescentic rhachis 1 mm wide, its margins incurved and tuberculate-setose. Spikelets plumply elliptic, 4.5–6 mm long, glabrous, glossy, subacute, supported by a short basal stipe; lower glume 1/3–1/2 spikelet length, 11-nerved, separated from the upper by a short internode; upper glume and lower lemma thinly cartilaginous; upper lemma cartilaginous, faintly striate to indistinctly rugose, acute. Fig. 91:5, 6.

Open grassy slopes and in woodland clearings; 1100–2100 m. EW TU GD GJ WG SU IL KF GG SD BA, HA; tropical and South Africa; introduced elsewhere in the tropics. *M.G. & S.B. Gilbert* 1521; *Mooney* 5481 & 5868; *Gilbert & Phillips* 8846.

B. brizantha is a variable grass known to include tetraploid (2n=36) and hexaploid (2n=54) forms. The apparently single row of large, cartilaginous, dully shining spikelets is characteristic of this species.

B. decumbens *Stapf* [syn. *Urochloa decumbens* (*Stapf*) *Webster*], native to western parts of East Africa, is a closely related and sometimes intergrading species, more valuable as a pasture plant on account of its decumbent, leafy growth habit, the culms arising from long, prostrate, many-noded bases. Typical *B. decumbens* also differs from *B. brizantha* by its membranous, hairy spikelets on a flat rhachis 1–1.7 mm wide. Some intermediate forms, selected and widely distributed in the tropics as pasture plants, have the habit of *B. decumbens* coupled with the inflorescence characters of *B. brizantha* e.g. *Scott* 55 (SU-AR).

7. *B. longiflora* *W.D. Clayton* (1980);
 - type: Kenya, *Polhill & Paulo* 674 (K holo.).

Slender, straggling perennial from a knotty rootstock; culms wiry, much-branched, 20–120 cm high. Leaf-blades narrowly lanceolate, 6–20 mm wide, glabrous to pilose, the margins pectinate-ciliate. Inflorescence of 2–4 stiffly spreading racemes on an axis 3–7 cm long; racemes 2–5 cm long, few-spiculate, the spikelets borne loosely, singly or some in pairs, on a triquetrous rhachis. Spikelets narrowly elliptic-oblong, 6.5–8.5 mm long, thinly pubescent to subglabrous, sharply acute, supported by a short basal stipe; lower glume 1/4–1/2 spikelet length, separated from the upper by a short internode; upper glume and lower lemma chartaceous; upper lemma crustaceous, shiny, almost smooth, obtuse.

Bushland on sandy soils; 1200 m. HA; S Somalia and coastal areas of Kenya. *M.G. & S.B. Gilbert* 2055B.



Figure 91. *BRACHIARIA* spp.: *B. SERRATA*: 1 - habit x 3/4; 2 - spikelet x 8. *B. JUBATA*: 3 - inflorescence x 3/4; 4 - spikelet x 8. *B. BRIZANTHA*: 5 - inflorescence x 3/4; 6 - spikelet x 8. *B. SEMIUNDULATA*: 7 - habit x 3/4; 8 - spikelet x 8. 1 & 2 from Mooney 5518; 3 & 4 from Gilbert 1348; 5 & 6 from Gilbert & Getachew 2869; 7 & 8 from Gilbert & Getachew 2781. Drawn by Eleanor Catherine.

8. *B. chusqueoides* (Hack.) W.D. Clayton (1980);
Panicum chusqueoides Hack. (1895) - type:
 South Africa, *Rehmann* 8648 (K iso.).

Tufted or trailing perennial from a knotty base; culms slender, wiry and brittle, much-branched. Leaf-blades narrowly lanceolate, 3–12 cm long, 3–12 mm wide, cordate, margins cartilaginous-serrate, often crinkled, tip acuminate. Inflorescence of 2–7 racemes spaced along a pubescent axis up to 12 cm long; racemes few-spiculate, the spikelets borne loosely, singly, in pairs or the lower on short branchlets, on a pubescent triquetrous rhachis. Spikelets elliptic, 3–5 mm long, chartaceous, acute, supported by a basal stipe 0.2–0.5 mm long; lower glume 1/3–1/2 spikelet length, clasping, 3-nerved; upper glume 7-nerved; upper lemma rugose, coriaceous, acute.

Bushland; 900 m. SD; coastal bushland from Kenya to Natal, rarely inland. *Gilbert, Ensermu & Vollesen* 7697.

Specimens from southern Africa tend to have smaller spikelets, shorter, narrower leaf-blades and a more delicate habit. The single collection from Ethiopia is particularly vigorous with exceptionally large spikelets 5–5.5 mm long.

9. *B. serrata* (Thunb.) Stapf (1919);
Holcus serratus Thunb. (1794) - type: South Africa, *Thunberg* (UPS-Thunb. 23856 holo.).
Panicum gossypinum A. Rich. (1850); *P. serratum* (Thunb.) Spreng. var. *gossypinum* (A. Rich.) Th. Dur. & Schinz (1894); *B. serrata* var. *gossypina* (A. Rich.) Stapf in *Fl. Trop. Afr.* 9: 538 (1919) - types: Ethiopia, TU, Mt. Scholoda, *Schimper* 174 [175] (K isosyn.) & *Schimper* 1196 (P syn.).

Slender perennial from a tough rootstock, basal leaf-sheaths conspicuously tomentose; culms erect to decumbent, 15–50(–80) cm high. Leaf-blades broadly linear with cartilaginous margins, 2–5 mm wide, widely spreading. Inflorescence narrow, composed of 5–8 short racemes on an axis 4–9 cm long; racemes erect, 0.8–2 cm long, the spikelets borne singly on distinct pedicels in 2 loose rows along a slender triquetrous rhachis. Spikelets 2.2–3.5 mm long, elliptic, silky-ciliate with silvery-pink hairs; lower glume half as long as the spikelet, 3-nerved, villous; upper glume transversely ciliate above the middle with long silky hairs, otherwise pubescent, thinly cartilaginous below the fringe, membranous above, cuspidate; lower lemma similar but with a membranous groove along the midnerve, awn-pointed; upper lemma coriaceous with a recurved, cuspidate tip. Fig. 91:1, 2.

Open scrubland and in woodland clearings on dry, rocky, sandy or gritty soils; 1300–2500 m. EW TU GG SD HA; tropical and South Africa. *Gilbert & Getachew* 2699; *Gilbert & Jefford* 4368; *Mooney* 8007.

B. serrata is easily recognizable by its thick basal clusters of velvety leaf-sheaths, and by its attractive; pink, fringed spikelets. There is a gradual transition southwards through Africa to specimens with larger spikelets up to 4.5 mm long.

10. *B. lachnantha* (Hochst.) Stapf (1919);
Panicum lachnanthum Hochst. (1855) - type:
 Ethiopia, TU, Dschadscha, *Schimper* in Herb. Buchinger 1210 (STR holo.).

Dense tussocky perennial from a knotty rootstock, basal leaf-sheaths and nodes silky-tomentose; culms erect, 30–100 cm high. Leaf-blades linear, 5–6 mm wide, shortly pubescent to glabrescent above, pilose below, acuminate. Inflorescence of 3–15 racemes 2–5 cm long on an axis 5–15 cm long; spikelets borne singly (or occasionally paired near the base) in 2 dense rows on a narrow triquetrous rhachis; rhachis and pedicels clothed in spreading silky hairs to 4 mm long. Spikelets narrowly elliptic, pilose with the hairs longer towards the tip, 4–4.8 mm long, acute; lower glume 1/4 spikelet length, clasping, separated from the upper by a brief internode; upper glume and lower lemma 5-nerved; upper lemma crustaceous, shiny, indistinctly striate, sub-acute.

Grassland or clearings in *Acacia* woodland, especially on black clay soils; 1400–1700 m. TU HA SD; Somalia, Uganda, Kenya and N Tanzania. *Burger* 2996; *Friis et al.* 805; *Sebsebe & Tewolde* 901 (ETH).

A distinctive species, forming fairly large, tough tussocks, with silky-hairy racemes of spikelets borne along a slender rhachis.

11. *B. ambigens* Chiov. (1951);
 - type: Ethiopia, GG, Asile [Uacille], *Corradi* 967 (FT holo.).

Densely tufted perennial; culms 25–50 cm high, often fasciculately branched somewhat above the base. Leaf-blades linear, pubescent, provided also with spaced tubercle-based setae to 3.5 mm long, particularly along the cartilaginous margins. Inflorescence of 4–15 narrowly ascending to suberect racemes on an axis 1–8 cm long; racemes 1–4 cm long, the spikelets borne singly in 2 rows on a glabrous, triquetrous rhachis. Spikelets elliptic, 2.5–3.5 mm long, pubescent, silky-pilose on the flanks, acuminate; lower glume 1/3–1/2 spikelet length; upper glume pubescent; lower lemma with a silky longitudinal fringe on each side around the marginal nerves; upper lemma rugose, subacute with a mucro 0.2–0.4 mm long.

Deciduous bushland and semi-desert grassland; c 1500 m. GG; Kenya, N Tanzania.

12. *B. eruciformis* (J. E. Smith) Griseb. (1853);
Panicum eruciforme J. E. Smith (1806); type:
 Greece, *Sibthorp* (OXF holo.).
Panicum pubinode A. Rich. (1850) - type:
 Ethiopia, Tacazze R., *Schimper* 1855 (K iso.).

Brachiaria poaeoides sensu Cufodontis, *Enum.*: 1315 (1969), non Stapf (1919).

Tufted, softly hairy annual; culms slender, loosely ascending, 20–50 cm high. Leaf-blades broadly linear, 2–5 mm wide, acute. Inflorescence usually narrow, of 4–10 erect or narrowly ascending racemes on an axis 3–6 cm long; racemes 1–3 cm long, lower racemes usually with 1 or 2 appressed basal branchlets; spikelets borne singly in 2 rows on a narrow, triquetrous rhachis. Spikelets narrowly elliptic, 1.8–3 mm long, pilose, subacute; lower glume a tiny, cuff-like scale 0.2–0.8 mm long, up to 1/4 spikelet length (usually less); upper glume and lower lemma 5-nerved, membranous; upper floret readily deciduous, thinly crustaceous, smooth and glossy, obtuse. Fig. 92:6, 7.

Open and disturbed situations in grassland and bushland and as an arable weed, especially on black clays; 1200–2200 m. EW TU GD GJ SU AR KP SD BA HA; throughout Africa from the Mediterranean to South Africa; eastwards to India. *Gilbert* 3329; *M.G. & S.B. Gilbert* 1424; *Parker* E326.

The only Ethiopian species with a fertile floret which is shed from the mature spikelet. The fertile floret is also distinctive due to its smooth glossy texture and obtuse tip.

13. *B. breviglumis* *W. D. Clayton* (1980);
- type: Kenya, *Bally & Smith* 14513 (K holo.).

Slender, loosely tufted annual; culms 15–25 cm high. Leaf-blades narrowly lanceolate, 1–6 cm long and 2–4 mm wide. Inflorescence of 3–5 erect racemes appressed to an axis 1–6 cm long; racemes 0.5–1.5 cm long, the spikelets borne singly in 2 rows on a triquetrous rhachis. Spikelets broadly elliptic, 2 mm long, conspicuously silvery-villous, the hairs extending beyond the spikelet tip, acute; lower glume 1/5 spikelet length, an obscure scale hidden beneath the silky hairs; upper glume 7-nerved; lower lemma 5-nerved; upper lemma granular-rugulose, subacute, mucronulate.

Bushland; c 1000 m. HA; Kenya. *Boudet* 8014.

14. *B. reptans* (L.) *Gardner & C.E. Hubb.* (1938);
Panicum reptans L. (1759); *Urochloa reptans* (L.) *Webster* (1987) - type: Jamaica, *Browne* (LINN holo.).

Annual; culms usually decumbent, 15–60 cm high. Leaf-blades lanceolate, 2–8 cm long, 3–15 mm wide. Inflorescence of 5–15 racemes on an axis 1–8 cm long; racemes 1–4 cm long, the spikelets borne in crowded pairs on hirsute pedicels along a triquetrous rhachis. Spikelets broadly elliptic, 1.5–2.2 mm long, glabrous, acute; lower glume 1/8–1/4 spikelet length, truncate; upper lemma rugose, subacute, mucronulate.

Sudan, East Africa, Arabian Peninsula; tropical Asia; introduced throughout the tropics.

A tropical weed to be expected in Ethiopia.

15. *B. leersioides* (*Hochst.*) *Stapf*,
Panicum leersioides *Hochst.* (1855) - type:
Ethiopia, TU, Dehli Dikeno, *Schimper* in Herb.
Buchinger 1173 (STR holo., P iso.).
Brachiaria distichophylla sensu Cufodontis,
Enum. (1969), non (Trin.) *Stapf* [= *B. villosa* (*Lam.*)
A. Camus]].

Slender tufted annual, often glaucous with a white waxy coating, particularly on the inflorescence; culms much branched, 15–60 cm high. Leaf-blades linear, 1–7 mm wide, glabrous, setaceously acuminate. Inflorescence of 3–12 distant, diverging or deflexing racemes on an axis 5–15 cm long; racemes 2–6 cm long, the spikelets borne mostly in contiguous pairs on a triquetrous rhachis (sometimes with short basal branchlets or rarely mostly single). Spikelets narrowly elliptic, 2.3–3.2 mm long, glabrous, subacute, without a stipe; lower glume 1/3–1/2 spikelet length, inflated, separated from the upper glume by a distinct internode; upper glume and lower lemma membranous, 5-nerved; upper lemma coarsely rugose, subacute. Fig. 92:1, 2.

Dry *Acacia* bushland and woodland, often on sandy soils in light shade; 730–1700 m. EE EW TU WU SU GG HA SD; southwards through East Africa to Mozambique; westwards to Sudan and Chad; and in the Arabian Peninsula. *M.G. & S.B. Gilbert* 2358, 2286; *Friis, Mesfin & Vollesen* 2989.

Best separated from other species with similar-sized, paired spikelets by the absence of a stipe beneath the lower glume but instead with a distinct internode between the glumes. The glabrous, rather blunt spikelets and waxy deposits in the inflorescence are also characteristic.

16. *B. serrifolia* (*Hochst.*) *Stapf* (1919);
Panicum serrifolium *Hochst.* (1855) as
"serraeifolium" - type: Ethiopia, without locality,
Schimper s.n. (TUB holo.?).

Moderately robust annual; culms erect, 40–100 cm high. Leaf-blades narrowly lanceolate, cordate, 8–20 mm wide, glabrous or with stiff, appressed hairs, the margins cartilaginous, conspicuously crinkled-serrate. Inflorescence of 4–13 narrowly ascending or occasionally finally divergent racemes on an axis 10–25 cm long; racemes 3–9 cm long, the spikelets borne loosely in pairs (primary pedicels to 4 mm long) on a stiff, triquetrous rhachis. Spikelets obovate-oblong, 4–5 mm long, glabrous, subacute, stipe absent or almost so; lower glume 1/3–1/2 spikelet length; upper glume 7-nerved, chartaceous; upper lemma coarsely rugose, subacute. Fig. 92:11.

Acacia bushland; 1000–1500 m. EW TU HA GG SD; westwards to Niger and southwards through East Africa to Zimbabwe. *M.G. & S.B. Gilbert* 2055A; *Friis, Mesfin & Vollesen* 2855; *Pappi* 6046.

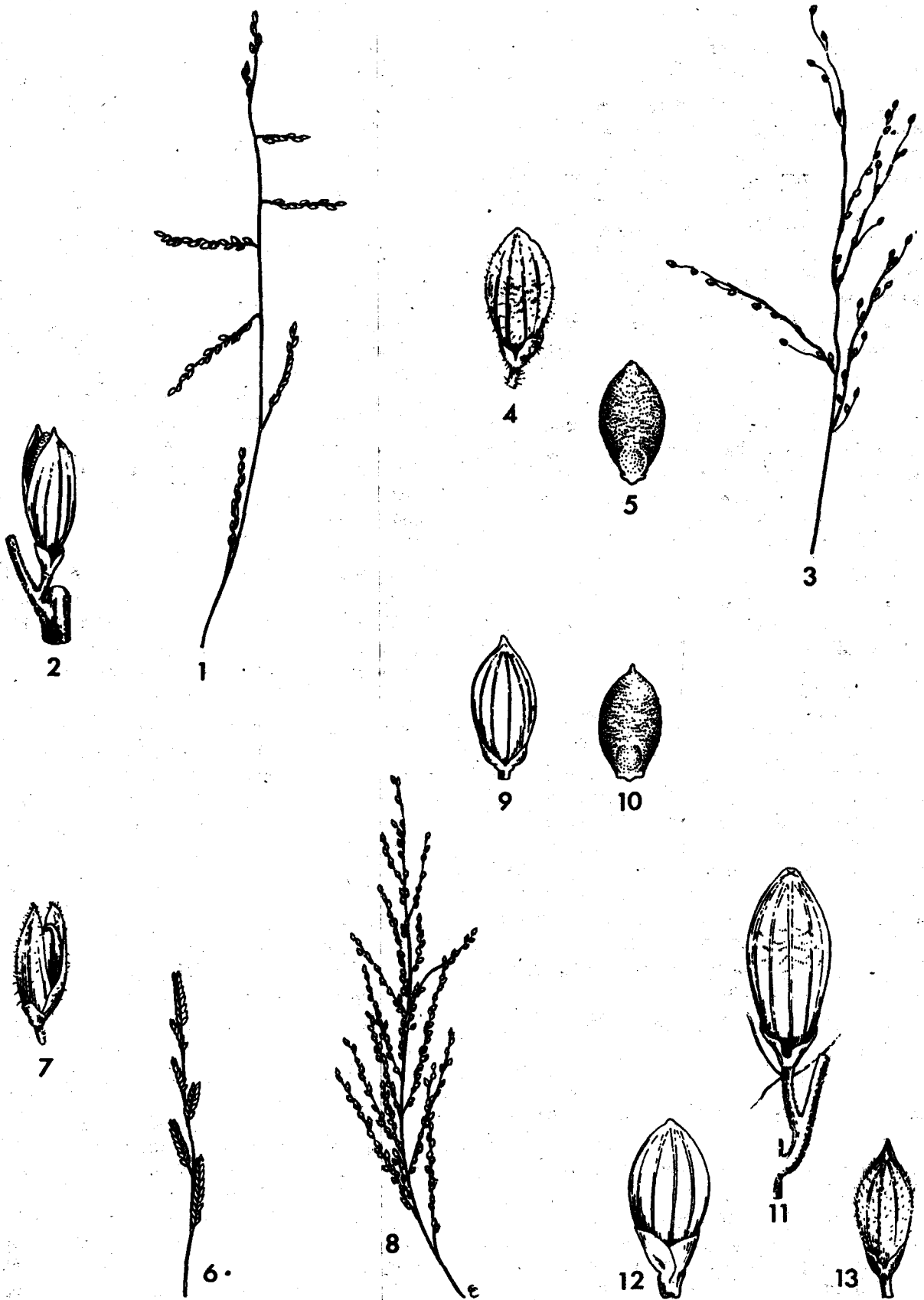


Figure 92. *BRACHIARIA* spp.: *B. LEERSIOIDES*: 1 - inflorescence x 3/4; 2 - spikelet x 8. *B. DEFLEXA*: 3 - inflorescence x 3/4; 4 - spikelet x 8; 5 - fertile floret x 8. *B. ERUCIFORMIS*: 6 - inflorescence x 3/4; 7 - spikelet x 8. *B. LATA*: 8 - inflorescence x 3/4; 9 - spikelet x 8; 10 - fertile floret x 8. *B. SERRIFOLIA*: 11 - spikelet x 8. *B. OVALIS*: 12 - spikelet x 8. *B. XANTHOLEUCA*: 13 - spikelet x 8. Sources not recorded. Drawn by Eleanor Catherine.

17. *B. comata* (A. Rich.) Stapf (1919);

Panicum comatum A. Rich. (1850) - types: Ethiopia, Kouaeita, *Quartin Dillon* (P syn.) & *Guendepa*, *Schimper* 1196 (K isosyn.).

P. kotschyianum Steud. (1854); *Brachiaria kotschyana* (Steud.) Stapf (1919).

P. villosum Lam. var. *erythraeum* Chiov. in *Ann. Ist. Bot. Roma* 8: 302 (1908) - types: Eritrea, *Pappi* 22, 928, 1447, 2014, 4780 (FT syn.).

P. secernendum Mez (1917); *Brachiaria secernenda* (Mez) Henr. (1940) - types: Ethiopia, TU, Djeladjeranne, *Schimper* 1612 (K isosyn.) & *Schimper* 710 (P syn.).

Brachiaria epaleata Stapf (1919) - types: Ethiopia, GD, Matamma, *Schweinfurth* 1146 & TU, Djeladjeranne, *Schimper* 1612 (both K syn.).

Straggling annual; culms ascending or often decumbent and rooting at the lower nodes, 25–110 cm high. Leaf-blades narrowly lanceolate, 5–12 mm wide, margins cartilaginous. Inflorescence of 7–20 loosely ascending, often slightly flexuous racemes along an axis 6–25 cm long; racemes 2–12 cm long, the spikelets borne mostly on side branchlets or in fascicles along the triquetrous rhachis, single or paired only towards the raceme tips. Spikelets elliptic, 1.5–2.5 mm long, glabrous, evenly pilose or the hairs longer towards the tip, sometimes forming a silky subapical fringe up to 1 mm long; lower glume 1/3–1/2 spikelet length; upper lemma granular-striate, acute.

Roadsides and open places on disturbed ground; 650–2300 m. EE EW TU GD GJ WG SU AR KF GG; westwards to Nigeria; East Africa and Zaire; Yemen. *De Wilde & Gilbert* 238 & 240; *Fukui* 1431; *Parker* E383.

At first sight *B. comata* appears anomalous in *Brachiaria*, with its compound racemes of spikelets borne on side branches, but the spikelets are typical of the genus and are often indistinguishable from those of *B. scalaris*. As in *B. deflexa*, the spikelet-clusters are reduced to the usual arrangement of single or paired spikelets towards the raceme tips.

B. comata is not distinct from *B. scalaris*, but grades gradually into it through forms where the spikelet-clusters are confined to the lower part of the inflorescence. Where the clusters are small or few in number assignment to one or other species becomes rather arbitrary. Typical *B. comata* plants are often rather more robust than those of *B. scalaris* with longer, more numerous, obviously compound racemes.

B. comata also exhibits wide but continuous variation in spikelet indumentum. The spikelets may be glabrous, evenly pilose, or with a tendency for the hairs to be longer towards the tip, in extreme cases forming a subapical fringe.

18. *B. scalaris* Pilg. (1928);

Panicum scalare Mez (1904) non Schweinf. (1894) - type: Tanzania, *Volkens* 657 (K iso.).

Straggling annual; culms decumbent or ascending, 20–55 cm high. Leaf-blades lanceolate, 3–10 mm wide, pilose, the margins cartilaginous. Inflorescence pyramidal in outline, composed of 7–10 stiffly divergent racemes on an axis 3–7 cm long; racemes 1–3 cm long, the basal sometimes with a few short racemelets, spikelets borne loosely in pairs or singly on a triquetrous rhachis. Spikelets elliptic, 1.5–2 mm long, glabrous or pubescent, acute; lower glume 1/3 spikelet length; upper glume and lower lemma 5-nerved; upper lemma granular-striate, acute.

Roadsides and weedy places; 750–1400 m. AF EW TU GD GJ KF GG; East Africa and southwards to Zimbabwe. *Gilbert & Thulin* 523; *Friis et al.* 2311; *Baldrati* 2839 (FT).

B. villosa (Lam.) A. Camus is a very closely related species occurring from Mauretania to Sudan and also in India. It differs from *B. scalaris* mainly in its longer (2–2.7 mm), sharply acute spikelets. In spikelet indumentum *B. villosa* mirrors exactly the range of variation in *B. comata* from glabrous forms to those with a silky subapical fringe.

19. *B. semiundulata* (A. Rich.) Stapf (1919);

Panicum semiundulatum A. Rich. (1850) - types: Ethiopia, TU, Adua [Adoua], *Schimper* 289 & Shiré [Schiré], *Schimper* 1833 (both K isosyn.).

Delicate, loosely tufted annual; culms slender, straggling, ascending to 45 cm high. Leaf-blades lanceolate to ovate, 1.5–3 cm long and 0.5–1.2 cm wide, margins cartilaginous, crinkled-serrate. Inflorescence of 4–12 short, ascending racemes on an axis 2–7 cm long; racemes 0.7–2.3 cm long, the spikelets overlapping, borne singly in 2 neat rows (or occasionally paired at base of longer racemes) on a triquetrous, setose rhachis. Spikelets 1.5–2 mm long, plump, flat on the adaxial side, strongly gibbous on the abaxial, glabrous to pubescent, subacute; lower glume 1/3 spikelet length; upper lemma swollen, striate, acute. Fig. 91:7, 8.

Open, disturbed situations and on rocky slopes in grassland or bushland, in the open or in shade; also an arable weed; 1200–2200 m. TU GD GJ SU AR HA KF GG SD BA; East Africa, Sudan and in S India and Sri Lanka. *Gilbert & Getachew* 2879; *M.G. & S.B. Gilbert* 1423; *Mooney* 5906.

20. *B. ovalis* Stapf (1919);

- types: Eritrea, Habab, *Hildebrandt* 337 (whereabouts uncertain) & Ethiopia, without locality, *Salt* s.n. (BM, syn.) & Somalia, *Thompson* s.n. & *Appleton* s.n. (both K syn.).

Brachiaria glauca Stapf (1919) - type from Socotra.

Tufted annual; culms 10–80 cm high. Leaf-blades broadly linear to narrowly lanceolate, 4–12 mm wide, velvety-pubescent, acuminate. Inflorescence of 4–8 loosely ascending to widely diverging racemes on an axis 5–18 cm long; racemes 2–6 cm long (the longest sometimes with basal branchlets); spikelets loosely arranged singly or in pairs on short setose pedicels along a triquetrous rhachis. Spikelets plumply elliptic, 2.8–4 mm long, smooth and glabrous, dully shining, subacute to acute, supported by a basal stipe c 0.5 mm long; lower glume $1/4$ – $1/2$ spikelet length; upper glume 7-nerved, this and lower lemma thinly cartilaginous; upper lemma papillose to rugulose, subacute to mucronulate. Fig. 92:12.

Dry rocky slopes and semi-desert scrubland, often on loose sandy or alluvial soil in light shade; 400–1700 m. EE AF TU SU SD HA; Kenya, N Somalia, Sudan, S Arabia and Pakistan. *Burger* 3300; *Friis et al.* 899; *M.G. & S.B. Gilbert* 2324.

B. ovalis can be distinguished from the other annual species with loosely arranged, paired spikelets and a rugulose upper floret, by the smoothly cartilaginous, shiny texture of its spikelets.

21. *B. pubescens* (Chiov.) S.M. Phillips (1991);

B. serrifolia (Hochst.) Stapf var. *pubescens* Chiov. in *Webbia* 8: 65 (1951) - types: Ethiopia, GG, Dande, *Corradi* 396 & *Seghido, Corradi* 953 (both FT syn.).

Loosely tufted short-lived perennial; culms stiff, slender, weakly ascending and sometimes rooting at the lower nodes, 60–90 cm high, much branched, pubescent with villous nodes. Leaf-blades cauline, narrowly lanceolate, velvety-pubescent, 7–15 mm wide, the margins scaberulous. Inflorescence of 5–7 divergent racemes spaced along an axis 6–8 cm long; racemes 4–5.5 cm long, the spikelets borne in loosely contiguous pairs along the villous triquetrous rhachis, pedicels setose. Spikelets narrowly ovate, 3.8–4.2 mm long, pubescent, shortly acuminate, with a basal stipe c 0.5 mm long; lower glume $1/3$ spikelet length; upper glume 7-nerved; upper lemma indistinctly papillose-rugulose, subacute with a mucro 0.2 mm long.

Acacia-Commiphora bushland; 800–1200 m. GG, SD; Kenya. *Gilbert & Sebsebe* 8724; *Gilbert & Phillips* 9094.

B. pubescens belongs to the group of species centred on *B. ramosa* and resembles *B. ovalis* most closely, especially when the spikelets are almost glabrous. It forms a loose tuft with basal perennating buds, probably persisting for a few seasons.

22. *B. deflexa* (Schumach.) Robyns (1932);

Panicum deflexum Schumach. (1827); *Pseudo-brachiaria deflexa* (Schumach.) Launert (1970). - type: Ghana, *Thonning* (C holo.).

Panicum petiveri Trin. var. *robustissimum* Chiov. in *Ann. Ist. Bot. Roma* 8: 32 (1903); type: Eritrea, Assaorta, *Pappi* 3418 (FT holo.).

Annual; culms slender, solitary or tufted, 15–60 cm high (rarely much more). Leaf-blades broadly linear to narrowly lanceolate, 5–15 mm wide, velvety-pubescent. Inflorescence open, resembling a panicle, composed of 5–12 racemes on an axis 7–14 cm long; racemes distant, widely spreading, often compound with side-branches; spikelets mostly paired, distant along the slender rhachis, primary pedicels spreading, often exceeding the other spikelet of the pair and up to 10 mm long. Spikelets elliptic, 2.5–3 mm long, usually pubescent, acute, with a basal stipe 0.3–0.5 mm long; lower glume $1/3$ – $1/2$ spikelet length; upper glume 7-nerved; upper lemma rugose, acute. Fig. 92:3–5.

Roadsides and weedy areas in deciduous bushland and woodland, often in shade; 450–1400 m. EE EW TU GD SU IL KF GG SD BA HA; tropical Africa; eastwards through Arabia to Pakistan. *Gilbert & Getachew* 3072; *Friis et al.* 2826; *Hemming* 1035.

B. deflexa is usually readily distinguishable from other species of *Brachiaria* by its open, sub-paniculate inflorescence and indeed lies on the boundary between *Brachiaria* and *Panicum*. However, the spikelets resemble those of *B. ramosa*, into which it grades through intermediates with shorter-pedicelled, less widely spaced spikelet-pairs.

23. *B. ramosa* (L.) Stapf (1919);

Panicum ramosum L. (1767); *Urochloa ramosa* (L.) Webster (1987) - type: India, cult. at Uppsala (LINN holo.).

Panicum brevibradiatum Hochst. (1855) - type: Ethiopia, GD, Semien, *Schimper* in Herb. Buchinger 1513 (STR holo., P iso.).

P. petiveri Trin. var. *puberulum* Chiov. in *Ann. Ist. Bot. Roma* 8: 302 (1907) - types: Eritrea, Sabarguma, *Pappi* 4006 (K isosyn.) and many other syntypes.

Tufted annual; culms ascending, branching, 10–50 cm high. Leaf-blades broadly linear to narrowly lanceolate, velvety-pubescent, margins scaberulous. Inflorescence of 5–10 loosely erect to ascending racemes on an axis 6–13 cm long; racemes 3–6 cm long (often with branchlets towards the base), the spikelets borne mostly in loosely contiguous pairs, lightly appressed to the pubescent, triquetrous rhachis, primary pedicels 1–3 mm long, spikelets single towards raceme tips (rarely mostly single). Spikelets elliptic to narrowly elliptic, 2.5–3.5 mm long, glabrous, pubescent or hispidulous, acute to cuspidate, supported by a basal stipe 0.1–0.5 mm long; lower glume $1/3$ – $1/2$ spikelet length; upper glume 5–7-nerved; upper lemma rugose, acute.

Rocky slopes, open sandy plains and coastal dunes; sea level–1000 m. EE AF EW GD SU (Awash Valley); tropical Africa; eastwards through Arabia to tropical

Asia. Bally 6936; Burger 3479; M.G. & S.B. Gilbert 1727.

B. ramosa is a variable grass, lying at the centre of a cluster of closely related and intergrading annual species, characterized by their acute or cuspidate spikelets with a lower glume 1/3–1/2 the spikelet length, a rugose upper floret and usually a basal stipe. Their leaf-blades are broadly linear to lanceolate, velvety-pubescent (except *B. lata*), with unthickened, finely scaberulous margins. The boundary is particularly indistinct between *B. ramosa* and *B. deflexa*, *B. xantholeuca* and *B. lata* (see notes under these species). *B. leucacrantha*, *B. orthostachys* and *B. ovalis* also belong in this species group.

B. ramosa can be confused with *B. villosa*, but this has slightly smaller (2–2.7 mm) estipitate spikelets and cartilaginous, conspicuously serrate-undulate leaf-blade margins.

24. *B. lata* (Schumach.) C. E. Hubb. (1938);

Panicum latum Schumach. (1827) - type: Ghana, Thonning (C holo.).

Panicum amplexifolium Hochst. (1855). - types: Ethiopia, TU, Dschadscha, Schimper in Herb. Buchinger 1213 (STR syn., K isosyn.) & Schimper 1161 (STR syn.).

Panicum hamadense Mez (1917) - type: Ethiopia, TU, Hamado, Schimper 1088 (B holo., K iso.).

Coarse annual; culms erect, ascending or decumbent, solitary or tufted, 30–115 cm high. Leaf-blades lanceolate, 13–25 mm wide, glabrous or scattered-hispid; leaf-sheaths ciliate on the margins, the hairs extended on to the rounded base of the blade as tubercle-based setae. Inflorescence of 10–20 densely spiculate, ascending racemes crowded along an axis 9–13 cm long; racemes 3–6 cm long, the spikelets borne in closely contiguous, subessile pairs (primary pedicels up to 0.8 mm long) on a triquetrous, setose rhachis. Spikelets 2.5–3 mm long, elliptic, usually glabrous (occasionally pubescent), acute; lower glume 1/3–1/2 spikelet length; upper glume 7-nerved; upper lemma rugose, subacute with a mucro 0.2–0.3 mm long. Fig. 92:8–10.

Open, rocky slopes, roadsides and as a field weed; 550–1700 m. EW TU GD GJ/SU IL; westwards to Senegal and Mauretania; Arabian Peninsula. Aweke & Gilbert 710; Pappi 5970; Parker 455.

B. lata grades into *B. ramosa* and difficulty may be experienced in placing robust, broad-leaved specimens of *B. ramosa* with a similar facies to *B. lata*. The more densely spiculate, conspicuously setose racemes of *B. lata* provide the best distinguishing character. Additionally, estipitate spikelets, a mucronate upper lemma, and glabrous or hispidulous leaf-blades with marginal cilia at their base are all typical of *B. lata*, though none of these characters are reliable taken on their own. Headley 185 is one such intermediate, having the loose racemes, longer pedicels and velvety leaf-blades of *B.*

ramosa, together with the estipitate spikelets, mucronate upper lemma and ciliate leaf-bases of *B. lata*.

25. *B. xantholeuca* (Schinz) Stapf (1919);

Panicum xantholeucum Schinz (1888) - type: Namibia, Schinz 639 (K iso.).

Tufted annual; culms 12–60 cm high. Leaf-blades broadly linear, 5–8 mm wide, velvety-pubescent, acute. Inflorescence of 2–8 stiffly ascending racemes on an axis 3–9 cm long; racemes 1–5 cm long, the spikelets borne singly in 2 neat rows on short setose pedicels (rarely some spikelets paired), imbricate by about half their length on the triquetrous rhachis. Spikelets narrowly elliptic, 2.8–4.2 mm long, hispidulous, cuspidate, supported by a basal stipe 0.5 mm long; lower glume 1/3–1/2 spikelet length; upper glume and lower lemma 5-nerved, membranous; upper lemma lightly rugulose, acute. Fig. 92:13.

Open deciduous bushland, often in weedy places; 400–1300 m. EW SU IL HA; tropical Africa. Ash 2586; Pappi 1019 & 1385; Pavlov 332 (ETH).

B. xantholeuca is not completely distinct from *B. ramosa*, but can usually be distinguished from those specimens of *B. ramosa* with a high proportion of single spikelets in the inflorescence by the more tightly packed arrangement of its subessile spikelets, which overlap each other in 2 neat rows.

B. orthostachys (Mez) W. D. Clayton, distributed from Mauretania to Sudan, resembles *B. xantholeuca* but has glabrous spikelets and a 7-nerved upper glume.

26. *B. leucacrantha* (K. Schum.) Stapf (1919);

Panicum leucacranthum K. Schum. (1895) - types: Tanzania, Holst 2077 & 4163 (B syn.) & 2805 (K isosyn.).

Loosely tufted annual; culms 10–40 cm high, often prostrate and rooting at the nodes. Leaf-blades linear to narrowly lanceolate, 2–6 mm wide, velvety-pubescent. Inflorescence of 3–5 racemes on an axis 2–8 cm long; racemes 1–6 cm long, the spikelets loosely contiguous, borne singly in 1–2 rows on a triquetrous rhachis. Spikelets narrowly elliptic, 4–5 mm long, pubescent, becoming pilose above with the hairs forming a loose tuft on either side of the midnerve, caudate-acuminate, supported by a basal stipe ± 0.5 mm long; lower glume 1/3–1/2 spikelet length; upper glume and lower lemma 5-nerved; upper lemma granular-striate, acute.

Deciduous bushland, often on sandy soils in disturbed places; c 1000 m. GG; S Somalia, East Africa and Mozambique. Corradi 1176, 214.

107. UROCHLOA P. Beauv. (1812)

Annuals or perennials, often coarse and weedy; leaf-blades broadly linear to lanceolate; ligule a ciliate membrane. Inflorescence composed of racemes along a central axis, the spikelets single or paired on a flattened or triquetrous rhachis. Spikelets plano-convex, lanceolate or elliptic and cuspidate to acuminate, abaxial

(lower glume facing away from rhachis); lower glume variable, short and sheathing to almost equalling the spikelet; upper glume and lower lemma similar, equaling the spikelet, chartaceous (rarely coriaceous); lower lemma male or sterile with a well developed palea, 5-nerved, often setosely fringed along the margins; upper lemma broad, crustaceous, rugulose or granular, margins inrolled, shorter than the spikelet and tipped by a slender mucro lying inside the cuspidate spikelet-tip.

12 species in the Old World tropics, mainly Africa.

Urochloa is very closely related to *Brachiaria*, being distinguished mainly by the facies imparted by the plano-convex spikelets with cuspidate tips, enclosing a pronounced mucro from the fertile lemma. The abaxial spikelet orientation is also characteristic although less reliable, but this is not evident when the spikelets are paired. The flattened spikelets are sometimes taken for *Paspalum*, but this lacks the cuspidate spikelet-tip and also usually lacks a lower glume.

Some species are incompletely separated, especially in the *U. trichopus* complex where intermediates are to be expected, and it is usually not possible to distinguish between annual/perennial pairs without basal parts. Whilst a species may have predominantly single or paired spikelets, the opposite condition may also occur fairly readily. A tiny spikelet-rudiment is usually present on the pedicel of single-spiculate forms, which may develop to form a complete pair in parts of the inflorescence. In most species the spikelets may be either glabrous or marginally setosely fringed on the lower lemma. Usually these fringing hairs are appressed, but they occasionally spread like a halo at maturity, imparting a quite different appearance to the inflorescence than glabrous forms of the same species.

1. Spikelets spinosely warty, coriaceous.
 1. *U. sclerochlaena*
 - Spikelets not warty, chartaceous. 2
2. Lower glume 1/4-1/3(-1/2) spikelet length, ovate. 3
 - Lower glume 2/3-3/4 spikelet length, lanceolate or oblong. 4
3. Tufted annual; leaf-blade margins pectinate-ciliate; rhachis c 1 mm wide. 2. *U. panicoides*
 - Trailing perennial; leaf-blade margins glabrous; rhachis 0.5-0.7 mm wide. 3. *U. setigera*
4. Lower glume oblong, 3-nerved, often with a tuft of setae on the back; annual. 4. *U. trichopus*
 - Lower glume lanceolate, 5-nerved, lacking a setose tuft. 5
5. Perennial with tomentose basal sheaths; spikelets lanceolate; upper lemma mucro 0.3-0.5 mm long. 5. *U. oligotricha*
 - Annual; spikelets ovate; upper lemma mucro c 1 mm long. 6. *U. brachyura*

1. *U. sclerochlaena* Chiov. (1951);
 - type: Kenya/Ethiopia (GG) border, Elogo, *Corradi* 143 (FT lecto.).

U. sclerochlaena Chiov. var. *commelinoides* Chiov. in *Webbia* 8: 86 (1951) - type: Ethiopia, GG, Dande, along the Caschei, *Corradi* 717 (FT holo.).

Straggling wiry perennial; culms procumbent or scandent, becoming woody and brittle, branching at the nodes, sometimes developing hard knotty tufts, ascending to 30-65 cm high. Leaf-blades lanceolate, thin, 2-5.5 cm long, 4-13 mm wide, velvety pubescent, shortly acuminate. Inflorescence composed of 2-5 diverging racemes spaced on a fine axis 1-4 cm long; racemes 1-3.5 cm long, the spikelets borne in loose pairs on a slender triquetrous rhachis, longer pedicels 1-2 mm long. Spikelets hard, plumply elliptic, 2.5-4 mm long, pubescent, acute to cuspidate; lower glume sheathing, truncate, up to 1/4 spikelet length; upper glume deeply concave, thickly coriaceous, spinosely warty; lower lemma similar but narrower; lower palea hyaline at the centre back, otherwise thickly coriaceous; upper lemma broadly elliptic, granular, subacute with a mucro 0.2-0.4 mm long. Fig. 93:5.

Acacia-Commiphora bushland on sandy soil; c 800 m. GG SD; dry bushland of northern and coastal Kenya. *Friis* et al. 2890.

The plump spikelets have the facies of a *Brachiaria* species, and it is often misidentified as such. Whilst it is indeed on the borderline between the two genera, it is placed in *Urochloa* on account of the cuspidate spikelet tips and mucronate upper lemma.

2. *U. panicoides* P. Beauv. (1812);
 - type: Mauritius, *de Jussieu* (whereabouts uncertain, not G).
 - Panicum hochstetteranum* A. Rich. (1850); *Panicum controversum* Steud. (1854), nom. superfl., *Urochloa helopus* (Trin.) Stapf var. *hochstetterana* (A. Rich.) Chiov., *Fl. Somalia* 2: 444 (1932) - type: Ethiopia, TU, Adua [Adoua], *Schimper* 61 (K iso.).
 - P. trichopus* Hochst. subsp. *breviglume* Chiov. in *Nuov. Giorn. Bot. Ital., n.s.* 19: 419 (1912). - types: Eritrea, Ghinda, *Fiori* 1259 & 1260 (both FT syn.).
 - P. trichopus* Hochst. subsp. *breviglume* var. *glaberrimum* Chiov., l.c.: 419 (1912) - type: Eritrea, Ghinda, *Fiori* 1260 (FT holo.).
 - P. trichopus* Hochst. subsp. *breviglume* var. *trichophorum* Chiov., l.c.: 419 (1912) - type: Eritrea, Ghinda, *Fiori* 1259 (FT holo.).

Loosely tufted annual; culms geniculately ascending, up to 60 cm high. Leaf-blades linear-lanceolate, 6-15 cm long, 7-14 mm wide, glabrous, puberulous or thinly pilose, the margins pectinate-ciliate at least towards the subamplexicaul base. Inflorescence of 3-7(-10) stiff, diverging racemes spaced on an axis 2-6 cm long; racemes 2-6 cm long, the spikelets imbricate by c 1/3 of their length, borne singly or sometimes in pairs on a flattened rhachis 0.9-1.2 mm wide, thinly setose mainly from the short stout pedicels. Spikelets elliptic, 3.5-4.5 mm long, acute to cuspidate; lower glume

1/4–1/3(–1/2) spikelet length, ovate to ovate-oblong, 3–5-nerved, obtuse; upper glume 7–9-nerved with evident cross-veins, usually glabrous but occasionally pubescent; lower lemma glabrous or with a silky marginal fringe; upper lemma rugulose with a mucro 0.5–1 mm long. Fig. 93:4.

Weed of farmland and other disturbed places; 600–1900 m. EE EW TU SU AR GG SD HA; Sudan, Somalia and southwards to South Africa; Yemen, Oman (Dhofar); India; introduced to Australia. *Burger* 413; *Gilbert & Ermias* 1524; *Gilbert & Getachew* 2858.

3. *U. setigera* (Retz.) Stapf (1920);

Panicum setigerum Retz. (1786); *Brachyaria setigera* (Retz.) C. E. Hubb. (1938) - type: China, *Bladh* (LD hol.).

Slender trailing perennial; culms thin and tough, branching and rooting at the nodes, 20–45 cm high. Leaf-blades lanceolate, 3–12 cm long, 5–20 mm wide, glabrous or pubescent with glabrous margins, rounded at the base. Inflorescence of 2–8 slender, diverging racemes spaced on an axis 1–7 cm long; racemes 2–5 cm long, the spikelets paired or single (frequently accompanied by a reduced second spikelet), loosely imbricate on a subtriquetrous rhachis 0.5–0.7 mm wide, often setose on the pedicels. Spikelets lanceolate, 3–4.5(–5) mm long, acute to shortly acuminate; lower glume 1/4–1/3 spikelet length, ovate, 3(–5)-nerved, subacute; upper glume 7–9-nerved with only a few inconspicuous cross-veins, glabrous or pubescent; lower lemma glabrous; upper lemma rugulose with a mucro 0.3–0.5 mm long.

Shade of lowland riverine forest; c 1200 m. GG; East Africa, Zaire; India, Sri Lanka, Burma and Thailand. *M.G & S.B. Gilbert* 1556; *Gilbert & Thulin* 270.

Closely related to *U. panicoides* but with a different habit, slightly more slender racemes with narrower spikelets, and a more restricted habitat.

4. *U. trichopus* (Hochst.) Stapf (1920);

Panicum trichopus Hochst. (1844); *P. trichopodon* A. Rich. (1850) nom. superfl.; *Helopus trichopus* (Hochst.) Steud. (1854); *Eriochloa trichopus* (Hochst.) Benth. (1881) - type: Sudan, *Kotschy* 74 (K iso.).

Eriochloa trichopus (Hochst.) Benth. var. *glabrata* Schweinf. in *Bull. Herb. Boiss.* 2, App. 2: 17 (1894) - type: Eritrea, Dogali, *Schweinfurth* 258 (K iso.).

Panicum trichopus Hochst. var. *chiovendae* Lanza & Mattei in *Boll. Ort. Bot. Palermo* 9: 46 (1910) - types: Eritrea, Sciotel R., *Senni* 695 & Keren, *Senni* 696 & Agordat, *Senni* 697 (all PAL syn.).

Coarse tufted annual; culms geniculately ascending, often rooting at the lower nodes, 20–150 cm high. Leaf-blades broadly linear to lanceolate, 6–30 cm long, 10–20 mm wide, glabrous or tuberculate-hispid with rounded base and acuminate tip, the margins pectinate-ciliate.



Figure 93. *UROCHLOA* spp.: *U. TRICHOPUS*: 1 - inflorescence x 3/4; 2 - spikelet x 11; 3 - upper lemma x 11. *U. PANICOIDES*: 4 - spikelet x 11. *U. SCLEROCHLAENA*: 5 - spikelet x 11. 1–3 from *Headley* 182; 4 from *Mesfin et al.* 4096; 5 from *Frits et al.* 2890. Drawn by Eleanor Catherine.

Inflorescence composed of 3–15 ascending racemes spaced along a hispid axis 2–15 cm long; racemes 2–7 cm long, the spikelets single (infrequently paired), imbricate by c 1/2 their length on a flattened, narrowly winged rhachis 0.8–1.2 mm wide, thinly setose especially from the pedicels. Spikelets broadly elliptic to suborbicular, 3–5 mm long, glabrous or less often pubescent, cuspidate, sometimes mucronate; lower glume oblong, 2/3–3/4 spikelet length, broadly obtuse, often with a bunch of 1–5 appressed setae on the mid-nerve towards the tip; upper glume 5(–7)-nerved; lower lemma mostly with a silky marginal fringe of stiff hairs but the hairs occasionally short and sparse or absent; upper lemma papillose becoming rugulose on the flanks, with a mucro 0.5–1 mm long. Fig. 93:1–3.

Open grassland on light soils, often with *Acacia*; also in disturbed places and as an arable weed; sea level–1500 m. EE AF EW TU SU (Awash), GG, HA throughout tropical Africa, mainly in the east; Yemen. *Burger* 2890; *Gilbert* 1657; *Gilbert & Getachew* 2748.

The perennial counterpart of *U. trichopus* is *U. mosambicensis* (Hack.) Dandy, which differs only by the pos-

session of perennating buds at the base. It occurs from Kenya southwards to South Africa and, although reported from Ethiopia, no unequivocal specimens have been seen by the author. *Mooney* 8818 from the Robi valley (SU) is said to be perennial, but the Kew specimen lacks a base.

5. *U. oligotricha* (Fig. & De Not.) *Henr.* (1941);

Panicum oligotrichum Fig. & De Not. (1853) - type: Sudan, Nubia, *Figari* (whereabouts uncertain, not FT).

Helopus bolbodes Steud. (1854); *Panicum bolbodes* (Steud.) Schweinf. (1867); *Eriochloa bolbodes* (Steud.) Schweinf. (1894); *Urochloa bolbodes* (Steud.) Stapf (1920) - type: Ethiopia, TU, Dsche-ladscheranne, *Schimper* 2021 (P holo.).

Tufted perennial, the base knotty with silky-tomentose leaf-sheaths. Culms ascending, 30-60(-100) cm high. Leaf-blades linear, 10-40 cm long, 5-20 mm wide, acute, glabrous to pubescent or pilose, the margins usually tuberculate-ciliate towards the ligule. Inflorescence composed of 6-20 slender, densely spiculate racemes, the lower spaced, the upper clustered on a pilose axis 5-10 cm long; racemes 3-10 cm long, the spikelets usually paired on an unwinged rhachis 0.5-0.8 mm wide. Spikelets lanceolate, 3.5-5 mm long, acuminate; lower glume lanceolate, 2/3-3/4 spikelet length, 5-nerved, obtuse to acute; upper glume 7-nerved, glabrous or pubescent; lower lemma sometimes with setosely fringed margins; upper lemma rugulose with a mucro 0.3-0.5 mm long.

Wooded grassland, roadsides and as an arable weed; 1300-2000 m. EW TU GD; eastern Africa southwards to South Africa. *Schweinfurth* 1480; *Baldrati* 3872; *Te-wolde* 818 (ETH).

An infrequent species in Ethiopia, with lanceolate acuminate spikelets which are markedly narrower than in the much commoner *U. panicoides* and *U. trichopus*, from which it is also clearly distinguished by its tomentose perennial base.

6. *U. brachyura* (*Hack.*) *Stapf* (1920);

Panicum brachyurum *Hack.* (1888) - type: Namibia, *Schinz* 638 (K iso.).

Coarse, loosely tufted annual; culms ascending from a prostrate base, up to 120 cm high. Leaf-blades broadly linear, 5-30 cm long, 6-16 mm wide, pilose to almost glabrous, with rounded base and acute tip. Inflorescence composed of 2-10 ascending racemes on an axis 2-8 cm long; racemes 2.5-6 cm long, bearing paired spikelets on a flattened rhachis c 1 mm wide, setose mainly from the pedicels. Spikelets narrowly ovate, 3.5-6 mm long, cuspidate; lower glume lanceolate, 2/3-3/4 spikelet length, 5-nerved without setae on the upper mid-nerve, obtuse to acute; upper glume glabrous or pubescent; lower lemma sometimes with a setose marginal fringe; upper lemma granular to rugulose with a mucro c 1 mm long.

Roadsides and other weedy places; 2000 m. TU; southwards to South Africa. *Parker* E561; *Wilson* 699 (ETH).

A species predominantly of southern tropical and South Africa, occurring in Ethiopia only as a casual weed. The long, lanceolate, 5-nerved lower glume serves to distinguish it from both *U. panicoides* and *U. trichopus*, which occur in similar weedy habitats.

108. PASPALUM L. (1759)

Annuals or perennials; leaf-blades linear to narrowly lanceolate; ligule shortly membranous. Inflorescence composed of racemes arranged digitately or spread along a central axis, rarely solitary, the spikelets borne singly or in pairs in rows on a flattened, narrowly to broadly winged rhachis. Spikelets abaxial (upper lemma facing the rhachis), plano-convex, ovate to orbicular; lower glume usually absent (rarely a tiny scale present); upper glume as long as the spikelet, membranous; lower lemma similar or infrequently coriaceous, sterile without a palea; upper lemma coriaceous or crustaceous, obtuse with inrolled margins, the palea-tip included.

About 330 species in the tropics, predominantly in America.

Paspalum is best recognized by its racemes of round, plano-convex, abaxial spikelets lacking a lower glume.

Several South American species are grown for forage and erosion control in Africa. Two which are likely to occur in Ethiopia as escapes from cultivation are *P. dilatatum* Poir. and *P. notatum* Fluegge. Distinguishing characters for these are given in the key.

1. Upper glume without a marginal fringe. 2
- Upper glume with a marginal ciliate fringe. 6
2. Upper floret brown at maturity; racemes 1-11. 3
- Upper floret pallid at maturity; racemes paired. 5
3. Leaf-blades linear, 3-12 mm wide, narrowed towards the base, tapering to an acuminate tip.
 1. *P. scrobiculatum*
 - Leaf-blades lanceolate, 10-27 mm wide, rounded at the base, acute. 4
 4. Some spikelets with a small triangular lower glume, loosely imbricate; culms 2-3.5 mm in diameter, the nodes exposed. 2. *P. glumaceum*
 - Spikelets all lacking a lower glume, tightly imbricate; culms 3-7 mm in diameter, the nodes mostly covered by the papery leaf-sheaths. 3. *P. lamprocaryon*
 5. Upper glume and lower lemma thinly chartaceous; spikelets narrowly ovate-elliptic, dorsally flattened. 4. *P. vaginatum*
 - Upper glume and lower lemma cartilaginous; spikelets broadly ovate, plumply plano-convex. *P. notatum* (see note above)
 6. Racemes paired; plant stoloniferous. 5. *P. conjugatum*
 - Racemes mostly 3-5; plant tufted. *P. dilatatum* (see note above)

1. *P. scrobiculatum* L. (1767);

- type: India, cult. at Uppsala (LINN holo.).

P. orbiculare G. Forster (1786) - type: Society Is., Forster (GOET holo., K iso.).

P. commersonii Lam. (1791); *P. scrobiculatum* L. var. *commersonii* (Lam.) Stapf in *Fl. Trop. Afr.* 9: 573 (1919) - type: Mauritius, Commerson (P holo.).

Loosely tufted perennial; culms erect, or more usually geniculately ascending from an often decumbent or stoloniferous base, 30–75 cm high, 1.5–3 mm in diameter with exposed nodes. Leaf-blades linear, flat, 7–30 cm long, (3–)4–8(–12) mm wide, glabrous to pilose, tapering to a fine acuminate tip. Inflorescence composed of 1–5 straight ascending racemes 4–7.5 cm long; racemes subdigitate on an axis up to 2 cm long, the spikelets borne singly in 2 neatly imbricate rows on a flat winged rhachis 1.5–2.5 mm wide. Spikelets broadly elliptic to suborbicular, 2–3 mm long, brownish green; upper glume and lower lemma membranous (lower lemma rarely coriaceous), equalling the spikelet, 5–7-nerved with a single or paired marginal nerve and sometimes a nerve between the margin and midnerve; upper lemma brown, glossy, striate-punctulate. Fig. 94.

Favouring swampy and muddy ground, but sometimes in drier, weedy or lightly shaded places; also a weed of irrigated crops; 500–2000 m. EW GD WG SU IL KF GG SD BA HA; throughout the Old World tropics; cultivated in India as the cereal "Kodo". Friis et al. 7; Gilbert & Phillips 9053; Gilbert & Thulin 873.

P. scrobiculatum as a whole is a highly polymorphic species, but the Ethiopian population is relatively uniform. The description above only refers to the species as it occurs in Ethiopia, comprising slender, narrow-leaved plants with few racemes. Elsewhere the species may be much more vigorous, with stout culms up to 1.5 m high and 6 mm in diameter, larger leaf-blades and more numerous, longer racemes. Clayton [*Kew Bull.* 30: 101 (1975)] found variation to be continuous throughout the complex, which probably comprises an apomictic swarm. De Koning & Sosef [*Blumea* 30: 279–318 (1985)] assigned the variation to 3 varieties, based on a study of Malesian material, and also included *P. lamprocaryum* as a variety of *P. scrobiculatum*.

Parker E575 has some spikelets with a developed lower glume as in *P. glumaceum*, but its general facies and linear hairy leaves are more typical of *P. scrobiculatum*.

2. *P. glumaceum* W. D. Clayton (1975);

- type: Zambia, Astle 5458 (K holo.).

Loosely tufted perennial from a short knotty rhizome; culms erect or geniculately ascending, 40–100 cm high, 2–3.5 mm in diameter, the nodes exposed. Leaf-blades linear-lanceolate, soft and drooping, 10–30 cm long, 10–22 mm wide, glabrous or pubescent, rounded at the base, tip acute. Inflorescence composed of (1–)2–3

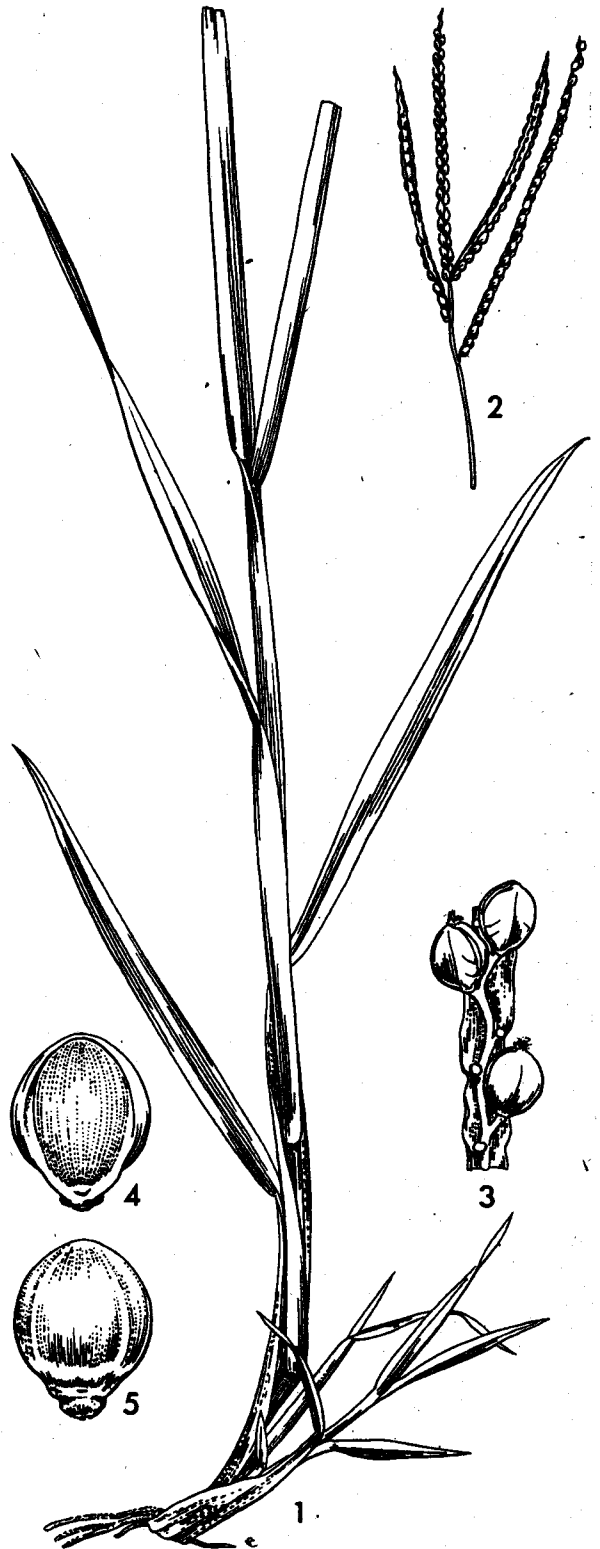


Figure 94. *PASPALUM SCROBICULATUM*: 1 - habit x 3/4; 2 - inflorescence x 3/4; 3 - section of raceme x 6; 4 - fertile floret from back x 15; 5 - fertile floret from front x 15. All from Gereau 1419. Drawn by Eleanor Catherine.

ascending racemes on an axis 1–6 cm long; racemes 4–12 cm long; spikelets loosely imbricate on a rhachis 1.5–2 mm wide, the pedicels with a winged tooth or occasionally paired. Spikelets broadly elliptic, 2.7–3.5 mm long, glabrous or pubescent; lower glume mostly

absent but a few spikelets (especially towards raceme-tips) with a triangular scale up to 1 mm long; upper glume and lower lemma both chartaceous; upper lemma brown, glossy, striate.

Damp shady places, especially in riverine forest and bamboo thicket; 1300 m. WG; Central African Republic, S Sudan and southwards to Zimbabwe and Madagascar. *Gilbert & Thulin* 748.

A segregate from *P. lamprocaryon* with a slightly different facies imparted by the more slender culms with exposed nodes arising from a knotty rhizome. The more loosely arranged spikelets always have a flat chartaceous lower lemma, whereas in *P. lamprocaryon* the lower lemma frequently mimics the indurated upper lemma. In at least some spikelets a distinct lower glume is developed and some spikelet-pairs are also commonly present.

3. *P. lamprocaryon* K. Schum. (1895);

P. scrobiculatum var. *lanceolatum* de Koning & Sosef in *Blumea* 30: 312 (1985) - type: Tanzania, *Stuhlmann* 3901 (B holo.).

P. auriculatum auct. non Presl.

Stout perennial; culms laxly spreading, up to 1 m or more high, 3–7 mm in diameter, decumbent and rooting at the lower nodes, leafy, frequently rather spongy with loose, papery overlapping sheaths. Leaf-blades linear-lanceolate, 8–30 cm long, 8–27 mm wide with broadly rounded base and abruptly acute tip, glabrous. Inflorescence composed of 2–11 racemes on an axis up to 9 cm long; racemes 4–12 cm long, the spikelets closely imbricate in 2 neat rows on a rhachis 2–3 mm wide. Spikelets broadly elliptic to rotund, 2–2.5 mm long, brown; upper glume chartaceous; lower lemma flat and chartaceous or more often coriaceous (then either flat or concave like the upper lemma); upper lemma brown, glossy, finely striate.

Swampy grassland, stream edges and damp places in woodland; 1400 m. WG; westwards to Senegal and southwards to southern tropical Africa. *Mesfin & Kagnew* 2246.

P. lamprocaryon is closely related to *P. scrobiculatum*, and whilst typical forms present little difficulty, poorly developed specimens can be problematical as the differences between the two species are entirely vegetative. It has in the past been regarded as conspecific with *P. auriculatum*, a taxon based on an Asiatic type which is now included within the range of variation of *P. scrobiculatum* [see de Koning & Sosef in *Blumea* 30: 279–318 (1985)].

4. *P. vaginatum* Sw. (1788);

- type: Jamaica, *Swartz* (S holo.).

Extensively creeping stoloniferous perennial; culms up to 60 cm high. Leaf-blades 2.5–15 cm long, 3–8 mm wide, stiffly ascending. Inflorescence composed of 2(–5) conjugate racemes 1.5–7.5 cm long, the spikelets borne singly in 2 rows on a winged rhachis, 1–2 mm wide.

Spikelets narrowly ovate-elliptic, 3–4.5 mm long, markedly flattened, acute, usually pale brownish-green; lower glume very rarely present as a minute scale; upper glume and lower lemma thinly chartaceous, glabrous, the midnerve often suppressed; upper lemma smooth, pallid at maturity.

Lowland saline marshes, mostly coastal but sometimes also inland. Throughout the tropics and extending into subtropical regions.

This is a fairly frequent grass of suitable habitats in northern Somalia. *Gillett* 4925 was collected just within the Somali side of the border with Ethiopia and it is to be expected also on the Ethiopian side.

5. *P. conjugatum* Berg. (1762);

Fröman & Persson, *Illustr. Guide Grasses Eth.*: 99 (1974) - type: Surinam (whereabouts uncertain).

Perennial growing in small tufts arising from wide-spreading stolons; culms 30–60 cm high. Leaf-blades linear-lanceolate, 4–20 cm long, 5–13 mm wide. Inflorescence composed of 2 conjugate racemes each 5–17 cm long, diverging or often horizontally spreading, the spikelets borne singly in 2 rows on a narrow rhachis c 0.5 mm wide. Spikelets orbicular, 1.5–1.7 mm long, pale yellow; upper glume ciliate on the margins; lower lemma similar but glabrous; upper lemma finely striate, pallid at maturity.

Damp forest clearings, often forming a close sward, and in old pastures; 1200 m. IL; native to America but now found throughout the tropics. *Getachew* Z. 60 (ETH).

109. SETARIA *P. Beauv.* (1812), *nom. conserv.*

Cymbosetaria Schweick. (1936)

Annuals or perennials; culms slender to robust or cane-like. Leaf-blades linear to lanceolate, sometimes plicate or narrowed to a false petiole; ligule ciliate from a membranous base. Inflorescence paniculate, either open with the spikelets clustered along the primary branches (these occasionally racemose), or contracted to densely spiciform, the spikelets (or some of them) supported by one to several bristles persistent after the spikelets fall. Spikelets elliptic, plano-convex, sometimes gibbous, glumes and lower lemma thinly membranous to herbaceous; lower glume up to half spikelet length, ovate from a clasping base; upper glume half as long to equaling the spikelet; lower lemma male or sterile, sometimes sulcate, its palea present, reduced or absent; upper lemma crustaceous, rugose, punctate, or smooth and glossy, its back strongly convex, the inrolled margins clasping the edges of the palea.

About 100 species in the tropics and subtropics.

The bristles represent reduced panicle-branches and may occasionally bear vestigial spikelets. *Setaria* can be readily distinguished from *Pennisetum* as the bristles are persistent, whereas in *Pennisetum* they form an involucre which falls with the spikelet.

Relatively few species of *Setaria* are clearly defined by easily recognizable characters. Several species are rather similar and are best characterized by a combination of characters, whilst others form highly variable complexes (notably *S. incrassata*, *S. sphacelata* and *S. megaphylla*).

Setaria italica (L.) P. Beauv. (Foxtail millet) is a crop plant cultivated as a cereal in China, and for fodder and birdseed in southern Europe and elsewhere. The spikelets are persistent in the dense spiciform panicle, only the upper floret disarticulating at maturity.

1. Base of leaf-blades sagittate. 2
- Base of leaf-blades not sagittate. 3
2. Spikelets suborbicular, gibbous; bristles conspicuous; annual. 1. *S. sagittifolia*
- Spikelets elliptic, not gibbous; bristles sparse and inconspicuous; perennial. 2. *S. appendiculata*
3. Bristles retrorsely scabrid, clinging to clothing; weedy annual. 4. *S. verticillata*
- Bristles antrorsely scabrid; annuals or perennials. 4
4. Panicle densely spiciform, cylindrical (sometimes lobed or interrupted in vigorous specimens); spikelets tightly clustered around main axis. 5
- Panicle loose, narrowly lanceolate to elliptic; spikelets on obvious branches. 10
5. Lower floret sterile, its palea much reduced or absent. 6
- Lower floret often male, its palea well developed. 7
6. Tussocky perennial, culms up to 2.5 m high; bristles ciliate. 3. *S. atrata*
- Tufted annual. *S. × verticilliformis* (see note under no. 4)
7. Nodes hairy; upper glume subequalling the spikelet and covering most of upper lemma, 5-7-nerved; upper lemma punctate-rugulose; bristles pallid or purplish. 8
- Nodes glabrous; upper glume 1/3-2/3 spikelet length and exposing much of upper lemma, 3-5-nerved; upper lemma rugose; bristles usually brown. 9
8. Tussocky perennial. 5. *S. incrassata*
- Annual. 6. *S. acromelaena*
9. Tussocky perennial. 7. *S. sphacelata*
- Annual. 8. *S. pumila*
10. Leaf-blades flat, not plicate; fertile floret rugose. 11
- Leaf-blades plicate (at least above ligule); fertile floret rugose or smooth. 15
11. Perennial forming dense tussocks, base invested with old leaf-sheaths; spikelets 2-3 mm long. 16. *S. lindenberiana*
- Annuals or loosely tufted perennial; spikelets 1.5-2.3 mm long. 12
12. Spikelets supported by a cluster of 2-3 bristles; annuals; panicle contracted. 13
- Spikelets supported by a single bristle. 14

13. Lower leaf-blades, or at least some of them petiolate; axis of inflorescence nearly always sparsely hirsute. 9. *S. petiolata*
- Lower leaf-blades not petiolate; axis of inflorescence scaberulous to puberulous. 10. *S. intermedia*
14. Annual; panicle conspicuously hispid; spikelets subacute; lower floret sterile. 11. *S. orthosticha*
- Perennial; panicle scaberulous (rarely hirsute); spikelets sharply acute; lower floret male. 12. *S. longiseta*
15. Annuals; fertile floret rugose. 16
- Perennials; fertile floret rugose or smooth and glossy. 17
16. Primary panicle-branches clearly racemose; spikelets alternating in 2 neat rows, each supported by a bristle; upper glume equalling spikelet and completely covering upper lemma; lower lemma 5-nerved. 13. *S. homonyma*
- Primary panicle-branches often compound; spikelets crowded, some on short branchlets; upper glume 2/3-4/5 spikelet length and exposing upper lemma tip; lower lemma 7-nerved. 14. *S. barbata*
17. Fertile lemma rugose; perennial forming dense tussocks. 16. *S. lindenberiana*
- Fertile lemma smooth (or rugulose under upper glume). 18
18. Culms slender, rambling or scandent, up to 1.5 m long; lower glume truncate; upper glume subequalling spikelet. 15. *S. kagerensis*
- Culms tufted, often robust and cane-like, up to 3 m high; lower glume rounded; upper glume 1/2-2/3 spikelet length. 19
19. Spikelets 2.5-3.2(-3.5) mm long, acute. 17. *S. megaphylla*
- Spikelets (3.2-)3.5-4(-4.5) mm long, acuminate-rostrate. 18. *S. poiretiana*

1. *S. sagittifolia* (A. Rich.) Walp. (1852);
Pennisetum sagittifolium A. Rich. (1850); *Panicum sagittifolium* (A. Rich.) Steud. (1854); *Cymbosetaria sagittifolia* (A. Rich.) Schweick. (1936) - types: Ethiopia, TU, R. Tacaze, Schimper 1655 (K isosyn.) & Tchélatchékanné, *Quartin Dillon* (P syn.).

Tufted annual; culms 40-100 cm high. Leaf-blades lanceolate, thin, the lower falsely petiolate, 10-35 cm long (excluding petiole), 5-18 mm wide, sagittate with lobes to 3 cm long, upper leaves with progressively shorter petioles and sagittate lobes, tip filiform; leaf-sheaths keeled. Panicle open, elliptic, 5-18 cm long, the branches spaced singly or in stiff whorls of up to 4 along the main axis; branches raceme-like, the spikelets secund, approximate, each subtended by a single fine, scaberulous bristle up to 15 mm long. Spikelets suborbicular, 2 mm long, laterally compressed, strongly gibbous; glumes scarious, the lower 1/3-1/2 spikelet length, 3-nerved, the upper 1/2-2/3 spikelet length, 5-nerved; lower lemma 5-nerved, male or sterile with a

well-developed or somewhat reduced palea; upper lemma keeled, gibbous, rugose.

Shady places in bushland on dry sandy soils; 850–1000 m. TU SU SD; Sudan and southwards to South Africa; also in Yemen. *Friis et al.* 2972; *Gilbert* 1655.

2. *S. appendiculata* (*Hack.*) *Stapf* (1899);

Panicum appendiculatum *Hack.* (1896) - type: Namibia, *Belck* (W holo.).

Tufted perennial; culms much branched, sometimes stoloniferous, ascending to 50–100 cm high. Leaf-blades linear, 7–30 cm long, 3–12 mm wide, tip setaceous, base sagittate without a false petiole, the lobes setaceous acuminate, up to 2 cm long. Panicle narrowly oblong, 10–25 cm long, the spikelets densely clustered along short primary branches; bristles sparse and inconspicuous, 3–12 mm long, sometimes only the primary branch-tips forming bristles; rhachis scaberulous to pubescent. Spikelets plumply elliptic, 2–2.7 mm long, sharply acute; lower glume 1/2 spikelet length, 5-nerved; upper glume c 3/4 spikelet length, 7–13-nerved; lower lemma male with a fully developed palea, 7–11-nerved; upper lemma rugose, cuspidate, not keeled or gibbous.

Shady places; 1000 m. GG; Uganda, Kenya, Tanzania; Namibia and South Africa (Cape Province). *Gilbert & Phillips* 9095U.

An uncommon grass with a disjunct distribution in Africa.

3. *S. atrata* *Hack.* (1892);

- type: Ethiopia, GD, Debra Tabor, *Schimper* 1209 (K iso.).

Setaria blepharochaeta *Chiov.* (1912) - types: Ethiopia, GD, *Chiovenda* 2231 & 2263 & Amhara-Dembia, Asoso, *Chiovenda* 1877 (all FT syn.).

Perennial forming dense tussocks; culms erect, 0.5–2.5 m high, silky-hairy below the panicle. Leaf-blades tough, pale green, often inrolled, 25–60 cm long, 4–6 mm wide, filiform. Panicle linear, spiciform, dense or interrupted, 7–45 cm long; bristles 4–8 mm long, 1–3 per spikelet, ciliate (sometimes sparsely), stiffly wavy, blunt; rhachis pubescent with scattered cilia. Spikelets lanceolate-elliptic, 2–2.8 mm long, acute, pallid with brown glumes and purple-flushed; lower glume 1/3 spikelet length, obtusely triangular; upper glume 1/3–1/2 spikelet length, broadly ovate; lower lemma thinly cartilaginous, 5-nerved, medianly depressed, sterile with its palea vestigial or absent; upper lemma indistinctly rugulose. Fig. 95:1, 2.

Swamps; 1300–2100 m. GD GJ WG SU KF SD; southern Sudan, East Africa and Malawi. *Friis et al.* 2078; *Gilbert & Thulin* 729; *Mooney* 7594.

The only other Ethiopian species with hairy bristles is *S. orthosticha*, which has a completely different annual habit and branched inflorescence.

S. restioidea (*Franch.*) *Stapf* from swampy places in southern Sudan, Uganda, Zaire and Angola, is to be expected in southwest Ethiopia. It differs from *S. atrata* chiefly by its much more numerous, glabrous bristles. Each small branchlet from the rhachis is terminated by a cluster of 5 or more bristles above the spikelets.

4. *S. verticillata* (*L.*) *P. Beauv.* (1812);

Panicum verticillatum *L.* (1762) - type: based on *Scheuchzer*, *Agrost.*: 47 (1719), not on specimen in LINN.

Pennisetum respiciens *A. Rich.* (1850); *Setaria respiciens* (*A. Rich.*) *Walp.* (1852); *Panicum respiciens* (*A. Rich.*) *Steud.* (1854); *Setaria verticillata* (*L.*) *P. Beauv.* var. *respiciens* (*A. Rich.*) *A. Br.*, *Cat. Sem. Hort. Berol.*: 7 (1871) - types: Ethiopia, TU, Tchélatchékanné, *Quartin Dillon* (*P* syn.) & Tacaze valley, *Schimper* 1654 (*K* isosyn.).

Setaria viridis (*L.*) *P. Beauv.* var. *insularis* *Terracc.* in *Ann. Ist. Bot. Roma* 5: 93 (1893) - types: Eritrea, Anfila Bay, Estam-Aghe Is., *Terracciano* 1552 & Crulli Is., *Terracciano* (both FT syn.).

S. adhaerens (*Forssk.*) *Chiov.* (1919).

Loosely tufted, much-branched annual; culms ascending, up to 1 m high, the nodes black. Leaf-blades broadly linear, to 30 cm long, 5–15 mm wide, flat, flaccid, usually pilose, scabrid especially along the margins, acuminate. Panicle densely spiciform (or lobed with short lateral branches on vigorous specimens), 4–15 cm long; bristles 3–8 mm long, tenaciously retrorsely barbed and often becoming entangled, a spikelet at each bristle base; rhachis hispidulous. Spikelets elliptic-oblong, 1.8–2 mm long, obtuse, green with obvious darker nerves; lower glume broadly ovate, 2/5–1/2 spikelet length, obtuse; upper glume equalling spikelet, 7-nerved; lower lemma 5-nerved with a much reduced palea; upper lemma dorsally compressed, rugulose. Fig. 95: 3, 4.

A weed of open and disturbed places, often in light shade; sea level–1700 m. EE EW TU SU AR IL GG SD BA HA; tropical and warm temperate regions of the world. *Gilbert* 2035; *W. de Wilde* 8458; *IECAMA* H-5.

One of the easiest species of *Setaria* to recognize, as it is the only one in Ethiopia to have retrorsely-barbed, clinging bristles.

A single specimen of the hybrid *S. × verticilliformis* *Dum.* (*S. verticillata* × *viridis*) is known from Ethiopia [*Smeds* 1130, collected at 1000 m at Awash (SU)]. This hybrid is widespread around the Mediterranean, in the Middle East and in the Arabian Peninsula where both parents grow together, and is probably a chance introduction in Ethiopia. *S. viridis* (*L.*) *P. Beauv.* is a widespread weed of temperate regions, differing from *S. verticillata* by its antrorsely-barbed bristles and pilose to villous rhachis. The hybrid has the antrorsely-barbed bristles of *S. viridis* but the shortly hispidulous rhachis of *S. verticillata*.

5. *S. incrassata* (Hochst.) Hack. (1892);

Panicum incrassatum Hochst. (1855) - type: Ethiopia, GD, Gandoma, Schimper in Herb. Buchinger 1211 (STR holo.).

Setaria avettae Pirota (1896) - types: Ethiopia, Cuolla Arussi, Ragazzi (FT syn.) & Kobbo to Dinghai Mesghia, Ragazzi (K isosyn.).

Setaria abyssinica Hack. (1901) - types: Ethiopia, TU, Hamedo, Schimper 1034 & 1039 & Abba Gerima, Schimper 1038 (all K isosyn.).

S. abyssinica Hack. var. *brevisetata* Chiov. in *Ann. Ist. Bot. Roma* 8: 311 (1907) - types: Eritrea, Deca Mere, Pappi 2435 (K isosyn.) & many other syn-types.

S. abyssinica Hack. var. *longisetata* Chiov., l.c.: 311 (1907) - types: Eritrea, Gaza Gobo, Pappi 100 (FT syn.) & Deggahen, Pappi 1389 (K isosyn.).

S. holstii Herrm. (1910).

S. phragmitoides Stapf (1930).

S. lynesii Stapf & C.E. Hubb. (1930).

S. phleoides Stapf (1930).

S. setulosa Stapf (1930).

S. nigrirostris sensu Cufodontis, *Enum.*: 1337 (1969) non (Nees) Th. Dur. & Schinz.

Perennial forming dense, tough tussocks, basal sheaths sericeous at ground level, eventually becoming fibrous; culms 50–150 cm high from an erect or geniculate base, unbranched, sometimes slightly swollen basally, the nodes bearded. Leaf-blades linear, 15–55 cm long, 3–5 mm wide, thinly hispid on the upper surface only, tip filiform. Panicle linear, densely spiciform, 4–16 cm long, pale green tipped purple or more generally purplish, the spikelets sessile in clusters of 1–3 (rarely more in robust specimens), supported by bunches of 2–6 stiffly wavy, scabrid bristles 3.5–11 mm long; rhachis tomentellous to pilose. Spikelets gibbously ovate, 2.3–3.3 mm long, laterally compressed; glumes firmly membranous, the lower c 1/2 spikelet length, the upper subequalling the spikelet and almost covering the upper lemma, 5–7-nerved; lower lemma 5-nerved, often depressed along the midnerve, male with a well-developed palea; upper lemma strongly convex, rugulose-punctate. Fig. 96:4–6.

Grassland, often on seasonally waterlogged, black clay, 1000–2600 m. EW TU GD GJ WU SU KF SD HA; westwards to Nigeria and southwards to South Africa. *Gilbert* 2575; *IECAMA* G-20; *Mooney* 8138.

The name *S. incrassata* encompasses a polymorphic complex of forms characterized by the possession of hairy nodes, a spiciform panicle, long upper glume and only weakly rugulose fruit. The main sources of variation lie in the general robustness of the plant, length of the spikelets and bristles, the number of spikelets in each cluster and their density on the main rhachis. Most collections from the southern half of Ethiopia are of rather slender plants with short, compact inflorescences (up to 8 cm) and very short bristles (3–5 mm), corre-



Figure 95. *SETARIA* spp.: *S. ATRATA*: 1 - inflorescence \times 3/4; 2 - spikelet cluster \times 7. *S. VERTICILLATA*: 3 - inflorescence \times 3/4; 4 - spikelet cluster \times 7. 1 & 2 from *Mooney* 7594; 3 & 4 from *Baldrati* s.n.. Drawn by Eleanor Catherine.

sponding to *S. phleoides* Stapf. These grade into taller, more typical *S. incrassata* with longer inflorescences (up to 15 cm) and bristles (4–9 mm). A few very robust plants from the Lake Tana area have very long inflorescences (up to 25 cm) of stout appearance due to the presence of up to 10 spikelets in each cluster (*S. lynesii*, *S. phragmitoides* Stapf). Other robust plants have the inflorescence interrupted between the spikelet clusters.

The upper glume in *S. incrassata* is frequently described as 7–9-nerved as against 5-nerved in *S. sphacelata*. In fact, it is often also 5-nerved in *S. incrassata* but is consistently longer than in *S. sphacelata*, covering most of the upper lemma. These two species complexes are themselves closely related and are best separated by looking at a combination of characters, as no single character is reliable in isolation. Besides the differences listed in the key, *S. incrassata* also differs from *S. sphacelata* by its plumper, somewhat laterally compressed spikelets with firmer-textured scales.

6. *S. acromelaena* (Hochst.) Th. Dur. & Schinz (1894); *Panicum acromelaenum* Hochst. (1855) - type: Ethiopia, Schimper in Herb. Buchinger 1513 (STR holo.).

Setaria abyssinica Hack. var. *annua* Chiov. in *Ann. Ist. Bot. Roma* 8: 311 (1907) - type: Eritrea, Terammi, Pappi 569 (FT holo., K fragment).

Tufted annual; culms 30–80 cm or more high, slender to robust, much branched, the nodes pubescent. Leaf-blades broadly linear, 6–20 cm long, 4–8 mm wide, sharply acuminate; leaf-blades and especially leaf-sheaths tuberculate-pilose. Panicle spiciform, 2–6 cm long, pale green occasionally tipped with purple, the spikelets sessile and supported by groups of stiff, scabrid bristles 4–9 mm long; rhachis pubescent to hispidulous. Spikelets gibbously ovate, 2–2.8 mm long, laterally compressed; lower glume c 1/2 spikelet length; upper glume subequalling the spikelet, 5–7-nerved; lower lemma 5-nerved, sterile with a narrow palea; upper lemma strongly convex on the back, punctate to obscurely rugulose.

Weedy places, especially on black clays; 1500–1900 m. EW TU WU SD HA; Sudan, Somalia and southwards to Tanzania. IECAMA I-12; Parker 4783 (ETH); Corradi 827.

The spikelets scarcely differ from those of *S. incrassata*, but the habit is clearly annual, the slender, branching culms producing many inflorescences.

7. *S. sphacelata* (Schumach.) Moss (1929);

Panicum sphacelatum Schumach. (1827) - type: Ghana, Thonning (C holo.).

Tussocky perennial from a short rhizome, the basal sheaths keeled, sometimes flabellate (especially in vigorous plants) or becoming fibrous; culms erect or ascending, slender to robust and cane-like, 0.5–3 m high with 2–16 glabrous nodes. Leaf-blades 10–50 cm long, 2–17 mm wide, convolute or flat, glabrous or scattered-setose, acute. Panicle linear, densely spiciform, 3–50 cm long, the spikelets single or in small groups supported below by clusters of fulvous bristles 1.5–12 mm long; rhachis pubescent. Spikelets elliptic, 2–3 mm long, plano-convex, often purple-tinged, acute; glumes thinly papery, the lower 1/2 spikelet length, 3-nerved, the upper 1/3–2/3(–3/4) spikelet length, 3–5-nerved; lower lemma male with a fully developed palea, 5-nerved, chartaceous; upper lemma rugose (rarely almost smooth), strongly convex, lightly keeled upwards. Fig. 96:7.

A wide range of habitats from grassland and arable land to deciduous woodland and forest margins, in dry to seasonally marshy situations; 1100–2600 m. EW TU IL KF SU AR SD; tropical and South Africa; Yemen; introduced elsewhere as a pasture and forage grass.

The name *Setaria sphacelata* is applied to an extremely polymorphic aggregate of forms, to which a large number of specific names has been applied. It

comprises a polymorphic series running from diploid to decaploid, the different ploidy levels crossing freely and bearing little relationship to gross morphology or habitat. Morphological variation has been partitioned into several varieties in an attempt to quantify the large differences in facies [Clayton in *Kew Bull.* 33: 503–505 (1979)], but it must be emphasized that the variation forms a continuum and these varieties are only weakly defined. Selected agricultural forms have been given cultivar names e.g. "Nandi", "Kazungula".

1. Basal leaf-sheaths fibrous; upper glume often 3-nerved. var. *aurea*
– Basal leaf-sheaths not fibrous, sometimes flabellate; upper glume 5-nerved. 2
2. Culms to 1 m high, 1–3 mm thick, 2–4-noded; leaf-blades 2–4 mm wide, often convolute. var. *sphacelata*
– Culms to 2 m high, 3–6 mm thick, 4–10-noded; leaf-blades 3–10 mm wide, flat; basal leaf-sheaths often flabellate. var. *sericea*

var. *aurea* (A. Br.) W.D. Clayton in *Kew Bull.* 33: 505 (1979);

Setaria aurea A. Br. (1841); *Panicum chrysanthum* Steud. (1841) based on *Setaria aurea* A. Br. non *Panicum aureum* (P. Beauv.) Trin. (1834) - type: cultivated at Karlsruhe, from seed collected by Schimper in Ethiopia (K iso.).

Pennisetum aureum A. Rich. (1850) - types: Ethiopia, TU, Semaieta Mt., Schimper 409 (K iso-syn.) & *Quartin Dillon & Petit* (P syn.).

Setaria trinervia Stapf (1930).

Distinguished mainly by its fibrous base.

Gilbert & Jefford 4377; Friis et al. 877; Mooney 8062.

var. *sphacelata*

Narrow-leaved plants of small stature.

Ash 1119; Friis et al. 849; W. de Wilde 10819.

var. *sericea* (Stapf) W.D. Clayton in *Kew Bull.* 33: 506 (1979);

Setaria anceps Stapf var. *sericea* Stapf in *Fl. Trop. Afr.* 9: 794 (1930) - type: Sudan, Schweinfurth 182 (K holo.).

Plants of moderate to tall stature with wider leaf-blades. Fröman 3312; W. de Wilde 6975.

Var. *splendida* (Stapf) W.D. Clayton is similar but larger with very stout culms to 3 m tall and 6–12 mm thick, leaf-blades 10–17 mm wide and panicles up to 50 cm long. It occurs in East Africa and Sudan, but has not yet been found in Ethiopia.

8. *S. pumila* (Poir.) Roem. & Schult. (1817);

Panicum pumilum Poir. (1816) - type: locality unknown, Desfontaines (?P holo.).

Panicum pallide-fuscum Schumach. (1827); *Setaria pallide-fusca* (Schumach.) Stapf & C.E. Hubb.



Figure 96. *SETARIA* spp.: *S. MEGAPHYLLA*: 1 - habit x 3/4; 2 - spikelet x 11. *S. POIRETIANA*: 3 - spikelet x 11. *S. INCRASSATA*: 4 - habit x 3/4; 5 - spikelet x 11; 6 - upper lemma x 11. *S. SPHACELATA*: 7 - spikelet x 11. 1 & 2 from Mooney 5916; 3 from Frits et al. 214; 4 from Gilbert 2575; 5 & 6 from Stewart C20; 7 from Amshoff 6975. Drawn by Eleanor Catherine.

(1930); *S. glauca* (L.) P. Beauv. var. *pallide-fusca* (Schumach.) Koyama in *Journ. Jap. Bot.* 37: 237 (1962).

Setaria glauca (L.) P. Beauv. var. *brevisetata* Chiov. in *Ann. Ist. Bot. Roma* 8: 36 (1903) - types: Eritrea, Assaorta, *Pappi* 3069 & Amasen, *Terracciano & Pappi* 124 & Mensa, *Terracciano & Pappi* 1774 & 2065 & Oculé Cusai, *Pappi* 4084 (all FT syn.).

Setaria erythraeae Mattei (1910) - type: Eritrea, Dembesan, *Senni* 715 (PAL holo.).

[*S. glauca* sensu F.T.A. 9: 814 (1930), non (L.) P. Beauv.]

Loosely tufted annual; culms slender to moderately stout, ascending, sometimes rooting at the lower nodes, 10–60 cm high, branching, the nodes glabrous. Leaf-blades linear, 5–25 cm long, 2–8 mm wide, acuminate. Panicle densely spiciform, up to 15 cm long, the spikelets sessile, pallid, single or paired and supported by bunches of 2–5 fine, scaberulous, usually golden- to dark-brown bristles 3–8 mm long; rhachis pubescent. Spikelets broadly elliptic, plano-convex, 1.8–2.5 mm long; lower glume 1/3 spikelet length; upper glume 3–5-nerved, 1/2 spikelet length or slightly less, exposing much of the upper lemma, lower lemma 5-nerved, male or sterile with a well-developed palea; upper lemma coarsely rugose.

Open disturbed places and as a weed of cultivation; 500–2400 m. EE EW TU GD GJ WG WU SU AR IL KF GG SD BA HA; tropical and warm temperate regions of the Old World; introduced to North America. Yellow Foxtail. *Ash* 2585; *Aweke & Gilbert* 1035; *Burger* 839.

Setaria pumila is a widespread and variable weedy annual of the warmer parts of the Old World. Populations from the Mediterranean and Middle East tend to have larger spikelets (2.5–3.5 mm) and may merit recognition at specific level [Clayton in *Kew Bull.* 33: 501–503 (1979)]. The correct nomenclature of this species, commonly known earlier as *S. pallide-fusca* or *S. glauca*, has been the subject of much controversy [summarized by Terrell in *Taxon* 25: 297–304 (1976)].

It can be distinguished from the weedy annual *S. acromelaena* by its glabrous nodes, generally narrower, straight-sided leaf-blades, and much shorter upper glume exposing the coarsely rugose upper floret.

9. *S. petiolata* Stapf & C.E. Hubb. (1930);
- type: Malawi, *Simons* (BM holo.).

Tufted annual; culms weak, 20–100 cm high. Leaf-blades broadly linear to narrowly lanceolate, thin, flaccid, 7–30 cm long, 2–10 mm wide, the lower narrowed into a false petiole, finely scabrid along the nerves, tip setaceous. Panicle contracted, 3–17 cm long, loosely spiciform to lanceolate with short primary branches, most spikelets associated with 2–3 bristles, lowermost spikelets on a branch often abortive, the upper with only a single or no bristle; bristles slender, 5–10 mm long,

scabrid; rhachis pubescent, usually also hirsute. Spikelets elliptic, gibbous, 1.5–2 mm long, the nerves conspicuous; lower glume 1/2 spikelet length; upper glume 1/2–3/4 spikelet length, 7-nerved; lower lemma 5-nerved and shallowly depressed along the midnerve, male or sterile, its palea well-developed; upper lemma keeled, rugose, pallid.

Deciduous bushland; 800 m. SD–Kenya border (Moyale); Kenya, Tanzania, Zambia, Malawi and Zimbabwe. *Gillett* 14121.

10. *S. intermedia* Roem. & Schult. (1817);

Panicum intermedium (Roem. & Schult.) Roth (1821) non Hornem. (1813) - type: India, *Heyne* (whereabouts uncertain).

Panicum tomentosum Roxb. (1820); *Setaria tomentosa* (Roxb.) Kunth (1829).

Ascending annual, often decumbent below and rooting at the nodes; culms weak, 15–100 cm high, the nodes glabrous. Leaf-blades broadly linear, 5–20 cm long, 2–10 mm wide, flaccid, not or indistinctly scabrid but often with tubercle-based bristles along the main nerves. Panicle contracted, 3–12 cm long, narrowly lanceolate, branched at least below, the rhachis scaberulous to puberulous; bristles 3–10 mm long, stiff, obscurely scaberulous. Spikelets broadly elliptic, 1.5–2 mm long; lower glume obtuse or acute, 1/3–1/2, the upper 1/2–2/3 spikelet length; lower floret sterile, sulcate, its palea almost as long as the lemma; upper lemma rugose, maturing golden-brown.

Grassland; 1350 m. EW; Caucasus, southern parts of the Arabian peninsula, Socotra, Zanzibar and India. *Ryding & Ermias* 1526.

11. *S. orthosticha* Herrm. (1910);

- type: Malawi, *Buchanan* 3 (B holo., K iso.).

Tufted annual; culms slender, erect or ascending, 10–150 cm high. Leaf-blades linear, flat, thin, 3–30 cm long, 1–8 mm wide, sparsely hispid, scaberulous on upper surface and margins. Panicle narrowly lanceolate, 1–16 cm long, the spikelets clustered along the ascending primary branches either directly or on secondary branchlets, each spikelet subtended by a stiffly wavy bristle; bristles 2–10 mm long, stout, scabrid and sometimes hispid in the lower half, becoming finer and ± smooth above; rhachis and branches conspicuously hispid. Spikelets elliptic, 1.2–1.8 mm long, subacute, glumes and lower lemma thinly membranous; lower glume 1/4–1/3 spikelet length; upper glume 2/3–3/4 spikelet length, 5-nerved; lower lemma 5-nerved, shallowly depressed around the midnerve, sterile with a somewhat reduced palea; upper lemma rugose, becoming golden- to dark-brown. Fig. 97:2.

Among rocks in shade; 1600 m. HA; southwards through East Africa to Mozambique and Zimbabwe. *Burger* 830 & 840.

Best recognized by the combination of annual habit, non-plicate leaf-blades, hispid inflorescence, stout scab-

rid bristles with smooth slender tips, and rugose fertile floret.

12. *S. longiseta* P. Beauv. (1819);
- type: Nigeria, Palisot de Beauvois (G holo.).
Setaria lasiothyrsa Massey (1926).

Tufted perennial; culms 50–150 cm high, branching. Leaf-blades linear, 7–40 cm long, 1–6(–10) mm wide, setaceous acuminate. Panicle lanceolate to ovate, 7–25 cm long, loose and open, the spikelets grouped around the primary branches on secondary branchlets, becoming racemose above, often purple-tinged; bristles 2–12 mm long, slender, flexuous, terminating the branchlets and supporting some single spikelets; rhachis scaberulous with occasional longer hairs (rarely hirsute). Spikelets lanceolate, 1.5–2.3 mm long, sharply acute, glumes and lower lemma firmly and smoothly membranous; lower glume 1/4–1/2 spikelet length; upper glume 2/3–3/4 spikelet length, 7-nerved; lower lemma 5-nerved, deeply sulcate along the midnerve, male with a well-developed palea; upper lemma finely rugose, becoming golden-brown.

S. longiseta is widespread in tropical Africa and has been reported from Ethiopia [Fröman & Persson, *Ill. Guide Grasses Eth.*: 119 (1974)]. It is to be expected in southwestern Ethiopia in lightly shaded places. It is similar to *S. orthosticha*, but besides the differences listed in the key, also differs from that species in its rather broader inflorescence and firmer, smooth texture of the spikelet-scales.

13. *S. homonyma* (Steud.) Chiov. (1919);
Panicum homonymum Steud. (1854) - type:
northwest India, Royle 47 (K iso.).
S. aequalis Stapf (1927).

Slender, loosely tufted annual; culms laxly ascending, 50–120 cm high, the nodes pubescent. Leaf-blades lanceolate, plicate, 10–30 cm long, 5–25 mm wide, thin, sparsely hispid to subglabrous; leaf-sheaths strongly keeled, pubescent on the margins. Panicle 12–20 cm long, narrowly pyramidal with spaced, ascending primary branches, these racemose, villous, the spikelets shortly pedicellate and alternating in 2 neat rows, most subtended by a single bristle; bristles 5–8 mm long, slender, ± smooth or scaberulous. Spikelets elliptic, 2–2.5 mm long, lightly dorsally compressed; lower glume a scarious rounded scale 1/4 spikelet length, upper glume equalling the spikelet and completely covering the upper lemma, 5–7-nerved; lower lemma 5-nerved, sterile with a reduced palea; upper lemma rugose.

Fig. 97:1.

Weedy places in shade; 1300–1800 m. SU AR SD HA; westwards through southern Sudan and Central African Republic to Cameroon and southwards to South Africa; also in India. *Burger* 804; *M.G. & S.B. Gilbert* 1323; *Thulin* 1319.

Recognized by the combination of broad plicate leaf-blades and neatly racemose panicle branches, often with

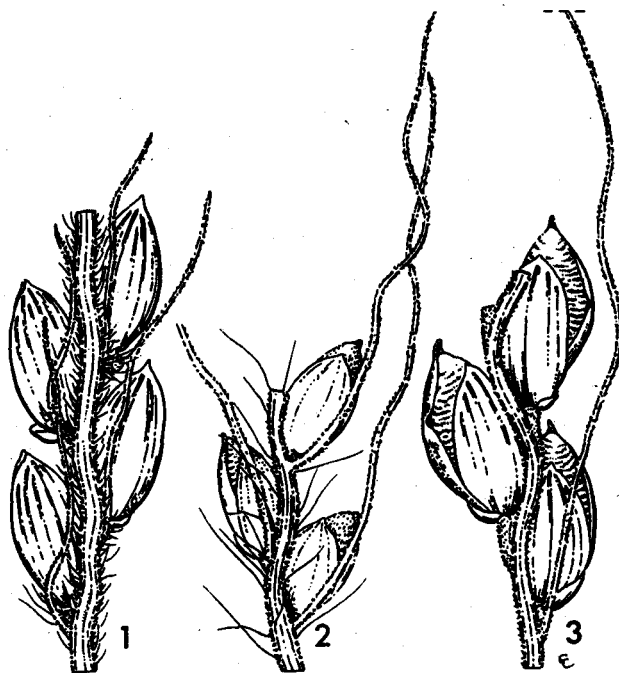


Figure 97. *SETARIA* spp.: group of spikelets and bristles x 9: 1 - *S. HOMONYMA*; 2 - *S. ORTHOSTICHA*; 3 - *S. BARBATA*. 1 from *Burger* 840; 2 from *Thulin* 1319; 3 from *Burger* 3185. Drawn by Eleanor Catherine.

the bristles lying inconspicuously along the length of the raceme.

14. *S. barbata* (Lam.) Kunth (1829);
Panicum barbatum Lam. (1791) - type: Mauritius (P holo.).

Loosely tufted annual; culms geniculately ascending, sometimes rooting at the lower nodes, 25–100(–150) cm high. Leaf-blades linear-lanceolate to lanceolate, plicate (at least near the ligule), 10–30 cm long, 5–30(–45) mm wide, thinly appressed-setose above, glabrous to pubescent below. Panicle narrow, (5–)10–15 cm long with short, ascending primary branches, these bearing crowded spikelets, either directly or on short secondary branchlets terminating in a bristle; branches pubescent to setose; bristles 4–10 mm long, sinuous, scaberulous. Spikelets elliptic, 2.5–3 mm long, plump; lower glume a rounded scale 1/3 spikelet length; upper glume 2/3–3/4 spikelet length exposing the upper part of the upper lemma, 7-nerved; lower lemma male with a well developed palea, 7-nerved, depressed along the midnerve; upper lemma strongly rugose. Fig. 97:3.

Disturbed, usually moist places in shade; 500–1600 m. EW TU SU AR IL GG HA; mainly western Africa eastwards to Sudan, infrequent in East Africa; Yemen; Mauritius; widespread but not common in tropical Asia; introduced to the West Indies. *Burger* 3185; *Gereau* 1203; *Gilbert & Thulin* 282.

15. *S. kagerensis* Mez (1917);

- type: Tanzania, Kagera R., *Stuhlmann* 1946 (B holo.).

Short-lived perennial; culms slender, weak, rambling or scandent and rooting at the lower nodes, 60–150 cm long, branching. Leaf-blades broadly linear to narrowly lanceolate, 10–30 cm long, 3–17 mm wide, plicate (at least near ligule), sometimes falsely petiolate. Panicle narrowly lanceolate, 10–20 cm long, primary branches bearing short secondary branchlets near their base, each terminating in a bristle, becoming racemose above; bristles rather sparse, setaceous, flexuous, 3–10 mm long; rhachis puberulous. Spikelets elliptic-oblong, 2–2.5 mm long, obtuse and apiculate, pallid or purplish with obvious nerves, firmly membranous; lower glume 1/4–1/3 spikelet length, its tip scarious, broadly obtuse to truncate; upper glume subequalling spikelet, 7-nerved; lower floret male, 7-nerved with the midnerve and sometimes also the laterals depressed; upper lemma smooth and glossy.

Shady places, mainly in riverine forest but extending to wooded grassland and bushland. Reported from Ethiopia [Fröman & Persson, *Ill. Guide Grasses Eth.*: 119 (1974)]. Sudan (near Uganda border), Uganda, Kenya, Tanzania, Rwanda and Burundi.

It is quite easily recognized by its weak, branching habit coupled with spikelets with a truncate lower glume, long upper glume and perfectly smooth, shiny fertile floret. The indented lower lemma nerves appear as sharp ridges on the lemma inner surface.

It may be confused with the annual species *S. homonyma*, but this has neater biseriate spikelets and a clearly rugose fertile floret.

16. *S. lindenberghiana* (Nees) Stapf (1899);

Panicum lindenberghianum Nees (1841) - types: South Africa, *Ecklon* (whereabouts uncertain) & *Drège* s.n. (K. isosyn.).

Perennial forming a dense tussock, the base surrounded by old leaf-sheaths; culms erect, slender to moderately robust, 30–120 cm high. Leaf-blades linear, plicate (at least when young and above ligule), 10–30 cm long, 1–10 mm wide, sometimes falsely petiolate, often pilose. Panicle narrow, loosely contracted, 5–20 cm long, primary branches short with most spikelets pedicelled and lacking bristles; bristles 2–10 mm long, slender, scaberrulous, mostly associated with secondary branchlets at base of branches; rhachis pubescent, occasionally pilose. Spikelets lanceolate to elliptic, (2–)2.5–3.3 mm long, pallid tipped brownish, acute; lower glume 1/3–1/2 spikelet length; upper glume 2/3 as long to almost equalling spikelet, 7-nerved; lower lemma 7-nerved, shallowly depressed around midnerve, male with a fully developed palea; upper lemma finely rugose, pallid becoming reddish-brown on exposed portion.

Grassland and open bushland. Zaire, Tanzania and southwards to South Africa. Reported from Ethiopia [Fröman & Persson, *Ill. Guide Grasses Eth.*: 119 (1974)].

The plication of the leaves is not always obvious, and must sometimes be sought at the blade base, the older leaves often flattening out. The species is best recognized by its tussock-forming perennial habit and rugose fertile floret. It may be confused with *S. longisetata*, but this has smaller purplish spikelets and a fuller, lanceolate to ovate panicle. The rugose fertile floret serves to distinguish it from small specimens of *S. megaphylla*.

17. *S. megaphylla* (Steud.) Th. Dur. & Schinz (1894);

Panicum megaphyllum Steud. (1854) - type: Gabon, *Jardin* (P holo.).

Panicum plicatile Hochst. (1855); *Setaria plicatilis* (Hochst.) Hack. ex Engl. (1892) - type: Ethiopia, TU, Aman Eski, *Schimper* in Herb. *Buchinger* 1456 (P iso.).

Panicum plicatile Hochst. var. *glabrescens* Chiov. in *Ann. Ist. Bot. Roma* 8: 31 (1903) - types: Eritrea, Asmara, *Ragazzi* 43 & *Dada*, *Terracciano & Pappi* 2049 (both FT syn.).

Panicum plicatile Hochst. var. *pilosum* Chiov., l. c.: 31 (1903) - type: Eritrea, Rora Ualicaue, *Terracciano & Pappi* 670 (FT holo.).

Setaria chevalieri Stapf (1930); *S. megaphylla* Th. Dur. & Schinz var. *chevalieri* (Stapf) *Berhaut*, *Fl. Sénégal*, ed. 2: 401 (1954).

Setaria acuta Stapf & C.E. Hubb. (1930) - type: Ethiopia, TU, Amba Sea, *Schimper* 789 (K holo.).

Large, clump-forming perennial; culms 1–3 m high, often cane-like, erect or geniculate. Leaf-blades lanceolate, plicate, 20–80 cm long, (1–)1.5–11 cm wide, narrowed to the ligule, acuminate; leaf-sheaths tuberculate-hispid to glabrescent. Panicle 15–60 cm long, spire-like with short, stiff, ascending primary branches or lower branches longer and drooping; spikelets clustered along length of primary branches on branchlets terminating in a bristle; bristles up to 20 mm long, fine, flexuous; rhachis pubescent. Spikelets elliptic, (2.2–)2.5–3.2(–3.5) mm long, acute, glumes and lower lemma smooth and thinly cartilaginous; glumes with scarious margins and rounded tip, the lower 1/3–1/2 spikelet length, 3–5-nerved, the upper 1/2–2/3 spikelet length, 5–7-nerved; lower lemma sterile or occasionally male, 5–7-nerved, equalling the upper lemma, its palea usually somewhat reduced; upper lemma smooth or rugulose under cover of the upper glume, glossy, pallid becoming light brown. Fig. 96:1, 2.

Damp places in shade of forest and thicket; 700–2400 m. EW TU GJ WG SU IL KF GG SD; tropical and South Africa; southwestern Arabian Peninsula; tropical America; a few records from India. *Fris* et al. 13; *Gilbert & Phillips* 9047; *Mesfin & Kagnew* 2156.

Setaria megaphylla is typically a robust, clump-forming grass with erect culms and an elongate inflorescence of numerous, acute, plump spikelets; it is the commonest of the African tall, shade-loving *Setarias*. However, this form represents only one facies of a complex of variable and intergrading plants, discussed by Clayton in *Kew Bull.* 33: 508 (1979). Included within *S. megaphylla* sensu lato is *S. chevalieri* (drooping, flexuous lower panicle-branches) and *S. plicatilis* (more slender, shorter, often geniculate culms forming a looser clump and an increased tendency to a male lower floret). The degree to which differences in habit and vigour are environmentally induced is impossible to determine from herbarium specimens.

S. poiretiana differs from *S. megaphylla* only in its longer spikelets, caused by the acuminate-rostrate extension of the lemma-tips. This is simply a matter of degree and there are many intermediates, so the validity of its status as a separate species is very doubtful. The name *S. acuta* refers to specimens of intermediate spikelet length (c 3.5 mm), but with the acute lemma-tips of *S. megaphylla*. The lower lemma may be a little longer than the upper, but this character is too variable to be of any taxonomic significance.

S. megaphylla also merges with the primarily Asiatic species *S. palmifolia* (König) Stapf which has a lax, ovate panicle with long, flexuous branches.

18. *S. poiretiana* (Schult.) Kunth (1829);

Panicum elongatum Poir. (1816) non Salisb. (1796); *Panicum poiretianum* Schult. (1824) based on *P. elongatum* Poir. - type: Brazil, Desfontaines (FI holo., K microfiche).

Setaria caudula Stapf (1930).

Large, clump-forming perennial; culms 1.2–2.5 m high, robust, erect. Leaf-blades lanceolate, plicate, 30–80 cm long, 1–10 cm wide. Panicle 30–60 cm long, spire-like with short, stiff, densely spiculate primary branches; bristles 3–15 mm long; rhachis pubescent. Spikelets narrowly elliptic, (3.2–)3.5–4(–4.5) mm long, acuminate-rostrate; lower glume 1/3–1/2, the upper 2/3–3/4 spikelet length; lower lemma sterile, equalling or up to 0.5 mm longer than the upper lemma, its palea somewhat reduced; upper lemma smooth or obscurely rugulose below, glossy, becoming light brown. Fig. 96:3.

Light to medium shade in forest and open woodland; 1700–2000 m. AR WG IL KF SD; Cameroon, Zaire (Kivu), Sudan and East Africa; also tropical America. *Burger* 3657; *Friis* et al. 214, 1664; *Mooney* 5695.

S. poiretiana is scarcely distinct from *S. megaphylla* (see note under that species).

110. *PASPALIDIUM* Stapf (1920)

Perennials. Leaf-blades linear; ligule a ciliate rim. Inflorescence composed of short erect racemes spaced along a central axis and ± appressed to shallow hollows

in it; raceme rhachis triquetrous or winged, usually terminating in an inconspicuous point or bristle, the spikelets imbricate, arranged singly in 2 neat rows or occasionally also on short basal branchlets. Spikelets dorsally compressed, chartaceous; lower glume abaxial, broad, much shorter than the spikelet; upper glume slightly shorter than the spikelet; lower lemma male or sterile (male with a well developed palea narrowly winged on the keels in the Ethiopian species); upper lemma crustaceous, its margins inrolled or only narrowly hyaline; tip of upper palea often briefly reflexed.

About 40 species throughout the tropics but concentrated in Australia.

1. Aquatic perennial with long spongy stolons; spikelets ovate; raceme rhachis 0.5–1 mm wide, narrowly winged. 1. *P. geminatum*
- Dry land perennial, tufted or with tough stolons; spikelets elliptic; raceme rhachis 0.2–0.4 mm wide, triquetrous. 2. *P. desertorum*

1. *P. geminatum* (Forssk.) Stapf (1920);

Panicum geminatum Forssk. (1775) - type: Egypt, Forsskål (C holo.).

Panicum emergens Hochst. (1855) - type: Ethiopia, Schimper in Herb. Buchinger 1180 (STR holo.).

Pale green perennial; culms procumbent, spongy, stoloniferous and rooting at the nodes, arising from a loose tuft, becoming very long (3 m or more) in open water, flowering shoots up to 45 cm high. Leaf-blades linear, flat, 8–30 cm long, 3–10 mm wide, smooth, glabrous, finely acuminate; leaf-sheaths loose and papery. Inflorescence 10–20 cm long; racemes 1–2.5 cm long, their rhachis narrowly winged, 0.5–1 mm wide, irregularly ciliate. Spikelets ovate, plano-convex, 2–2.5 mm long, acute-apiculate; lower glume 0–3-nerved, a broad truncate scale c 1/4 spikelet length; upper glume 5-nerved, broadly rounded, slightly shorter than the spikelet; lower lemma 5-nerved; upper lemma broadly elliptic, faintly rugulose, tip green, apiculate. Fig. 98.

Marshland, sandy stream-sides and lake shores, and in shallow open water, sometimes forming floating mats; up to 1700 m. AF SU GG SD BA HA; Old World tropics. *Ash* 1376; *Burger* 1135; *Gilbert* 3542.

2. *P. desertorum* (A. Rich.) Stapf (1920);

Panicum desertorum A. Rich. (1850) - type: Eritrea, Choho, *Quartin Dillon* (P holo.).

Tufted perennial, sometimes with tough, hard stolons; culms ascending, up to 1 m high. Leaf-blades linear, flat, often glaucous, 5–20 cm long, 2–6 mm wide, glabrous, finely acuminate. Inflorescence 10–22 cm long, with contiguous racemes along a filiform axis; racemes 1–3.5 cm long, their rhachis triquetrous, 0.2–0.4 mm wide, scaberulous. Spikelets elliptic to narrowly ovate, 2–2.8 mm long, acute; lower glume 0–3(–5)-nerved, broadly ovate, 1/3–1/2 spikelet length, obtuse to

truncate; upper glume 5(-7)-nerved, equalling the spikelet, obtuse; lower lemma 5-nerved; upper lemma lanceolate, weakly rugulose.

Dry open bushland, grassland plains and in dry river beds; sea level-800 m. EE AF HA; Sudan, Somalia, N Kenya and in the Arabian Peninsula. *Bally* 7056; *Burger* 3212; *IECAMA* I-94.

111. *STENOTAPHRUM* Trin. (1822)

Creeping annuals or perennials; leaf-blades linear to narrowly lanceolate. Inflorescence composed of very short racemes \pm sunk in pockets on one or both sides of an expanded foliaceous or corky axis, variously disarticulating at maturity but often the axis fracturing into segments, each with an embedded raceme; racemes bearing the spikelets singly, the rhachis ending in a point. Spikelets abaxial (lower glume facing outwards), dorsally compressed, plumply lanceolate to ovate; glumes membranous, both short or the upper as long as the spikelet; lower lemma coriaceous, smooth, acute; upper lemma chartaceous, slightly smaller than the lower; upper palea tip free.

7 species in the tropics and subtropics, especially on or near the seashore.

The indurated lower floret is very unusual in Paniceae, and together with the expanded inflorescence axis serves to protect the fertile upper floret.

S. secundatum (Walt.) Kuntze (1891);

Ischaemum secundatum Walt. (1788) - type from U.S.A.

Stoloniferous perennial forming a dense sward. Culms decumbent, much-branched, flowering shoots 10-30 cm high; leaf-blades broadly linear, up to 15 cm long, 4-10 mm wide, folded when young, obtuse; leaf-sheaths strongly keeled, often grouped in flabellate clusters. Inflorescence 5-12 cm long, the central axis \pm cylindrical, thick and corky, the reduced racemes embedded in cavities in one face, borne alternately on either side of a wavy midrib; racemes 4-10 mm long, bearing 1-3 spikelets on a rudimentary rhachis; rhachis disarticulating into segments, each with one raceme. Spikelets 4-5 mm long, lanceolate to narrowly ovate; lower glume up to 1/4 as long as the spikelet; upper glume equalling the spikelet.

Cultivated in public gardens as a ground cover under trees; c 1200 m. HA; naturally occurring along tropical and subtropical shores on both sides of the Atlantic Ocean and extending round South Africa to Mozambique; a pioneer of beaches and marshes near the coast, by saline and fresh water; now commonly cultivated in the tropics as a lawn grass (St. Augustine Grass). *Phillips* 117 (ETH).

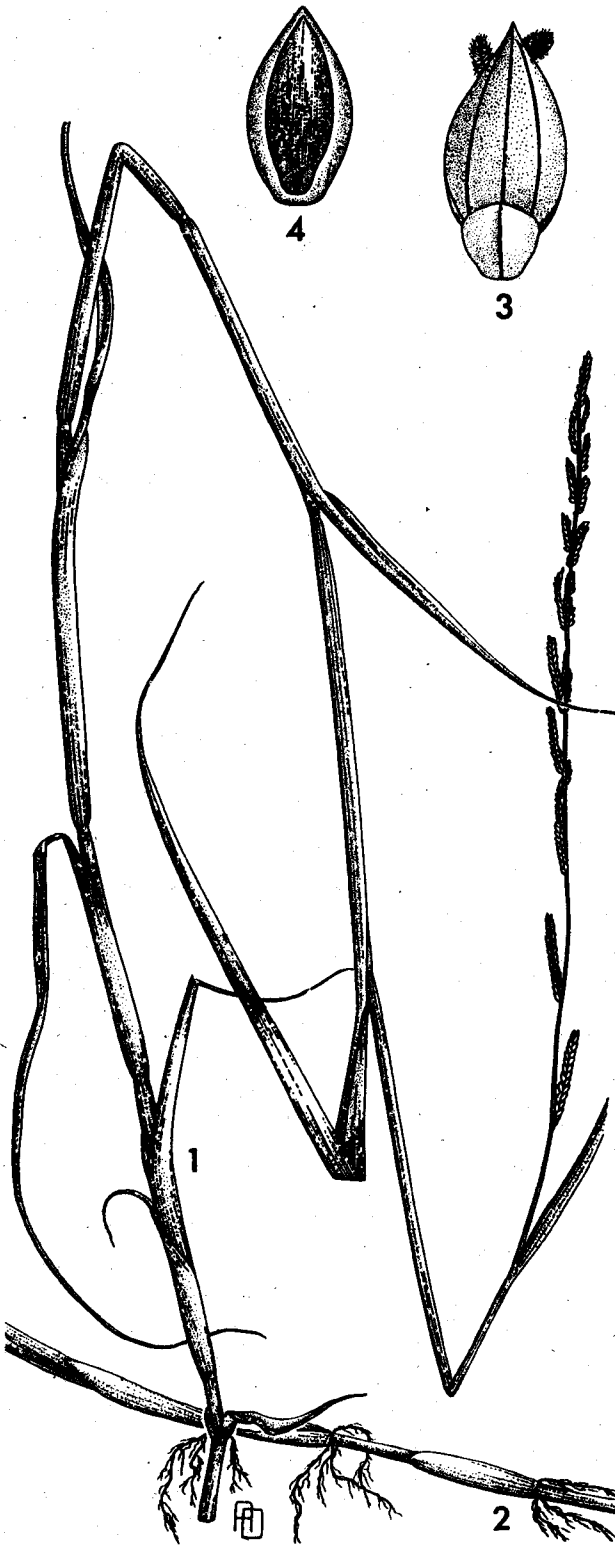


Figure 98. *PASPALIDIUM GEMINATUM*: 1 - habit x 1/2; 2 - stolon x 1/2; 3 - spikelet x 10; 4 - upper floret x 10. 1 from *Harris* 3054, 2 from *Palmer* 21; 3 & 4 from *Lind* 401a. Drawn by Ann Davies. (Modified from *Fl. Trop. E. Afr. Gramineae* 3: Fig. 133, with permission of the Editors).

112. *ACRITOCOAETE* Pilger (1902)

Annual. Leaf-blades narrowly lanceolate with cross-veins; ligule membranous. Inflorescence composed of secund racemes along a central axis, the spikelets pedicellate on a triquetrous rhachis, usually arranged singly, occasionally on short side branchlets towards the base of the raceme. Spikelets narrow, dorsally compressed, with long coiling awns arising from the upper glume and lower lemma which intertwine with awns from neighbouring spikelets; lower glume very small, adaxial; upper glume subequalling the spikelet; lower lemma sterile without a palea; upper lemma chartaceous, its flat, thin margins enclosing the palea.

Species 1; upland forests from Nigeria to Ethiopia and East Africa.

A. volkensis Pilger (1902);

- type: Tanzania, *Volkens* 1278 (K iso.).

Straggling annual or short-lived perennial; culms stoloniferous and rooting at the lower nodes, branching, 30–80 cm long. Leaf-blades 6–13 cm long, 6–12 mm wide, puberulous and thinly hispid, constricted at the base, tip setaceous. Inflorescence composed of 2–4 slender, loosely erect, distant racemes 5–7 cm long, the spikelets on pedicels 2–3 mm long. Spikelets narrowly lanceolate, 5–6 mm long, green; lower glume 0.5–0.8 mm long; upper glume and lower lemma scaberulous and sparsely setose, the acuminate tip tapering into a slender, coiling awn 1–2 cm long; upper lemma acuminate or aristulate with an awnlet 1–2 mm long. Fig. 99.

Shade of upland forest, sometimes forming colonies; 1700–3000 m. SU AR IL KF GG SD BA HA; mountains of Kenya, Uganda, Tanzania, Sudan, N Nigeria and Cameroon (Cameroon Mt.). *Burger* 3584; *Friis et al.* 1657; *Gilbert & Phillips* 9220.

113. *DIGITARIA* Haller (1768), *nom. conserv.*

Henrard, Monogr. Digitaria (1950); *Veldkamp in Blumea* 21: 1–80 (1973).

Annuals or tussocky to rhizomatous perennials; culms variable, erect to stoloniferous. Leaf-blades usually linear, sometimes setaceous or lanceolate; ligule membranous. Inflorescence composed of slender racemes, usually digitate or spread over a short axis, occasionally the axis elongate, sometimes with secondary branchlets; spikelets paired, ternate or in clusters of up to 6 on pedicels of varying length; rhachis triquetrous, sometimes winged on the angles, or flat and ribbon-like. Spikelets usually \pm elliptic, flattened on the front, convex on the back, glabrous or appressed-hairy to copiously villous, typically in stripes between the nerves; lower glume abaxial, very small or absent; upper glume variable, small or rarely absent to as long as the spikelet; lower lemma usually as long as the spikelet and prominently 5–9-nerved but occasionally reduced, a vestigial palea present; upper lemma chartaceous to

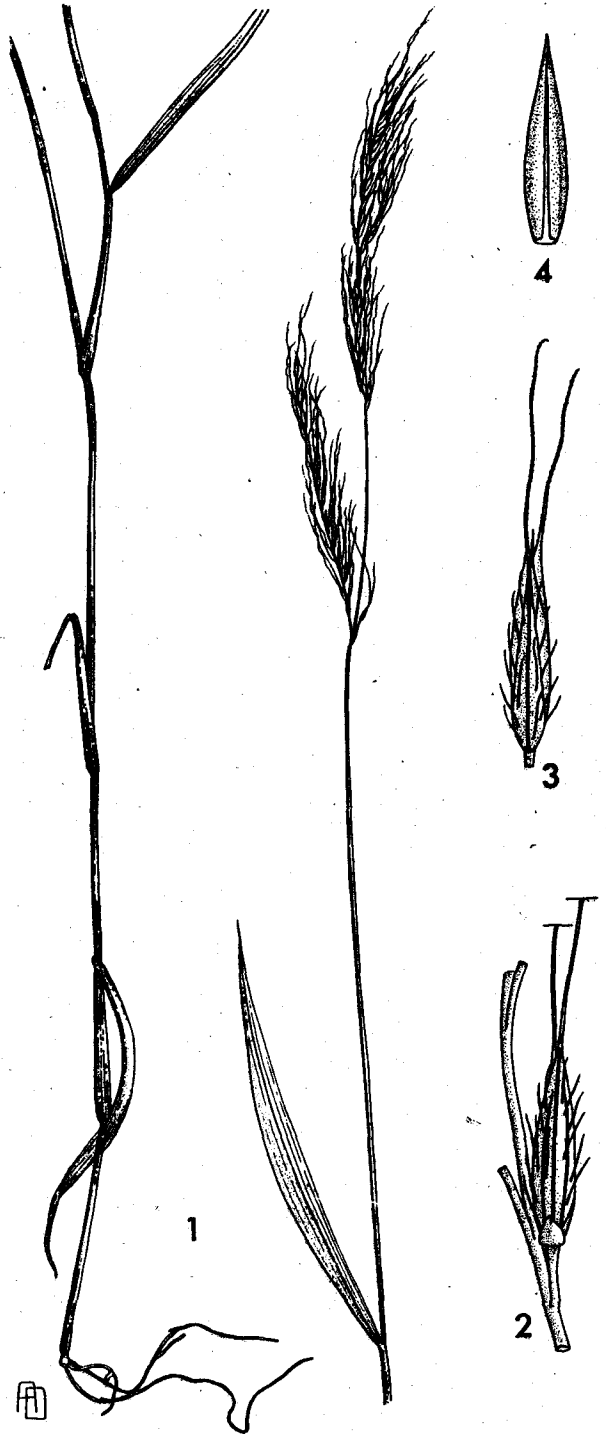


Figure 99. *ACRITOCOAETE VOLKENSII*: 1 - habit x 1/2; 2 - portion of raceme x 5; 3 - spikelet x 5; 4 - upper floret x 5. All from *Friis et al.* 1867. Drawn by Ann Davies. (Modified from *Fl. Trop. E. Afr. Gramineae* 3: Fig. 149, with permission of the Editors).

coriaceous with broad flat hyaline margins covering most of the upper palea, longitudinally striate, pallid to dark brown.

About 230 species in tropical and warm temperate regions, especially in the Old World.

Digitaria is not an easy genus to name. It has been traditionally subdivided on the nature of the spikelet-

hairs, which may be capitate, clavate, papillose, warty (verrucose) or with crooked tips. Whilst the hair type does provide a natural means of grouping species on the whole, a microscope is required so the character is impracticable as a primary step in identification. An easier first step is to examine the grouping of the spikelets. Many species have regularly paired spikelets, whilst in others the spikelets are grouped in clusters of 3 or more. Care is required as sometimes when the spikelets are ternate the longest pedicel may become fused to the rhachis so that the spikelets appear alternately paired and single, or one spikelet may be vestigial; occasionally one pedicel of a pair may be forked.

Another source of difficulty is the great variability, both within and between species which has led to many superfluous species being described in the past. Among the perennials in particular, complexes of intergrading species are commonplace. Whilst the core characters of the constituent species of such complexes may be readily recognized, it is not unusual for a specimen to be atypical in one or more respects due to introgression from other species in the complex.

The relative length of the spikelet scales and their indumentum can vary considerably within a species or even within a single raceme, where the two members of a spikelet-pair may be somewhat heteromorphic. The pubescence of the lower lemma may cover the whole scale but is frequently confined to the second interspace and along the margins. Its distribution and the spacing of the nerves appears to be of little significance.

1. Pedicel-tips with long setae overtopping the spikelets; spikelets glabrous, dark brown. 2
- Pedicel-tips glabrous or shortly hairy. 4
2. Annuals. 3
- Tussocky perennial; basal leaf-sheaths silky-hairy. 1. *D. diagonalis*
3. Lower lemma up to 1/3 spikelet length. 2. *D. intacta*
- Lower lemma equalling the spikelet. 3. *D. pseudodiagonalis*
4. Spikelets copiously silky-villous, the hairs extending 2-4 mm beyond spikelet tip. 5
- Spikelets glabrous to appressed-pilose (or if villous hairs only slightly overtopping spikelet). 6
5. Spikelets in groups of 3-4; lower glume cuff-like, truncate; lower lemma glabrous and sulcate around midnerve. 4. *D. gayana*
- Spikelets mostly paired; lower glume ovate, acute. 5. *D. neghellensis*
6. Spikelets in groups of 3 or more. 7
- Spikelets paired. 11
7. Annuals or rhizomatous perennial; rhachis winged. 8
- Tussocky perennials with a tough fibrous base; rhachis triquetrous. 9
8. Upper glume somewhat shorter and narrower than the spikelet, 3-nerved; fruit blackish;

spikelet-hairs clavate (rarely ± glabrous).

6. *D. ternata*
 - Upper glume as long as the spikelet, 5-nerved; fruit pale brown or grey; spikelet-hairs microscopically verrucose. 7. *D. longiflora*
 9. Upper glume 1/4-1/3 spikelet length; lower lemma slightly shorter than the spikelet; spikelet-hairs stoutly clavate. 8. *D. maitlandii*
 - Upper glume 1/3-3/4 spikelet length; lower lemma usually equalling the spikelet; spikelet-hairs slender, obtuse or minutely capitate. 10
 10. Leaf-blades involute; inflorescence of 2-5 racemes; spikelets (2.5-)3-3.7 mm long. 9. *D. setifolia*
 - Leaf-blades flat; inflorescence of 5-16 racemes; spikelets 2.1-3 mm long. 10. *D. compressa*
 11. Racemes stiffly radiating, plumose and espiculate in the lower half, sparsely spiculate above; inflorescence deciduous as a tumbleweed. 11. *D. pennata*
 - Racemes not plumose; inflorescence not a tumbleweed. 12
 12. Both glumes tiny, the brown upper lemma fully exposed. 12. *D. gymnotheca*
 - Upper glume well developed, 1/3 the length of the spikelet or more. 13
 13. Lower glume separated by an internode; upper glume longer than the lower lemma, spikelets rostrate. 13. *D. debilis*
 - Lower glume not separated by an internode; upper glume equalling or shorter than the lower lemma. KEY 2 14
- KEY 2**
14. Perennials, often tussocky with hairy basal leaf-sheaths. 15
 - Annuals, usually straggling. 22
 15. Spikelets glabrous, plump (if lanceolate with brown fruit see no. 14. *D. pearsonii*); plants with wiry rhizomes, mat-forming. 14. *D. abyssinica*
 - Spikelets hairy (sometimes inconspicuously); plants tufted or also with scaly rhizomes. 16
 16. Inflorescence axis elongate, much exceeding longest raceme. 17
 - Inflorescence digitate or the axis shorter than the racemes. 18
 17. Spikelets pilose to villous with hairs exceeding the spikelet; lower glume present; leaf-blades linear, 12-30 cm long; racemes not whorled. 16. *D. rivae*
 - Spikelets appressed-pubescent; lower glume absent; leaf-blades lanceolate, 6-12 cm long; racemes whorled. *D. arushae* (see note under no. 16)
 18. Upper glume as long as the spikelet, (3-)5-nerved; lower glume truncate and frill-like; spikelet-hairs with curled tips. 17. *D. gazensis*
 - Upper glume 1/2 as long to subequalling the spikelet, 3-nerved; lower glume ovate; spikelet-hairs with straight tips. 19

19. Spikelets obscurely hairy; racemes spread along a definite axis, often with branch racemelets; leaf-blades narrowly lanceolate; fruit brown. 15. *D. pearsonii*
 - Spikelets clearly hairy or bristly; racemes usually \pm digitate; leaf-blades linear. 20
20. Racemes loosely spiculate, rhachis slender, triquetrous; culm-bases bulbous; spikelets pilose, not bristly. 18. *D. nodosa*
 - Racemes closely spiculate, rhachis narrowly winged; culm-bases seldom bulbous; spikelets often with bristle-hairs. 21
21. Tussocky perennial; culms bushy, fasciculately branched; spikelets villous; lower lemma nerves smooth. 19. *D. macroblephara*
 - Rhizomatous perennial; culms erect to decumbent; spikelets appressed-pubescent; lower lemma nerves scabrid. 20. *D. milanjana*
22. Racemes mostly spaced singly along a well-developed central axis, slender, the spikelets loosely imbricate. 21. *D. velutina*
 - Racemes digitate or whorled if a short axis present, the spikelets closely overlapping. 23
23. Spikelets 1.7–2.5 mm long; lower glume obscure. 22. *D. nuda*
 - Spikelets 2.5–3.3 mm long; lower glume distinct, 0.2–0.4 mm long; bristle-hairs sometimes present on lower lemma. 23. *D. ciliaris*

1. *D. diagonalis* (Nees) Stapf (1898);
 - type: South Africa, Drège 4312 (K iso.).

Perennial forming dense tussocks; basal sheaths silky hairy and becoming fibrous; culms erect, 0.5–3 m high, the nodes hispid. Leaf-blades 10–60 cm long, 1–12 mm wide, glabrous or hirsute. Inflorescence composed of a few to numerous ascending or spreading racemes along a central axis; racemes 3–25 cm long; rhachis slender, triquetrous, scabrid or occasionally densely setose; the spikelets grouped in contiguous clusters of 2–6 on setose pedicels, the setae overtopping the spikelet. Spikelets elliptic, 1.2–2.5 mm long, glabrous, acute; lower glume absent; upper glume reduced to a hyaline nerveless scale up to 1/4 spikelet length; lower lemma equaling or slightly shorter than the spikelet, thin, 3-nerved; upper lemma coriaceous, dark brown, longitudinally striate-punctate. Fig. 101:1, 2.

Open grassland in a wide range of habitats from black swampy soils to sand and steep rocky slopes; 1200–2550 m. Tropical and South Africa; also in Yemen.

D. diagonalis is an exceedingly variable pan-African species in which 3 varieties may be distinguished, although these are all completely intergrading and represent no more than clinal variation within the species. A detailed investigation of this infraspecific variation has been carried out by Clayton [Kew Bull. 29: 527–533 (1974)]. Var. *diagonalis*, which is distinguished by a scanty inflorescence of few, rather stiff racemes and

long spikelets (1.9–2.5 mm long), occurs from Tanzania southwards to South Africa. The remaining 2 varieties both occur in Ethiopia, although most specimens are referable to var. *uniglumis*.

var. *uniglumis* (Hochst ex A. Rich.) Pilg. in Not. Bot. Gart. Berlin 10: 266 (1928);

Panicum uniglume Hochst. ex A. Rich. (1850); *Panicum diagonale* Nees var. *uniglume* (A. Rich.) Hack. in Engl., Hochgebirgssfl. Trop. Afr.; 117 (1891); *Digitaria uniglumis* (Hochst. ex A. Rich.) Stapf (1919) - types: Ethiopia, TU, Shire [Chiré], *Quartin Dillon* (P syn.) & Scholoda Mt., *Schimper* 97 (K isosyn.).

Culms 40–180 cm high; leaf-blades narrow, 1–5 mm wide; inflorescence of 8–28 racemes, the longest 2–11 cm long; spikelets 1.2–1.9 mm long.

EW TU GD GJ WG SU KF GG SD; southwards through East Africa to Zimbabwe. *Ash* 3102; *M. G. & S. B Gilbert* 1588; *Mooney* 6301; *Gilbert & Phillips* 8845.

var. *hirsuta* (De Wild. & Th. Dur.) Troupin in Fl. Garamba 1: 29 (1956);

Panicum diagonale Nees var. *hirsutum* De Wild. & Th. Dur., Pl. Thonn. Cong.: 4 (1900) as var. "hirsutior" - type: Zaire, *Thonner* 82 (BR holo.).

Culms robust, 1–3 m high; leaf-blades broad, 5–13 mm wide; inflorescence of 10–50 racemes, the longest 10–25 cm long; spikelets 1.4–2.1 mm long.

EW; Senegal to Sudan and southwards through Zaire to Angola and Zimbabwe. *Pappi* 5402.

2. *D. intecta* Stapf (1919);

- types: Sudan/Gonder border, Matamma, *Schweinfurth* 1156 & TU, Hamedo, *Schimper* 996 (both K syn.).

Tufted annual; culms slender, erect or geniculate, 20–85 cm high, the nodes hispid. Leaf-blades 7–20 cm long, 3–4 mm wide, setose around the ligule, scabrid on the upper surface, smooth below, acuminate. Inflorescence composed of 7–20 ascending racemes crowded along a short axis towards the culm tip; racemes 4–12 cm long; rhachis slender, triquetrous, scabrid; the spikelets grouped in contiguous clusters of 3–4 on pedicels of varying length tipped by white setae overtopping the spikelet. Spikelets elliptic, 1.2–1.3 mm long, glabrous, acute; glumes absent; lower lemma reduced to a hyaline, ovate, 1-nerved scale 1/4–1/3 spikelet length; upper lemma coriaceous, a rich dark brown, longitudinally striate-punctate.

Grassland on black clay, EW TU GD GJ WG; Uganda, Zambia. *Chiovenda* 2119; *Bigazzi & Tardelli* 735, 736, (FT); *Pappi* 344 (FT).

The spikelet of *D. intecta* consists almost entirely of the dark brown fertile floret, the lower lemma being reduced to a small scale, leaving the upper lemma margins and palea clearly exposed.

3. *D. pseudodiagonalis* Chiov. (Jan. 1919);

- type: Zaire, *Bovone* 92 (TO iso.).

Panicum minutiflorum Hochst. ex A. Rich. (1850) non (P. Beauv.) Rasp. (1825); *Digitaria minutiflora* Stapf (June 1919) - types: Ethiopia, TU, Shire [Chiré], *Quartin Dillon* (P syn.) & Djeladgeranne [Dschelatschegenne], *Schimper* 799 (K iso-syn.).

Slender annual; culms solitary or tufted, up to 70 cm high, the nodes hispid. Leaf-blades 5–30 cm long, 2–5 mm wide, acuminate. Inflorescence composed of a few to many racemes clustered towards the top of the culm; racemes 5–13 cm long, inserted singly or in groups in fuller inflorescences along a central axis 1–12 cm long, the spikelets grouped in contiguous clusters of 2–4 along the slender triquetrous rhachis; pedicels of varying length, tipped by white setae surrounding the spikelet. Spikelets elliptic, *c* 1 mm long, glabrous, acute; lower glume absent; upper glume reduced to a tiny hyaline scale; lower lemma equalling the spikelet, thin, 3-nerved; upper lemma coriaceous, a rich dark brown, longitudinally striate-punctate.

Disturbed places and as an arable weed; 1600–2000 m. TU GD GJ SU; Guinée, Sierra Leone, Cameroon, Zaire, Uganda, Tanzania, Zambia; also in Madagascar. *Mogk* 422; *Parker* E135.

D. pseudodiagonalis is very similar in facies to *D. inecta*, but has even smaller spikelets, and is readily distinguished by its long lower lemma which covers the upper lemma margins and palea.

4. *D. gayana* (Kunth) A. Chev. (1911);

Panicum gayanum Kunth (1829) - type: Senegal, *Roger* 56 (K iso.).

Loosely tufted annual; culms 20–60 cm high. Leaf-blades broadly linear, 3–15 cm long, 4–8 mm wide, coarse. Inflorescence of (1–)2–6 digitate, erect racemes; racemes 5–18 cm long, the spikelets in groups of 3–4 on a sharply triquetrous rhachis winged on the angles. Spikelets narrowly ovate, 2–3 mm long, copiously silky-villous with often pinkish hairs; lower glume a hyaline cuff 0.3–0.4 mm long; upper glume almost equalling but narrower than the spikelet, 3-nerved, silky-villous with smooth, straight hairs; lower lemma equalling the spikelet, rigidly 5-nerved with membranous interspaces, depressed around the midnerve, villous with stout papillose hairs along the lateral nerves and thinner hairs along the margins which extend 2–4 mm beyond the spikelet tip; upper lemma gibbously ellipsoid, keeled, rostrate, yellowish or pale brown.

Weedy places and old farmland. Not yet recorded from Ethiopia, but occurring from Sudan to Senegal and from Kenya and Uganda southwards to Zimbabwe and Namibia. [*Baldrati* 88 in *Cufodontis Enum.*: 1330 is *D. ciliaris* (Retz.) Koel].

5. *D. neghellenis* Lebrun (1988);

- type: Ethiopia, SD, Mt. Filtu, *Rippstein* 842 (ALF holo.).

Loosely tufted perennial; culms many-noded, branching above from an erect base, 45–90 cm high. Leaf-blades lanceolate, 5–8 cm long, 5–10 mm wide, pubescent, margins cartilaginous, acute; leaf-sheaths pubescent and conspicuously hispid. Inflorescence composed of 4–9 suberect racemes along an axis about as long as the longest raceme; racemes 3–12 cm long, the spikelets mostly paired on a triquetrous rhachis, lowermost pedicels often forked. Spikelets elliptic, 2.5–3 mm long, copiously silky-villous with fine, smooth, white or faintly pinkish hairs; lower glume narrowly ovate, 0.5 mm long; upper glume equalling the spikelet, 5-nerved (outermost nerves fine) with broad, hyaline, often purple-tinged margins, silky-villous in 2 broad lateral bands, the hairs converging upwards and extending to 4 mm beyond the spikelet tip; lower lemma 7-nerved, otherwise resembling upper glume; upper lemma elliptic, dorsally compressed, apiculate, mid-brown to blackish. Fig. 100:1.

Acacia bushland or woodland; 1000–1600 m. SD BA; Oman (Dhofar). *Friis* et al. 891; *Gilbert* 3342; *Sandford* in *Mooney* 7424.

6. *D. ternata* (A. Rich.) Stapf (1898);

Cynodon ternatus A. Rich. (1850) - types: Ethiopia, TU, Adua [Adoua], *Schimper* 76 (K iso-syn.) & *Quartin Dillon* (P syn.).

D. ternata forma *glabrispicula* (Fiori) Cuf., *Enum.*: 1333 (1969) - type: Eritrea, Asmara, *Baldrati* (FT holo.).

Loosely tufted annual; culms ascending, glabrous or pilose with long, fine hairs towards the tip, 20–85 cm high. Leaf-blades linear, flat, up to 25 cm long, 2–9 mm wide, acuminate. Inflorescence composed of 2–8 subdigitate racemes; racemes 3–20 cm long, the spikelets in groups of 3–4(–5); rhachis narrowly winged with a low, broad midrib; pedicel-tips hispid with setae 0.2–0.8 mm long. Spikelets elliptic, pale greyish-green, 1.7–2.5 mm long; lower glume absent or represented by a minute hyaline rim; upper glume 2/3–4/5 spikelet length, narrower than the spikelet, 3-nerved, appressed-pilose to hirsute in stripes between the nerves and along the margins, the hairs clavate, 0.1–0.5 mm long; lower lemma equalling the spikelet, 5-nerved with a central group of 3 and 2 marginal nerves, hairy along the margins and between the central group and lateral nerves (sometimes also between the central nerves), the hairs the same as on the upper glume; upper lemma narrowly ovate, blackish. Fig. 101:4–6.

Open grassy places, roadsides and as an arable weed; 700–2400 m. EE EW TU GD GJ WG WU SU AR KF GG SD HA; throughout tropical and South Africa; eastwards to India, China and Indonesia. *Ash* 2135; *Gilbert & Getachew* 2859; *Mooney* 5946.

The lower lemma nervation with a central group of 3 nerves is characteristic of *D. ternata* and its allies.

D. thouaresiana (Fluegge) A. Camus is a very closely related species which is widespread in East Africa and may occur in Ethiopia. It has slightly smaller spikelets (1–1.7 mm) which are only very shortly pubescent (hairs up to 0.1 mm), and the pedicel-tips are only scaberulous or with a few short hairs. *D. iburua* Stapf is a derivative from *D. ternata* with glabrous spikelets, which is grown as a minor crop in West Africa. A few weedy specimens from Ethiopia (*Parker* E209, *Taddesse Ebba* 101) are also \pm glabrous, with only a few scurfy clavate hairs along the lower lemma margins. Such plants are probably glabrous variants of *D. ternata* (forma *glabrispicula*), and it seems preferable to restrict the name *D. iburua* to the crop plant.

7. *D. longiflora* (Retz.) Pers. (1805);

Paspalum longiflorum Retz. (1786) - type: India, König (K iso.) - type: Uganda, Hitchcock 24905 (L. holo., EA K iso.).

Digitaria flexilis Henr. (1950).

D. corradii Chiov. (1951) - types: Ethiopia, SD, Mega, Corradi 998, 1039, 1271 (all FT syn.).

Annual or short-lived perennial from a shortly rhizomatous base; culms ascending, leafy, 10–60 cm high. Leaf-blades broadly linear, 1–9 cm long, 1–5 mm wide, acute; blades and sheaths glabrous or hirsute. Inflorescence of 2(–4) slender, digitate racemes 1–10 cm long; spikelets ternate on a ribbon-like winged rhachis with a low, rounded midrib. Spikelets narrowly elliptic, 1.2–1.8 mm long; lower glume absent or a minute hyaline rim; upper glume equalling the spikelet, 5-nerved, appressed-pubescent between the nerves (or some of them); lower lemma similar but 7-nerved; upper lemma ellipsoid, pale brown or pale grey.

Open places in deciduous bushland and in disturbed and weedy situations; 500–1900 m. IL GG SD; throughout the Old World tropics; introduced in America. *Gilbert & Jefford* 4371; *Gilbert & Phillips* 8908.

The spikelet hairs can be seen to be verrucose when viewed under a microscope, a character shared with several other species sometimes placed together in the section *Verrucipilae* Stapf.

8. *D. maitlandii* Stapf & C.E. Hubb. (1927);

- type: Uganda, Maitland 766 (K holo.).

Densely tufted perennial, the basal sheaths tomentose and becoming fibrous; culms erect, 25–100 cm high. Leaf-blades linear, 5–30 cm long, 2–5 mm wide, usually villous. Inflorescence composed of 4–10 racemes on a short axis 1–4 cm long; racemes 4–10 cm long, the spikelets ternate on the shallowly triquetrous, unwinged rhachis. Spikelets elliptic, 1.8–2.2 mm long; lower glume vestigial, a minute hyaline rim; upper glume a broad, hyaline, 1–3-nerved scale $2/5$ – $1/3$ spikelet length, pilose on the margins with clavate hairs, broadly emarginate; lower lemma narrowly oblong, $3/4$

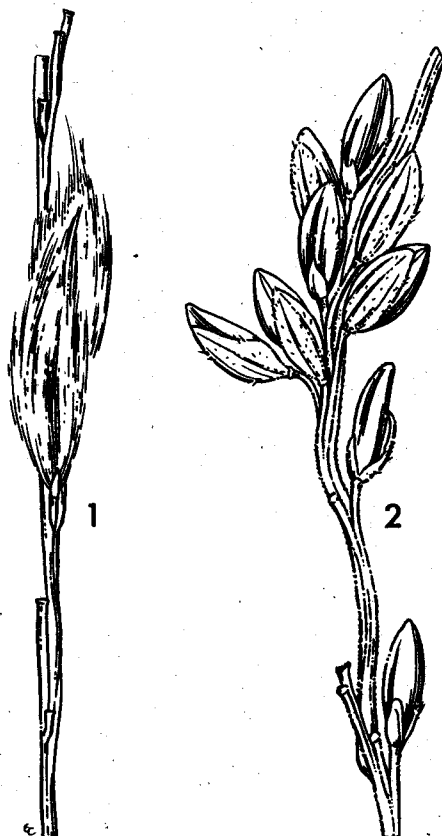


Figure 100. *DIGITARIA* spp.: spikelets on portion of raceme x 7: 1 - *D. NEGHELLENSIS*; 2 - *D. COMPRESSA*. 1 from Friis et al. 891; 2 from Stewart 67. Drawn by Eleanor Catherine.

to almost as long as the spikelet, 3–5-nerved, clavate-pilose along the margins (sometimes also on the back); upper lemma elliptic, dark brown.

Grassland from East Africa southwards to South Africa.

D. maitlandii is a common species in East Africa and is to be expected in Ethiopia. Its stout, fibrous perennial base serves to distinguish it easily from *D. ternata*, which has similar clavate spikelet-hairs.

9. *D. setifolia* Stapf (1898);

- types: South Africa, Baur 287 & MacOwan 1300 (both K syn.).

D. bovonei Chiov. (1914) - type: Zaire, Shaba, Bovone 70 (TO holo.).

D. nardifolia Stapf (1919) - types: Angola, Gossweiler 2386 & Zaire, [Katanga] Shaba, Homblé 10 (K syn.).

Dense tussocky perennial, surrounded at the base by the fibrous remains of old leaf-sheaths; culms erect, 30–85 cm high. Leaf-blades tough, involute, 10–30 cm long, 1–3 mm wide. Inflorescence composed of a fascicle of 2–4(–5) narrowly ascending, straight racemes on an axis 0.5–4 cm long; racemes 3.5–9 cm long, often compound below, the spikelets in groups of 2–4 along the unwinged, triquetrous rhachis. Spikelets elliptic-oblong,



Figure 101. *DIGITARIA* spp.: *D. DIAGONALIS*: 1 - habit x 1/2; 2 - section of raceme x 4. *D. PENNATA*: 3 - inflorescence x 1/2. *D. TERNATA*: 4 - habit x 1/2; 5 - section of raceme x 4; 6 - spikelet x 17. 1 & 2 from M.G & S.B Gilbert & Tewolde 2499; 3 from Gilbert & Sebsebe 8701; 4-6 from Ash 2135. Drawn by Eleanor Catherine.

2.5–3.8 mm long, usually brown-hairy; lower glume a tiny scale up to 0.5 mm long; upper glume 3/4 spikelet length, 3-nerved, appressed-pilose to hirsute with slender, brown, often capitellate hairs; lower lemma equaling the spikelet, 7-nerved, hairy all over like the upper glume or the hairs confined to the 2nd internerve space and margins; upper lemma elliptic, dark brown.

Damp areas in upland grassland; 2000 m. GD SD; from Zambia, Angola and adjacent Zaire southwards to South Africa; also in Sierra Leone. *Chiovenda* 975; *Gilbert & Jefford* 4299.

Specimens with small spikelets (<3 mm long) from Angola, Zaire (Shaba) and Zambia have been separated as *D. bovonei* Chiov. (syn. *D. nardifolia* Stapf), but there is complete intergradation with *D. setifolia* and small-spiculate forms also occur elsewhere in the range. The degree of hairiness of the lower lemma is also very variable, from a thick overall covering to appressed stripes between the first and second lateral nerves and along the margins, and ranging in colour from a deep brown to just a pale brown tint in the hairs towards the spikelet tip. However, the hairs always have a long, slender shaft with an obtuse to swollen capitellate tip (seen under a microscope), the swelling often becoming more obvious towards the spikelet-tip.

10. *D. compressa* Stapf (1919);
- type: Zimbabwe, *Mundy* (K holo.).

Dense tussocky perennial, surrounded at the base by the fibrous remains of old leaf-sheaths; culms erect, 50–125 cm high. Leaf-blades usually flat, 10–30 cm long, (2–) 4–7 mm wide, glabrous to hirsute. Inflorescence composed of (5–)6–16 loosely ascending racemes on an axis (2–)5–9 cm long; racemes 4–15 cm long, usually compound below, the spikelets in groups of 2–4 along the unwinged, triquetrous rhachis. Spikelets lanceolate to narrowly elliptic-oblong, 2.1–3 mm long; lower glume a minute scale or rim <0.5 mm long; upper glume (1/3–) 1/2–2/3(–3/4) spikelet length, 3–5-nerved, usually appressed-pilose with slender, pallid or pale brown, obtuse to capitellate hairs; upper lemma equalling spikelet (rarely slightly shorter), 7-nerved, appressed-pilose with the hairs usually confined to the 2nd internerve space and margins, occasionally completely glabrous; upper lemma elliptic, mid to dark brown. Fig. 100:2.

Grassland; 1300–2000 m. KF SD; Tanzania, Zaire (Shaba), southern tropical Africa and in Nigeria. *Smeds* 1169; *Stewart* 67; *W. de Wilde* et al. 6878.

D. compressa is a variable species very closely related to *D. setifolia*, but can usually be distinguished from it by its flat leaf-blades and more numerous, looser racemes often spaced along a longer axis. The spikelets tend to be smaller and narrower and less noticeably brown-hairy, but there is much overlap. The spikelet-hairs of both species vary identically from merely obtuse to definitely capitellate but are always fine and slender, in contrast to the obviously thick, clavate hairs of *D. maitlandii*.

11. *D. pennata* (Hochst.) T. Cooke (1908);
Panicum pennatum Hochst. (1855) - type: Ethiopia, TU, Gurrsarfa, *Schimper* in Herb. Buchinger 1497 (STR holo., P iso.).

Bushy perennial; culms hard and smooth, wiry, 30–100 cm high, fasciculately branched, the culm-bases bulbously thickened and clothed in densely hairy cataphylls. Leaf-blades narrowly lanceolate, 5–9 cm long, 3–6 mm wide, pubescent. Inflorescence large, composed of 6–14 stiffly radiating racemes mostly arranged in a single whorl, the whole inflorescence breaking off at maturity; racemes 10–25 cm long, conspicuously plumose except towards the tips, few-spiculate, the spikelets arranged in distant pairs appressed to the rhachis in the distal part of each raceme. Spikelets narrowly lanceolate-oblong, 2.5–3.2 mm long; lower glume reduced to a tiny nerveless scale; upper glume 3-nerved and lower lemma 5-nerved, both equalling the spikelet, the nerves forming prominent ribs with dense lines of appressed (or rarely loose) silky hairs between the nerves; upper lemma narrowly lanceolate, dark brown. Fig. 101:3.

Acacia-Commiphora bushland, usually growing under the protection of bushes; 750–1500 m. EW TU SU SD HA; Somalia, Kenya, Tanzania; eastwards through the Arabian Peninsula to Pakistan and N India. *Ash* 2437; *Burger* 3279, 2966; *Friis* et al. 1008.

D. pennata is unique among Ethiopian *Digitaria* species in possessing a deciduous inflorescence which blows about in the wind as a tumbleweed, hence dispersing the seeds. Its long, plumose, few-spiculate racemes are quite unmistakable. *D. aridicola* Napper from Kenya is a closely related species, also a tumbleweed, which may occur in southern Ethiopia. It differs from *D. pennata* by its glabrous racemes with smaller spikelets (1.1–1.3 mm long) lacking glumes.

12. *D. gymnotheca* W. D. Clayton (1974);
- type: Kenya, *Bogdan* 2589 (K holo.).

Straggling or stoloniferous perennial; culms wiry, branching, 30–60 cm high. Leaf-blades broadly linear, 5–20 cm long, 3–7 mm wide, glabrous to setose, tip filiform, the old dead leaves tightly curling. Inflorescence of 2–6 slender racemes, subdigitate or spread on a short axis up to 2 cm long; racemes 8–15 cm long, stiffly ascending, the spikelets borne in contiguous pairs on a triquetrous rhachis indistinctly winged on the angles; lower spikelet of a pair often vestigial towards the raceme base, the upper progressively longer-pedicelled upwards. Spikelets lanceolate, 2.7–3.8 mm long; glumes both minute, separated from the lower lemma by a brief internode, lower glume 0.2 mm long, upper glume 0.4–0.5 mm long; lower lemma as long as the spikelet, prominently 7–11-nerved, glabrous or inconspicuously pubescent on the back, the margins thinly to copiously white-villous with hairs extending beyond the tip, those of the upper spikelet sometimes spreading like

a halo at maturity; upper lemma narrowly ellipsoid, golden to dark brown, subacuminate.

Acacia-Commiphora bushland, usually in the shade of bushes or rocks on sandy soil; 1100–1250 m. GG BA; northern and coastal Kenya. *Gilbert & Phillips* 9131, 9134; *Gilbert & Ermias* 8452.

A very local species, distinctive on account of its long stiff racemes of spaced spikelets, with an exposed brown fruit. The curly dead leaves are also characteristic.

13. *D. debilis* (Desf.) Willd. (1809);

Panicum debile Desf. (1798) - type: Algeria, *Desfontaines* (P holo.).

Tufted annual; culms ascending from a decumbent or shortly stoloniferous base, 20–60 cm high. Leaf-blades 3–13 cm long, 2–6 mm wide, glabrous or often the lower sheaths and blades densely pilose, acute. Inflorescence a fascicle of 3–17 slender, pale green racemes on an axis up to 6 cm long; racemes 3–16 cm long, the spikelets paired along the triquetrous rhachis. Spikelets narrowly lanceolate, 2.3–3.7 mm long, rostrate; lower glume a tiny, hyaline, truncate scale separated from the rest of the spikelet by a short internode; upper glume equalling the spikelet, prominently 5-nerved, appressed crinkly-hairy along the margins and in 2 lines on the back (these lines often short), acuminate-rostrate; lower lemma 7-nerved, shorter than the upper glume but similarly hairy, acuminate; upper lemma narrowly lanceolate, sharply acute, light purplish-grey. Fig. 102:8.

Damp places; below 2000 m. KF; throughout Africa; also in the western Mediterranean and Madagascar. *Stewart* 63.

Best recognized by its beaked spikelets and tiny lower glume like a small frill set slightly below the rest of the spikelet.

14. *D. abyssinica* (Hochst. ex A. Rich.) Stapf (1907);

Panicum abyssinicum Hochst. ex A. Rich. (1850) - type: Ethiopia, TU, Mt Scholoda, *Schimper* 82 (K iso.).

Panicum muticum A. Rich. (1850), non *Forsk.* (1775); *P. scalarum* Schweinf. (1894); *Digitaria abyssinica* (Hochst. ex A. Rich.) Stapf var. *scalarum* (Schweinf.) Stapf in *Kew Bull.* 1907: 213 (1907); *Digitaria mutica* Rendle (1911); *D. scalarum* (Schweinf.) Chiov. (1916); *D. vestita* Fig. & De Not. var. *scalarum* (Schweinf.) Henr. (1950); *Dichanthium scalarum* (Schweinf.) Gilliland (1952) - types: Ethiopia, TU, Adua, *Schimper* 95 (K iso-syn.) & *Memsah* and *Ouodgerate*, *Quartin Dillon & Petit* (P syn.).

Slender perennial with wiry rhizomes, sometimes forming extensive mats; culms 20–80 cm high, erect or ascending from a decumbent to stoloniferous base. Leaf-blades broadly linear, flat, 4–14 cm long, 2–12 mm wide, glabrous or thinly hispid; leaf-sheaths glabrous to

villous. Inflorescence usually pyramidal, composed of 4–13 racemes inserted singly on a short axis 1–6 cm long; racemes 3–7 cm long, the spikelets borne in pairs on a triquetrous, sometimes narrowly winged rhachis. Spikelets elliptic, 1.8–2.2 mm long, plump, glabrous, slightly shiny; lower glume a small nerveless scale up to 1/3 spikelet length but usually less, variable in shape and texture, triangular to broad and truncate with hyaline margins; upper glume 3/4 to as long as the spikelet, 3–7-nerved; lower lemma equalling the spikelet, 7-nerved; upper lemma pale grey, pale brown or occasionally darker brown. Fig. 102:1, 2.

A ruderal species of upland grassland or bushland, forming a closed sward under heavy grazing; also a widespread arable weed; 1400–2700 m. EW TU GD WU GJ WG SU AR IL KF GG SD BA HA; southwards to South Africa and westwards to Cameroon, also in Madagascar and Sri Lanka. *Gilbert* 3177; *Gilbert & Getachew* 2613; *Mooney* 8061.

D. abyssinica is a very variable species, both vegetatively and in spikelet characters. It has thin wiry rhizomes which sometimes form extensive mats, and the aerial shoots may either be erect from these rhizomes and much branched at ground level forming a cluster of leaf-blades, or longer with a laxer, decumbent to stoloniferous base. *D. pearsonii* Stapf may key out here as its spikelets are only very inconspicuously appressed-hairy, but this has more pointed, lanceolate, acute spikelets and a usually shorter, strictly 3-nerved upper glume.

It is possible to distinguish two ill-defined forms within the species, the commoner of which is often referred to as *D. scalarum*. This form tends to have narrower leaf-blades (c 5 mm wide or less) than typical *D. abyssinica* (c 9 mm wide) and a broader thinner lower glume, but there is so much overlap that it is impracticable to maintain two separate species. The lower glume characteristically has a firmer, triangular to ovate central portion (representing the whole glume in "abyssinica" forms), but often hyaline margins are developed which may extend across the tip ("scalarum" forms). However, variation in this character forms a complete continuum, and is uncorrelated with other spikelet variables eg. number of nerves in the lower glume or fruit colour.

15. *D. pearsonii* Stapf (1919);

- type: Angola, *Pearson* 2333 (K holo.).

Panicum abyssinicum A. Rich. var. *velutinum* Chiov. in *Ann. Ist. Bot. Roma* 8: 294 (1908); *Digitaria abyssinica* (A. Rich.) Stapf var. *velutina* (Chiov.) Henr. (1950) - types: Eritrea, *Pappi* 1955, 2817 & many other syntypes (all FT syn.).

Lax perennial with wiry rhizomes; culms ascending from a decumbent base, rooting at the lower nodes, 30–70 cm high. Leaf-blades narrowly lanceolate, 4–20 cm long, 3–15 mm wide, pilose. Inflorescence composed of 6–20 widely diverging racemes on an axis 2.5–15 cm long (shorter than the longest raceme); racemes 3–17

cm long, frequently with branch racemelets, the spikelets borne loosely in pairs on a triquetrous, barely winged rhachis. Spikelets narrowly lanceolate to lanceolate-oblong, 1.8–2.5 mm long, acute to acuminate, very obscurely appressed-pubescent; lower glume an ovate scale 0.2–0.3 mm long; upper glume 1/2–3/4 spikelet length, 3-nerved, pubescent; lower lemma equalling the spikelet, 7-nerved, pubescent (often obscurely); upper lemma lanceolate, acute, brown.

Forest margins and weedy places. Eritrea BA; eastern and southern tropical Africa. *Friis et al.* 5676; *Tekle Hagos* 69 (ETH).

D. pearsonii can be very difficult to distinguish from the annual species *D. velutina* when the basal parts are missing, but is usually more robust, frequently with compound racemes and the fruits are uniformly a clear mid-brown, whereas in *D. velutina* they are most frequently grey. *D. velutina* often also has slightly shorter, elliptic-oblong, more obviously silky-pilose spikelets.

D. pearsonii can also be confused with *D. abyssinica* when the spikelet-hairs are very sparse, but this has plumper elliptic spikelets not usually exceeding 2 mm long, and a bigger, 3–7-nerved upper glume.

16. *D. rivae* (Chiov.) Stapf (1907);

Panicum rivae Chiov. (1897) - type: Ethiopia, Ogaden, Riva 303 (FT holo.).

Digitaria botryostachya Stapf (1919) - type: Ethiopia, Ardaga, Drake-Brockman 131 (K holo.).

Densely tufted perennial from a knotty rootstock or short stout rhizome, the basal sheaths tomentose; culms erect, hard, 30–125 cm high, the nodes glabrous or occasionally bearded. Leaf-blades linear, 12–30 cm long, 3–7 mm wide, narrowed to the ligule, acuminate. Inflorescence narrow, composed of 6–30 or more short, usually suberect racemes laxly and irregularly crowded along an elongate axis 5–25 cm long (longer than the longest raceme), often the lowermost \pm whorled; racemes 2–10 cm long, the spikelets paired on a very slender triquetrous rhachis (sometimes a pedicel forked and bearing 2 spikelets). Spikelets elliptic, 1.5–2.5 mm long; lower glume vestigial or a small ovate scale to 0.5 mm long; upper glume 3/4–7/8 spikelet length, 3-nerved, villous; lower lemma equalling the spikelet, 7-nerved, silky-pilose to villous with conspicuous white hairs slightly overtopping the spikelet except around the midnerve; upper lemma brown. Fig. 102:6, 7.

Acacia-Commiphora bushland and wooded grassland; 1200–1500 m. SD HA; Somalia, Kenya, Tanzania. *Burger* 3287; *Friis et al.* 981, 3179; *Gilbert* 3362.

D. arushae W. D. Clayton from S Kenya and N Tanzania is a closely related species with a similar knotty rootstock and elongate inflorescence of many racemes. It differs in the following characters: looser, much branched habit; shorter lanceolate leaf-blades (6–12 cm long) of firmer texture with conspicuously crin-

kled margins and rounded base; racemes in whorls and usually with scattered long white hairs; spikelets only shortly appressed-pubescent and lacking a lower glume.

D. rukwae W. D. Clayton from Tanzania, Zambia and Mozambique also belongs to this group. It has softer, rather stouter culms than *D. rivae*; scaly rhizomes; racemes spread on an axis longer or occasionally somewhat shorter than the racemes; and only shortly pilose spikelets.

17. *D. gazensis* Rendle (1911);

- type: Mozambique, *Swynnerton* 1593 (BM holo.).

Densely tufted perennial from a short knotty rhizome, the basal sheaths tomentose; culms ascending or decumbent at the base, 40–150 cm high, the nodes dark and bearded. Leaf-blades linear, 5–20 cm long, 3–5(–10) mm wide, usually softly pilose, acute. Inflorescence composed of 5–20 slender, ascending racemes spread along a common axis shorter than or \pm equalling the longest raceme; racemes 5–20 cm long, usually purplish or dark grey, appressed branch racemelets frequent, loosely spiculate, the spikelets paired on a very slender triquetrous rhachis. Spikelets narrowly elliptic, 1.5–2.5 mm long; lower glume up to 0.5 mm long, a truncate hyaline frill; upper glume equalling the spikelet, 5-nerved, pilose; lower lemma equalling the spikelet, 7-nerved, pubescent to pilose with fine, flexuous, curly-tipped hairs; upper lemma yellowish-grey to greyish-purple.

Sudan, Zaire and in eastern and southern tropical Africa.

Reported from Ethiopia [Fröman & Persson, *III. Guide Grasses Eth.*: 50 (1974)].

D. gazensis is related to *D. rivae*, which differs by its elongate inflorescence of shorter racemes, slightly shorter 3-nerved upper glume and brown fruit. It is typically a softly hairy plant with a velvety base and fairly long, slender racemes of small grey spikelets. The tips of the spikelet-hairs are characteristically bent over like a shepherd's crook (microscope required).

18. *D. nodosa* Parl. (1842);

- type: Canary Is. (whereabouts unknown).

Panicum piriferum Chiov. (1908); *Digitaria pirifera* (Chiov.) Chiov. (1916) as "*D. pyriformis*" - type: Eritrea, Dongollo, *Pappi* 4326 (FT holo.).

Densely tufted perennial, culm-bases bulbous, the basal sheaths pubescent to tomentose; culms erect, hard, 20–100 cm high, mostly unbranched, the nodes dark and glabrous. Leaf-blades linear, 8–25 cm long, 2–5 mm wide, velvety to glabrescent. Inflorescence composed of 4–20 racemes, these digitate or spread on a short axis to 9 cm long (shorter than racemes); racemes slender, 6–10 cm long, the spikelets paired, loosely overlapping on a slender triquetrous rhachis, the longer pedicels often filiform. Spikelets narrowly elliptic-oblong, 2.2–3.2 mm

long; lower glume a small ovate scale 0.1–0.4 mm long; upper glume 2/3 as long to subequalling the spikelet, 3-nerved, villous; lower lemma equalling the spikelet, 7-nerved, appressed-pilose to shortly villous; upper lemma variable, usually grey or pale to yellowish brown.

Grassland on dry sandy and gravelly soils; 800–1300 m; EE EW SD; Canary Is., N Africa, Arabia and eastwards to Pakistan and Afghanistan; Somalia. *Edwards & Tewolde Berhan* 3886; *Pappi* 2596; *Rippstein* 776.

A subtropical species extending southwards into Eritrea and Somalia, with a few atypical outliers in East Africa.

D. nodosa is closely related to *D. eriantha* Steud. from southern tropical and South Africa, which often produces stolons and has spikelets with a shorter upper glume (1/2–2/3 spikelet length).

19. *D. macroblephara* (*Hack.*) *Stapf* (1919);

Panicum macroblepharum *Hack.* (1900) - type: Somalia, *Keller* 136 (W holo.).

Perennial forming a bushy tussock, basal sheaths silky-pubescent; culms 15–100 cm high from an erect base, many-noded and fasciculately branched, some culms arching down into creeping stolons, nodes bearded. Leaf-blades 3–15 cm long, 2–5 mm wide. Inflorescence digitate or subdigitate, composed of 2–11 ascending racemes; racemes 2–20 cm long, the spikelets paired on a triquetrous, narrowly winged rhachis. Spikelets narrowly elliptic-oblong, 2.5–3.5 mm long, villous, the hairs slightly exceeding the spikelet and often purple-tinged; lower glume a small ovate scale 0.2–0.3 mm long; upper glume 2/3–3/4 spikelet length, 3-nerved, villous; lower lemma equalling the spikelet, 7-nerved, the central interspaces conspicuously glabrous, otherwise villous with fine silky hairs, sometimes bristle-hairs also present from the marginal nerves; upper lemma grey or pale brown.

Rocky slopes in open bushland (especially *Acacia-Commiphora*); 1100–1700 m. GG SD; Sudan, Somalia, Uganda, Kenya, Tanzania. *Gilbert & Jefford* 4632; *Tewolde & Getahun* 1601 (ETH); *Sebsebe* 210 (ETH).

D. rivae has similar but smaller villous spikelets and is easily distinguished by its elongate inflorescence. The bushy, fasciculately branching, sometimes stoloniferous habit of *D. macroblephara* is very characteristic, coupled with its digitate racemes and the frequent presence of bristle-hairs in the spikelets.

In Sidamo *D. macroblephara* may introgress with *D. nodosa*. *Gilbert & Jefford* 4632 has the habit and spikelets of *D. macroblephara* but the brown glabrous nodes of *D. nodosa*.

20. *D. milanijana* (*Rendle*) *Stapf* (1919);

Panicum milanijanum *Rendle* (1894) - type: Malawi, *Whyte* (BM holo.).

Digitaria gallaensis *Chiov.* (1916) - type: Ethiopia, Galla Arussi, west shore of L. Zwai [Zuai], *Nagri* 1550 (FT holo.).

Loosely tufted perennial with scaly rhizomes, the basal sheaths glabrous or pubescent; culms 50–200 cm high, erect or ascending (occasionally stoloniferous), nodes usually glabrous. Leaf-blades linear, flat, 15–30 cm long, 3–12 mm wide. Inflorescence digitate or subdigitate, composed of 2–18 erect or spreading, closely spiculate racemes; racemes 8–25 cm long, the spikelets paired on a narrowly winged rhachis with triquetrous midrib. Spikelets narrowly elliptic, 2–3.2(–3.5) mm long; lower glume an ovate scale 0.2–0.5 mm long; upper glume 1/2–2/3 spikelet length, 3-nerved, appressed-pilose; lower lemma equalling the spikelet, 7-nerved with the nerves scabrid (midnerve scarcely so), the nerves equidistant or the central glabrous interspaces wider, pubescent to appressed-pilose, sometimes also pectinate with stiff bristles; upper lemma greyish or pale brown.

A weedy species from a wide range of habitats, usually in disturbed places; 500–1800 m. TU WU SU AR IL SD; southwards to South Africa; introduced as a fodder grass to other tropical countries. *W. de Wilde* 7083 & 11028; *Sandford* K5 (ETH).

A very variable species, best recognized by its rhizomatous habit and digitate inflorescence of straight, greyish racemes with only moderately hairy, but often bristly spikelets. The scabrid spikelet-nerves are characteristic, other members of this complex having smooth nerves, but are often obscured by the spikelet pubescence. The tiny scabridities are most clearly visible towards the spikelet tip.

D. macroblephara often also has bristle-hairs on the lower lemma, but differs by its non-rhizomatous bushy habit and villous spikelets.

21. *D. velutina* (*Forssk.*) *P. Beauv.* (1812);

Phalaris velutina *Forssk.* - type: Yemen, *Forskål* (C holo.).

Panicum fenestratum *Hochst.* ex *A. Rich.* (1850); *P. sanguinale* *L.* var. *fenestratum* (*A. Rich.*) *Schweinf.* in *Bull. Herb. Boiss.* 2, App. 2: 18 (1894); *Digitaria fenestrata* (*A. Rich.*) *Rendle* (1899) - types: Ethiopia, TU, Adua, *Schimper* 85 (K isosyn.) & *Aderbati*, *Quartin Dillon* (P syn.).

Panicum sanguinale *L.* var. *cognatum* *Schweinf.* in *Bull. Herb. Boiss.* 2, App. 2: 18 (1894), nom. nud. based on: Eritrea, *Schweinfurth* 146, 1180 (K).

P. psilostachyum *Th. Dur. & Schinz* (1895), nom. nud. based on: Ethiopia, *Sellada*, *Schimper* 2256 (K).

P. abyssinicum *A. Rich.* var. *setigerum* *Chiov.* in *Nuov. Giorn. Bot. Ital.*, n.s., 19: 418 (1912) - type: Eritrea, *Dongollo*, *Fiori* 1238 (FT holo.).



Figure 102. *DIGITARIA* spp.: *D. ABYSSINICA*: 1 - habit x 3/4; 2 - spikelet x 17. *D. VELUTINA*: 3 - habit and inflorescence x 3/4; 4 - spikelet pair x 4; 5 - spikelet x 17. *D. RIVAE*: 6 - inflorescence x 3/4; 7 - spikelet x 17. *D. DEBILIS*: 8 - spikelet x 17. 1 & 2 from De Wilde 7808; 3-5 from Gilbert, Thulin & Aweke 541; 6 & 7 from Gilbert 3362; 8 from Stewart 63. Drawn by Eleanor Catherine.

Loosely tufted to straggling annual; culms slender, 20–60 cm high, ascending from a decumbent base, often rooting at the lower nodes. Leaf-blades broadly linear to lanceolate, 3–10 cm long, 4–10 mm wide, thin, pilose. Inflorescence composed of 3–14 widely divergent, straight racemes spaced along an axis 1–6 cm long (axis shorter than the longest raceme); racemes slender, 3–10 cm long (the lower occasionally with branch racemelets), spikelets borne loosely in pairs, overlapping by scarcely half their length; rhachis triquetrous, narrowly winged, sometimes with long fine hairs. Spikelets narrowly elliptic-oblong, 1.5–2.2 mm long, appressed silky-pubescent (sometimes obscurely), subacute; lower glume obsolete or a tiny scale up to 0.2 mm long; upper glume 2/3–7/8 as long as the spikelet but narrower, 3-nerved; lower lemma equalling the spikelet, 7-nerved, glabrous around the midnerve, rarely the lateral hairs spreading into a ciliate fringe; upper lemma usually grey, occasionally grey-brown or violet-tinged. Fig. 102:3–5.

A weed of disturbed and arable land, usually on light soils in shade; 700–2000 m. EE EW TU GD GJ SU AR IL KF GG SD BA HA; Egypt and Yemen to South Africa. *Edwards & Tewolde-Berhan* 3678; *Moo-ney* 5505; *Ash* 1232.

D. horizontalis Willd. from tropical America and West Africa is very similar, but has slightly longer, narrower spikelets (2–2.5 mm long) and a shorter upper glume less than half the length of the spikelet. Variants with ± glabrous spikelets can also be confused with *D. abyssinica* but *D. velutina* has flatter, narrower spikelets and lacks rhizomes.

D. velutina, *D. nuda* and *D. ciliaris* represent different facies of a single intergrading complex (which also includes *D. horizontalis*, *D. sanguinalis* and other widespread weedy annuals) and are not clearly delimited from each other. *D. velutina* is much the most common member of this complex in Ethiopia.

22. *D. nuda* *Schumacher*. (1827);

- type: Ghana, *Thonning* (C holo.).

Annual; culms decumbent at the base, sometimes mat-forming, 10–50(–100) cm high. Leaf-blades broadly linear, 5–20 cm long, 3–8 mm wide. Inflorescence digitate or with a short axis to 2 cm long, composed of 2–20 whorled racemes; racemes slender, 4–20 cm long, the spikelets borne in closely overlapping pairs; rhachis winged with a triquetrous midrib, sometimes with long fine hairs. Spikelets narrowly lanceolate, 1.7–2.5 mm long, sharply acute; lower glume an obscure rim or absent; upper glume 1/2–2/3 spikelet length, 3-nerved, appressed-hairy; lower lemma equalling the spikelet, 7-nerved, puberulous to appressed silky-pilose, rarely the lateral hairs spreading into a ciliate fringe; upper lemma pallid, grey or greyish-brown.

Weedy places; 500 m. IL; a ruderal species, its distribution centred on tropical Africa but with sporadic

occurrences throughout the tropics. *Mesfin* T. 6769 (ETH).

Very similar to *D. velutina*, with appressed-hairy spikelets mostly < 2.5 mm long and an obsolete lower glume, but distinguished by its ± digitate inflorescence of whorled racemes and often more closely overlapping spikelets.

23. *D. ciliaris* (Retz.) Koel. (1802);

Panicum ciliare Retz. (1786) - type: China, *Wennerberg* (LD lecto.).

Panicum adscendens Kunth (1817); *Digitaria adscendens* (Kunth) Henr. (1934) - types: Central & South America, *Humboldt & Bonpland* (whereabouts uncertain).

Digitaria chrysoblephara Fig. & De Not. (1854); *D. adscendens* (Kunth) Henr. subsp. *chrysoblephara* (Fig. & De Not.) Henr., *Monogr. Digitaria*: 126 (1950); *D. ciliaris* (Retz.) Koel. subsp. *chrysoblephara* (Fig. & De Not.) Blake in *Proc. Roy. Soc. Queensland* 81: 12 (1969); *D. ciliaris* (Retz.) Koel. var. *chrysoblephara* (Fig. & De Not.) R.R. Stewart in *Kew Bull.* 29: 444 (1974) - type: Sudan, *Figari* (whereabouts uncertain).

Panicum sanguinale L. var. *blepharanthum* Th. Dur. & Schinz, *Consp. Fl. Afr.* 5: 762 (1895) - type: Ethiopia, TU, Djeladgeranne, *Schimper* 1616 (K iso.).

Panicum sanguinale L. var. *macrostachyum* Th. Dur. & Schinz, *Consp. Fl. Afr.* 5: 763 (1895), nom. nud. based on: Ethiopia, TU, Mawerr, *Schimper* 2162 (K).

Digitaria marginata Link (1812); *D. adscendens* (Kunth) Henr. subsp. *marginata* (Link) Henr., *Monogr. Digitaria*: 998 (1950) - type: cultivated at Berlin, originally from Brazil (B holo.).

Digitaria fimbriata Link (1827); *D. marginata* Link var. *fimbriata* (Link) Stapf in *Fl. Trop. Afr.* 9: 440 (1919); *D. adscendens* (Kunth) Henr. var. *fimbriata* (Link) Cuf., *Enum.*: 1327 (1969) - type: cultivated at Berlin, originally from Brazil (B holo.).

Digitaria marginata Link var. *nubica* Stapf in *Fl. Trop. Afr.* 9: 441 (1919); *D. adscendens* (Kunth) Henr. subsp. *nubica* (Stapf) Henr., *Monogr. Digitaria*: 432 (1950); *D. ciliaris* (Retz.) Koel. subsp. *nubica* (Stapf) S.T. Blake in *Proc. Roy. Soc. Queensland*: 81: 12 (1969) - type: Sudan, *Kotschy* 429 (K lecto.).

Coarse annual; culms sprawling, ascending, 20–100 cm high. Leaf-blades broadly linear, 3–25 cm long, 3–10 mm wide. Inflorescence digitate or subdigitate, composed of 2–12 stiff straight racemes; racemes 6–22 cm long, occasionally with long white hairs, the spikelets paired and closely overlapping on a winged rhachis with triquetrous midrib. Spikelets narrowly elliptic-oblong, 2.5–3.4 mm long, acute; lower glume ovate, 0.2–0.5 mm long; upper glume 2/3–3/4 spikelet length, 3-nerved, appressed-pilose; lower lemma equalling the

spikelet, 7-nerved, appressed-pilose with fine soft hairs, bristle-hairs often also present, appressed and hidden when young, becoming yellowish, patent and often forming a ciliate frill at maturity; upper lemma grey to pale brown.

Weedy places; up to 2000 m. EE EW TU GD IL SD; East Africa and a few other scattered localities in Africa; common elsewhere in the tropics. *Aweke & Gilbert* 716; *Pappi* 5976; *Ryding* 1718 (ETH).

D. ciliaris is widespread in the tropics but is replaced to a large extent in Africa by *D. nuda*. It is extremely variable in the spacing of the nerves and occurrence of bristle-hairs in the lower lemma; in the presence of a ciliate frill around the spikelets at maturity; and the presence of hairs on the rhachis. However, these characters vary independently of each other, and may even vary along one raceme or between the two spikelets of a pair.

114. SNOWDENIA *C. E. Hubb.* (1929)

Beckera Fresen. (1837)

C. E. Hubbard in *Hook., Ic. Pl.* 7, t. 3647 (1967).

Annuals or perennials; leaf-blades linear to lanceolate, flat; ligule membranous, sometimes hairy on the back or ciliate. Inflorescences cylindrical, racemose, axillary from the upper leaf-sheaths on long-exserted, filiform, flexuous peduncles, single or in fascicles of 2-6; spikelets imbricate, pedicellate on a slender, angled rhachis. Spikelets lanceolate to oblong, dorsally compressed, membranous; glumes both very small, truncate to obtusely ovate, nerveless; lower lemma as long as the spikelet, sterile without a palea, 5-7-nerved, flat across the back, inflexed and upwardly keeled along the lateral nerves, usually extended into a fine scabrid awn; upper lemma subequalling the lower, 3-nerved, obtuse to acute, sometimes mucronate, the broad, flat, hyaline margins almost contiguous over the reduced, hyaline palea.

4 species centred on the uplands of Ethiopia and East Africa; extending to Yemen and Sudan.

Snowdenia is a close-knit small genus, often confused with *Pennisetum unisetum* and its allies, to which it is probably related. In *Snowdenia* the spikelet-bristle arises at the tip of the lower lemma, whereas in *Pennisetum* it is situated below the glumes.

1. Spikelets truncate to abruptly acute, 2-3.2 mm long; plants loosely tufted, slender to robust.
 1. *S. polystachya*
- Spikelets acuminate, 3.5-5.5 mm long; plants rambling or scandent with weak, slender culms. 2
2. Annual; spikelets 3.5-4.5 mm long with an awn 1-5 mm long; culms and leaf-sheaths scabrid (at least near the nodes).
 2. *S. petitiana*
- Perennial with basal buds; spikelets 4.3-5.5 mm long, often awnless; culms and leaf-sheaths smooth.
 3. *S. mutica*

1. *S. polystachya* (*Fresen.*) *Pilg.* (1938);

Beckera polystachya Fresen. (1837) - type: Ethiopia, without precise locality, *Rüppell* s.n. (FR holo.).

Beckera valida Fresen. (1844) - type: cultivated in Europe from seed collected by *Schimper* in Ethiopia, (K iso.).

B. schimperi Hochst. (1844); *B. polystachya* Fresen. var. *schimperi* (Hochst.) Th. Dur. & Schinz, *Consp. Fl. Afr.* 5: 736 (1895) - type: Ethiopia, TU, Adua [Adoa], *Schimper* 91 (K iso.).

Loosely tufted annual; culms slender to robust, decumbent, rooting and much-branched at the lower nodes, 30-200 cm high, smooth, the nodes pubescent. Leaf-blades broadly linear, thin and flaccid, 3-25 cm long, 5-17 mm wide, sparsely tuberculate-hispid, the base narrowly rounded, tip acute to acuminate, usually extended into a fine bristle up to 1(-6) mm long; leaf-sheaths loose, smooth, tuberculate-hairy near the ligule. Peduncles 1-6 per leaf-axil; racemes 2.5-5 cm long, the spikelets closely imbricate on pedicels 0.2-0.5 mm long. Spikelets lanceolate or oblong, 2-3.2 mm long, asperulous; glumes both truncate, 0.2-0.4 mm long; lower lemma spinulose on the lateral keels upwards, narrowly truncate to minutely bidenticulate or abruptly acute, tipped with a slender, flexuous awn (1-2-6.5(-10) mm long; upper lemma narrowly truncate, sometimes shortly mucronate; upper palea 0.3-1 mm long. Fig. 103:1, 2.

Roadsides, fallow land and as an arable or garden weed, in the open or light shade; 1500-2700 m. EW TU GD WU GJ WG SU AR IL KF SD HA; predominantly Ethiopia, but extending to Sudan (Jebel Marra), Yemen and neighbouring Saudi Arabia; introduced to East Africa as a fodder grass. *Boulos* 9579; *Gilbert & Getachew* 2712; *Mooney* 5774.

S. polystachya varies greatly in vigour, apparently reacting strongly to soil fertility and moisture. There is also a wide, though continuous, range in awn length, but spikelet length is more uniform and the essentially flat-topped, obtuse spikelet shape is characteristic. It is much the commonest species of *Snowdenia* in Ethiopia.

Ash 2100 has exceptionally long spikelets (4-4.5 mm), but is otherwise typical of *S. polystachya*.

2. *S. petitiana* (*A. Rich.*) *C. E. Hubb.* (1967);

Beckera petitiana A. Rich. (1850) - type: Ethiopia, TU, Kouayeta near Beless, *Quartin Dillon & Petit* (P holo.).

Beckera scabra Pilg. (1932); *Snowdenia scabra* (Pilg.) Pilg. (1938).

Slender annual; culms rambling or scandent, rooting at the lower nodes, ascending up to 90 cm, internodes and leaf-sheaths densely retrorsely scabrid to almost smooth, the nodes retrorsely appressed silky-villous. Leaf-blades narrowly lanceolate, thin, 3-13 cm long, 4-15 mm wide, sparsely tuberculate-hispid, narrowed to



Figure 103. *SNOWDENIA* spp.: *S. POLYSTACHYA*: 1 - habit x 2/3; 2 - spikelet x 8. *S. PETITIANA*: 3 - spikelet x 8. 1 from Meyer 8850; 2 from Friis et al. 1619; 3 from Thulin 1403. Drawn by Eleanor Catherine.

the base, the tip finely acute, sometimes shortly mucronate; ligule pubescent on the back. Peduncles 1-4 per leaf-axil; racemes 3-7 cm long, the spikelets borne loosely on pedicels mostly > 0.5 mm long. Spikelets lanceolate, 3.5-4.5 mm long, asperulous; glumes truncate to obtusely ovate, 0.2-0.7 mm long; lower lemma scabrid on the keels upwards, acuminate, tipped with an awn 1-5 mm long; upper lemma acute with a mucro 0.8-1 mm long; upper palea 0.7-1.7 mm long. Fig. 103:3.

Damp places in light shade; 1900-2100 m. TU SU AR SD; East Africa. *De Wilde* 8246; *Gillett* 14646; *Thulin* 1403.

The degree of scabridity of the culms and leaf-sheaths is very variable, and may sometimes be confined to an inconspicuous roughness below the nodes or near the top of the leaf-sheaths. However, besides the more elongate spikelets, it may also be distinguished from *S. polystachya* by its generally more delicate, wiry, rambling habit; looser inflorescences of slightly more spaced spikelets on a smoother rachis with longer pedicels; merely scabrid rather than spinulose lower lemma-keels and hairier nodes.

3. *S. mutica* (*Hochst. ex Fresen.*) *Pilg.* (1938);

Beckera mutica Hochst. ex Fresen. (May 1844); Hochst. (Aug. 1844) - type: Ethiopia, GD, Mt Aber, *Schimper* s.n. (FR holo.).

Beckera gracilis Hochst. (1855); *Snowdenia gracilis* (Hochst.) *Pilg.* (1938) - type: Ethiopia, GD, *Schimper* in Herb. Buchinger 1332 (STR holo., P iso.).

Slender perennial from a knotty rootstock with basal buds; culms rambling, branching, rooting at the lower nodes, smooth and slender, up to 90 cm long, the nodes loosely pilose. Leaf-blades linear, up to 15 cm long, 4-10 mm wide, thinly tuberculate-hispid or glabrescent, narrowed to the base, finely acuminate; leaf-sheaths smooth; ligule glabrous. Peduncles 1-2 per leaf-axil; racemes very loose and slender, 3-7 cm long, the pedicels 0.5-1 mm long. Spikelets narrowly lanceolate-oblong, 4.3-5.5 mm long, asperulous; glumes 0.4-1 mm long, broadly rounded or lobed; lower lemma spinulose on the keels upwards, sharply acuminate, sometimes extended into a short awn up to 4 mm long; upper lemma acute, shortly mucronate; upper palea to 2.5 mm long.

Damp shady places and caves; 2100-2400 m. GD; endemic. *Schimper* 467 & 1275.

S. mutica is apparently confined to the Semien mountains and has not been collected again since 1854. It is very close to *S. petitiiana* but is clearly perennial, and besides the key differences, has rather more straight-sided spikelets, linear leaf-blades, a hairy ligule and loosely pilose nodes.

115. PARATHERIA Griseb. (1866)

Prostrate perennials; leaf-blades linear; ligule a ciliolate rim. Inflorescence linear, spiciform, composed of spaced or loosely imbricate, erect, 1-spiculate racemlets deciduous at maturity, the lower portion below the spikelet forming a pungent stipe, the upper portion extended beyond the spikelet as a stout bristle. Spikelets linear-lanceolate, acuminate; both glumes reduced to small nerveless scales at the spikelet base; lower lemma as long as the spikelet, sterile without a palea; upper lemma similar, chartaceous, its thin flat margins enclosing much of the palea.

2 species; one in Africa, South America and the West Indies, and the other confined to Sierra Leone.

P. prostrata Griseb. (1866);

- type: Cuba, Wright.

Loosely tufted perennial with slender, trailing, branching culms forming rooting mats, the nodes bearded. Leaf-blades 4–6 cm long, 2–4 mm wide, glabrous or villous, acute. Inflorescence 5–15 cm long, the base usually enclosed within the uppermost leaf-sheath, branches and bristles scabrid. Spikelets 9.5–12 mm long, glabrous, seated on a short stout pedicel with a circlet of hairs to 3 mm long at its tip; glumes both 0.8–2 mm long, ovate, obtuse; lemmas 7–9-nerved.

Marshy soils and shallow water; KF; West Africa, Zaire, Zambia, Namibia; Madagascar; West Indies and South America. *Stewart* 74.

The lowermost spikelets of the inflorescence enclosed within the uppermost leaf-sheath are cleistogamous with a reduced or absent bristle; similar bristleless cleistogamous spikelets also occur in some of the other leaf-sheath axils.

116. PENNISETUM Rich. (1805)

Beckeropsis Fig. & De Not. (1854)

Clayton in Hook., *Ic. Pl.* 37, t. 3643 (1967).

Annuals or perennials, tufted or rhizomatous, prostrate to over 3 m high; leaf-blades convolute to broadly linear; ligule ciliate or rarely membranous. Inflorescence a cylindrical to subglobose, much reduced spiciform panicle, either terminal or with many axillary inflorescences from the upper leaf-sheaths gathered into a leafy false panicle. Spikelets arranged singly or in groups, subtended by 1 to many bristles, each cluster comprising an involucre; involucres deciduous at maturity, sessile or shortly stalked, occasionally extended below into a stipe; bristles scabrid or plumose. Spikelets usually lanceolate, membranous, dorsally compressed (except in *P. squamulatum* and *P. schweinfurthii*); glumes often small and not exceeding 1/2 spikelet length; lower lemma male or sterile, equalling the spikelet or reduced; upper floret fertile, equalling the spikelet, membranous or indurated; anther-tips glabrous or penicillate; stigmas separate or simple and elongate.

About 80 species throughout the tropics.

Pennisetum is a large and varied genus but the bristly, spike-like inflorescence is always readily recognizable. The only other panicoid genus with a similar bristly inflorescence is *Setaria*, but in *Setaria* the bristles are not deciduous with the spikelets, but remain on the rachis at maturity. The bristles are thought to be derived from reduced panicle-branches [Sohns in *Journ. Wash. Acad. Sci.* 45: 135–143 (1955); Butzin in *Willdenowia* 8: 67–79 (1977)].

Species with a leafy false panicle composed of many, short, axillary inflorescences and spikelets subtended by a single bristle, have traditionally been separated as *Beckeropsis*. On the whole, this is a well-defined group of tall grasses with long, broadly linear leaf-blades, often narrowed at the base into a false petiole. However, *Beckeropsis* grades into the main body of *Pennisetum* through species such as *P. trisetum*, *P. glaucifolium* and *P. trachyphyllum* which have fewer, longer inflorescences arranged both terminally and from the upper leaf axils, and involucres with a few to many bristles.

The shape and relative proportions of the lower spikelet scales are much more variable in *Pennisetum* than is usual in the Paniceae, so it is best to work backwards from the upper lemma when interpreting spikelet structure. On the other hand, the general facies is usually reliable and species-characteristic, but such habit characters are not so readily translated into key couplets as spikelet characters.

Some species of *Pennisetum* have attractive, ciliate or plumose bristles, a character which is usually obvious and provides an easy first step to identification. However, some caution is required as the character is not always completely stable and some normally hairy-bristled species may rarely produce glabrous or very sparsely hairy variants e.g. *P. setaceum*, *P. polystachion* and the crop plant *P. glaucum*. Conversely, a few normally glabrous-bristled species may occasionally have weakly hairy bristles e.g. *P. sphacelatum*. A tiny, but useful character, not used in the keys because of its inconspicuous nature, is the presence of penicillate anther-tips. These are found in *P. glaucum* and its wild relatives (sect. *Pennisetum*) and sometimes in *P. thunbergii*. All other Ethiopian species have glabrous anthers.

1. Inflorescence reduced to 2–4 spikelets enclosed within the upper leaf-sheath; anthers and stigmas long-exserted; low, sward-forming perennial. 9. *P. clandestinum*
- Inflorescence spiciform, clearly exserted above the leaves, or rarely the base only included within the uppermost leaf-sheath 2
2. Involucral bristles, or at least the inner, ciliate to plumose (if a suffrutescent desert grass, see 16. *P. divisum*). 3
- Involucral bristles glabrous (if cultivated see 6. *P. glaucum*). KEY 2 16

3. Spikelets dimorphic, all pedicelled, a cluster of male spikelets surrounding a central bisexual spikelet of different shape. 4
 - Spikelets all alike, at least one sessile. 5
4. Rhachis pubescent, involucre-stumps 0.5 mm long; spikelets 5-8 mm long on pedicels 1.5-4 mm long; leaf-blades narrowed towards base.
 1. *P. squamulatum*
 - Rhachis woolly, involucre-stumps 1.5-4 mm long; spikelets 8-9 mm long on pedicels 0.5-1 mm long; leaf-blades broadly rounded at base.
 2. *P. schweinfurthii*
5. Rhachis with sharp decurrent wings below the involucre-scars; upper floret deciduous; bristles densely woolly with crinkled, matted hairs. 6
 - Rhachis not winged; upper floret persistent; bristles ciliate, the hairs not crinkled, often tubercle-based. 7
6. Involucres 1-spiculate, the spikelet sessile.
 3. *P. polystachion*
 - Involucres 1-5-spiculate, at least one spikelet pedicelled; bristles fluffy. 4. *P. pedicellatum*
7. Culms tall, often 2 m or more high; upper lemma indurated, smooth and shiny below, membranous above. 8
 - Culms seldom exceeding 1 m; upper lemma of uniform texture. 11
8. Robust perennial up to 6 m high. 5. *P. purpureum*
 - Slender to robust annuals. 9
9. Cultivated; involucres persistent at maturity, with a basal stipe 1-2.5 mm long. 6. *P. glaucum*
 - Wild; involucres deciduous at maturity, sessile or with stipes < 1 mm long. 10
10. Involucres sessile; mature grain slender, 0.6-1 mm thick. 7. *P. violaceum*
 - Involucres with a stipe 0.3-1.5 mm long; mature grain turgid, 1-2 mm thick.
 8. *P. sieberianum*
11. Inflorescence narrowly oblong to subrotund; spikelets 6.5-16 mm long; lower lemmas 6-15-nerved; low, rhizomatous perennials. 12
 - Inflorescence linear; spikelets 3.2-7 mm long; lemmas 1-5-nerved. 14
12. Bristles up to 20 mm long; spikelets 14-16 mm long; inflorescence 3.5-4 cm long, inconspicuously bristly with few involucres, scarcely exerted from the uppermost leaf-sheath.
 10. *P. longistylum*
 - Bristles 25-65 mm long; spikelets 6.5-12.5 mm long; inflorescence conspicuously bristly with many involucres, oblong to subspherical. 13
13. Inflorescence ovoid to subspherical, pallid, 5-10 cm wide; spikelets 9-12.5 mm long; anthers 4-6.7 mm long. 11. *P. villosum*
 - Inflorescence oblong, purplish, 2.5-4.5 cm wide; spikelets 6.5-8 mm long; anthers 2.5-3.8 mm long. 12. *P. yemense*
14. Longest bristles 17-40 mm long, usually obviously ciliate with tubercle-based hairs around the spikelets; inflorescence loose, 8-25 cm long. 15
 - Longest bristles 4-12 mm long, sparsely and inconspicuously ciliate; inflorescence very dense, 5-12 cm long. 26. *P. sphacelatum*
15. Involucres 2-4-spiculate, borne upon a slender stipe 1-3 mm long; spikelets 5-7 mm long; glaucous, tussocky perennial. 13. *P. setaceum*
 - Involucres 1-spiculate; spikelets 3.2-4.7 mm long; shortly rhizomatous perennial, culms many-noded, fasciculately branched. 14. *P. gracilescens*

KEY 2

16. Inflorescences terminal on the culms and branches. 17
 - Inflorescences terminal and also axillary from the upper leaf-sheaths, or all axillary and gathered into a leafy false panicle. KEY 3 28
17. Ligule membranous; culms stiff, much branched; inflorescence slender and loose, rhachis narrow with spaced involucre-stumps. 15. *P. stramineum*
 - Ligule ciliate. 18
18. Plant woody, suffrutescent; leaves glaucous, inrolled. 16. *P. divisum*
 - Plant tufted or rhizomatous, not woody. 19
19. Rhachis angled with sharp, decurrent wings below the involucre-scars; annual. 17. *P. ramosum*
 - Rhachis not winged, cylindrical, usually with rounded ribs; perennials (except *P. pumilum*). 20
20. Spikelets 7-12 mm long, mat-forming perennial with trailing rhizomes and stolons. 18. *P. riparium*
 - Spikelets 2.5-5.5 mm long. 21
21. Upper glume 3/4 spikelet length or more; culms bushy, rigid, fasciculately branching at the nodes. 19. *P. meianum*
 - Upper glume up to 1/2 spikelet length; culms erect or ascending, not fasciculately branching. 22
22. Lower lemma 1/6-1/2(-2/3) spikelet length, 0-1-nerved, usually cuspidate or mucronate. 23
 - Lower lemma more than 3/4 spikelet length, 3-7-nerved, obtuse to acuminate. 26
23. Inflorescence 1-2 cm long, ovoid to oblong; culms 5-20 cm high; culm-sheaths inflated. 20. *P. humile*
 - Inflorescence 2.5-11 cm long, linear (occasionally narrowly oblong); culms 25-100 cm high; culm-sheaths tight. 24
24. 5-14 bristles in each involucre. 21. *P. thunbergii*
 - 1-2(-3) bristles in each involucre. 25
25. Loosely tufted perennial; culms decumbent and rooting at the base; leaf-blades linear, spikelets 4-4.5 mm long; bristles 7.5-8.2 mm long. 22. *P. uliginosum*
 - Delicate, densely tufted perennial; culms wiry, erect; leaf-blades filiform; spikelets 3 mm long, bristles 5-5.5 mm long. 23. *P. thulinii*

26. Small annual; culms 10–18 cm high; each spikelet subtended by a single involucre bristle.
 24. *P. pumilum*
 – Perennials 45 cm to 2 m or more high; each spikelet surrounded by many involucre bristles. 27
27. Rhizomatous perennial; culms 50 cm to 2 m or more high, often reed-like; usually glabrous at the summit; inflorescence 8–30 cm long.
 25. *P. macrourum*
 – Densely tussocky perennial; culms 45 cm to 1.2 m high, villous at the summit; inflorescence 5–12 cm long. 26. *P. sphacelatum*

KEY 3

28. Bristles several below each spikelet; inflorescences terminal and also axillary, or if all axillary forming a scanty false panicle. 29
 – Bristles solitary below each spikelet; inflorescences all axillary, usually many, gathered into a copious false panicle. 32
29. Inflorescences 6–32 cm long; involucre bristles 20–30, obvious, mostly exceeding the spikelet, the longest 15–25 mm long. 30
 – Inflorescences 2–7 cm long; involucre bristles 2–9(–15), mostly obscure, only the longest exceeding the spikelet, this 3.6–11 mm long. 31
30. Nodes black, glabrous; rhachis with sessile involucre-scars 27. *P. trachyphyllum*
 – Nodes pale, silky-villous; rhachis with peg-like involucre-scars 0.3–0.5 mm long. 28. *P. glaucifolium*
31. Longest bristle 7–11 mm, clearly exceeding spikelet; lower leaf-sheaths glabrous (except margins). 29. *P. trisetum*
 – Longest bristle 3.6–4.5 mm, scarcely exceeding spikelet; lower leaf-sheaths tuberculate-hispid. 30. *P. beckeroides*
32. Perennials, usually robust; leaf-blades firm; spikelets scaberulous. 33
 – Annuals; leaf-blades thin and flaccid; spikelets spinulose-scabrid. 34
33. Inflorescences 1–5 in each leaf-axil; bristles up to 25 mm long. 31. *P. unisetum*
 – Inflorescences crowded in fascicles of up to 12 in each leaf-axil; bristles 5–9 mm long. 32. *P. pirottae*
34. Lower leaf-blades rounded or cordate, abruptly contracted into a false petiole. 33. *P. petiolare*
 – Lower leaf-blades gradually narrowed into a false petiole. 34. *P. nubicum*

1. *P. squamulatum* Fresen. (1837);
 – type: Ethiopia, GD, Semien [Simen], Rüppell s.n. (FR holo.).
P. pentastachyum A. Rich. (1850) - types: Ethiopia, TU, Tacazze, *Quartin Dillon* (P syn.) & *Ouadgerate*, *Petit* (P syn.) & Mt. Scholoda, *Schim-per* 315 (P syn., K isosyn.).

P. pentastachyum A. Rich. var. *violaceum* Avetta in *Ann. Ist. Bot. Roma* '6: 64 (1895) - type: Ethiopia, SU, *Ragazzi* (FT holo.).

P. proximum Weeke (1907) - type: without locality, *Schimper* 851 (K iso.).

Dense tussocky perennial; culms erect, moderately slender to stout, 60 cm to 2 m high. Leaf-blades tough, (3–)6–20 mm wide, glabrous or shortly hispid, narrowed to the sheath, the tip filiform. Inflorescence linear, 10–20 cm long; rhachis pubescent, bearing involucre-stumps 0.5 mm long. Involucres comprising 3–6 male spikelets on a short axis, surrounding a single terminal fertile spikelet of different shape, all invested in many bristles (longest 10–20 mm long), the inner bristles plumose; spikelets 5–8 mm long on pedicels 1.5–4 mm long. Male spikelets narrowly oblong, laterally compressed, membranous; lower glume tiny; upper glume 1/3–3/4 spikelet length, acuminate; lower lemma 2/3 to almost equalling upper lemma, acute. Fertile spikelet narrowly elliptic, dorsally compressed; glumes distant, the lower almost suppressed, the upper to 1/5 spikelet length; lower lemma ovate, up to 1/4 (rarely 1/2) spikelet length, broadly obtuse to acute; upper lemma sharply acute to caudate-acuminate. Fig. 104:4, 5.

Stony slopes and roadsides; 1100–2400 m. EW TU GD GJ SU KF GG HA; Kenya and N Tanzania. *Ash* 2246; *Gilbert & Thulin* 486; *Sandford* Mg3 (ETH).

P. squamulatum varies considerably in the height and robustness of its culms and width of its leaf-blades, but can always be distinguished from other Ethiopian species (except the much rarer *P. schweinfurthii*) by its involucre of pedicelled spikelets comprising a cluster of male spikelets surrounding a central bisexual spikelet of different shape.

2. *P. schweinfurthii* Pilger (1901);

– type: Sudan/Ethiopia border, GD, Matamma [Chatamma], *Schweinfurth* 1500 (K iso.).

Stout annual; culms erect, 1–2 m high. Leaf-blades flat, 2–3 cm wide, tuberculate-hispid or glabrescent, rounded or slightly cordate at the base, acuminate. Inflorescence linear, 14–20 cm long; rhachis woolly, bearing conspicuous, peg-like, often recurved involucre-stumps 1.5–4 mm long. Involucres comprising a circlet of 4 male spikelets surrounding one fertile spikelet of different shape, all invested in numerous short bristles (longest 20 mm long), the inner shortly plumose; spikelets 8–9 mm long, their pedicels 0.5–1 mm long. Male spikelets narrowly oblong, laterally compressed; lower glume vestigial; upper glume and lower lemma equalling the spikelet, coriaceous, subacute and shortly mucronate; upper lemma similar but slightly shorter and thinner. Fertile spikelet narrowly elliptic-oblong, dorsally compressed; lower glume vestigial; upper glume and lower lemma 1/5 spikelet length; upper lemma sharply acute.

Clay soils; c 1000 m. GD; Sudan.

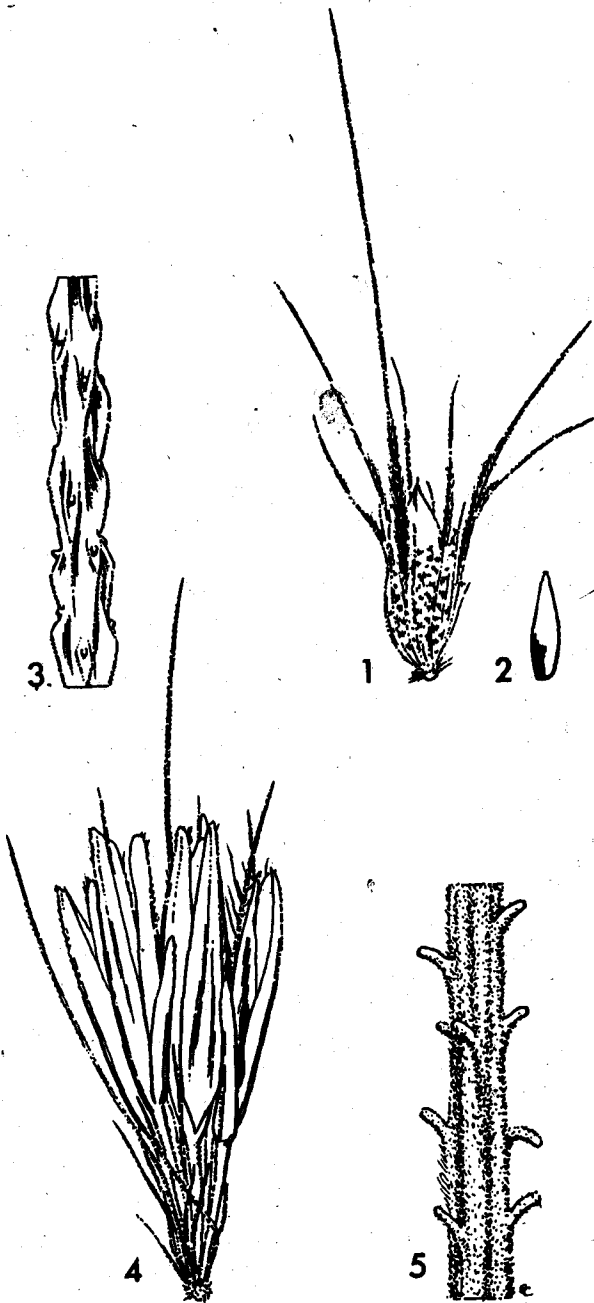


Figure 104. *Pennisetum polystachion*: 1 - involucre x 7; 2 - upper floret x 7; 3 - rhachis x 9. *P. squamulatum*: 4 - involucre x 7; 5 - rhachis x 9. 1-3 from Mogk 366; 4 & 5 from Tore Ouren 21354. Drawn by Eleanor Catherine.

A grass of very local distribution in eastern Sudan and just extending over the border into Ethiopia, but apparently frequent within this area. Although closely related to *P. squamulatum*, *P. schweinfurthii* can be distinguished at a glance by its stouter, woolly inflorescence axis bearing much longer, spreading involucre-stumps. The involucre-stumps are also more compact and less feathery due to the shorter pedicels and the larger, coriaceous male spikelets obscuring the few plumose bristles, which only become evident when the male spikelets are turned back.

3. *P. polystachion* (L.) Schult. (1824);

Panicum polystachion L. (1759) - type: India (LINN holo.).

Tufted annual or short-lived perennial; culms much-branched, 75-200 cm high; leaf-blades linear, flat, 4-10 mm wide. Inflorescence linear, 10-20 cm long; rhachis angular with sharp decurrent wings below the involucre scars, the involucre-stumps densely packed, often spreading at right angles to the rhachis at maturity. Involucres comprising many bristles encircling and obscuring a single sessile spikelet; bristles densely ciliate in the lower half with crinkled and matted hairs, longest bristle 10-20 mm long. Spikelets narrowly lanceolate, 3-4.5 mm long; lower glume absent or a small triangular scale; upper glume equalling the spikelet, obtuse, apiculate; lower lemma slightly shorter, male or sterile, obtusely 3-lobed; upper floret 2/3 spikelet length, cartilaginous, smooth and shiny, readily deciduous at maturity. Fig. 104:1-3.

Open grassland, by roadsides and in disturbed places; 400-1700 m. TU GD GJ SU WG IL KF GG; throughout the tropics; sometimes cultivated for pasture or fodder. Ash 3110; Gereau 1328; Mesfin & Kagnew 2245.

P. polystachion is a widespread and polymorphic species, varying in vigour, duration (annual or perennial) and in bristle length and colour (purplish or yellowish). A variant with glabrous bristles, subsp. *atrichum* (Stapf & C.E. Hubb.) Brunken, is widespread in tropical Africa, but has not yet been found in Ethiopia.

The softly crinkled involucre-stumps and the shiny, deciduous upper floret are both clear-cut characters for distinguishing it from all other Ethiopian species (except the closely related *P. pedicellatum*).

4. *P. pedicellatum* Trin. (1834);

- type: Cape Verde Is., Peters s.n. (whereabouts uncertain, not LE).

Tufted annual; culms much branched, 30-150 cm high; leaf-blades flat, 5-11 mm wide. Inflorescence linear, 8-12 cm long, moderately dense; rhachis angular with sharp decurrent wings below the involucre scars. Involucres fluffy, comprising many slender bristles enclosing and obscuring 1-5 spikelets, at least one spikelet pedicellate (the spikelet pedicellate in 1-spiculate forms); pedicels 0.5-3.5 mm long, hairy; bristles densely woolly-ciliate with crinkled, matted hairs around the spikelet, longest bristle 15-25 mm long. Spikelets 3.5-5.5 mm long, fluffy at the base; lower glume 1/3-3/4 spikelet length, the margins ciliate with long crinkled hairs; upper glume equalling the spikelet, obtuse, apiculate; lower lemma slightly shorter, male or sterile, 3-lobed; upper floret 3/4 spikelet length, cartilaginous, smooth and shiny, readily deciduous at maturity.

Bushed stony hillsides and in disturbed, weedy places; 600-1200 m. Westwards to Senegal; coastal East

Africa and Zambia; also recorded from India and Thailand. Sometimes grown for pasture or forage.

subsp. *pedicellatum*

P. lanuginosum Hochst. (1844) - type: Sudan, Kotschy 394 (K iso.).

P. lanuginosum Hochst. var. *majus* Hochst. in *Flora* 27: 253 (1844) - type: Ethiopia, Tacaze, Schimper 793 (K iso.).

P. amoenum A. Rich. (1850); *P. pedicellatum* var. *amoenum* (A. Rich.) Chiov. in *Ann. Ist. Bot. Roma* 8: 315 (1908) - types: Ethiopia, TU, Aderbati, Quartin Dillon & Petit (P syn.) & Schimper 641 (P syn.).

P. dillonii Steud. (1854) - type: Ethiopia, TU, Aderbati, Quartin Dillon 164 (K iso.).

P. pedicellatum var. *pallidum* Chiov. in *Ann. Ist. Bot. Roma* 8: 314 (1908) - types: Eritrea, Moccada, Pappi 2475 and many other syntypes (all FT syn.).

Spikelets (2-)3-5 in each involucre; at least one pedicel 1.5-3.5 mm long.

EW TU GD. Hemming 1018; Parker 403.

subsp. *unispiculum* Brunken in *Journ. Linn. Soc.* 79: 62 (1979);

- type: Ghana, Rose Innes GC30227 (K iso.).

Spikelets 1(-2) in each involucre; pedicel 0.5-1.5 mm long.

GD GJ SU. Aweke & Gilbert 1029a; Mesfin & Kagnew 1565; Tewolde Berhan 808 (ETH).

This subspecies may reflect introgression from *P. polystachion*. It intergrades with subsp. *pedicellatum* through 2-spiculate forms with a short pedicel.

5. *P. purpureum* Schumach. (1827);

- type: Ghana, Thonning (C holo., BM iso.).

Robust perennial forming large, bamboo-like clumps, sometimes producing stolons; culms 2-6 m high, often rooting at the base, many-noded, branching. Leaf-blades flat, to 120 cm long and 5 cm wide, glabrous or stiffly hairy, the midrib prominent. Inflorescence linear, dense, 7-30 cm long; rhachis densely pubescent, closely beset with small involucre-stumps. Involucres comprising many slender bristles enclosing 1-5 spikelets; inner bristles thinly ciliate (sometimes sparsely or even glabrous), the longest 10-40 mm long; terminal spikelet fertile, sessile, other spikelets (when present) similar but male on pedicels c 1 mm long. Spikelets 5-7 mm long, lanceolate, gibbous; lower glume vestigial or absent; upper glume 1/4-1/2 spikelet length, acute; lower lemma male or barren, 1/2-3/4 spikelet length, acuminate; upper lemma membranous and obviously 5-nerved above, toughened, smooth and shiny in the lower third, acuminate; anther-tips penicillate. $2n=28$.

Riversides, forest margins and other disturbed sites on fertile soils; up to 2400 m. SU IL (cult. in KF); widespread in moister areas of tropical Africa; intro-

duced throughout the tropics and subtropics. "Elephant Grass", "Napier Grass". Meyer 9092; Siegenthaler 1496.

P. purpureum is a valuable pasture and fodder grass, widely cultivated throughout the tropics and subtropics in areas of sufficient rainfall, and a wide range of cultivars has been developed.

6. *P. glaucum* (L.) R. Br. (1810);

Panicum glaucum L. (1753) - type: Sri Lanka, Hermann (BM holo.).

Pennisetum spicatum (L.) Koernicke (1885).

P. americanum (L.) Leeke (1907).

P. typhoides (Burm.) Stapf & C.E. Hubb. (1933).

P. echinurus (K. Schum.) Stapf & C.E. Hubb. (1933).

P. vulpinum (A. Br. & Bouché) Stapf & C.E. Hubb. (1933).

P. perspiciosum Stapf & C.E. Hubb. (1933).

Robust annual; culms often exceeding 3 m; leaf-blades 1 m or more long, up to 7 cm wide. Inflorescence 10-150 cm long, linear to broadly elliptic, dense; rhachis tomentose. Involucres persistent, with a basal stipe 1-25 mm long, comprising 1-9 spikelets enclosed by almost glabrous to densely plumose bristles, these often shorter than the spikelets. Spikelets obovate, 3-6 mm long; upper lemma ovate, pubescent along the margins upwards; anther-tips penicillate; grain swollen, protruding from the spikelet. $2n=14$.

Western lowlands from Eritrea to Illubabor and in lowland Harerge; usually interplanted with *Sorghum*.

P. glaucum is a crop plant ("pearl millet", "bulrush millet") widely cultivated in Africa in areas of low rainfall for both fodder and grain. It is particularly important in the Sahel zone of West Africa.

P. glaucum is generally supposed to be a cultivated derivative of *P. violaceum* (Lam.) L. Rich. The determination of the correct scientific name for this plant has been plagued by much nomenclatural controversy [see Terrell in *Taxon* 25: 297-304 (1976); Kerguelen in *Bull. Soc. Bot. Fr.* 124: 341 (1977)]. The taxonomic treatment of the considerable variation within the crop has been equally diverse. Previously very many different species of local distribution were described [e.g. Stapf in *Fl. Trop. Afr.* 9: 1029-1053 (1934)], but nowadays the crop plant is treated as a single species subdivided into cultivars [Brunken in *Econ. Bot.* 31: 163-174 (1977); Bono in *Agron. Trop.* 28: 229-355 (1973)].

P. glaucum, the weedy annuals associated with it and the perennial species *P. purpureum* form the section *Pennisetum* of the genus, characterized by penicillate anther-tips, a partially indurated shiny upper floret and ciliate bristles. They cross readily to produce hybrids, the sterile triploid hybrid *P. purpureum* \times *P. glaucum* being sometimes also cultivated for fodder. The systematics of the section are discussed by Brunken in *Amer. J. Bot.* 64: 161-176 (1977).

7. *P. violaceum* (Lam.) L. Rich. (1805);

Panicum violaceum Lam. (1791) - type: Senegal, Roussillon (P holo.).

Penicillaria fallax Fig. & De Not. (1854); *Pennisetum fallax* (Fig. & De Not.) Stapf & C.E. Hubb. (1933) - type: Sudan, Figari (GE holo.).

Pennisetum mollissimum Hochst. (1844).

Pennisetum americanum (L.) Leeke subsp. *monodii* (Maire) Brunken in *Amer. J. Bot.* 64: 170 (1977).

Annual; culms slender to stout, up to 3 m high, the nodes pubescent. Leaf-blades linear, up to 2.5 cm wide, scabrid above and on the margins. Inflorescence linear, dense, 3–20 cm long; rhachis tomentose, closely beset with short involucre stumps. Involucres sessile, with many slender bristles surrounding 1–2 shortly pedicelled spikelets; bristles thinly ciliate to densely plumose, the longest up to 18 mm long. Spikelets 4–7 mm long, lanceolate, slightly gibbous; glumes reduced to small rounded scales up to 1 mm long or the lower suppressed; lower lemma as long as the spikelet and male or much shorter and sterile, acuminate; upper lemma subequalling the spikelet, membranous, scaberulous and obviously 5-nerved near the tip, becoming indurated, smooth and shiny below, anther-tips penicillate. $2n=14$.

A weed of disturbed habitats on sandy soils. EW; westwards to Senegal and in the foothills of the central Saharan mountains. *Pappi* 6036.

P. violaceum is a polymorphic annual weed of the Sahel zone which hybridizes freely with the crop plant *P. glaucum* (L.) R. Br., and on this account it is treated by Brunken (1977) as a subspecies of the latter. However, from a practical point of view it seems more convenient to separate specifically the wild forms of this complex with deciduous, sessile involucre from the crop plant.

There is a great deal of variation within *P. violaceum* in the degree of hairiness of the bristles. Specimens with only thinly hairy bristles have been separated as *P. fallax*, but there is continuous variation into forms with densely fluffy involucre, even within single populations.

8. *P. sieberianum* (Schlecht.) Stapf & C.E. Hubb. (1933);

Penicillaria sieberiana Schlecht. (1852) - type: Ethiopia/Sudan border, Matamma, Schweinfurth 1194 (K iso.).

Pennisetum americanum (L.) Leeke subsp. *stenostachyum* (A. Br. & Bouché) Brunken in *Amer. J. Bot.* 64: 173 (1977).

P. dalzielii Stapf & C.E. Hubb. (1933).

Robust annual; culms often exceeding 3 m; leaf-blades 1 m or more long, up to 4 cm wide. Inflorescence 5–150 cm long, dense; rhachis tomentose. Involucres deciduous, with a basal stipe 0.3–1.5 mm long, comprising

usually 2 spikelets enclosed by almost glabrous to densely plumose bristles which shortly exceed the spikelets. Spikelets lanceolate to obovate, 4–6 mm long; upper lemma lanceolate to ovate, scaberulous to pilose near the margins upwards; anther-tips penicillate; grain somewhat swollen, enclosed within the spikelet or protruding from it. $2n=14$.

A weed in actively cultivated or recently abandoned fields of *P. glaucum*. Eritrea, GD; westwards through the Sahel zone to Senegal; also in Angola and Namibia.

P. sieberianum hybridizes freely with *P. glaucum* and mimics the crop vegetatively, but sheds its involucre at maturity; it seems to persist only for a year or two after cultivation ceases. It hybridizes equally freely with *P. violaceum* and is thought to have arisen by hybridization between *P. glaucum* and *P. violaceum*, followed by selection pressure to vegetatively mimic the crop and hence survive within it.

9. *P. clandestinum* Chiov. (1903);

P. longistylum Hochst. ex A. Rich. var. *clandestinum* (Chiov.) Leeke in *Zeitschr. Naturwiss.* 79: 23 (1907) - type: Ethiopia, Schimper 2084 (whereabouts uncertain).

Low, sward-forming perennial with slender rhizomes and extensive, stouter, much branched stolons closely clothed with subinflated, imbricate leaf-sheaths. Vegetative shoots to 20 cm high with linear, flat leaf-blades to 15 cm long and 2–5 mm wide; flowering shoots more compact, 2–4 cm high with leaf-blades 1–4 cm long. Inflorescence reduced to a cluster of 2–4 spikelets enclosed within the uppermost leaf-sheath, only the spikelet-tips protruding; involucre bristles very delicate, 1/2–3/4 as long as the spikelets. Spikelets narrowly lanceolate, papyraceous, 13–20 mm long, acuminate; lower glume absent; upper glume cuff-like, usually 1–3 mm long (sometimes absent); lower lemma 10–13-nerved, equalling the spikelet, sterile; upper fertile lemma similar; anthers long-exserted on thread-like filaments up to 5 cm long; stigma simple or shortly bifid, up to 3 cm long. Fig. 105:4.

Forest clearings, lake shores, grassy areas and roadsides; 1400–3000 m. EW GD SU SD BA HA; the highlands of East Africa; widely introduced to upland areas in the tropics and to the subtropics as a pasture grass. Gillett 14776; M.G. & S.B. Gilbert 1308; De Wilde 7470 (ETH).

P. clandestinum is widely cultivated under the name "Kikuyu Grass". It forms a close sward resistant to grazing on fertile soils in highland areas. The anthers emerge at night on their long filaments and are visible in the morning as a greyish-white haze over the sward.

10. *P. longistylum* Hochst. ex A. Rich. (1850);

- type: Ethiopia, TU, Adoa, Schimper 65 (P holo., K iso.).

Low, mat-forming, rhizomatous perennial; culms 10–20 cm high. Leaf-blades flat, to 20 cm long, 0.5 mm wide; leaf-sheaths imbricate, papery. Inflorescence oblong, 3.5–4 cm long, shortly exerted or the base included within the uppermost leaf-sheath. Involucres composed of many slender bristles encircling a single sessile spikelet, most bristles about as long as the spikelet, the longer stouter ones thinly plumose in the lower third, to 2.5 cm long. Spikelets narrowly lanceolate, 14–16 mm long; lower glume vestigial; upper glume ovate, thin, 1/6–1/4 the length of the spikelet; lower lemma male or barren, almost equalling the spikelet, closely and prominently 11–15-nerved, obtuse; upper lemma similar, acute; stigma simple or shortly bifid, up to 3 cm long.

Stream banks; 1500–2500 m. EW TU GD SU; unknown elsewhere. *Baldrati* 31; *Pappi* 873.

This seldom-collected species forms a link between the anomalous *P. clandestinum* and the more typical *Pennisetum* species *P. villosum*. All three are low-growing, much-branched rhizomatous perennials with narrowly lanceolate, prominently multi-nerved spikelets and a simple stigma. The short, few spiculate inflorescence of *P. longistylum* is intermediate between the much-reduced, enclosed spikelet cluster of *P. clandestinum* and the densely spiculate head of *P. villosum*. Likewise, its relatively short, sparsely ciliate involucre bristles are intermediate between the few short scaberulous bristles of *P. clandestinum* and the long, conspicuously plumose bristles of *P. villosum*.

11. *P. villosum* Fresen. (1837);

Cenchrus villosus (Fresen.) O. Kuntze (1898) - type: Ethiopia, GD, Semien [Simen], *Rüppell* s.n. (FR holo.).

P. villosum var. *humile* Hochst. ex A. Rich., *Tent. Fl. Abyss.*, 2: 387 (1850) - type: Ethiopia, TU, Adoa, *Schimper* 316 (K iso.).

P. villosum x *P. ruppellii* Chiov. in *Ann. Ist. Bot. Roma* 8: 320 (1908) based on: Eritrea, Scimezana, *Pappi* 716 & Amasen, *Micheletti* 125 (both FT).

P. longistylum hort., non Hochst.

Low, mat-forming rhizomatous perennial; culms loosely geniculately ascending, 12–45 cm high; leaf-blades flat, 3–5 mm wide. Inflorescence densely ovoid to subspherical, 5–10 cm long and wide. Involucres comprising a whorl of numerous, slender bristles 3.5–6.5 cm long enclosing 1–2 subsessile spikelets; bristles softly plumose in the lower 1/3–1/2 (or occasionally the outer sparsely plumose or glabrous), supported by a basal bearded stipe 0.5–1 mm long. Spikelets lanceolate, 9–12 mm long; lower glume vestigial or a rounded nerveless scale to 1 mm long; upper glume lanceolate, 1-nerved, 1/2 spikelet length, acuminate; lower lemma male or sterile, equalling the spikelet, narrowly lanceolate, prominently and closely 6–13-nerved, sharply acuminate; upper lemma similar, 5-nerved, coriaceous

in the lower half, stigma simple or bifid near the tip. Fig. 105:3.

Roadsides and open grassy places; 1800–2800 m. EW TU GD WU SU HA; N Somalia, Arabian peninsula; cultivated as an ornamental in warm regions of the world. *Ash* 2060; *Bally* 10050; *Mooney* 4834.

A conspicuously showy grass, the large, softly plumose, subspherical inflorescences distinguishing it from all other species of *Pennisetum*.

12. *P. yemense* Defters (1889);

- type: Yemen, *Defters* 369 (P holo.).

P. pappianum Chiov. (1905); *P. ruppellii* x *P. longistylum* Chiov. in *Ann. Ist. Bot. Roma* 8: 319 (1908) - type: Eritrea, Ocule Cusai, *Pappi* 1502 (FT holo.).

Perennial from a short woody rhizome; culms ascending, 30–80 cm high; leaf-blades flat or folded, 4–5 mm wide, tapering to a fine, scaberulous tip. Inflorescence oblong, dense, 5–16 cm long and 2.5–4.5 mm wide, purple-tinged; rachis pubescent, ribbed with sessile scars. Involucres comprising many slender bristles enclosing 1(–2) spikelets, supported by a basal stipe to 1 mm long; inner bristles ciliate, sometimes sparsely, longest bristle 25–40 mm long. Spikelets lanceolate, 6.5–10 mm long; lower glume a nerveless scale up to 1 mm long; upper glume lanceolate, 1-nerved, 1/3–1/2 spikelet length, acuminate; lower lemma male or sterile, equalling the spikelet, 7–9-nerved, acuminate; upper lemma similar, thinly coriaceous below, 5–7-nerved; stigma bifid.

Stream banks; 2500 m. EW; N Yemen and adjacent parts of Saudi Arabia. *Baldrati* 2791.

P. yemense is somewhat similar in facies to *P. orientale* L. Rich., a species from North Africa and Arabia which is to be expected in Eritrea. However, this has a longer, looser inflorescence, stipitate hairier involucres which usually contain more than one spikelet, and a 3–5-nerved lower lemma. The long, multi-nerved lower lemma of *P. yemense* links it more closely to *P. villosum* and its allies.

13. *P. setaceum* (Forssk.) Chiov. (1923);

Phalaris setacea Forssk. (1775) - type: Egypt, *Forsskål* (whereabouts uncertain, not C).

P. macrostachyum Fresen. (1837), non (Brogn.) Trin. (1834); *P. ruppellii* Steud. (1854), *nom. superfl.* - type: Ethiopia, TU, Halei to Temben, *Rüppell* s.n. (FR holo.).

P. ruppellii Steud. var. *depauperatum* Schweinf. in *Bull. Herb. Boiss.* 2, App. 2: 96 (1894) - type: Eritrea, Mahio, *Schweinfurth* 25 (Z holo.).

P. orientale Rich. var. *altissimum* Chiov. in *Ann. Ist. Bot. Roma* 7: 66 (1897) - type: Ethiopia, TU, Goelleb, *Schimper* 2130 (K iso.).

P. scoparium Chiov. (1903) - type: Eritrea, Habab, *Terracciano* & *Pappi* 1597, 1601, 1602 & 1603 (all FT syn.).

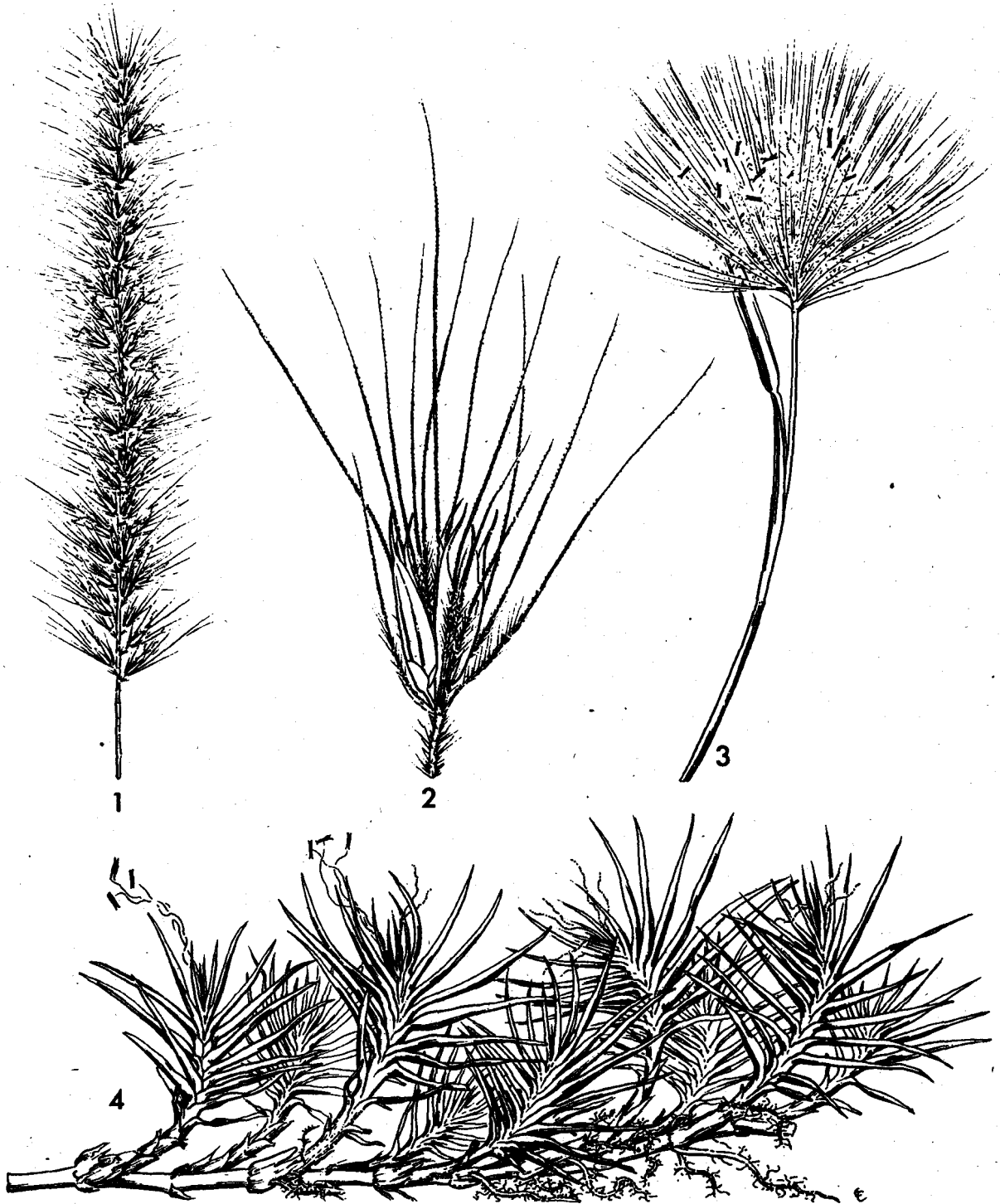


Figure 105. *PENNISETUM* spp.: *P. SETACEUM*: 1 - inflorescence x 1/2; 2 - involucre x 4. *P. VILLOSUM*: 3 - inflorescence x 1/2. *P. CLANDESTINUM*: 4 - habit x 3/4. 1 & 2 from *Imp. Coll. Agric. B43*; 3 from *Ash 2033*; 4 from *Chandler 2583*. Drawn by Eleanor Catherine.

P. erythraeum Chiov. (1903) - type: Eritrea, As-saorta, *Terracciano & Pappi 3228* (FT holo.).

Tough glaucous perennial forming dense tussocks; culms 20-90 cm high. Leaf-blades rigid, convolute, 1-2.5 mm wide, the midrib thickened, appearing as a deep groove or broad pale band on the upper (inner) surface. Inflorescence linear, 10-25 cm long, pallid or purple-tinged; rhachis pubescent, ribbed, involucre scars sessile. Involucre axis extended below as a slender villous

stipe 1-3 mm long, the longer bristles loosely plumose (longest 2.5-4 cm long), enclosing 2-4 spikelets, the terminal spikelet sessile, the remainder shortly pedicelled. Spikelets narrowly lanceolate, 5-7 mm long; lower glume vestigial to 1/3 spikelet length, broadly obtuse; upper glume 1/2-3/4 spikelet length, acuminate; lower lemma equalling the spikelet, male or sterile, acuminate; upper lemma resembling the lower.

Fig. 105: 1, 2.

Dry stony soils and in rock crevices; 1000–2500 m. EW TU WU GJ SU GG SD HA; Kenya and N Tanzania, Somalia, Sudan; also in N Africa and SW Asia; cultivated in many warm regions as an ornamental. *Bally* 7092; *Burger* 1071; *Gilbert & Getachew* 2701.

The inner bristles may rarely be only very sparsely plumose or even completely glabrous (*P. scoparium*, *P. erythraeum*).

The panicles are frequently infested with ants, which lay their eggs among the spikelet scales.

14. *P. gracilescens* Hochst. (1855);

- type: Ethiopia, TU, Dschadscha, *Schimper* in Herb. Buchinger 1411 (STR holo., K iso.).

Slender perennial; culms smooth and glabrous, rigid, many-noded, fasciculately branched, decumbent and rooting below, then ascending to 50–65 cm. Leaf-blades narrowly linear, 1–4 mm wide, with setaceous tips. Inflorescence linear, 8–15 cm long; rhachis ribbed, scaberulous, bearing short peduncle-stumps. Involucres comprising a single sessile spikelet encircled by many slender bristles; bristles mostly plumose in the lower half, the longest 17–25 mm long. Spikelets 3.2–4.7 mm long, narrowly elliptic-oblong, thinly membranous; glumes ovate, the lower 1/4–1/3 spikelet length, obtuse, the upper 1/2–2/3 spikelet length, sharply acute; lower lemma sterile, equalling the spikelet, 3–5-nerved, acute and mucronate (mucro 0.5–1 mm long); upper lemma slightly shorter, 3–5-nerved, briefly mucronate.

Among damp rocks; 1800–2500 m. EW TU SU; Sudan (Jebel Marra). *Schimper* 255 (probably = 1411) & 1065; *Pappi* 3054; *Tewolde Berhan* 1193 (ETH).

15. *P. stramineum* Peter (1930);

- type: Tanzania, *Peter* 43215 (B holo., destr.).

Perennial from a short tough rhizome; culms slender, stiff, much branched, 30–120 cm high. Leaf-blades flat, 2–9 mm wide, often pubescent, margins smooth, tip finely attenuate; ligule membranous, lacinate. Inflorescence linear, 2–15 cm long, slender and rather loose; rhachis sinuous, narrowly triquetrous, smooth or scaberulous with spaced involucre-stumps. Involucres comprising many scabrid bristles enclosing 1–2 sessile spikelets (2nd spikelet often reduced); longest bristles 6–12 mm long. Spikelets lanceolate, 4–5.5 mm long; glumes ovate, subacute, the lower up to 1/4 spikelet length, the upper 1/3–2/3 spikelet length; lower lemma male, equalling the spikelet, scaberulous upwards, acuminate-mucronate; upper lemma similar but slightly shorter.

Acacia bushland, often on black clays; 1700 m. SD; Kenya, Tanzania, Somalia and N Yemen. *Gilbert & Jefford* 4497.

16. *P. divisum* (Gmel.) Henr. (1938);

Panicum divisum Gmel. (1791) - type: Arabia, *Forsskål* (C holo.).

Woody perennial from a short rhizome; culms suffruticosely branched, forming bushes up to 150 cm high. Leaf-blades stiff, glaucous, up to 7.5 cm long, 1–1.5 mm wide, tightly convolute, often shorter than the sheath, pungent; leaf-sheaths loose, the lower with deciduous blades. Panicle oblong, 5–12 cm long; rhachis slender, finely scaberulous, narrowly angular with well-spaced, sessile, cupular involucre-scars. Involucres comprising a single sessile spikelet enclosed by numerous bristles, seated on an oblong stipe 0.5–1 mm long; bristles glabrous or occasionally the inner thinly ciliate with tubercle-based hairs, the longest 7–20 mm long. Spikelets narrowly lanceolate, 6.5–8.5 mm long; lower glume 1–3-nerved, 1/2–3/4 spikelet length, acute to acuminate; upper glume subequalling the spikelet, 7-nerved, acute to acuminate; lemmas similar, the lower male, both as long as the spikelet, 5-nerved, sharply acuminate.

Stony ground and sand in deserts; EW; N Somalia, N Africa, the Middle East, Arabia, Pakistan and NW India. *Pappi* 8386.

17. *P. ramosum* (Hochst.) Schweinf. (1867);

Gymnothrix ramosa Hochst. (1844) - type: Sudan, *Kotschy* 199 (K iso.).

Pennisetum arvense Pilger (1901) - type: Ethiopia, TU, Hamedo, *Schimper* 1058 & GD, Dembea, *Schimper* 1399 (both K isosyn.).

Tufted annual; culms coarse, 50–150 cm high, much branched, with dark nodes, scabrid below the inflorescence. Leaf-blades somewhat glaucous, often folded, 4–10 mm wide, margins with spaced teeth, subacute; leaf-sheaths keeled. Inflorescence narrowly oblong, dense, 2–6 cm long; rhachis stiff, closely beset with cupuliform involucre-scars, strongly angled with sharp, decurrent wings below the scars, hispidulous. Involucres narrow, a single whorl of stiff, scaberulous bristles enclosing one sessile spikelet; bristles connate at the extreme base, the longest 10–20 mm long. Spikelets 5–7 mm long; lower glume 1/6–1/4 spikelet length; upper glume subequalling the spikelet, 7-nerved, sharply acute; lower lemma male or sterile, equalling the spikelet, similar to the upper glume, 5-nerved; upper lemma thinly coriaceous, acuminate-mucronate. Fig. 106:3, 4.

Rough grassland and as a weed of arable land and roadsides, often on heavy black clays in seasonally wet areas; 1200–2000 m. EW TU GD GJ SU AR KF GG SD; westwards to Nigeria; East Africa. *Friis* et al. 538; *Mesfin & Kagnew* 1788; *Fröman* 3265.

With its slightly connate, flattened bristles, *P. ramosum* lies on the borderline between *Pennisetum* and *Cenchrus*.

P. ramosum can be distinguished from all other Ethiopian species except *P. polystachion* and *P. pedicellatum* by its conspicuously angled and winged rhachis, and from these two by its stiff, glabrous bristles and persistent upper floret.

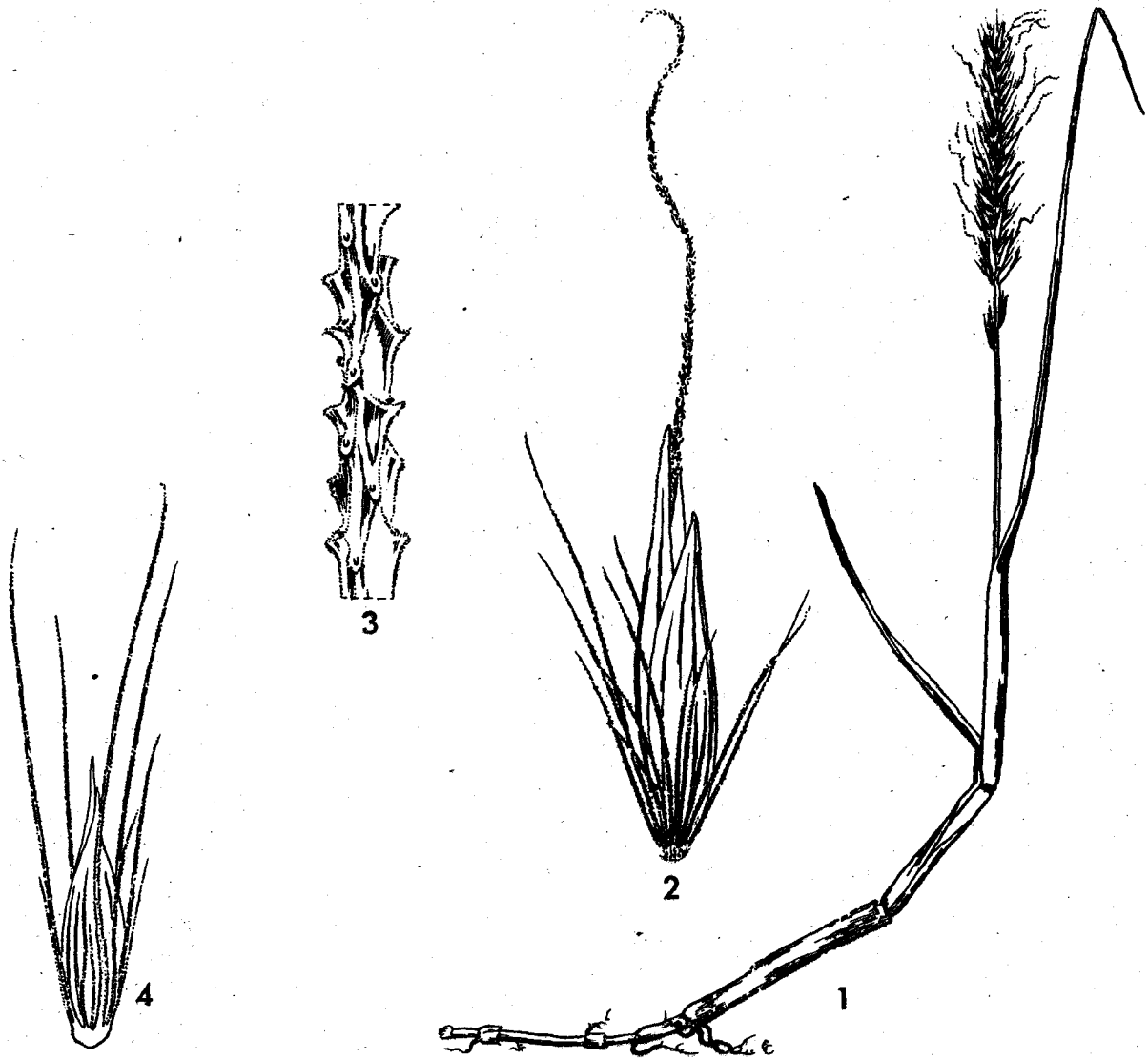


Figure 106. *PENNISETUM RIPARIUM*: 1 - habit x 3/4; 2 - involucre x 7. *P. RAMOSUM*: 3 - rhachis x 9; 4 - involucre x 7. 1 & 2 from Ash 2045; 3 & 4 from Friis et al. 538. Drawn by Eleanor Catherine.

18. *P. riparium* Hochst. ex A. Rich. (1850);

Gymnothrix riparia (Hochst. ex A. Rich.) Walp. (1852) - type: Ethiopia, TU, Adua, Schimper 84 (P holo., K iso.).

P. dowsonii Stapf & C.E. Hubb. (1933) - type: Kenya, Dowson 562 (K holo.).

P. salifex Stapf & C.E. Hubb. (1933).

Mat-forming perennial with long, stout, often spongy rhizomes and stolons; culms trailing and rooting at the nodes, eventually ascending up to 80 cm. Leaf-blades flat or folded, 3-6 mm wide. Inflorescence broadly linear, dense, 3-9 cm long, often enclosed at the base in the uppermost leaf-sheath; rhachis angular, scaberulous, the involucre-scars sessile. Involucres comprising 1-3 subsessile spikelets surrounded by many scabrid bristles \pm equalling or slightly shorter than the spikelets; spikelets 7-11 mm long, narrowly lanceolate; lower glume absent; upper glume a small nerveless scale up

to 1.5 mm long; lower lemma male or sterile, 1/3 as long to almost equalling the spikelet; 1-9-nerved; upper lemma 7-9-nerved, acute; stigma long-exserted, simple or bifid near the tip. Fig. 106:1, 2.

Semi-aquatic grass of marshy river banks and seasonally flooded meadows, sometimes floating; 2300-2700 m. TU SU; East Africa. Ash 2045; Gilbert 4087; Mooney 8151.

The length and nervation of the lower lemma is extremely variable in this species, ranging from a small 1-nerved scale, 1/3 the length of the spikelet, up to a well-developed 9-nerved lemma almost equalling that of the fertile floret. Specimens with 1-5-nerved lower lemmas ranging up to 2/3 of the spikelet length (the usual form in Ethiopia), have been separated as *P. dowsonii* Stapf & C.E. Hubb., but there is no clear discontinuity between such forms and those with longer lemmas. The length and nervation of the lower lemma may even increase from base to apex of a single inflorescence.

19. *P. mezianum* Leake (1907);

- types: Tanzania, Uhlig 1076 (K isosyn.) and several other syntypes.

Bushy perennial from a short rhizome; culms up to 100 cm high, slender, hard and rigid below, smooth, many-noded and fasciculately branched at the nodes to form dense clusters of short, leafy shoots. Leaf-blades flat or folded, 2–4 mm wide, glabrous. Inflorescence very dense, oblong, 1–3 cm long; rachis puberulous with sharply angled ribs and closely packed, cupuliform involucre-stumps. Involucres comprising one sessile spikelet surrounded by many scaberulous bristles, the base with an oblong, puberulous stipe 0.2 mm long; longest bristle 5–10 mm long. Spikelets 3.5–4.7 mm long; lower glume 1-nerved, half the spikelet length, acute; upper glume 5-nerved, 3/4 to almost as long as the spikelet, apiculate; lemmas equalling the spikelet, 5-nerved, acuminate-subulate, the lower male or sterile, membranous, the upper slightly firmer. Fig. 107:5–7.

Open grass plains or scrubland, favouring seasonally waterlogged black soils; 1250–1700 m. SD; Sudan, East Africa. Gilbert 3323; Gilbert & Jefford 4499; Gillett 14180.

P. massaicum Stapf is a closely related East African species which may also occur in Sidamo. It is distinguished by its thinly hairy leaves and scaberulous culm-tip.

20. *P. humile* Hochst. ex A. Rich. (1850);

Gymnothrix humilis (Hochst. ex A. Rich.) Walp. (1852) - type: Ethiopia, TU, Semien, Entehetkab [Enschedeap], Schimper 1372 (P holo., K iso.).

P. humile var. *nanum* Engl., *Hochgebirgsfl. Trop. Afr.*: 123 (1892) - type: Ethiopia, TU, Mt. Bachit, Schimper 119 (B syn.) & Mt. Guna, Schimper 1514 (K isosyn.).

Low, densely tufted perennial from an underground rhizome; culms 5–20 cm high, stiffly erect from an ascending base. Leaf-blades flat or rolled, 2 mm wide, loosely pilose to glabrous below, finely acuminate; culm sheaths inflated. Inflorescence a compact ovoid to oblong head 1–2 cm long; rachis with rounded ribs, pubescent, closely beset with involucre-stumps. Involucres comprising a single whorl of 6–9 slender, scaberulous bristles scarcely exceeding the solitary, sessile spikelet. Spikelets lanceolate-oblong, 4–5.3 mm long; glumes very small, nerveless, denticulate, the lower up to 1/4, the upper 1/4–1/3 spikelet length; lower lemma sterile, 2/5–1/2 spikelet length, nerveless or obscurely 1-nerved, acute; upper lemma equalling the spikelet, thinly membranous, 5-nerved, acute to apiculate. Fig. 107:8.

Damp upland meadows and in grassy glades in *Hypericum* and *Hagenia* woodland; 2800–4000 m. TU GD GJ SU AR BA; endemic to the Ethiopian mountains. M.G. & S.B. Gilbert 1794; Mooney 7136; Thulin 1644.

This small upland species, with its distinctive ovoid inflorescences, is usually distinguishable at a glance

from other Ethiopian *Pennisetum* species. It belongs, however, to the *P. thunbergii* group of species and specimens of *P. thunbergii* from heavily grazed highland areas may develop short, oblong inflorescences similar to those of *P. humile*. Such forms can be distinguished from *P. humile* by their mucronate lower lemmas and tighter, non-inflated culm leaf-sheaths.

21. *P. thunbergii* Kunth (1829);

- type: South Africa, Thunberg (UPS-Thunb. 1868 lecto., selected here by I. Hedberg).

P. glabrum Steud. (1854); *P. schimperi* A. Rich. var. *glabrum* (Steud.) Th. Dur. & Schinz, *Consp. Fl. Afr.* 5:784 (1894); *P. schimperi* A. Rich. var. *pubiflora* A. Rich., *Tent. Fl. Abyss.* 2: 381 (1850) - type: Ethiopia, TU, Mt. Scholoda, Schimper 11 (K iso.).

P. adoense Steud. (1854); Ethiopia, TU, Adoa, Schimper 94 (K iso.).

P. glabrum Steud. var. *filiforme* Chiov. in *Ann. Ist. Bot. Roma* 8; 322 (1908) - type: Eritrea, Asmara, Pappi 5061 (FT holo.).

Rhizomatous perennial forming loose tufts; culms erect or geniculately ascending, 25–100 cm high, sometimes hairy below the inflorescence. Leaf-blades flat or folded, 2–4 mm wide, the tip filiform; ligule a densely ciliate rim c 0.3 mm long. Inflorescence linear, 3–11 cm long, sometimes flexuous, moderately to very dense; rachis ribbed, scaberulous, closely beset with short involucre-stumps. Involucres truncate, comprising one sessile spikelet enclosed by 5–14 bristles of varying length and thickness, the longest 5–12 mm long. Spikelets narrowly lanceolate-oblong, 3–5 mm long; lower glume usually absent, occasionally represented by a tiny, narrow rudiment; upper glume broad, truncate, 1/6–1/4 spikelet length; lower lemma sterile, 1/3–2/3 spikelet length, abruptly cuspidate-mucronate; upper lemma scaberulous upwards, apiculate to mucronate; upper palea ciliolate across the tip; anthers glabrous, with 1 or 2 hairs, or penicillate. Fig. 107:1–4.

Grassland in dry, moist or even marshy places on a variety of soils; also roadsides and as a weed of arable land; 1700–3000 m. EW TU GD GJ WU SU AR IL WG KF GG SD BA HA; southwards to South Africa; also Yemen and Sri Lanka. Ash 1320; Burger 752; Friis et al. 1462.

P. thunbergii is a variable species found in a wide range of habitats, but favouring moist grassland. In Ethiopia there are two main variants, but a loose, rhizomatous habit is characteristic of the whole species. The commoner form has a usually purple inflorescence, with ascending involucre and glabrous anthers or with only 1 or 2 hairs at the anther-tip (*P. glabrum*). The other variant has a very dense, pale yellowish-green inflorescence with densely packed, often horizontally spreading involucre and anthers with a distinct tuft of short hairs at the tip (*P. adoense*). However, there is some intergradation and the distinction does not hold up elsewhere in Africa.



Figure 107. *PENNISETUM* spp.: *P. THUNBERGII*: 1 - habit x 3/4; 2 - spikelet showing upper glume and involucral bristles x 9; 3 - spikelet showing lower lemma x 9; 4 - rhachis x 11. *P. MEZIANUM*: 5 - habit x 3/4; 6 - involucre x 9; 7 - rhachis x 11. *P. HUMILE*: 8 - uppermost leaf and inflorescence x 3/4. 1 from Lythgoe & Evans 595; 2-4 from Stewart C4; 5 from Carter & Stannard 684; 6 & 7 from Stordy s.n.; 8 from Leakey & Evans 625. Drawn by Eleanor Catherine.

P. thunbergii lies at the centre of a small, closely knit group of species, characterized by spikelets with very short glumes and a reduced, sterile lower lemma, a scaberulous or puberulous ribbed rhachis, and often also a minutely papillose upper leaf-surface. The group includes *P. uliginosum*, *P. thulinii*, *P. humile* and *P. pumilum* (see notes under these species).

22. *P. uliginosum* Hack. (1892);

- type: Ethiopia, GD, Gerra, *Schimper* 1488 (1486 in protologue an error) (W holo, K B iso.).

Slender, loosely tufted or shortly stoloniferous perennial; culms decumbent, rooting at the lower nodes, 30–80 cm high. Leaf-blades folded, 1–2 mm wide, smooth and glabrous. Inflorescence slender, 5–6.5 cm long, sparingly bristly; rhachis 0.5 mm wide, scaberulous, loosely beset with involucre-stumps 0.3–0.5 mm long. Involucres composed of one sessile spikelet subtended by 1–2 scaberulous bristles 7.4–8.2 mm long (occasionally a third much shorter, finer bristle present). Spikelets narrowly lanceolate, membranous, 4–4.5 mm long; glumes and lower lemma reduced to small truncate, hyaline scales around the base of the fertile floret; lower glume up to 0.5 mm and upper glume to 0.8 mm long; lower lemma 1/6–1/3 spikelet length, 1-nerved, mucronate; upper lemma scabrid except towards the base, narrowly obtuse, mucronate; upper palea scabrid between the nerves, ciliate across the tip.

Wet grassland; 2500 m. GD SU; unknown elsewhere. *Ash* 2594.

P. uliginosum differs from *P. thunbergii* only in its looser, slender inflorescence with fewer bristles and spikelets with a slightly shorter lower lemma and more obviously ciliate upper palea tip. It may not merit separate specific rank, but is maintained here in the absence of intermediates.

23. *P. thulinii* S.M. Phillips (1991);

- type: Ethiopia, AR, SW of Asella, *Thulin* 1541 (K holo., UPS iso.).

Slender, densely tufted perennial; culms wiry, erect, 40 cm high. Leaf-blades convolute, filiform, 1–1.5 mm wide, smooth and glabrous. Inflorescence 2.5–3.5 cm long, very slender, sparingly bristly; rhachis 0.3 mm wide, the involucre-stumps distant, 0.3 mm long. Involucres composed of one sessile spikelet subtended by 2 scaberulous bristles, the longer 5–5.5 mm long. Spikelets narrowly lanceolate, 3 mm long; lower glume absent; upper glume a nerveless truncate scale 0.4 mm long; lower lemma sterile, reduced to a broad, 1-nerved scale 1/5 spikelet length, apiculate-mucronate with a mucro 0.4–1 mm long; upper lemma scabrid except towards the base, narrowly obtuse, mucronate; upper palea scabrid between the nerves, ciliate across the tip.

Rocky river banks; 2200 m. AR; unknown elsewhere.

P. thulinii has very similar spikelets to *P. uliginosum*, but is a more delicate grass with a densely tufted habit, markedly finer leaf-blades and shorter, narrower inflorescence.

24. *P. pumilum* Hack. (1892);

- type: Ethiopia, GD, Gafat, *Schimper* 1486 (1488 in protologue an error) (W holo., K iso.).

Small tufted annual; culms slender, erect, 10–20 cm high. Leaf-blades narrowly linear, inrolled, 1–1.5 mm wide, conspicuously papillose on the inner surface. Inflorescence slender, loose, 2–4 cm long; rhachis angled, somewhat flattened, the involucre-stumps distant. Involucres composed of one sessile spikelet subtended by a single scaberulous bristle 7.5–10.5 mm long. Spikelets lanceolate-oblong, membranous, 2.8–3.5 mm long; glumes vestigial or absent, their position represented by a short conical stump at the spikelet base; lower lemma ovate, sterile, subequalling the spikelet, 5-nerved, scaberulous, obtuse; upper lemma equalling the spikelet, 5-nerved, scaberulous only at the rounded, apiculate tip; upper palea-keels shortly excurrent.

Short wet grassland; c 1500 m. GD IL; unknown elsewhere. *Mooney* 7571 (ETH).

P. pumilum resembles *P. uliginosum* and grows in similar wet grassland, but differs clearly from it in the absence of glumes and in the much larger, 5-nerved lower lemma, smooth upper floret and upper palea without a ciliate tip. The conspicuous, large papillae covering the upper surfaces of the leaf-blades are an unusual feature of *P. pumilum*.

25. *P. macrourum* Trin. (1826);

- types: South Africa, *Schwarz*, *Link* (whereabouts uncertain, not LE).

P. giganteum A. Rich. (1850); *Gymnothrix gigantea* (A. Rich.) Walp. (1852) - type: Ethiopia, TU, Adua, Mariam-Chawito R., *Quartin Dillon & Petit* 186 (P holo.).

P. riparioides Hochst. ex A. Rich. (1850); *Gymnothrix riparioides* (Hochst. ex A. Rich.) Walp. (1852) - type: Ethiopia, TU, Adua, *Schimper* 93 (K isosyn.) & Shire [Chiré], *Quartin Dillon* (P syn.).

P. quartinianum A. Rich. (1850); *Gymnothrix quartiniana* (A. Rich.) Walp. (1852) - type: Ethiopia, TU, Shire [Chiré], *Quartin Dillon & Petit* 184 (P holo., K iso.).

P. giganteum A. Rich. var. *minor* Leeke in *Zeitschr. Naturwiss.* 79: 41 (1907) - type: Ethiopia, TU, Worrhey, *Schimper* 1044 (B holo., K iso.).

P. tenue Mez (1917) non Fig. & De Not. (1852); *P. stenorrhachis* Stapf & C.E. Hubb. (1933) - type: Sudan/GD border, Matamma, *Schweinfurth* 1508 (B holo.).

Rhizomatous perennial; culms slender to robust and reed-like, sometimes forming large clumps, 50 cm to 2 m or more high. Leaf-blades tough, glaucous with a broad white midrib, 3–10 mm wide, flat or convolute,

extended into a filiform tip; ligule a ciliate rim c 1 mm long, often also villous at the blade base. Inflorescence linear, fairly dense, 8–30 cm long, often drooping; rhachis cylindrical, scaberulous to puberulous with very short involucre-stumps. Involucres comprising a single sessile spikelet enclosed by many scaberulous bristles usually about the same length as the spikelet; one bristle stouter and 8–15 mm long. Spikelets 3–5 mm long, lanceolate-acuminate; lower glume <1 mm; upper glume 1/5–1/2 spikelet length, usually 1-nerved and acute; lower lemma 3/4 to as long as the spikelet, male or sterile, (3–)5–7-nerved, acuminate to cuspidate; upper lemma similar.

River banks and stream beds; 700–2100 m. TU GD WG SU AR KF GG SD HA; tropical and South Africa but rare west of Cameroon; Yemen. *Friis et al.* 317, *M.G. & S.B. Gilbert* 2206; *Parker* 205.

The *P. macrourum* aggregate encompasses a polymorphic assemblage of waterside *Pennisetum* forms, all with similar spikelets and a rhizomatous habit, but varying widely in vigour and other characters contributing to the general facies. Whilst it is possible to recognize certain of the more distinctive forms (such as *P. giganteum* with its stout, robust culms and *P. martinianum* with its slender habit and delicate, feathery inflorescences), such forms are completely intergrading, and a proper understanding of variation must await a detailed study of the group.

Some broad-leaved forms closely resemble *P. trachyphyllum* and *P. glaucifolium* which are also tall grasses with very similar spikelets, but axillary inflorescences are never present in *P. macrourum*. *P. macrourum* is further distinguished from these two by its pale brown glabrous nodes. Some of the more slender forms can be confused with *P. thunbergii*, but this has a much shorter lower lemma.

26. *P. sphacelatum* (Nees) Th. Dur. & Schinz (1894); *Gymnothrix sphacelata* Nees (1841) - types: South Africa, 3 Drège s.n. syntypes (2 isosyn. at K). *P. schimperii* A. Rich. (1850); *Gymnothrix schimperii* (A. Rich.) Walp. (1852) - types: Ethiopia, TU, Adua, *Quartin Dillon* s.n. & *Schimper* 287 (387 in protologue in error) (both K isosyn.), non *Schimper* 94 (*P. thunbergii*).

Coarse perennial forming dense tussocks; culms erect, 45–120 cm high, villous below the inflorescence. Leaf-blades convolute, tough and wiry, strongly ribbed; leaf-sheaths woolly at the mouth. Inflorescence linear, very dense, 5–12 cm long; rhachis cylindrical, pubescent with rounded ribs, very closely beset with short, semi-acrescent involucre-stumps. Involucres comprising 9–19 bristles enclosing a single spikelet, shortly conical at the base; bristles usually glabrous, occasionally weakly plumose, the longest 4–12 mm long. Spikelets lanceolate, 3–5 mm long, acuminate to caudate; lower glume a nerveless scale up to 1/4 spikelet length; upper glume 1-

nerved, 1/6–2/3 spikelet length, acute to cuspidate or mucronate; lower lemma sterile, prominently 5-nerved, slightly shorter to longer than the upper lemma, sharply acuminate to caudate; upper lemma similar.

. Upland grassland; an unpalatable grass frequent in overgrazed pastures; 1900–2800 m. EW TU GD WU SU AR KF GG SD BA HA; southwards through East Africa to South Africa. *Burger* 692; *Gilbert* 4092; *Mooney* 5958.

Specimens from East Africa have weakly plumose bristles but this variant is rare in Ethiopia, where the bristles are normally glabrous or at most with a few inconspicuous hairs.

27. *P. trachyphyllum* Pilg. (1901);
- types: Tanzania, *Holst* 3253 (K isosyn.) and several other syntypes.

Tall perennial; culms decumbent and rooting at the base, laxly ascending, 1–3 m high or more, the nodes black; inflorescences terminal and also axillary from the upper leaf-sheaths. Leaf-blades broadly linear, flat, 12–25 mm wide with a broad whitish midrib, sharply acuminate; ligule a ciliolate rim 0.3 mm long. Inflorescences slender, 12–32 cm long, fairly lax, flexuous, occasionally branched near the base; rhachis finely ribbed, scaberulous, the involucre-scars sessile. Involucres comprising 1–2 subsessile spikelets surrounded by many scaberulous bristles; longest bristle 15–25 mm long. Spikelets lanceolate-acuminate, 5–7.5 mm long; lower glume 1/6–1/4 spikelet length; upper glume 1/3–1/2 spikelet length, 1–5-nerved, sharply acute to mucronate; lower lemma equalling the spikelet, sterile, 5–7-nerved, scaberulous, narrowly acuminate to cuspidate; upper lemma similar but tougher and smoother. Fig. 108:1–3.

Light shade of forest margins and clearings, sometimes scrambling through shrubs; 1500–2000 m. WU SU IL KF SD; East Africa, Sudan and Cameroon. *Fröman* 3267; *Friis et al.* 1584; *Mooney* 6056; *Mesfin T.* 6546 (ETH).

The black nodes of *P. trachyphyllum* are distinctive, and when coupled with the tall, broad-leaved habit and axillary inflorescences, render confusion with other Ethiopian species unlikely.

28. *P. glaucifolium* Hochst. ex A. Rich. (1850); *Gymnothrix glaucifolia* (Hochst. ex A. Rich.) Walp. (1852) - type: Ethiopia, TU, Mt. Scholoda [Selleuda], *Schimper* 390 (P holo., K iso.). *Gymnothrix cladodes* Hochst. ex Steud. (1854) as syn. of *P. glaucifolium* based on *Schimper* 1084 (K).

P. laxum Hochst. ex Leeke (1907) - type: Ethiopia, TU, Bellaka, *Schimper* 324 (K FT iso.).

P. glaucifolium A. Rich. var. *procera* Chiov., in *Ann. Ist. Bot. Roma* 8: 321 (1908) - types: Eritrea, Amasen, *Pappi* 2377 (FT syn.) & 3712, 4650 (FT?).

P. glaucifolium A. Rich. var. *glaberrima* Chiov., l.c. 321 (1908) - types: Eritrea, Oculé Cusai, Pappi 1599 (FT syn.) & 1847 (FT?).

Rhizomatous perennial forming loose clumps; culms tough, smooth, woody below, 80–150 cm high, silky-pilose at the nodes (rarely glabrous), branching and sometimes forming fascicles of leafy shoots; inflorescences terminal and also axillary from the upper leaf-sheaths. Leaf-blades flat, 6–13 mm wide with a broad white midrib, tapering to a filiform tip; ligule membranous, 1–3 mm long. Inflorescences fairly loose, slender, flexuous, 6–12 cm long, pale green; rhachis angular, scaberulous, loosely beset with involucre-stumps. Involucres comprising many scaberulous bristles enclosing one sessile spikelet, one bristle longer and stouter, up to 16 mm long. Spikelets 4.7–5 mm long, firmly membranous; lower glume reduced to a small nerveless scale; upper glume 1/5–1/2(–3/4) spikelet length, 1–3(–5)-nerved, truncate to acute; lower lemma equalling the spikelet, male, 5–7-nerved, scaberulous, cuspidate; upper lemma similar but slightly shorter.

Among rocks in shade; 1800–2500 m. EW TU SU; unknown elsewhere. *De Wilde* 8673.

P. glaucifolium is a seldom collected species, recognizable by its tall culms with silky nodes, axillary inflorescences and membranous ligule. The name *P. laxum* has been applied to a few collections of smaller, more slender plants with a longer, 3–5-nerved upper glume (equalling about 3/4 spikelet length) than is usual in *P. glaucifolium*. Their status is difficult to determine until more material becomes available, but they have the smooth hard culms with hairy nodes of *P. glaucifolium* and probably represent an extreme form of the species.

29. *P. trisetum* Leake (1907);

- type: Ethiopia, GD, Efaq, *Schimper* 1411 (B holo., K iso.).

Tall perennial; culms stout, woody, to 3 m high, smooth, the nodes sometimes coarsely tuberculate-hairy; inflorescences axillary from the upper leaf-sheaths. Leaf-blades flat, 10–12 mm wide, narrowed to the base, finely acuminate; ligule 1.5–3 mm, coarsely ciliate from a membranous rim. Inflorescences fairly loose, slender, 2–7 cm long; rhachis angular, scaberulous to puberulous, loosely beset with involucre-stumps. Involucres comprising one sessile spikelet subtended by one stout bristle 7–11 mm long and 1–5(–14) more delicate bristles which are shorter than the spikelet. Spikelets 3–4.4 mm long, narrowly lanceolate; lower glume c 0.5 mm long, nerveless, truncate; upper glume 1/4–1/3 spikelet length; lower lemma equalling the spikelet, male or sterile, scaberulous, abruptly acuminate to cuspidate; upper lemma resembling the lower.

Roadsides, forest clearings and other disturbed places; 1600–2600 m. GD WU SU IL KF BA; southwards through East Africa to Zimbabwe. *Friis* et al. 593; *Mooney* 8536 & 8681.

30. *P. beckeroides* Leake (1907);

- type: Ethiopia, GD, Debra Eski, *Schimper* 38 (B holo., K P iso.).

Tall perennial; culms erect, 1 m or more high; inflorescences axillary from the upper leaf-sheaths. Leaf-blades flat, 5–8 mm wide, finely acuminate; lower leaf-sheaths loosely hispid with tubercle-based hairs; ligule 4–5 mm long, coarsely ciliate from a membranous base. Inflorescences slender, dense, 5–7 cm long; rhachis with rounded ribs and short peduncle-stumps, scaberulous. Involucres comprising one sessile spikelet subtended by one stouter bristle 3.6–4.5 mm long which only slightly exceeds the spikelet, and up to 8 slender shorter bristles. Spikelets 3–3.5 mm long, lanceolate-oblong; lower glume 1/2–1/3 spikelet length, 1-nerved, acute; upper glume 1/2 spikelet length, 3-nerved, acute; lower lemma equalling the spikelet, male, scaberulous, subacute; upper lemma similar but smooth and apiculate.

2700 m. GD; unknown elsewhere.

P. beckeroides is known only from the type collection. It is extremely close to *P. trisetum*, differing only in its slightly denser inflorescence with the involucre-bristles scarcely exceeding the spikelets, and in its rather long ligule and tuberculate-hispid lower sheaths. It may prove to be no more than an extreme variant of *P. trisetum*.

31. *P. unisetum* (Nees) Benth. (1881);

Gymnothrix uniseta Nees (1841); *Beckeropsis uniseta* (Nees) K. Schum. (1895) - type: South Africa, *Drège* s.n. (K iso.).

Beckera glabrescens Steud. (1854) - type: without locality, *Schimper* 2017 (P holo.).

Tufted perennial; culms usually robust, 1–3 m high, the nodes glabrous or appressed-villous. Leaf-blades broadly linear, coarse, flat, 10–20 mm wide, with filiform tips, gradually narrowed towards the ligule and sometimes falsely petiolate; ligule 1–2 mm, silky-ciliate from a membranous rim. Inflorescences numerous on long, slender peduncles from the upper leaf-axils and gathered into a large, nodding, false panicle; the subtending leaf-blades much smaller than the culm leaves, bearded abaxially at the sheath junction. Individual inflorescences slender, 2–4.5 mm long, often purple. Involucres comprising one spikelet 2.5–3.2(–3.9) mm long subtended by a single fine bristle (3.3–)5–15(–25) mm long; glumes subequal, truncate to emarginate, up to 0.5 mm long (rarely the upper acute and up to 1/3 spikelet length; lemmas equalling the spikelet, scaberulous, acute, the lower male or sterile. Fig. 108:6.

Wooded grassland, field borders and among shrubs, often on disturbed sites in light shade; 1100–2100 m. EW TU GD WG SU IL KF GG SD HA; tropical and South Africa; Yemen. *Ash* 2694; *Burger* 3266; *M.G. & S.B. Gilbert & Tewolde* 2503.

P. procerum (Stapf) W.D. Clayton is a very similar species found in rock crevices in Kenya and Uganda,

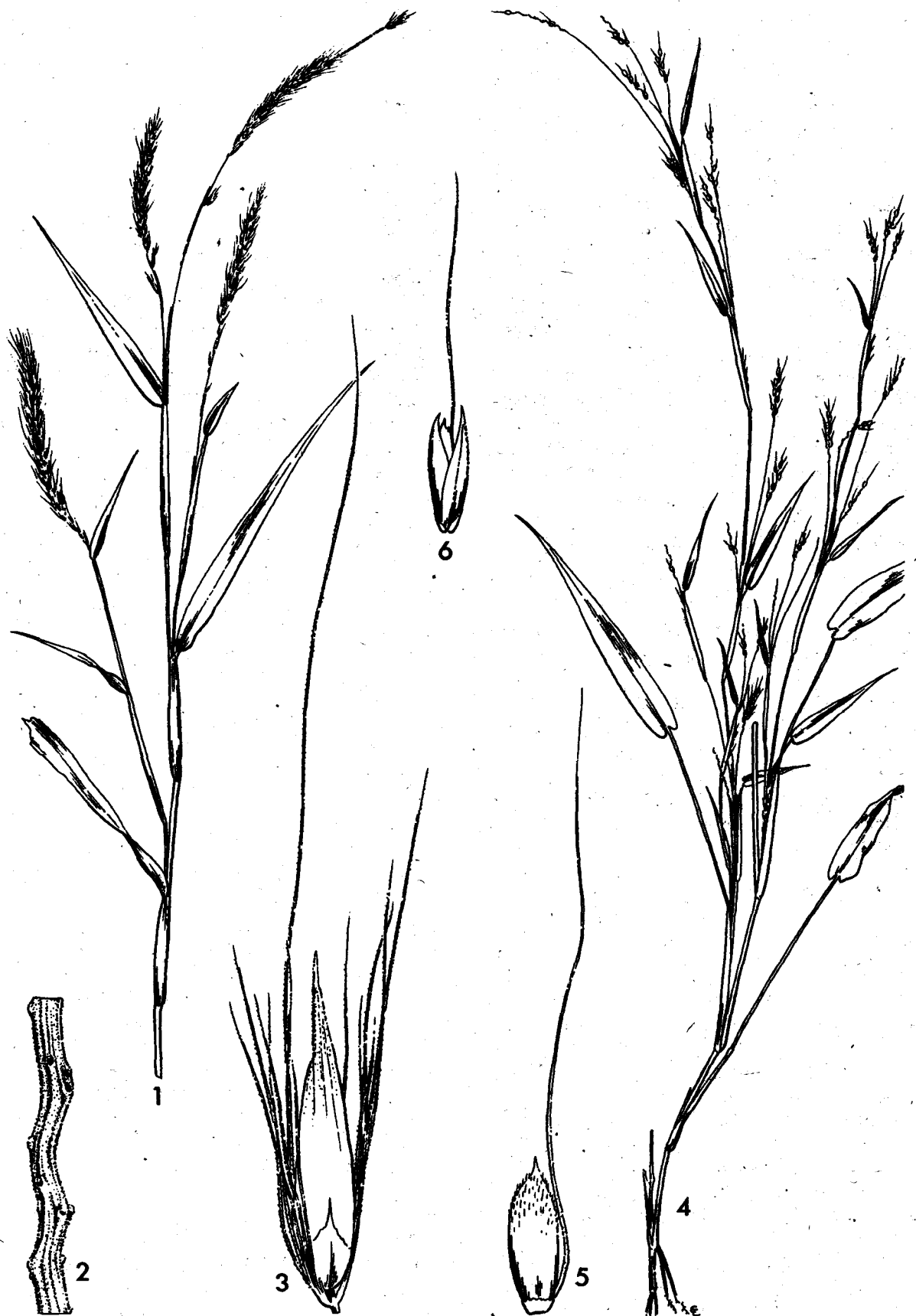


Figure 108. *Pennisetum* spp.: *P. TRACHYPHYLLUM*: 1 - part of compound inflorescence x 1/3; 2 - rhachis x 9; 3 - involucre x 9. *P. PETIOLARE*: 4 - habit x 1/3; 5 - spikelet and subtending bristle x 9. *P. UNISETUM*: 6 - spikelet and subtending bristle x 9. 1-3 from Parker E170; 4 from De Wilde 8821; 5 from Friis et al. 2261; 6 from Ash 2189. Drawn by Eleanor Catherine.

which differs from *P. unisetum* in its slender wiry culms, very narrow, almost filiform leaf-blades 1–4 mm wide and slightly longer spikelets 3–4 mm long.

32. *P. pirottiae* Chiov. (1903);

Beckeropsis pirottiae (Chiov.) Stapf & C. E. Hubb. (1933) - type: Eritrea, Barca, Agordat, Terracciano & Pappi 2814 (FT holo.).

Robust perennial forming dense tussocks; culms smooth and hard, up to 3 m high, profusely branched, especially from the upper nodes. Leaf-blades firm, flat, 6–12 mm wide, narrowed towards the sheath, finely acute. Inflorescences crowded in fascicles of up to 12 on short peduncles from the upper leaf-sheaths, gathered into a copious false panicle; each inflorescence slender, 1.5–3 cm long, the spikelets appressed along the scaberulous rhachis. Spikelets 3–3.5 mm long, subtended by a single basal bristle 5–9 mm long; glumes nerveless, truncate, emarginate, the lower *c* 0.5 mm long, the upper 0.8–1 mm long; lemmas equalling the spikelet, 5-nerved, minutely asperulous, sharply acute, the lower sterile.

Sandy and silty soil of river banks; 500 m. EW; E Sudan. Expedition Corni-Calciati-Bracciani 67.

P. pirottiae occurs in the Blue Nile and Upper Nile provinces of Sudan, where it is sometimes dominant on river banks, and is to be expected in adjacent, low-lying areas of Ethiopia.

33. *P. petiolare* (Hochst.) Chiov. (1908);

Gymnothrix petiolaris Hochst. (1844); *Beckera petiolaris* (Hochst.) Hochst. (1844); *Beckeropsis petiolaris* (Hochst.) Fig. & De Not. (1854) - type: Ethiopia, TU, Mt. Scholoda, Schimper 126 (K iso.).

Setaria dioica Hochst. (1841) nom. nud. based on Schimper 126 (supposedly the female plant of a dioecious species) and also on Schimper 262 (supposedly the male plant which is a specimen of *P. unisetum*.)

Pennisetum dioicum A. Rich. (1850) - types: Ethiopia, TU, Mt. Scholoda, [Selleuda], Schimper 126 (K isosyn.) & Shire [Chiré], Quartin Dillon (P syn.).

Tufted annual; culms usually slender, branched, 70 cm–2 m high. Leaf-blades broadly linear, thin and flaccid, 8–24 mm wide, sparsely pilose, abruptly rounded or cordate at the base, the lower blades contracted into a slender false petiole up to 8(–13) cm long, upper blades sessile. Inflorescences axillary from the upper leaf-sheaths, 3–5 cm long, borne on long capillary peduncles; rhachis slender, scabrid, loosely beset with spreading involucre-stumps. Spikelets narrowly elliptic, 2.5–3.2 mm long, each subtended by a single fine bristle 8–25 mm long; glumes < 0.5 mm, truncate or emarginate; lemmas equalling the spikelet, sharply acute, the lower sterile, both spinulose-scabrid, the prickles longer near the tip. Fig. 108:4, 5.

Roadsides, field margins and other disturbed places, often in light shade; 1000–1800 m. EW TU GD GJ WG

SU IL KF; Sudan. Ash 2679; De Wilde 8821; Friis et al. 2261.

A very distinctive species on account of its cordate, apparently petiolate lower leaf-blades.

34. *P. nubicum* (Hochst.) K. Schum. ex Engl. (1894);

Gymnothrix nubica Hochst. (1844); *Beckera nubica* (Hochst.) Hochst. (1844); *Beckeropsis nubica* (Hochst.) Fig. & De Not. (1854); *Pennisetum nubicum* - types: Sudan, Kotschy 13, 152 (both K, isosyn.) & Kotschy 368 (TUB, syn.).

Tufted annual; culms erect, much branched upwards, 50 cm–2 m high. Leaf-blades linear, flat, 4–14 mm wide, thin, finely acute, gradually narrowed into a false petiole up to 5 cm long. Inflorescences axillary from the upper leaf-sheaths, borne on capillary, flexuous peduncles and gathered into a copious false panicle; each 3–7 cm long, slender; rhachis scabrid, loosely beset with involucre-stumps. Spikelets narrowly elliptic, 2–3 mm long, each subtended by a single fine bristle 17–37 mm long; glumes 0.5 mm, truncate or emarginate; lemmas equalling the spikelet, the lower sterile, spinulose-scabrid, sharply acute, the upper scaberulous to spinulose, mucronate.

Roadsides and waste places; 800–2000 m. EE EW TU; Sudan, N Yemen. Robertson 1217; Schweinfurth 1270.

P. nubicum is very closely related to *P. petiolare*, but besides the tapering leaf-blade bases, also tends to have leaf-blades of firmer texture, a more copious false panicle and longer bristles.

117. *CENCHRUS* L. (1753)

De Lisle in *Iowa Journ. Sci.* 37: 259 (1963).

Annuals or perennials; leaf-blades linear, usually flat; ligule a ciliate rim. Inflorescence spiciform, composed of spiny or bristly, sometimes prickly, deciduous burrs arranged along an angular, often sinuous rhachis. Each burr composed of an involucre of spines and bristles surrounding 1 or more sessile spikelets; inner whorl of spines flattened, united below into a shallow disc or a deeper cup, grooved on the outer face, often ciliate within around the spikelets, the free tips flattened and spiny or extended into slender bristles; outer bristles shorter, slender. Spikelets lanceolate, acute; glumes shorter than the spikelets, the lower sometimes suppressed; lower lemma equalling the spikelet, membranous; upper floret a little firmer.

22 species in tropical and warm temperate regions.

Cenchrus mitis Anderss. is a species of coastal bushland on sandy soils at or near sea level from Somalia southwards to Mozambique. It has been reported from Ethiopia [Fröman & Persson, *III. Guide Grasses Eth.*: 39 (1974)], but this seems an unlikely extension of its known distribution, and has not been confirmed.

Cenchrus is closely related to *Pennisetum*, from which it differs in that the inner bristles of the involucre

are flattened into spines (at least below), and connate to a greater or lesser degree to form a disc or cup. *Cenchrus ciliaris* lies on the boundary, but the globular, spiny burrs of most species are quite distinctive and easily recognizable. *Pennisetum ramosum* is another borderline species as its bristles are briefly connate at the base of the involucre.

1. Inner spines of involucre extended beyond the spikelets as long, flexuous bristles; outer bristles numerous. 2
- Inner spines stiff and flattened, not extended into slender bristles (outer bristles when present mostly shorter than inner spines). 4
2. Inner bristles 15-27 mm long, all equal; basal disc of involucre 2-3 mm across; annual.

1. *C. prieurii*

- Inner bristles 7-14 mm long, one usually stouter and longer than the rest; basal disc or cup of involucre 0.5-2 mm across. 3
3. Inner bristles connate for 0.5(-1) mm above the rim of the basal disc; perennial, culms up to 1 m high. 2. *C. ciliaris*

- Inner bristles connate for 1-2 mm above the basal disc, forming a cup; annual or short-lived perennial, culms up to 40 cm high.

3. *C. pennisetiformis*

4. Spines antrorsely barbed. 5
- Spines retrorsely barbed, tenaciously prickly. 6
5. Body of involucre glabrous; inner spines connate for about 1/2 their length, free tips narrowly triangular; outer bristles very short. 4. *C. setigerus*
- Body of involucre pubescent; inner spines connate for 1/3-2/3 their length, free tips acicular; outer bristles numerous. *C. mitis* (see note above)
6. Inner spines connate at base only to form a shallow cup; spines glabrous (or ciliate internally). 5. *C. biflorus*
- Inner spines connate for 1/3-1/2 their length to form a deep cup; cup and free tips pubescent externally. 6. *C. echinatus*

1. *C. prieurii* (*Kunth*) *Maire* (1931);

Pennisetum prieurii *Kunth* (1831) - type: Senegal, *Leprieur* (P holo.).

Cenchrus macrostachyus *Hochst.* ex *Steud.* (1854) - type: Sudan, *Nubia*, *Kotschy* 4 (K iso.).

Loosely tufted annual; culms 12-30 cm high; leaf-blades 3.5-5 mm wide, finely acute. Inflorescence cylindrical, 5-9 cm long with closely set, long-bristly involucre on the scabrid, sinuous rhachis. Involucres with many slender, antrorsely scabrid bristles 15-27 mm long, far exceeding the spikelets, united at the base to form a shallow, elliptic disc 2-3 mm across; inner bristles stouter and somewhat flattened in the lower portion, enclosing and obscuring the spikelets, grooved on the outer face and ciliate on the margins or inner face, the tips extended into long fine bristles; outer bristles slender throughout. Spikelets 1-2 per involucre, 4-5 mm long. Fig. 109:3.

Open sandy places; 1000 m. TU-GD; extending westwards through the Sahel zone to Senegal and Mauretania; also in Arabia, Pakistan and N India. *Schimper* 2131.

C. prieurii is clearly distinguished from *C. ciliaris* by its annual habit, longer bristles and broader basal disc. Additionally, the inner spines curve tightly inwards around the spikelets, and are ciliate over this area only with short, dense hairs 0.5 mm long, the spreading, bristle-like tips being glabrous. In *C. ciliaris* the hairs are longer (1-2 mm), looser, and frequently extend beyond the level of the spikelets on to the flexuous tips.

2. *C. ciliaris* *L.* (1771);

Pennisetum cenchroides *Rich.* (1805), *nom. superfl.*; *P. ciliare* (*L.*) *Link* (1827) - type: South Africa, *König* (LINN holo.).

Pennisetum ciliare (*L.*) *Link* var. *anachoreticum* *Chiov.* in *Ann. Ist. Bot. Roma* 7: 66 (1897); *Cenchrus ciliaris* *L.* var. *anachoreticus* (*Chiov.*) *Pirotta* in *Ann. Ist. Bot. Roma* 8: 325 (1908) - types: *Ogaden*, *Riva* 307 & 312 (both FT syn.).

Tufted or shortly rhizomatous perennial; culms up to 1 m high, hard, slender to moderately stout, often much branched, erect or ascending from a decumbent or stoloniferous base. Leaf-blades flat, 4-8 mm wide, green or glaucous, with scattered, tubercle-based hairs. Inflorescence cylindrical, 3-15 cm long, densely bristly with closely set involucre on the puberulous, angular rhachis. Involucres composed of many flexuous, antrorsely scabrid bristles; inner bristles 7-14 mm long (one stouter and slightly longer), connate at the extreme base to form a shallow disc 0.5-1.5 mm wide, somewhat flattened around the spikelets, grooved on the outer face, ciliate on the inner margins, the tips extended into flexuous bristles clearly exceeding the spikelets; outer bristles numerous, shorter, slender. Spikelets 1-4 per involucre, 3-5 mm long. Fig. 109:1, 2.

Bushland and wooded grassland in dry areas, usually on light soils; sea level-2400 m. AF EE EW TU WU SU WG KF GG SD HA; Africa to India; introduced to America and Australia as a pasture grass for dry areas. *Ash* 2436; *Burger* 2166; *M.G. & S.B. Gilbert* 1565.

C. ciliaris is an extremely polymorphic species and is known to include a range of different chromosome numbers. Some superior variants have been selected as named cultivars for agricultural use. A few collections of a short, rhizomatous *Cenchrus* from the Rift Valley with very slender inflorescences appear to represent an extreme variant of this species (*Persson & Fröman* 2349; *Persson* 2070; *M.G. & S.B. Gilbert & Tewelde* 2490). These plants have unusually short, glabrous or very sparsely ciliate involucre bristles scarcely exceeding the spikelets (2.8-3.8 mm long) and lack the single longer, stouter involucral bristle usually (but not invariably) found in *C. ciliaris*.



Figure 109. *CENCHRUS* spp.: *C. CILIARIS*: 1 - habit x 3/4; 2 - involucre x 9. *C. PRIEURII*: 3 - involucre x 9. *C. PENNISETIFORMIS*: 4 - involucre x 9. 1 & 2 from Burger 2166; 3 from Schimper 2131; 4 from Gilbert et al. 7620. Drawn by Eleanor Catherine.



Figure 110. *CENCHRUS SETIGERUS*: 1 - inflorescence x 3/4; 2 - involucre x 5. *C. BIFLORUS*: 3 - inflorescence x 3/4; 4 - involucre x 5; 5 - detail of bristle x 27. 1 & 2 from Burger 3211; 3-5 from Glover & Gilliland 342. Drawn by Eleanor Catherine.

C. ciliaris may easily be mistaken for a species of *Pennisetum*, as the fusion of the bristles at the base of the involucre is far from obvious, but it is linked to the main body of *Cenchrus* through *C. pennisetiformis*. The flattening and grooving of the bristles around the spikelets is a characteristic feature of *Cenchrus* not found in *Pennisetum*.

3. *C. pennisetiformis* Steud. (1854);

C. ciliaris L. var. *pennisetiformis* (Steud.) Pirotta in *Ann. Ist. Bot. Roma* 8: 326 (1908) - types: Saudi Arabia, Schimper 973 (K isosyn.) & 974 (P syn.).

C. pennisetiformis Steud. var. *brevisetosus* Courb. in *Ann. Sci. Nat. ser. 4, Bot.* 18: 139 (1862) - type: Eritrea, Dasse Is., Courbon (P holo.).

Pennisetum cenchroides Rich. var. *hamphilahense* Terracc. in *Ann. Ist. Bot. Roma* 5: 93 (1893); *P. ciliare* (L.) Link var. *hamphilahense* (Terracc.) Th. Dur. & Schinz, *Consp. Fl. Afr.* 5: 778 (1894) - types: Eritrea, Ferehan to Haressan, Terracciano & Crulli Is., Terracciano (whereabouts uncertain, not FT).

C. pennisetiformis Steud. var. *intermedia* Chiov. in *Ann. Ist. Bot. Roma* 8: 45 (1903) - types: Eritrea, Dahalak, Terracciano 469 (FT syn.) & many other syntypes.

Tufted annual or short lived perennial; culms 10-40 cm high, ascending, branching; leaf-blades 2-4 mm wide,

softly pilose to glabrescent, finely acute. Inflorescence 2-5 cm long, oblong, densely bristly, the involucre contiguous along the sinuous rachis. Involucres composed of many flexuous, antrorsely scabrid bristles; inner bristles 8-12 mm long (one sometimes stouter and slightly longer); flattened around the spikelets, connate below to form a shallow cup 2 mm wide and 1-2 mm high, grooved on the outer face, ciliate on the inner margins, the tips extended into flexuous bristles clearly exceeding the spikelets; outer bristles numerous, shorter, slender. Spikelets 1-3 per involucre, 3-5.5 mm long. Fig. 109:4.

On the sandy soils of plains and thin semi-desert *Acacia* scrubland; sea level-1000 m. EE AF EW GG SD; N Kenya, Sudan, Somalia; through Arabia to India; a good grass for grazing in arid areas. Ash 2513; Gilbert, Ensermu & Vollesen 7620; Bally 6764.

C. pennisetiformis is not completely distinct from *C. ciliaris*, but can be distinguished by its involucre as opposed to the small basal disc of *C. ciliaris*. There is also a tendency towards a smaller, annual habit and a preference for sub-desert habitats.

4. *C. setigerus* Vahl (1806);

Cenchrus ciliaris L. var. *setigerus* (Vahl) Maire & Weiller (1952) - type: Arabia, Forsskal (C holo.).

Loosely tufted perennial, the culm bases somewhat bulbous; culms laxly ascending, 20-60 cm high. Leaf-blades flat, 4-8 mm wide, sheaths and upper blade surface with long, scattered hairs. Inflorescence rather stiff 4-10 cm long, the involucre overlapping by about half their length. Involucres 3-7 mm long; inner spines connate for 1/4-1/2 their length to form a tough cup, the free tips erect, flattened, narrowly triangular, antrorsely scaberulous with a broad green groove on the outer face, the inner face shortly ciliate; outer spines very short or almost suppressed, reduced to acicular bristles around the periphery of the cup. Spikelets 1-4 per involucre, 3.5-5 mm long. Fig. 110:1, 2.

Dry grassland; sea level-1400 m. EE AF EW TU SU GG HA; East Africa, Sudan and eastwards through Arabia to India; introduced to several other tropical countries as a forage grass for dry areas. Bally 6641; Burger 2917; Gilbert & Thulin 216.

The flattened, triangular spines of the cupuliform involucre are characteristic of *C. setigerus*, but occasionally specimens occur with elongated, slender spines and quite well developed outer bristles e.g. Taddesse Ebba 809. Such forms may represent introgression from *C. ciliaris*.

5. *C. biflorus* Roxb. (1820);

- type: India (K, drawing 2110 in Icon. Roxb.).

C. catharticus Del. (1839) - type: cultivated in Europe, seed from Sudan (MPU holo.).

C. niloticus Fig. & De Not. (1854) - types: Sudan, Figari (FT syn., K isosyn.) & Egypt, Figari (whereabouts uncertain).

Loosely tufted, scaberulous annual; culms up to 90 cm high; leaf-blades flat, 3–7 mm wide, the tips filiform. Inflorescence 2–15 cm long, with spiny involucre contiguous along a sinuous, twisted rhachis. Involucres 4–11 mm long with 2–3 whorls of spines; inner spines erect, connate at the base to form a shallow, ovoid or diamond shaped disc-like cup, free portion flattened with 1–3 green grooves on the outer face, densely to loosely ciliate in the lower half especially on the inner surface (rarely glabrous), fiercely retrorsely barbellate on the pungent, recurving tips; outer spines many, similarly barbellate but shorter, spreading and stoutly acicular. Spikelets 1–3 per involucre, 3.5–6 mm long.

Fig. 110:3–5.

A noxious weed with prickly, clinging burrs of overgrazed and waste places on sand; sea level–1000 m. EE EW TU HA; tropical Africa, extending eastwards through Arabia to Pakistan and India. *Pappi* 7201; *Schimper* 120.

Some specimens from the Ogaden region have glabrous spines, but such forms are only a local variant and may sometimes grow alongside typical plants with ciliate spines (*Glover & Gilliland* 342).

6. *C. echinatus* L. (1753);

- type: Bermuda, *Dickinson* in Herb. Sloane (BM syn.).

Annual; culms ascending, 15–90 cm high; leaf-blades 3–10 mm wide, glabrous to villous. Inflorescence 2–10 cm long with globose, prickly involucre contiguous along the rhachis. Involucres 5–10 mm long, all spines and bristles retrorsely barbellate; inner spines connate for 1/3–1/2 their length to form a globose cup, the flattened free tips triangular, erect, cup and tips pubescent; outer spines in 2 divergent whorls, a median whorl of stout, rigid spines ± equalling the inner teeth and an outermost whorl of much shorter, slender bristles. Spikelets 2–3 per involucre, 5–7 mm long.

A native of America; now widespread as a weed throughout the tropics and subtropics. Although not yet reported from Ethiopia, it occurs in Kenya, Tanzania and in the Arabian Peninsula.

118. *ODONTELYTRUM* Hack. (1898)

Perennial. Inflorescence spiciform, each spikelet borne upon a stipe and surrounded by a sheathing, lobed scale forming an involucre, disarticulating at the base of the stipe at maturity. Spikelets narrowly lanceolate, dorsally compressed, papyraceous; lower glume absent or very small, upper glume 1/3–1/2 the length of the spikelet, 1-nerved, acute; lower lemma male, subequalling the spikelet, 7–9-nerved; upper lemma faintly 5-nerved, thinly cartilaginous, its margins covering most of the palea; stigma simple, long-exserted.

Species 1; eastern and northeastern Africa and in Yemen.

The involucre scale is presumed to be homologous with the burr in *Cenchrus*.

O. abyssinicum Hack. (1898);

Stapf in *Hook. Ic. Pl.* 31: t. 3074 (1916) - type: Ethiopia, GD, Gaffat to Debra Tabor, *Schimper* 1121 (K iso.).

Aquatic perennial, often purple-tinged; culms spongy, trailing, branching and rooting at the nodes under water, ascending to 40 cm above the surface. Leaf-blades linear, flat, up to 20 cm long, 5–7 mm wide, a broad white midrib on the upper surface; ligule a lacinate membrane. Inflorescence cylindrical, enclosed at the base by the uppermost leaf-sheath, 4–10 cm long; spikelets erect, basal stipe oblong, 1–4 mm long; involucre scale irregularly lobed, scaberulous, incompletely sheathing on the adaxial side, one lobe almost free, awn-like and 12–28 mm long. Spikelets 10–14 mm long, the upper floret brown in the lower half, green above. Fig. 111.

An aquatic grass of lakes, streams and flooded grassland, often forming extensive floating mats; 2000–3100 m. GD SU AR BA; Tanzania, Yemen; introduced into South Africa. *M.G. & S.B. Gilbert* 1920; *Phillips* 3; *Thulin* 1475.

119. *ANTHEPHORA* Schreb. (1779)

Annuals or perennials; leaf-blades flat; ligule membranous. Inflorescence spiciform, narrowly cylindrical, the spikelets borne in deciduous, oblong or conical clusters along the sinuous rhachis. Clusters shortly stipitate below, composed of several spikelets enclosed within an involucre whorl of tough, indurated, shortly connate scales; scales narrowly lanceolate to elliptic-oblong, constricted at the base, glabrous, scabrid or variously hairy, the tips subacute to aristate, each subtending a single spikelet with its lower lemma towards the scale. Spikelets lanceolate or elliptic; lower glume absent; upper glume subulate from a broad base, pubescent; lower lemma equalling the spikelet, thinly membranous, 5–7-nerved, pubescent on the back, often also ciliate near the margins in the upper third; upper floret thinly cartilaginous.

12 species; mostly tropical Africa and Arabia, one species in tropical America.

The indurated involucre scales subtending the spikelets were long thought to be the lower glumes, but more probably the lower glumes are suppressed and the scales are better regarded as being derived from involucre sterile spikelets, as in some other members of the *Cenchrinae* [*Clayton & Renvoize* in *Gen. Gram.*: 306 (1986)].

Introgression appears to take place freely between the species occurring in Ethiopia where their distributions overlap, with the resultant occurrence of a range of intermediates.



Figure 111. *ODONTELYTRUM ABYSSINICUM*: 1 habit x 2/3; 2, 3 - front and rear views of spikelet with involucre scale x 5; 4 - involucre scale x 5; 5 - spikelet x 5. All from Greenway & Kamuri 12617. Drawn by Ann Davies. (Reproduced from *Fl. Trop. E. Afr. Gramineae* 3: Fig. 154, with permission of the Editors).

1. Involucral scales glabrous, smooth and shiny, tips broadly subacute; stipe glabrous. 1. *A. laevis*
- Involucral scales appressed-pilose to densely villous, tips sharply acute to aristate; stipe bearded. 2
2. Inflorescence obscurely hairy; involucral scales lanceolate-elliptic, appressed-pilose, acute, erect; lower lemma eciliate or with hairs to 1 mm long. 2. *A. nigritana*
- Inflorescence conspicuously hairy; involucral scales narrowly lanceolate, villous, acuminate-aristate, recurved; lower lemma densely ciliate with hairs 1-2.5 mm long. 3. *A. pubescens*

1. *A. laevis* Stapf & C.E. Hubb. (1930)

A. elegans auct. non Schreb. (1810) var. *laevis* Schweinf. in *Bull. Herb. Boiss.* 2, App. 2: 17 (1894) nom. event.; Schweinf. ex Chiov. in *Ann. Ist. Bot. Roma* 8: 27 (1903) - type: Eritrea, Saati, *Schweinfurth* 324 (K. holo.).

A. hochstetteri Hochst. (1844) var. *tellini* Chiov. in *Ann. Ist. Bot. Roma* 8: 291 (1908) - type: Eritrea, Samhar, Mai Atal, *Tellini* 1455 (FT holo.).

Tufted perennial; culms slender, ascending, 45-150 cm high. Leaf-blades 2.5-5 mm wide, glabrous or puberulous; ligule 1-5 mm long. Inflorescence narrowly cylindrical, stiff, 7-12 cm long, the spikelet clusters tightly erect, often purplish or blackish. Clusters 6-7-spiculate, oblong; basal stipe 0.3-0.8 mm long, glabrous; involucral scales elliptic-oblong, 4.3-5.5 mm long, equaling the spikelets, glabrous (or with a very few appressed hairs near the base), smooth and shiny, broadly subacute; lower lemma eciliate or ciliate with hairs up to 1 mm long. Fig. 112:6, 7.

Dry, stony soils. EE; southern Red Sea Hills and coastal lowlands of Sudan; shore of Dead Sea.

A. laevis is a grass of very restricted distribution, known only from near the Red Sea and north to the Dead Sea. The smooth, shiny, broad-tipped, often blackish involucral scales are distinctive, appearing sometimes almost petal-like. A few specimens with hairier, more sharply acute scales probably indicate introgression from *A. nigritana* (e.g. *Jackson* 2853 from Sudan).

2. *A. nigritana* Stapf & C.E. Hubb. (1930);

- types: Nigeria, *Barter* 1380 & *Dalziel* 507 & 260 (all K syn.).

Tufted perennial; culms erect or geniculately ascending, 70-150 cm high, nodes glabrous to villous. Leaf-blades flat, 4-8 mm wide, often glaucous, usually glabrous, acute; ligule 0.8-6 mm long. Inflorescence narrowly cylindrical, stiff, 12-24 cm long, the spikelet clusters tightly erect. Clusters 6-7(-8)spiculate; basal stipe oblong, 1-2 mm long, bearded with hairs up to 1 mm long; involucral scales lanceolate-elliptic to elliptic-oblong, 4-6.5 mm long, equalling or slightly shorter than the spikelets, appressed-pubescent to villous in the lower half, scaberulous above, acute; lower lemma

eciliate or thinly ciliate with hairs 0.3-1 mm long. Fig. 112:4, 5.

Dry sandy and gravelly soils; c 1500 m. EW; a Sahel species extending westwards to N Nigeria, Niger and Mali; also in Arabia, Kenya (Turkana) and N Somalia. *Harrison* 1304.

Typical *A. nigritana* is clearly distinguishable from *A. pubescens* by its narrower, often longer inflorescence which appears glabrous to the naked eye, and by its broader involucral scales, hairy only in the lower half, the triangular upper portion scabrid. However, difficulties can arise where both species occur, particularly in Eritrea where intermediates are frequent. Such intermediates have the shorter lanceolate involucral scales with acute tips found in *A. nigritana*, but the more copious villous pubescence of *A. pubescens*.

3. *A. pubescens* Nees (1841);

- type: South Africa, *Lichtenstein* 569 (B holo., destr.).

A. hochstetteri Nees (1844); *Hypudaaurus cenchroides* Hochst. ex A. Braun (1841) nom. nud., Hochst. (1844) in syn.; *Anthephora cenchroides* K. Schum. (1895) nom. superfl. - type: Ethiopia, TU, Mt Scholoda, *Schimper* 71 (K iso.).

A. abyssinica A. Rich. (1850) - types: Ethiopia, TU, Shire [Chiré], *Quartin Dillon* & *Memshah*, *Quartin Dillon* (both P syn.).

Perennial forming dense tussocks from a short stout rhizome; culms erect, 50-120 cm high. Leaf-blades flat, 3-7 mm wide, glaucous, usually shortly pubescent, sometimes also with coarse, tubercle-based setae especially near the ligule; ligule 3-7 mm long. Inflorescence 5-20 cm long, conspicuously silky-hairy, the spikelet clusters densely packed. Clusters 6-7-spiculate; basal stipe 0.3-1 mm long, bearded with hairs 1-2 mm long; involucral scales narrowly lanceolate, 5.5-9 mm long, densely villous, the tips extended above the spikelets, recurved, narrowly acuminate to acuminate-aristate; lower lemma ciliate with widely spreading, silky hairs 1.5-2.5 mm long protruding between the involucral scales. Fig. 112:1-3.

Rocky slopes on sandy soils; 1600-2300 m. EW TU SU; northern Cape Province, Transvaal, Namibia and Botswana, extending northwards into Angola; occasional in Kenya (Turkana), N Somalia and E Sudan. *M.G. & S.B. Gilbert* 2442; *Mooney* 8065.

A. pubescens is a widespread tussock grass of dry veld areas in southern Africa, where it shows little variation. The inflorescence is always conspicuously hairy, and the involucre scales have tapering, subaristate, recurving tips with the long cilia on the spikelets protruding between them. However, there is a tendency for more northern plants to exhibit more variation, sometimes with a more slender or branching habit, or with merely acuminate, less densely hairy involucral



Figure 112. *ANTHEPHORA* spp.: *A. PUBESCENS*: 1 - habit x 3/4; 2 - involucre x 9; 3 - lower lemma x 9. *A. NIGRITANA*: 4 - involucre x 9; 5 - lower lemma x 9. *A. LAEVIS*: 6 - involucre x 9; 7 - lower lemma x 9. 1-3 from Mooney 8065; 4 & 5 from Harrison 1304; 6 & 7 from Bally 7019. Drawn by Eleanor Catherine.

scales and shorter hairs on the stipe and lower lemma. This variation is complicated in northeastern Africa by introgression from *A. nigritana*, e.g. *Pappi* 1726, which is densely villous like *A. pubescens* but has the lanceolate acute scales of *A. nigritana*. Such intermediate forms have been regarded in the past as a separate species, *A. hochstetteri* Hochst.

ISACHNEAE Benth. (1881)

Annuals or perennials, usually low-growing. Leaf-blades linear, lanceolate or ovate; ligule ciliate. Inflorescence a panicle or composed of racemes along a central axis. Spikelets all alike, small, awnless, 2-flowered with the florets similar or not, disarticulating above the glumes and usually tardily between the florets, the lower floret bisexual (infrequently male), the upper floret female or bisexual; glumes half as long to equalling the spikelet, membranous, 0–9-nerved, persistent or falling soon after the florets; lemmas membranous or coriaceous, the upper often smaller and firmer, rounded on the back, obscurely 0–7-nerved, glabrous to pilose, the margins infolded over the edges of the palea; palea about as long as its lemma; stamens 2–3; stigmas 2. Grain ellipsoid to plano-convex, the hilum punctiform to linear.

5 genera in the tropics, mainly in Asia; typically in aquatic environments and in forest shade.

The tribe is clearly allied to *Panicaceae*, being distinguished by the presence of 2 fertile florets and by certain anatomical trends (polygonal silica-bodies and radially elongate chlorenchyma cells).

1. Upper lemma indurated, coriaceous; glumes finally deciduous. Isachne
- Upper lemma membranous; glumes persistent. Coelachne

120. ISACHNE R. Br. (1810)

Annuals or perennials; culms usually ascending from a prostrate base. Leaf-blades linear to lanceolate or ovate. Inflorescence an open or contracted panicle. Spikelets 2-flowered with the florets similar or not, contiguous, the lower bisexual or sometimes male, the upper female or bisexual; rachilla disarticulating below each floret, the glumes falling soon afterwards; glumes subequal, membranous, 3/4 to as long as the spikelet; lemmas elliptic-oblong to orbicular, obscurely 5–9-nerved, obtuse, the lower similar to the upper or larger and thinner, the upper chartaceous to thinly coriaceous, glabrous or pubescent; stamens 3. Grain ellipsoid to plano-convex.

About 100 species in the tropics and subtropics, esp. Asia.

I. mauritiana Kunth (1830);

Fröman & Persson, *Illustr. Guide Grasses Eth.*: 84 (1974) - type: Mauritius (P. holo.).

I. aethiopica Stapf & C. E. Hubb. (1933) - type from Tanzania.

Rambling perennial; culms 30–60 cm high, geniculate ascending from a prostrate base rooting at the nodes. Leaf-blades linear-lanceolate to lanceolate, 7–20 cm long, 5–17 mm wide, glabrous, scaberulous, sparsely and stiffly pilose, or pubescent. Panicle broadly ovate, 10–20 cm long, very loose and open with the spikelets on long pedicels. Spikelets obovoid, turgid, 1.2–1.8 mm long, usually both florets bisexual; glumes broadly elliptic, as long as the florets, 5–9-nerved, glabrous or with a few hairs towards the tip; lemmas broadly elliptic to subrotund, the lower a little longer than the upper, thinly coriaceous, glabrous.

Reported from swampy ground in wet forest up to 2000 m. Cameroon and Zaire, East Africa to Zimbabwe, a few records from West Africa; Madagascar and Mauritius.

121. COELACHNE R. Br. (1810)

Low-growing annuals or perennials; culms slender, decumbent or ascending. Leaf-blades small, linear to lanceolate. Inflorescence an open or contracted panicle. Spikelets with both florets membranous in texture but dissimilar, the lower bisexual and the upper female, separated by a slender rachilla-internode; glumes persistent, subequal, 1/3–2/3 of spikelet length, broadly obtuse; lemmas nerveless or obscurely nerved, glabrous to pubescent or pilose, the upper a little shorter than the lower.

10 species in the Old World tropics; streamsides and marshy places.

C. africana Pilg. (1916);

- types: Tanzania, *Stolz* 1221 (K isosyn.) & Zambia, *Fries* 1105 & 1217.

Low, mat-forming perennial; culms very slender, straggling and branching, rooting at the nodes, 5–25 cm high, the nodes hairy. Leaf-blades narrowly lanceolate, thin, ± glabrous, 1–2 cm long, 2–4 mm wide, prominently nerved with no obvious midrib, acute. Panicle lanceolate, 2–6 cm long, the short branches well spaced, divaricate, subracemose and few-spiculate. Spikelets oblong, 2–2.5 mm long, the florets obtuse, green or purple-tinged; lower glume broadly oblong, nerveless, c 1/3 of spikelet length, the tip rounded; upper glume broadly ovate, 5-nerved, 1/2 of spikelet length, obtuse; lower lemma ovate, 1.8–2 mm long, basally pubescent; anthers 2, 0.5–0.9 mm long; upper lemma narrowly ovate, pilose in the lower half and along the margins. Fig. 113.

Wet rocks by waterfalls and the waterlogged soils and shallow water of ponds and stream margins; 1700–2700 m. KF SD; southwards through East Africa to Zimbabwe and Mozambique; Madagascar. *Fries* et al. 1083 & 2193; *Mooney* 6174; *Sebsebe & Tewolde* 947 (ETH).



Figure 113. *COELACHNE AFRICANA*: 1 - habit x 3/4; 2 - spikelet x 25; 3 - florets removed from glumes x 25. 4 - lower glume x 25; 5 - upper glume x 25. Drawn by Eleanor Catherine. (Modified from *Fl. Zamb.* 10(3): Fig. 52, with permission of the Editors).

ARUNDINELLEAE Stapf (1898)

Annuals or perennials; leaf-blades linear to filiform, rarely lanceolate; ligule usually ciliate, less frequently a membranous rim. Inflorescence an open to contracted panicle, often large with numerous spikelets, the spikelets commonly in triads, sometimes with connate pedicels. Spikelets 2-flowered, the lower floret male or sterile and the upper floret fertile, lanceolate, slightly laterally compressed, often gaping, disarticulating below the upper floret and sometimes also below the lower; glumes persistent, unequal with the upper \pm as long as the spikelet and the lower half as long or less, chartaceous to coriaceous, 3-nerved, often brown and tuberculate-setose, the upper often caudate; lower lemma resembling the upper glume, 3-9-nerved; upper lemma shorter than the lower, terete, firm, 5-11-nerved, often pubescent or with tufts of hair, borne upon a truncate to bidentate or pungent callus, the tip emarginate or bifid, awned from the sinus; awn usually flattened and geniculate with a twisted column, persistent or deciduous at maturity; anthers 2-3; grain with a large embryo and linear or punctiform hilum.

12 genera in the tropics, mainly in the Old World. The tribe as a whole favours the shallow soils of poor grassland and rocky hillsides.

In contrast to the usual situation in grasses, the panicle is exserted whilst the spikelets are still immature and incompletely developed, and caution is therefore re-

quired when measuring spikelet parts. The shape of the callus at the base of the fertile floret is important (in Ethiopia especially in *Loudetia*) but it is not possible to determine this in immature specimens.

1. Upper lemma conspicuously scaberulous; ligule membranous. 122. *Arundinella*
- Upper lemma smooth, usually hairy, ligule ciliate. 2
2. Upper lemma bearded, the hairs in transverse lines or tufts, lower lemma 5-9-nerved. 123. *Danthionopsis*
- Upper lemma uniformly hairy, lower lemma 3-nerved. 124. *Loudetia*

122. *ARUNDINELLA* Raddi (1823)

Annuals or perennials, mostly with tough erect culms. Leaf-blades usually linear, rigid, flat or convolute, rarely lanceolate and flaccid; ligule a membranous rim. Panicle open or contracted, often with simple raceme-like primary branches and spikelets shortly pedicellate in pairs, rarely diffuse. Spikelets usually gaping, disarticulating between the florets; glumes membranous to chartaceous, 3-5-nerved, unequal, the upper as long as the spikelet, often caudate, the lower shorter, acute to mucronate; lower lemma 3-5-nerved, smooth with a hyaline palea; upper lemma coriaceous, 1-7-nerved, scaberulous, entire or bidentate, usually with a geniculate awn, occasionally the awn straight or missing, or

the lateral teeth also awned; callus short, rounded; palea wingless, scaberulous on the back; grain with a punctiform hilum.

About 50 species in the tropics and subtropics, concentrated in Asia.

Arundinella is a homogeneous genus, clearly delimited from other members of the tribe. The single species in Ethiopia is unusual in having thin lanceolate leaf-blades and a large, diffuse panicle of unpaired, long-pedicelled spikelets.

A. pumila (Hochst. ex A. Rich.) Steud.;

Acratherum pumilum Hochst. ex A. Rich. (1850) & Atlas t. 100 - type: Ethiopia, TU, Aderbati [Adde Arbati], *Schimper* 642 (P holo., K B iso.).

Slender, yellowish-green annual; culms erect, 8–50 cm high. Leaf-blades lanceolate, 3–12 cm long, 5–15 mm wide, thin and flaccid, glabrous below, a few appressed hairs above, acuminate. Panicle ovate, diffuse, 5–20 cm long, primary branches divaricate to horizontal, the rachis sometimes sparsely tuberculate-pilose, the numerous spikelets solitary on long, capillary pedicels. Spikelets 1.8–2.2 mm long, pallid with obvious green nerves; glumes chartaceous, narrowly ovate, separated by a short internode; lower glume 3-nerved, 1.3–1.5 mm long, acuminate; upper glume (3–)5-nerved, acuminate-caudate, the tip emarginate; lower lemma slightly exceeding the lower glume, male or sterile, narrowly ovate, 3-nerved, obtuse; upper lemma c 1 mm long, golden-brown, awned from the depressed-truncate tip; awn 3–3.5 mm long with a purple column and pallid limb; callus laterally shortly bearded. Fig. 114.

Wet, mossy rocks and banks in shade; 1200 m. TU GD; westwards to Sierra Leone and Mali; Oman (Dhofar); India to Indonesia. *De Wilde & Gilbert* 234.

123. **DANTHONIOPSIS** Stapf (1916)

Perennials or rarely annuals. Leaf-blades linear to lanceolate; ligule ciliate. Panicle open or contracted, the spikelets in groups of 2–3. Spikelets 2-flowered, disarticulating above the glumes, the florets falling separately, membranous to chartaceous; glumes very unequal, 3–5-nerved, nearly always glabrous, the lower acute, the upper ± as long as the spikelet, caudate-acuminate; lower lemma (3–)5–9-nerved, male; upper lemma membranous to coriaceous, 7–9-nerved, bearded, the hairs arranged in transverse tufts or lines, or sometimes glabrous, bifid with the lobes sometimes aristulate, awned from the sinus; awn flat, geniculate with a twisted column; callus usually square to oblong, obtuse or rarely 2-toothed; palea-keels winged, the wings clasped by the inrolled margins of the lemma and often terminating in a clavate swelling or auricle, sometimes papillose between the keels; grain with a linear hilum.



Figure 114. *ARUNDINELLA PUMILA*: 1 - habit x 1/3; 2 - spikelet x 30; 3 - fertile floret x 30. All from *De Wilde & Gilbert* 234. Drawn by Eleanor Catherine.

About 20 species, mainly in central and South Africa; also in Guinée, Sierra Leone, Sudan and eastwards to Pakistan.

The genus characteristically has a short blunt callus and winged palea.

D. barbata (Nees) C. E. Hubb. (1934);

Tristachya barbata Nees (1841); *Xerodanthia barbata* (Nees) Phipps (1966) - type: Yemen, *Schimper* 788 (K iso.).

Tristachya bricchettiana Chiov. (1897) - type: Ethiopia, HA, Zeila to Jeldeso [Gildessa] road, *Robecchi-Bricchetti* s.n. (FT holo.).

Tough glaucous perennial from a knotty rhizome; culms thin and hard, 40–80 cm high, fasciculately branched below, the nodes woolly. Leaf-blades narrowly lanceolate, 3–11 cm long, 4–10 mm wide, margins cartilaginous, tip pungent; lower sheaths imbricate, softly villous with deciduous blades. Panicle untidy, 8–15 cm long, the spikelets in triads (occasionally 1 or 2 spikelets abortive) borne on simple or sparsely branched, flexuous, usually paired branches. Spikelets chartaceous; glumes prominently 3-nerved, asperulous, the

lower lanceolate, 4–5 mm long, the upper narrowly lanceolate-oblong, 6–9 mm long; lower lemma 7-nerved; upper lemma coriaceous, villous, bearded at the base, topped by a spreading cirlet of hairs 3 mm long from 2 tufts, one below each lateral lobe; central awn column dark brown on the inner face, the limb stiffly falcate, 10–16 mm long, lateral lobes aristulate, the awnlets 4–5 mm long; callus narrowly oblong, bidentate; palea-keels thickened in the lower 2/3 and terminating in a clavate swelling, narrowly winged above. Fig. 115:1–4.

Crevices between volcanic boulders, stony slopes and coastal sand in semi-desert; sea level–1100 m. EE AF SU (Awash) HA; SE Egypt, Sudan (Red Sea Hills), N Somalia, Saudi Arabia and Yemen. *Burger* 2183; *Gilbert* 3477; *Hemming* 1033.

The lower male floret is shed early before the upper hairy fertile floret, so that the spikelets often misleadingly appear to be one-flowered.

124. LOUDETIA Steud. (1854), *nom. conserv.*

Tufted, sometimes large perennials, or rarely annuals; leaf-blades linear to filiform; ligule ciliate. Panicle open to contracted, rarely spiciform, the spikelets solitary or loosely paired. Spikelets lanceolate, brown, 2-flowered, often gaping, chartaceous, disarticulating below the upper floret and tardily below the lower; glumes unequal, separated by a short internode, 3-nerved, glabrous or hairy, sometimes tubercled, the upper about as long as the spikelet; lower lemma similar to the upper glume, half as long to equalling the spikelet, 3-nerved, usually male; upper lemma thinly coriaceous, 5–9-nerved, glabrescent, pubescent or hirsute, bifid with the lobes acute to mucronate, awned from the sinus; awn geniculate with a twisted column, deciduous (except *L. phragmitoides*); callus oblong to linear, truncate, bidentate or obliquely pungent; anthers 2, rarely 3; grain with a linear hilum.

26 species; tropical and South Africa; Madagascar, Oman.

A genus mainly of African deciduous bushland and wooded grassland, especially on poor, shallow soils on hillsides. The panicles of rich brown, often tuberculate-setose, awned spikelets are characteristic.

1. Upper lemma hirsute; awn with a short column <3 mm long, not deciduous. 1. *L. phragmitoides*
- Upper lemma pubescent; awn with a well-developed column, deciduous at maturity. 2
2. Glumes acuminate-setaceous, the lower often awned; anthers 3. 2. *L. flavida*
- Glumes obtuse to narrowly truncate; anthers 2. 3
3. Callus of upper floret truncate to slightly emarginate; culms robust, up to 3 m high. 3. *L. arundinacea*
- Callus of upper floret bidentate; culms seldom exceeding 1 m high. 4

4. Upper lemma bifid, the lobes 0.2–1 mm long; spikelets 8–13 mm long. 4. *L. simplex*
- Upper lemma emarginate, the lobes <0.2 mm long; spikelets 6–9 mm long. 5. *L. kagerensis*

1. *L. phragmitoides* (Peter) C. E. Hubb. (1934);

Trichopteryx phragmitoides Peter (1930) - type: Burundi, Peter 38380 (B holo., destr., K fragment).

Robust perennial tussock grass; culms cane-like, 2–4 m high, leafy. Leaf-blades linear, up to 1 m long, 1–2 cm wide, tough, acuminate; leaf-sheaths glabrous to hispid. Panicle narrowly oblong, 30–60 cm long, contracted with numerous crowded branches, the spikelets borne mostly in loose pairs, their bases surrounded by stiff setae from the pedicel-tips. Spikelets 6–7 mm long; glumes scaberulous, often sparsely setose from brown tubercles; lower glume lanceolate, 1/2–2/3 the spikelet-length, obtuse; upper glume narrowly lanceolate-caudate, subacute; lower lemma glabrous, sterile with a reduced palea; upper lemma 3–4 mm long, 7-nerved, loosely hirsute with silky spreading hairs lengthening to 2 mm towards the tip, bidentate with lobes 0.5–0.7 mm long; awn not deciduous, strongly geniculate with a column only 1.5–3 mm long and a slender curving limb 9–16 mm long; callus 0.2 mm long, truncate; anthers 2. Fig. 116:3, 4.

Marshy ground; 1800 m. KF; throughout tropical Africa. *Stewart* C-17.

This distinctive species, forming tall tussocks with plume-like panicles in swamps, has been surprisingly seldom collected in Ethiopia. It is to be expected in suitable habitats throughout the southern and western parts of the country.

2. *L. flavida* (Stapf) C. E. Hubb. (1934);

Trichopteryx flavida Stapf (1897) - types: South Africa, Transvaal, *Rehmann* 4730 & *Nelson* 75 (both K syn.).

Trichopteryx pennata Chiov. (1897); *Loudetia pennata* (Chiov.) C. E. Hubb. (1934) - type: Ethiopia, SD, Gobbo Duaya, *Riva* 184(1483) ["187" in protologue in error] (FT holo.).

Compactly tufted perennial, the culm-bases slightly swollen, basal leaf-sheaths usually woolly-tomentose, occasionally merely pubescent; culms erect, 30–150 cm high, the nodes bearded. Leaf-blades narrowly linear and flat to filiform, 8–30 cm long, 1.5–3.5 mm wide, hairy or glabrous, the tip filiform. Panicle narrowly ovate to narrowly oblong, loose and flexuous to fairly dense, 6–30 cm long, the axis and branches glabrous, pubescent or tuberculate-hispid, these and also the spikelets borne singly or in pairs. Spikelets 8–13.5 mm long; glumes glabrous to setose from dark tubercles; lower glume lanceolate, c 1/2 the spikelet length, acuminate or aristulate with an awnlet to 1.5 mm long; upper glume narrowly lanceolate-oblong, shorter than the lower lemma, tapering to a setaceous tip; lower



Figure 115. *DANTHONIOPSIS BARBATA*: 1 - habit x 3/4; 2 - inflorescence x 3/4; 3 - spikelet triad x 4; 4 - fertile lemma x 4. *LOUDETIA FLAVIDA*: 5 - base of plant x 3/4; 6 - inflorescence, x 3/4; 7 - glumes and lower floret x 4; 8 - upper floret x 4. 1 from Bally 6864; 2-4 from Popov 1378; 5-8 from Gilbert et al. 234. Drawn by Eleanor Catherine.

lemma male, linear-lanceolate, glabrous, acuminate-aristulate; upper lemma 3–4.5 mm long, pubescent, the hairs becoming clavate towards the acutely bidentate tip; awn deciduous, flexuous, 2–3.5 cm long, the column puberulous; callus linear, 0.5–0.8 mm long, narrowly truncate to subacute; anthers 3. Fig. 115:5–8.

Rocky slopes in deciduous bushland or open woodland; 1300–1900 m. GG SD HA; westwards to Ghana and southwards to South Africa (Transvaal); Oman (Dhofar). Friis et al. 817; Gilbert & Thulin 234; Gilbert & Phillips 8903.

Although rather variable vegetatively, *L. flavida* is a well-marked species, differing from other Ethiopian *Loudetia* by its sharply tipped glumes, clavate hairs on the upper lemma and by the presence of 3 anthers.

Over most of its range *L. flavida* has glabrous glumes and glabrous or pubescent panicle axis and branches. However, the panicle-branches are occasionally hirsute from small tubercles and this is the usual condition in Ethiopia. Likewise, the glumes are often sparsely tuberculate-setose in East Africa and Ethiopia, sporadically becoming densely setose. Such densely setose plants with hirsute panicle-branches have been separated as *L. pennata*, but the character appears to be of negligible taxonomic significance. Plants with glabrous or thinly setose glumes may occur in the same population, or even within the same panicle (Gilbert & Thulin 234).

3. *L. arundinacea* (Hochst. ex A. Rich.) Steud. (1854); *Tristachya arundinacea* Hochst. ex A. Rich. (1850); *Trichopteryx arundinacea* (Hochst. ex A. Rich.) Engl. (1892) - type: Ethiopia, TU, Gapta [Guendepita], Schimper 1214 (K iso.).
L. arundinacea (Hochst. ex A. Rich.) Steud. var. *hensii* (De Wild.) C.E. Hubb. in Pic.-Serm., *Miss. Studio Lago Tana* 7: 180 (1951).
L. arundinacea (Hochst. ex A. Rich.) Steud. var. *trichantha* (Peter) C.E. Hubb. ex Hutch., *Fl. W. Trop. Afr.* 2: 544 (1936).

Robust perennial tussock grass; culms erect, 0.8–3 m high, leafy, glabrous or hairy, the nodes often bearded with soft silky hairs. Leaf-blades linear, flat, 30–70 cm long, 6–10 mm wide, glabrous to tuberculate-hispid especially on the margins and lower surface, tapering towards the ligule and long setaceous tip; leaf-sheaths glabrous to hirsute. Panicle often ample, 20–60 cm or more long, the branches conspicuously whorled, slender and scabrid, the spikelets borne in loose pairs at their tips. Spikelets 6–11 mm long; glumes glabrous or setose from dark tubercles; lower glume lanceolate-oblong, 1/3–1/2 spikelet length, obtuse; upper glume narrowly lanceolate, the elongate tip clasping the awn-base, narrowly truncate; lower lemma male, narrowly elliptic, glabrous; upper lemma pubescent, 7-nerved, 4–7 mm long, acutely bidentate with the lobes 0.7–1 mm long; awn 2.5–4.5 cm long, weakly geniculate, the column loosely twisted, deciduous at maturity; callus 0.5 mm

long, truncate to shallowly emarginate; anthers 2. Fig. 116:5, 6.

Rocky or boulder-strewn hillsides in bushland or open woodland, sometimes the dominant grass; also in grassland and swamps; 500–1600 m. TU GD IL KF GG SD, HA; westwards to Senegal and southwards to Angola and Mozambique. Burger 834; Gereau 1240; Gilbert & Phillips 8875.

Most Ethiopian specimens, including the type, have glabrous spikelets. Those with tuberculate-setose glumes may be referred to as var. *hensii* (syn. var. *trichantha*).

Gereau 1255 (KF) has spikelets resembling those of *L. arundinacea*, though rather small, but has a very slender habit and unusual dichotomously splayed panicle-branches and pedicels.

4. *L. simplex* (Nees) C. E. Hubb. (1934);

Tristachya simplex Nees (Jun. 1841); *Trichopteryx simplex* (Nees) Engl. (1892); *Arundinella simplex* (Nees) Roberty (1955) - type: South Africa, Drège s.n. (K iso.).

Loudetia elegans A. Braun (Dec. 1841); *Tristachya elegans* (A. Braun) A. Rich. (1850); *Trichopteryx elegans* (A. Braun) Engl. (1892) - type: Ethiopia, TU, Mt. Scholoda [Selleuda], Schimper 18 (K iso.).

Compactly tufted perennial, the basal leaf-sheaths silky-pilose to tomentose, becoming fibrous with age; culms erect, (30–)60–150 cm high, the nodes bearded with stout, tubercle-based setae or glabrescent. Leaf-blades linear to filiform, flat or convolute, 10–30 cm long, 2–6 mm wide, ± glabrous or with a few scattered setae, especially on the margins, the tip filiform. Panicle loosely diffuse or narrower and contracted, 10–30 cm long, the filiform flexuous branches several per node, often verticillate but not conspicuously so, the spikelets borne singly or in loose pairs. Spikelets 8–13 mm long; glumes glabrous or setose from dark tubercles; lower glume narrowly ovate, 1/3 the spikelet length or slightly more, broadly obtuse; upper glume linear-lanceolate, the elongate tip clasping the awn-base, narrowly truncate; lower lemma male, similar to the upper glume; upper lemma pubescent, 7-nerved, 4–7 mm long, acutely bidentate with the lobes 0.2–1 mm long; awn 2.5–5 cm long, deciduous at maturity; callus oblong, 0.5–1 mm long, bidentate; anthers 2. Fig. 116:1, 2.

Grassy hillsides and in wooded grassland, sometimes dominant; 1200–2500 m. TU WG KF; tropical and South Africa; Madagascar. Ash 3083; Stewart 65; W. de Wilde 7813.

L. simplex is very variable vegetatively, in panicle shape and in the hairiness of the glumes. The habit and woolly basal sheaths are very similar to those of *L. flavida*, from which it can be readily distinguished by its blunt glumes and 2-toothed callus. The spikelets closely resemble those of *L. arundinacea* but this is a

taller, more vigorous grass, with wider leaf-blades and a large panicle with conspicuously whorled branches.

5. *L. kagerensis* (K. Schum.) Hutch. (1936);
Trichopteryx kagerensis K. Schum. (1895); Fröman & Persson, *Ill. Guide Grasses Eth.*: 89 (1974) - type: Tanzania, Stuhlmann 1961 (B holotype).

Tufted perennial; culms 25–90 cm high, slender, wiry, glaucous, the nodes black and glabrous, erect or ascending; basal leaf-sheaths glabrous, or at most thinly silky pubescent. Leaf-blades linear, flat, 2.5–15 cm long, 1–4 mm wide. Panicle elliptic-oblong, 5–16 cm long, moderately dense, the branches delicately ascending and flexuous. Spikelets 6–9 mm long, the glumes and lower lemma white-setose from black tubercles; lower glume ovate-elliptic, usually $\pm 1/2$ as long as the spikelet, narrowly obtuse to subacute; upper glume lanceolate, obtuse; lower lemma similar to the upper glume; upper lemma 3.5–5 mm long, sparsely pubescent, obscurely and usually obtusely bilobed (lobes <2 mm long); awn 2–3 cm long; callus narrowly oblong, 0.5–1 mm long, bidentate; anthers 2.

Reported in Ethiopia from open grassland on poor soils and rocky hillsides up to 2400 m; East Africa; Guinée to Angola.

L. kagerensis is very closely related to *L. simplex* but has on average smaller spikelets which are always setose, a slightly longer lower glume and a more slender, wiry habit with shorter leaf-blades.

ANDROPOGONEAE Dumort. (1824)

Clayton in *Kew Bull.* 27: 457–474 (1972) & 28: 49–57 (1973).

Annuals or perennials, sometimes tall and robust. Leaf-blades usually linear, rarely lanceolate or filiform; ligule scarious, or occasionally ciliate. Inflorescence composed of fragile racemes (tough in cultivated forms and *Hemarthria*), these terminal in panicles with elongate central axis, or more frequently digitate, paired or single, often axillary, subtended by spathes and gathered into a compound false panicle. Racemes composed of paired spikelets (with a terminal triad), almost always one spikelet sessile and the other pedicelled, rarely the racemes reduced to the terminal triad or even a single spikelet (*Cleistachne*); rarely the pedicelled vestigial or absent and if pedicels also reduced or absent then the sessile spikelets apparently single. Spikelets 2-flowered, those of a pair alike or more usually of different form and sex, the sessile fertile and the pedicelled male or barren (sexes reversed in *Trachypogon*); 1 or more of lowermost spikelet-pairs sometimes infertile, resembling the pedicelled, persistent (homogamous pairs); rhachis fracturing beneath each spikelet-pair; rhachis-internodes and pedicels adjacent, filiform, linear or thickened, sometimes very stout and partially enclosing the spikelet, falling with the sessile spikelet



Figure 116. *LOUDETIA* spp.: 1,3,5 glumes and lower floret; 2,4,6 upper floret with callus. *L. SIMPLEX*: 1 & 2 (from De Wilde 7813); *L. PHRAGMITOIDES*: 3 & 4 (from Stewart C17); *L. ARUNDINACEA*: 5 & 6 (from Gilbert & Phillips 8875). Drawn by Eleanor Catherine.

(pedicelled spikelet falling separately); an obtuse to pungent callus below the sessile spikelet. Sessile spikelet: glumes hardened, enclosing the delicate hyaline florets, lower variable, convex or 2-keeled, upper boat-shaped, fitting between internode and pedicel; lower floret male or barren, often reduced to a 2-keeled lemma; upper lemma fertile, narrow, entire or bifid, awnless or bearing a stout geniculate awn with twisted column. Pedicelled spikelet usually lanceolate and chartaceous, often smaller than the sessile.

Apart from a few anomalous genera, the members of this tribe can be readily recognized by their fragile racemes bearing paired spikelets, one sessile and the other pedicelled. The dispersal unit is thus composed of sessile spikelet, rhachis-internode and pedicel (pedicelled spikelet usually falls separately), all parts of which contribute to the protection of the seed.

In the more primitive members both spikelets of a pair are alike and fertile, and are arranged in a terminal panicle. In most genera, however, the pedicelled spikelet has lost its fertility and differs in shape and texture from the sessile. In some it is much reduced, in extreme cases its pedicel being reduced to a vestige or fused to the thickened internode. The sessile spikelets then appear single, and these species can be very confusing and difficult to name from keys, although the fragile rhachis gives a good clue to the correct tribe. Another trend apparent throughout *Andropogoneae* is the reduction of the large terminal inflorescence to a few digitate or paired racemes, often arising from the axils of leaves with inflated sheaths and reduced blades. In the most advanced genera the ultimate unit is a boat-shaped sheath without a blade (spatheole) subtending 1 or 2 short racemes, and by repeated axillary branching many of these are gathered into a compound leafy panicle.

The spikelets are basically 2-flowered, but this is not always readily apparent as the florets are delicate and often reduced. However, it is seldom necessary to dissect the spikelets in order to identify a member of *Andropogoneae*. The tip of the fertile lemma is sometimes important (whether entire or bilobed), but if the awn is gently drawn out the small lemma at its base can be examined with a hand lens.

1. Spikelets, or at least one of a pair, bisexual. 3
 - Spikelets all unisexual, the sexes separated in different inflorescences or different parts of the same inflorescence. 2
2. Spikelets unisexual in different inflorescences, the male in terminal panicles, the female in sheathed axillary "cobs"; cultivated (maize). 2
 - 160. *Zea*
 - Spikelets unisexual in the same inflorescence, male spikelets in a solitary raceme protruding from a bony bead-like utricle which encloses the female spikelet. 161. *Coix*
3. Spikelets arranged singly, unaccompanied by a vestige of second spikelet or pedicel. 4
 - Spikelets paired, one sessile and the other pedicelled (triads in *Chrysopogon*, *Sorghastrum* & *Lasiurus*; all pedicelled in *Imperata*); pedicelled spikelet sometimes reduced or vestigial. 6
4. Spikelets awned, exposed on slender rhachis-internodes and pedicels. 5
 - Spikelets awnless; sunken in the rhachis. 159. *Ophiuros*
5. Inflorescence large with an elongate central axis; robust annual to 2.5 m high. 132. *Cleistachne*
 - Inflorescence of digitate racemes; slender, often trailing annuals or perennials < 1 m high. 138. *Arthraxon*
6. Rhachis-internodes and pedicels slender, filiform to linear, or if thickened upwards the upper lemma awned. 7

- Rhachis-internodes and pedicels stout, angular, columnar or widening upwards, internode and pedicel sometimes connate; lemmas awnless. KEY 3 33
- 7. Spikelets of a pair similar, both fertile. 8
 - Spikelets of a pair different in shape and sex. 11
- 8. Inflorescence with an elongate central axis, longer than the lowest raceme. 9
 - Inflorescence of subdigitate racemes. 128. *Eulalia*
- 9. All the spikelets pedicelled; raceme rhachis tough; panicle silvery, densely spiciform. 125. *Imperata*
 - One spikelet of the pair sessile; raceme rhachis fragile, disarticulating at maturity. 10
- 10. Panicle large with numerous, usually silvery racemes; culms robust, cane-like, 2-6 m high. 126. *Saccharum*
 - Panicle narrow with few, appressed, brown racemes; culms slender, seldom exceeding 1 m high. 127. *Eriochrysis*
- 11. Sessile spikelet male or sterile; pedicelled spikelet fertile. 129. *Trachypogon*
 - Sessile spikelet fertile; pedicelled spikelet male, sterile or suppressed. 12
- 12. Racemes borne on an elongate central axis or its branches, with the axis clearly longer than the lowest raceme, not supported by spathes. 13
 - Racemes solitary, paired or subdigitate, often supported by spathes. 17
- 13. Pedicels and internodes solid. 14
 - Pedicels and internodes with a translucent, frequently purple, median line of oil-containing cells. 16
- 14. Lower glume of sessile spikelet dorsally compressed; racemes of several spikelet-pairs; pedicelled spikelets awnless. 15
 - Lower glume of sessile spikelet laterally compressed; racemes reduced to a triad of one sessile and two pedicelled spikelets; pedicelled spikelets awned. 133. *Chrysopogon*
- 15. Pedicels all bearing a spikelet. 130. *Sorghum*
 - Pedicels sterile, lacking spikelets. 131. *Sorghastrum*
- 16. Inflorescence an open panicle with capillary branches, each branch tipped with a triad of one sessile and two pedicelled spikelets. 134. *Capillipedium*
 - Inflorescence of many racemes in loose whorls on a central axis; racemes of > 8 spikelet-pairs. 135. *Bothriochloa*
- 17. Pedicels and internodes with a translucent, frequently purple, median line of oil-containing cells. 18
 - Pedicels and internodes solid. 19
- 18. Racemes erect or divergent, without basal pairs of homologous spikelets. 135. *Bothriochloa*
 - Racemes nodding, with 1-3 basal pairs of homologous spikelets. 136. *Euclasta*

19. Fertile lemma awned from the tip; homogamous pairs usually present. 20
 - Fertile lemma awned from the back or the sinus of the 2-toothed tip; homogamous pairs present or not. KEY 2 22
20. Callus obtuse; sessile spikelet sometimes with a circular pit. 137. *Dichanthium*
 - Callus pungent; sessile spikelet never pitted. KEY 2 21

KEY 2

21. Raceme with 2 large homogamous pairs at the base forming an involucre; racemes and spatheoles gathered into dense, fan-shaped bunches. 150. *Themeda*
 - Raceme with 2-several successive homogamous pairs resembling the pedicelled spikelets, not forming an involucre. 151. *Heteropogon*
22. Fertile lemma awned from low down on the back; culms slender, often trailing; leaf-blades lanceolate. 138. *Arthraxon*
 - Fertile lemma awned from the sinus of the 2-toothed tip. 23
23. Sessile spikelet ovate, conspicuously warty and ridged; pedicel without a spikelet. 139. *Thelepogon*
 - Sessile spikelet not warty; pedicel bearing a spikelet. 24
24. Lower floret of sessile spikelet male, with a palea. 25
 - Lower floret of sessile spikelet sterile, reduced to a lemma. 26
25. Racemes paired or digitate; ligule membranous. 140. *Ischaemum*
 - Racemes solitary; ligule ciliate. 141. *Sehima*
26. Callus of sessile spikelet short, obtuse (except *Diheteropogon*), inserted into the hollowed internode-tip, tip of callus hidden; lower glume of sessile spikelet flat or concave across the back (convex in *Schizachyrium*), the flanks 2-keeled or sharply inflexed. 27
 - Callus of sessile spikelet often acute to pungent, applied obliquely to the internode-tip, tip of callus exposed; lower glume of sessile spikelet convex with rounded flanks. 30
27. Callus of sessile spikelet acute to pungent; awn hairy; pedicelled spikelet larger than the sessile. 142. *Diheteropogon*
 - Callus of sessile spikelet obtuse; awn glabrous; pedicelled spikelet not larger than the sessile. 28
28. Racemes solitary; lower glume of sessile spikelet shallowly convex. 143. *Schizachyrium*
 - Racemes paired or digitate (or if solitary, lower glume of sessile spikelet concave and nerveless along the midline). 29
29. Racemes not deflexed, borne on unequal, \pm terete raceme-bases; leaves not aromatic. 144. *Andropogon*

- Racemes deflexed at maturity, borne on short, flattened raceme-bases barely exerted from the spatheole; leaves aromatic. 145. *Cymbopogon*
30. Racemes solitary, each cradled by a conspicuous, reddish spatheole; spikelets hairy. 146. *Monocymbium*
 - Racemes paired (sometimes solitary in *Hyparrhenia mobukensis* with glabrous spikelets). 31
31. Lower glume of sessile spikelet with a median groove; raceme-base extended into a scarious appendage 4-11 mm long. 147. *Hyperthelia*
 - Lower glume of sessile spikelet uniformly convex (grooved in *Hyparrhenia multiplex*); raceme-base appendage if present < 4 mm long. 32
32. Upper raceme-base up to 1 cm long but usually much shorter. 148. *Hyparrhenia*
 - Upper raceme-base 1.5-2.5 cm long, the racemes of a pair placed end to end; raceme-pair with 2 stout awns to 11 cm long. 149. *Exotheca*

KEY 3

33. Pedicel free from rhachis internode. 34
 - Pedicel adnate to the rhachis internode, often scarcely distinguishable; pedicelled spikelet sometimes absent. 37
34. Rhachis disarticulating obliquely; lower glume of sessile spikelet clearly bifid with pointed lobes. 152. *Elionurus*
 - Rhachis disarticulating horizontally; lower glume of sessile spikelet entire or emarginate. 35
35. Racemes silky-villous; spikelets often in triads. 153. *Lasiurus*
 - Racemes glabrous; spikelets in pairs. 36
36. Lower glume of sessile spikelet long-caudate; racemes terminal, digitate; trailing aquatic perennial. 154. *Vossia*
 - Lower glume of sessile spikelet not caudate, winged on the keels; racemes axillary, forming a copious compound panicle. 155. *Coelorhachis*
37. Racemes tough, not disarticulating; sessile and pedicelled spikelets similar; perennials. 156. *Hemarthria*
 - Racemes fragile; sessile and pedicelled spikelets (when present) dissimilar; annuals. 38
38. Lower glume of sessile spikelet globose, coarsely ornamented, wider than the rhachis. 157. *Hackelochloa*
 - Lower glume of sessile spikelet oblong, the spikelet narrower than the rhachis and sunk within it. 39
39. Pedicelled spikelet present. 158. *Rottboellia*
 - Pedicelled spikelet absent. 159. *Ophiuros*

125. IMPERATA Cyr. (1792)

Erect, rhizomatous perennials; leaf-blades basal, linear to inrolled; ligule scarious. Inflorescence a terminal, silky, cylindrical, spiciform panicle with numerous

short racemes; raceme-rhachis slender, not disarticulating, bearing paired spikelets, both spikelets of a pair on slender pedicels; spikelets and inflorescence branches enveloped in and obscured by long silky white hairs, these arising from the very short spikelet callus and from the glumes. Spikelets of a pair alike, small, delicate, ± terete, deciduous with the long involucre of callus-hairs from the pedicel tip; glumes subequal, as long as the spikelet, thinly membranous, lanceolate to oblong; lower floret usually reduced to an empty hyaline lemma, shorter than the spikelet; upper lemma fertile, similar to the lower lemma but slightly shorter, awnless, its palea short and broad; lodicules absent; stamens 1-2; grain ellipsoid.

8 species throughout the tropics, extending to warm temperate regions.

Imperata is related to *Saccharum*, being distinguished chiefly by its spiciform panicle of tough racemes with pedicelled spikelets.

I. cylindrica (L.) Raeuschel (1797);

Lagurus cylindricus L. (1759) - type: Europe (LINN holo.).

Vigorously rhizomatous perennial forming tough tufts from long scaly rhizomes; culms erect, 10-120 cm high, the nodes glabrous or bearded. Leaf-blades stiffly erect, linear, flat (in Ethiopia) with a stout white midrib, up to 100 cm long, 2-20 mm wide, acuminate. Panicle up to 20 cm long, densely cylindrical or the lowermost branches looser. Spikelets linear-oblong, 2.2-6 mm long with the enveloping callus-hairs 2-3 times as long; glumes narrowly lanceolate, several-nerved, pilose with long silky hairs, the tips ciliate; lower lemma oblong, c 1/2 spikelet length, the tip truncate-fimbriate and ciliate; upper lemma and palea similar but slightly shorter; stamens 2. Fig. 117:6.

Roadside ditches; 900-1600 m. WG IL KF; throughout the Old World tropics, extending to the Mediterranean and Middle East. Ash 2830; Friis et al. 2281; Sato 142 (ETH).

A widespread and often pernicious weed of disturbed ground and cultivations in warm parts of the Old World, but seldom found in Ethiopia. Populations from the Mediterranean and Middle East usually have narrow rolled leaf-blades, whereas in the tropics the leaf-blades are flat.

126. SACCHARUM L. (1753)

Erianthus Michx. (1803)

Narenga Bor (1940)

Tufted or rhizomatous perennials; culms robust, solid, often several metres high; leaf-blades broadly to narrowly linear; ligule scarious or ciliate. Inflorescence terminal, a large, often plumose panicle with elongate central axis, its branches bearing numerous racemes. Racemes fragile, the sessile and pedicelled spikelet of a pair similar, both fertile; rhachis-internodes and pedi-

cels slender. Spikelets lanceolate, dorsally compressed; callus short, obtuse, inserted into the slightly expanded internode or pedicel tip, bearing long silky hairs surrounding the spikelet; lower glume membranous or becoming coriaceous below (rarely completely coriaceous), flat to convex, laterally 2-keeled; upper glume navicular, centrally 1-nerved; lower floret reduced to a sterile hyaline lemma; upper fertile lemma entire or rarely bidentate, sometimes very narrow or small, with or without a short straight awn; stamens 2-3.

35-40 species throughout the tropics and subtropics, mostly in damp situations.

The fluffy callus hairs are an efficient aid to wind dispersal.

Saccharum officinarum L. is sugar cane, widely cultivated for sugar on moist soils throughout the tropics and subtropics. It seems to have originated in New Guinea, but now comprises a complex aggregate of hybrids (Stevenson, *Genetics and breeding of sugar cane*, 1965).

1. Spikelets membranous, at least in the upper part, acute to caudate; panicle silvery-white or off-white. 2
- Spikelets coriaceous throughout, truncate; panicle brownish-red. 1. *S. narenga*
2. Leaf-blades up to 4 cm wide; panicle-axis glabrous to pubescent; spikelets up to 4 mm long; cultivated. *S. officinarum* (see note above)
- Leaf-blades up to 2 cm wide; panicle-axis hirsute; spikelets 3.5-7 mm long; wild. 2. *S. spontaneum*

1. *S. narenga* (Nees ex Steud.) Hack. (1889);

Saccharum narenga Wall., Cat. no. 8856B (1848), nom. nud.; *Eriochrysis narenga* Nees ex Steud. (1855); *Sclerostachya narenga* (Nees ex Steud.) Grassl (1972) - type: Himalaya (K-WA).

Eriochrysis porphyrocoma Hance (1876); *Saccharum porphyrocomum* (Hance) Hack. (1889); *Narenga porphyrocoma* (Hance) Bor (1940).

Eriochrysis giordaniana Chiov. (1940) - type: Ethiopia, SU, Amara, Robi plain [below Debre Sina], *Giordano* 1721 (FT holo.).

Tall, coarse, clump-forming perennial from a stout rhizome; culms up to 6 m high, conspicuously bearded at the nodes, appressed-hirsute below the panicle. Leaf-blades flat or folded, up to 2 m long, 4-30 mm wide, narrowed into a false petiole, the margins harshly scabrid, tip attenuate. Panicle 20-55 cm long, narrow and dense with short ascending branches, golden-brown with white or violet hairs; racemes with filiform rhachis internodes and pedicels. Spikelets 2-3 mm long, the callus-hairs half as long to equalling the spikelet; lower glume narrowly lanceolate-oblong, coriaceous throughout, glabrous or thinly long-pilose with ciliate margins, flattened across the back, the margins intumed, becoming keeled and scabrid near the truncate tip; upper glume similarly coriaceous with ciliate margins; lower

lemma lanceolate, hyaline, the back reddish-brown and pilose upwards, margins ciliate; upper lemma similar, truncate, awnless.

Damp or well-drained, often sandy soils; 1300 m. SU; Pakistan, India and tropical SE Asia from the Himalayas to Malaysia.

This Asiatic grass is known in Ethiopia only from the type collection of *Eriochrysis giordaniana*, collected in 1937. It represents the most westerly known locality for the species, and if truly native in Ethiopia, it is curious that such a large and conspicuous grass should not have been collected since.

2. *S. spontaneum* L. (1771);

- type: India, Malabar, König (LINN holo.).

Robust rhizomatous perennial forming dense stands; culms cane-like, 2–5 m high. Leaf-blades tough, glaucous with a broad white midrib, 50–100 cm long, the margins scabrid, tip filiform. Panicle plumose, 30–60 cm long, glistening silvery-white, the central axis hirsute; racemes usually much longer than the supporting branches. Spikelets 3.5–7 mm long with callus-hairs 2–3 times as long; glumes membranous becoming coriaceous in the lower third, margins ciliate, tips acuminate to caudate; upper lemma subulate, unawned or sometimes suppressed. Fig. 117:7–9.

River banks and alluvial sand of river beds and islands, often growing with *Phragmites*. Africa and warm parts of Asia.

Saccharum spontaneum is a variable grass, usually divided into two geographically orientated subspecies, one mainly Asian and the other African, on the basis of leaf shape. Although most Ethiopian material is referable to the African subspecies *aegyptiacum*, Ethiopia lies at the overlap zone where the distributions of the two subspecies meet, and consequently variation in Ethiopia is continuous from one subspecies into the other.

1. Leaf-blades 2–7 mm wide, narrowed to the midrib towards the ligule; ligule triangular.

subsp. *spontaneum*

- Leaf-blades 6–20 mm wide, the lamina continuous on each side of the midrib down to the ligule; ligule crescentic. subsp. *aegyptiacum*

subsp. *spontaneum*

300–900 m. AF HA; northwards to Egypt; Arabia; widely distributed in warm parts of Asia. Gilbert 3470; Tadesse Ebba 811.

Subsp. *spontaneum* extends westwards from Arabia across the Red Sea into Egypt and Sudan. A few specimens with narrow leaf-blades from the eastern lowlands are best placed in this subspecies, although they are scarcely different from the narrowest-leaved forms of subsp. *aegyptiacum*.

subsp. *aegyptiacum* (Willd.) Hack. in DC., *Monogr. Phan.* 6: 115 (1889);

Saccharum aegyptiacum Willd. (1809); *S. spontaneum* L. var. *aegyptiacum* (Willd.) Hack., l.c. (1889) - type: Egypt, Schwartz s.n. (B holo.).

500–2000 m. EW TU IL GG SD; southwards to Malawi, westwards to Ghana and north to Egypt and Syria. Gilbert & Phillips 9073; Mesfin Tadesse & Kagnew 2391; Mooney 7343.

Saccharum ravennae (L.) Murray, which is frequent along water courses in northern Somalia, also has a large white or greyish, plumose panicle, but the spikelets are conspicuously awned.

127. **ERIOCHRYSIS** P. Beauv. (1812)

Tufted perennials; leaf-blades narrow, ligule ciliate or a short ciliate membrane. Inflorescence composed of a number of short, erect, densely spiculate racemes along a central axis; racemes fragile, the rhachis-internodes and pedicels short, linear to clavate, about half the length of the spikelets; spikelets of a pair similar, dorsally compressed, unawned; callus very short, truncate, bearded with hairs encircling the spikelet. Sessile spikelet bisexual, elliptic; lower glume coriaceous to chartaceous, back shallowly convex, margins inturned, ciliate; lower lemma sterile, lanceolate, hyaline, almost equalling the spikelet; upper lemma c 1/2 spikelet length, margins ciliate, the tip entire or minutely bidentulate and mucronulate; palea absent; stamens 3. Pedicelled spikelet slightly smaller, bisexual.

7 species; Africa and tropical America with one species in India; on marshy soils. The African species occur most frequently in southern tropical Africa, with sporadic occurrences as far west as Senegal. Apparently very rare in Ethiopia.

Eriochrysis is a homogeneous genus closely related to *Saccharum*, but differing by its smaller brown inflorescence of relatively few racemes borne directly on the main axis; slightly dissimilar sessile and pedicelled spikelets; and by the possession of the normal hollow grass culm unlike the solid culms found in *Saccharum*.

1. Callus hairs up to half the spikelet length, golden-brown; sessile spikelet 3-denticulate. 1. *E. brachypogon*
- Callus hairs fluffy, exceeding the spikelet, pale yellow-brown; sessile spikelet acute. 2. *E. pallida*

1. *E. brachypogon* (Stapf) Stapf (1917);

Saccharum brachypogon Stapf (1908) - types: Mali, Chevalier 716 (P syn.) & Nigeria, Barter 1351 (K syn.) & Central African Republic, Chevalier 8251 (P syn.).

Tussocky perennial surrounded at the base by old grey leaf-sheaths; culms erect, 60–100 cm high, the nodes bearded. Leaf-blades narrowly linear, inrolled, 7–30 cm

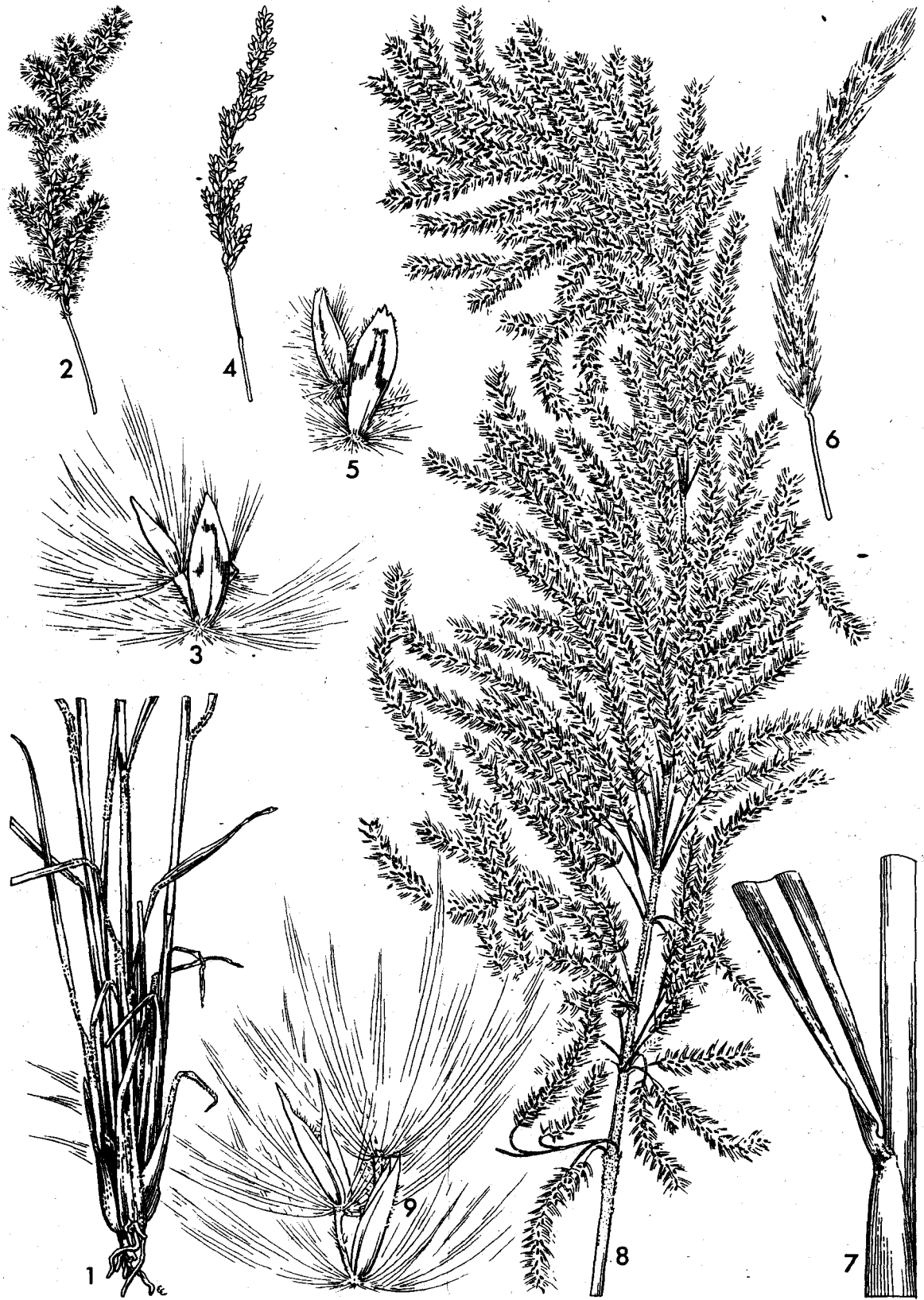


Figure 117. *ERIOCHRYSIS PALLIDA*: 1 - base of plant x 3/4; 2 - inflorescence x 1/2; 3 - spikelet pair x 5; *E. BRACHYPOGON*: 4 - inflorescence x 1/2; 5 - spikelet pair x 5. *IMPERATA CYLINDRICA*: 6 - inflorescence x 1/2. *SACCHARUM SPONTANEUM*: 7 - leaf base x 3/4; 8 - inflorescence x 1/2; 9 - spikelet pair x 5. 1 & 3 from Chiparawasha 347; 2 from Stewart A55; 4 & 5 from Stewart C8; 6 from Ash 2830; 7 from Gilbert & Phillips 9073; 8 & 9 from Mooney 7343. Drawn by Eleanor Catherine.

long, 1–3 mm wide, often reddish. Inflorescence 4–14 cm long, composed of 4–16 racemes 1.5–4 cm long; rhachis-internodes and pedicels linear-clavate, ciliate; spikelets bearded from the callus with a cirlet of golden-brown hairs up to 1/2 the spikelet length. Sessile spikelet 3.5–6 mm long; lower glume elliptic, coriaceous with thinner patches upwards, shiny, ciliate to densely villous on the inturned margins, tip 3-denticulate; upper glume usually glabrous on the keel, ciliate on the flanks; lower lemma ciliate; upper lemma ciliate, the tip minutely bidenticulate and mucronulate. Pedicelled spikelet 3–4 mm long. Fig. 117:4, 5.

Marshy grassland. KF; tropical and South Africa. Stewart C-8.

2. *E. pallida* Munro (1868);

Saccharum pallidum (Munro) Benth. (1881); *S. munroanum* Hack. (1889), nom. superfl.; *Eriochrysis munroana* (Hack.) Pilg. (1932) - types: South Africa, Burke 75 & Zeyher 1793 (both K syn.).

Densely tufted perennial; culms slender, erect, 40–140 cm high, the nodes bearded. Leaf-blades narrowly linear, flat, 6–20 cm long; 1–4 mm wide, hispidulous, acute. Inflorescence conspicuously hairy, 3–10 cm long, composed of 5–14 racemes 1–3.5 cm long; rhachis-internodes and pedicels linear, long-ciliate with hairs to 7 mm long; bearded from the callus with encircling yellow-brown hairs exceeding the spikelet. Sessile spikelet 3.5–6 mm long; lower glume elliptic, coriaceous becoming thinner with visible nerves near the tip, long-ciliate on the inturned margins, acute; upper glume villous on the flanks and back near the tip; lower lemma ciliate; upper lemma minutely bidenticulate and mucronate with long hairs on the margins and tip. Pedicelled spikelet c 3 mm long. Fig. 117:1–3.

Marshy grassland on black soil. KF; tropical and South Africa. Stewart 49, A55.

128. *EULALIA* Kunth (1829)

Tufted perennials or rarely annual; leaf-blades linear; ligule a truncate, often ciliate membrane. Inflorescence terminal, composed of 1-many subdigitate, long slender racemes; racemes fragile, hairy; spikelets of a pair alike; rhachis-internodes and pedicels slender; callus short, obtuse, shortly bearded, shallowly articulated at the internode-tip. Spikelets dorsally compressed; lower glume cartilaginous to coriaceous, ± flat across the back with incurving margins, sometimes keeled near the tip, usually lacking intercarinal nerves (but nerves present in Ethiopian species), often obtuse or truncate; upper glume similar but with a rounded median keel, usually awnless; lower floret reduced to a sterile lemma; upper lemma bidentate to deeply bifid, a glabrous geniculate awn arising from the sinus.

About 30 species in the Old World tropics.

The terminal digitate inflorescence can superficially resemble that of some species of *Andropogon*, but the awned fertile pedicelled spikelets provide a ready means of separation. *Eulalia* is in fact more closely related to *Saccharum*, which differs by its elongate paniculate inflorescence and long fluffy callus-hairs.

1. Inflorescence of (3–)6–12 racemes; leaf-blades 9–12 mm wide, flat, densely villous; spikelets glabrous on the back (hairy near the margins).

1. *E. villosa*

- Inflorescence of 1–6 racemes; leaf-blades 3–5 mm wide, often rolled, thinly hispid; spikelets hairy on the back.

2. *E. polyneura*

1. *E. villosa* (Thunb.) Nees (1841);

Andropogon villosus Thunb. (1794); *Pollinia villosa* (Thunb.) Spreng. (1824); *Pogonatherum villosum* (Thunb.) Roberty (1960) - type: South Africa, Thunberg (UPS-Thunb. 23914 holo.).

Pollinia sericea Chiov. (1897); *Eulalia sericea* (Chiov.) Stapf (1917) - type: Ethiopia, SD, Giaribule to Herr, Riva 109 (FT holo.).

Tussocky perennial, the whole plant softly villous, often reddish-tinged; culms erect, moderately robust, 1–2.5 m high. Leaf-blades held erect, broadly linear, flat, densely villous, up to 40 cm long, 9–12 mm wide, narrowed to the ligule, acute. Inflorescence of (3–)6–12 slender digitate racemes; racemes 10–20 cm long, yellowish- or golden-brown with white hairs; internodes and pedicels stoutly linear, ciliate. Spikelets 6–7 mm long; lower glume narrowly elliptic, coriaceous with 2 intercarinal nerves (one lying alongside each keel), the back glabrous, gently concave to almost flat, the incurved margins hairy, becoming keeled and ciliate towards the narrowly truncate tip; upper glume hairy along the keel, acute; lower lemma thinly cartilaginous below the middle, hyaline above; upper lemma half as long as the spikelet or less, bifid for 1/3–1/2 its length; awn 1–2 cm long. Fig. 118.

Rough, usually wet, upland grassland; 1700–2500 m. IL KF SD; southwards to South Africa; Madagascar; India. Friis et al. 177; Gilbert & Phillips 8852; Mesfin & Kagnev 2448.

2. *Eulalia polyneura* (Pilg.) Stapf (1917);

Pollinia polyneura Pilg. (1907) - type: Kenya, Baker in F.D. 19 (EA iso.).

Perennial forming loose tussocks from a short rhizome; culms compressed at the base with keeled sheaths, ascending, 60–120 cm high, the nodes bearded. Leaf-blades tough, flat or convolute, 10–45 cm long, 3–5 mm wide, hispid, the margins scabrid, tip acute. Inflorescence of 1–6 subdigitate erect racemes on a short axis up to 3 cm long; racemes 8–15 cm long, glossy golden-brown with white or occasionally violet-tinged hairs; internodes and pedicels very slender, ciliate. Spikelets 6–8 mm long; lower glume narrowly elliptic-oblong, coriaceous with 5–7 intercarinal nerves (visible on inside), shallowly convex or flat across the back, villous,

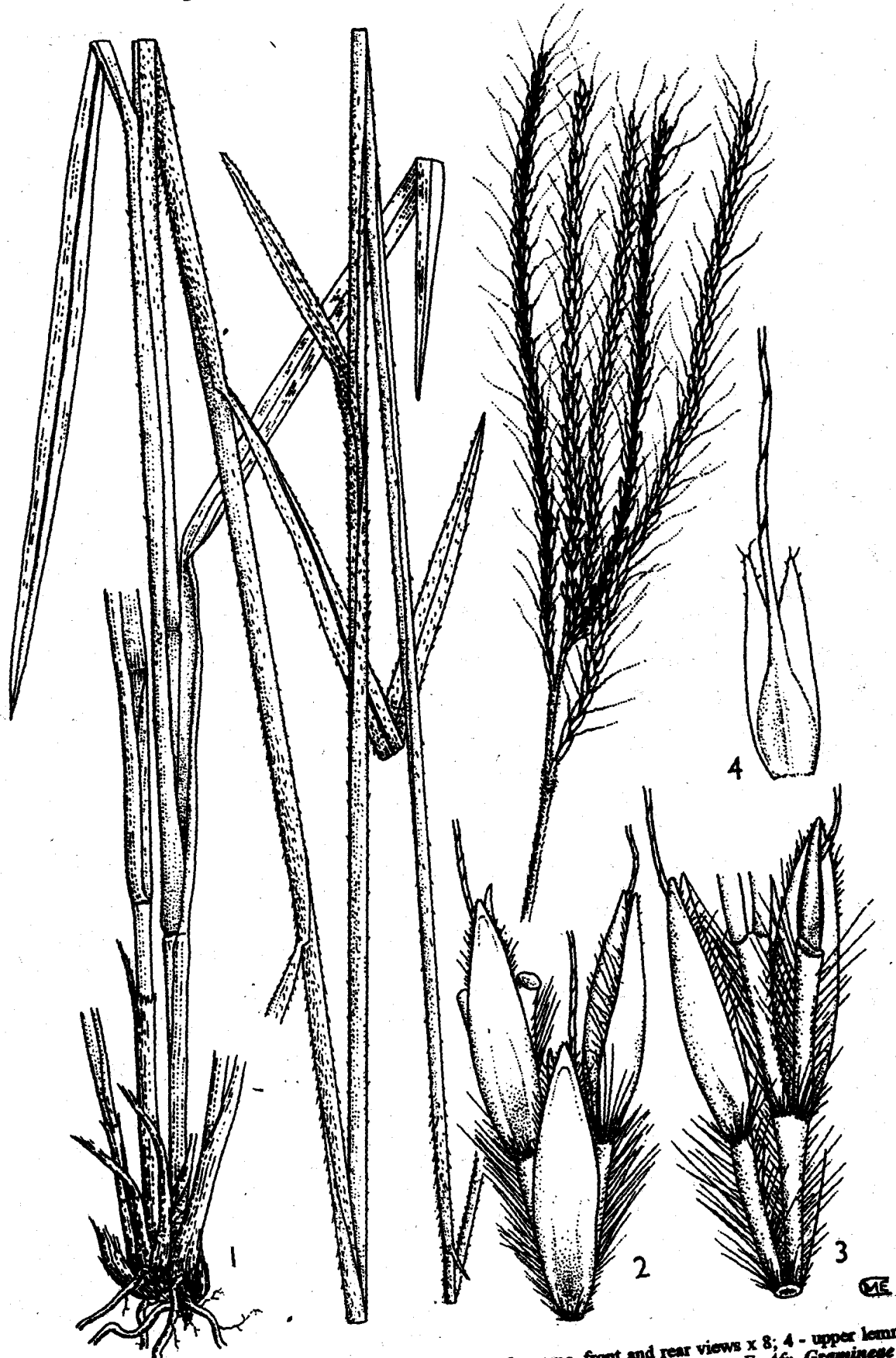


Figure 118. *EULALIA VILLOSA*: 1 - habit x 4/5; 2, 3 - portion of raceme, front and rear views x 8; 4 - upper lemma x 13. All from Milne-Redhead & Taylor 8948. Drawn by Maureen Church. (Reproduced from *Fl. Trop. E. Afr. Gramineae* 3: Fig. 165, with permission of the Editors).

the margins incurved, becoming keeled and scabrid near the ciliate, truncate tip; upper glume fractionally longer, similarly truncate and ciliate; lower lemma hyaline; upper lemma 3/4 as long as the spikelet, bifid for almost half its length, the teeth twining around the awn-base; awn 10–16 mm long.

Upland grassland, sometimes swampy, 2000–3000 m. SU AR KF SD BA HA; Kenya, Tanzania and Mozambique. Friis et al. 3553; Mooney 5309; Stewart 105.

A less robust species than *E. villosa* with shorter culms, tough narrow leaf-blades and very slender rachis-internodes and pedicels. It is unusual in *Eulalia* in possessing several intercarinal nerves across the back of the lower glume, but these are only visible from the inside.

129. **TRACHYPOGON** Nees (1829)
Homopogon Stapf (1908)

Tufted annuals or perennials; leaf-blades linear to convolute; ligule membranous. Inflorescence terminal, a solitary raceme or 2-several racemes arranged digitately; raceme-rachis tough, not disarticulating; internodes elongate, slender; pedicels filiform; spikelets narrowly oblong. Sessile spikelet raised on a short stout stipe, persistent, usually male or sterile, similar to the pedicelled but unawned and lightly dorsally flattened. Pedicelled spikelet fertile, subterete; callus pungent, obliquely inserted on the pedicel-tip; lower glume coriaceous, obtuse to truncate; upper glume thickly 3-nerved with grooves between; lower floret reduced to a hyaline lemma; upper lemma stipitiform, entire or bidentate, passing into a large hairy awn.

3–5 species in Africa and south and central America.

Trachypogon exhibits a reversal of the normal situation in the Andropogonoid spikelet-pair, as the pedicelled spikelet is awned and fertile instead of the sessile spikelet. It is the only genus in Ethiopia with a geniculate awn arising from the pedicelled spikelet coupled with an unawned sessile spikelet.

T. spicatus (L.f.) Kuntze (1891);

Stipa spicata L.f. (1781); *Trachypogon capensis* Trin. (1832), nom. superfl.; *Andropogon spicatus* (L.f.) Steud. (1854) - type: South Africa, Cape, Thunberg (LINN holo.).

Densely tufted perennial of variable habit; culms erect, slender to stout, 30–200 cm high. Leaf-blades linear to convolute, 15–40 cm long, 1–7 mm wide, the tip filiform; leaf-sheath with auricles at the mouth. Raceme solitary (rarely up to 5), 4–30 cm long; spikelets 6–10 mm long, usually pubescent (but sometimes glabrous or villous). Sessile spikelet male, grey; lower glume with inflexed margins, very narrowly winged upwards. Pedicelled spikelet on a white-bearded callus 1–3 mm long; lower glume convex, not winged, upper lemma

awn 4–7 cm long with a flexuous plumose column and scaberulous limb. Fig. 119.

Wooded grassland and dry grassy hillsides; 1600–2100 m. SD BA; tropical and South Africa. Gillett 14550; Mooney 5482; Friis et al. 5577B (ETH).

130. **SORGHUM** Moench (1794), nom. conserv.

Snowden, The cultivated races of *Sorghum*. Adlard & Son, London (1936); Garber in *Univ. California Publ. Bot.* 23: 283–361 (1950); Snowden in *J. Linn. Soc. Bot.* 55: 191–260 (1955); Celarier in *Cytologia* 23: 395–418 (1959); de Wet & Huckaby in *Evolution* 21: 787–802 (1967); Doggett, *Sorghum*. Longmans (1970); de Wet, Harlan & Price in *Amer. Journ. Bot.* 57: 704–707 (1970); Harlan & de Wet in *Crop Sci.* 12: 172–176 (1972); de Wet in *Amer. J. Bot.* 65: 477–484 (1978); Ivanyukovich & Doronina in *Trudy Prikl. Bot. Genet. Selek.* 69: 18–27 (1980); Clayton & Renvoize, *Fl. Trop. E. Afr.*, Gramineae pt. 3 (1982).

Annuals or perennials, sometimes with rhizomes; culms often robust. Leaf-blades linear to lanceolate; ligule scarious or rarely ciliate. Inflorescence a terminal panicle with elongate central axis, the primary branches simple or branched, bearing short fragile racemes (tough in cultivated species) of paired spikelets; rachis-internodes and pedicels slenderly linear, ciliate. Sessile spikelet dorsally compressed, its callus obtuse or rarely pungent (in Australia), bearded, inserted into the internode-tip; lower glume shallowly convex with rounded flanks, crustaceous, often hairy, 2-keeled at the membranous tip; lower floret reduced to an empty hyaline lemma; upper lemma bidentate with a bigeniculate awn from the sinus, or infrequently awnless; grain mostly obovoid, dorsally compressed. Pedicelled spikelet male or sterile, usually much narrower than the sessile, chartaceous, pubescent, awnless.

20–30 species in tropical and subtropical regions of the Old World; one species endemic in Mexico. Introduced to America.

The species of *Sorghum* occurring in Ethiopia fall into two distinct sections, which are not closely related and do not interbreed. Section *Parasorghum* comprises only wild plants. Most Ethiopian plants fall within subsect. *Arundinacea* of section *Sorghum*, comprising the very great variety of freely interfertile diploid ($2n=20$) forms of cultivated sorghum, its wild progenitor and intermediates between the two arising from widespread hybridisation and backcrossing. Previously many of these forms were accorded separate specific status (Snowden, 1936 & 1955), but it is now recognized that they all represent one biological species without any genetic barriers (de Wet & Huckaby, 1967). Nowadays they are either all included within the all-encompassing name *S. bicolor* at subspecific and cultivar level (de Wet, 1978), or for reasons of practical convenience the crop, wild and intermediate forms are grouped under



Figure 119. *TRACHYPOGON SPICATUS*: 1 - habit x 2/3; 2 - portion of raceme x 2½; 3 - spikelet pair x 3½; 4 - detail of raceme x 2½; 5 - tip of upper lemma and base of awn x 5. 1 from *Chabwela* 5332; 2 & 3 from *Mdehwa*; 4 & 5 from *Greenway & Kanuri* 14339. Drawn by Ann Davies. (Reproduced from *Fl. Trop. E. Afr. Gramineae* 3: Fig. 163, with permission of the Editors).

three separate binomials (Doggett, 1970; Clayton & Renvoise, 1982) as in this treatment.

Sorghum × *drummondii* (Steud.) Millsp. & Chase [= *S. bicolor* subsp. *drummondii* (Steud.) de Wet] is the name generally applied to weedy derivatives of hybridization between the crop plant *S. bicolor* and *S. arundinaceum*. These plants occur in fields of the crop, and may persist for a while in abandoned cultivations. They typically have closer panicles than the wild type, with more or less tough racemes of larger grains, which however are not free threshing as in cultivated sorghum, but remain tightly enclosed by the glumes. The races represented by the species names *S. aterrimum* Stapf, *S. elliotii* Stapf, *S. hewisonii* (Piper) Longley, *S. niloticum* (Piper) Snowden, *S. nitens* (Büsse & Pilg.) Snowden, and *S. sudanense* (Piper) Stapf belong here. *Sorghum sudanense* (Sudan Grass) is widely grown in America and elsewhere as a forage crop. It must be emphasized that *S.* × *drummondii* is merely a species of convenience, and that free gene flow between wild and cultivated forms has led to continuous variation.

Section *Sorghum* also includes subsect. *Halepensia*, a group of freely interfertile, strongly rhizomatous tetraploid ($2n=40$) perennials comprising *S. halepense* (L.) Pers. This is native from southern Eurasia eastwards to India, but is now distributed throughout the world in warm temperate regions as a weed. The forage known as Johnson Grass is a selection of *S. halepense*. The species introgresses with grain sorghum (*S. bicolor*) where both grow together. *S.* × *alrum* Parodi (Columbus Grass) is another widely grown rhizomatous forage which originated in Argentina by such introgression from *S. bicolor*.

1. Nodes of culm glabrous or pubescent; panicle-branches subdivided; awns usually < 3 cm long (sect. *Sorghum*). 2
- Nodes of culm with a ring of spreading white hairs; panicle-branches simple; awns 2.6–6 cm long (sect. *Parasorghum*). 4
2. Racemes fragile, readily disarticulating; leaf-blades 1–3(–7) cm wide; wild.
 1. *S. arundinaceum*
 - Racemes tough or tardily disarticulating; leaf-blades broad, wavy, up to 12 cm wide; cultivated or spontaneous. 3
 3. Grain enclosed by the glumes; racemes tough or sessile spikelets tardily deciduous; crop weed.
 - S.* × *drummondii* (see note above)
 - Grain large, usually exposed by the gaping glumes; racemes tough, the sessile spikelets persistent; cultivated. 2. *S. bicolor*
4. Sessile spikelet 8–10 mm long, lanceolate; pedicelled spikelet 6–10 mm long.
 3. *S. purpureo-sericeum*
 - Sessile spikelet 5–7 mm long, elliptic-oblong; pedicelled spikelet 3–5 mm long. 4. *S. versicolor*

1. *S. arundinaceum* (Desv.) Stapf (1917);

Andropogon arundinaceus Willd. (1806), non Berg (1767); *Rhaphis arundinacea* Desv.; *S. bicolor* (L.) Moench var. *arundinaceum* (Desv.) de Wet & Huckaby (1967); *S. bicolor* (L.) Moench subsp. *arundinaceum* (Desv.) de Wet & Harlan in Harlan, de Wet & Stemler, *Origins Afr. Pl. Domestication*: 455 (1976). - type: Ghana [Guinea], *Isert* (B holo.).

Andropogon verticilliflorus Steud. (1854); *A. sorghum* (L.) Brot. subsp. *verticilliflorus* (Steud.) Piper in *Proc. Biol. Soc. Wash.* 28: 37 (1915); *Sorghum verticilliflorum* (Steud.) Stapf (1917); *S. bicolor* (L.) Moench var. *verticilliflorum* (Steud.) de Wet & Huckaby (1967) - type: Réunion (whereabouts unknown).

Andropogon sorghum (L.) Brot. var. *aethiopicus* Hack. in DC., *Monogr. Phan.* 6: 504 (1889); *Sorghum aethiopicum* (Hack.) Stapf (1917); *S. bicolor* (L.) Moench var. *aethiopicum* (Hack.) de Wet & Huckaby (1967) - types: Sudan, *Kotschy* 173 (K iso-syn.) and several other syntypes.

Andropogon sorghum (L.) Brot. subsp. *abyssinicus* Piper in *Proc. Biol. Soc. Wash.* 28: 39 (1915); *Sorghum abyssinicum* (Piper) Stapf (1917), non *S. abyssinicum* (Fresen.) Kuntze (1891); *S. macrochaeta* Snowden (1936), nom. nov. - type: Sudan/GD border, Matamma, *Schweinfurth* 1521 (K iso.).

Sorghum panicoides Stapf (1917) - type: Eastern Ethiopia, without precise locality, *Figari* s.n. (K holo.).

S. lanceolatum Stapf (1917).

S. castaneum C.E. Hubb. & Snowden (1936).

Tufted annual or short-lived perennial; culms slender to robust, usually erect, 1–4 m high, the nodes glabrous or appressed-pubescent. Leaf-blades variable, up to 50 cm or more long, 1–3(–7) cm wide. Panicle up to 60 cm long, narrow with suberect branches varying to open with widely spreading stiff or flexuous branches; primary branches whorled, bearing the racemes on secondary branchlets; racemes fragile, with 2–8 spikelet-pairs. Sessile spikelet 4–10 mm long; lower glume lanceolate to elliptic, white or fulvously pubescent to glabrescent or sometimes tomentose, pallid or becoming brown or blackish at maturity; awn up to 3 cm long, occasionally absent. Pedicelled spikelet linear-lanceolate, male or sterile, deciduous.

Rough grassland, field margins, abandoned cultivations and along water courses; also as a weed of cultivated sorghum; 600–2400 m. AF EW GD WU GJ SU AR IL GG SD HA; throughout tropical and South Africa; also in India (Punjab). *Burger* 3031; *Gilbert & Phillips* 9150; *Gilbert & Thulin* 177.

S. arundinaceum comprises an extremely variable complex of intergrading forms of wild sorghum, which are fully interfertile with each other and also with the crop plant *S. bicolor*. Many were originally described as

separate species (Snowden, 1955, lists 13 species under his subsection *Arundinacea*), but nowadays the variation is consigned to 4 broad groups or races at infra-specific level, although the old specific names can still be used for convenience (De Wet, Harlan & Price, 1970; Doggett, 1970):

S. verticilliflorum. Robust perennial; large open panicle with rather stiff branches; racemes of 4–8 spikelet-pairs; sessile spikelets 4–8 mm long; awn obvious, 1–2.5 cm long.

Most Ethiopian specimens fall within the *S. verticilliflorum* group, the commonest form in eastern and southern Africa. De Wet (1970) postulates that cultivated sorghum arose from this race. The type of *S. macrochaeta* falls within its variation range.

S. aethiopicum. Annual or weak biennial; narrow panicle with suberect branches; racemes of 1–4 spikelet-pairs; sessile spikelets large, 6–10 mm long, tomentose; awns obvious, up to 3 cm long.

Restricted to the Sahel zone from Mali to Eritrea. Parker E470.

S. arundinaceum. Robust perennial; leaf-blades broad, to 7 cm wide; ample panicle with many long flexuous branches; sessile spikelets 6–9 mm long; awn poorly developed or absent, 0–1 cm long.

The wet forests of West Africa.

S. virgatum. Leaf-blades narrow, 0.5–1.5 mm wide; panicle linear with scanty branches; sessile spikelets lanceolate, 6.5–7 mm long, usually hairy above the middle; awn inconspicuous, 0.8–1.6 cm long.

The Nile valley in Egypt and Sudan, also in Chad. Considered by Doggett (1970) to be *S. arundinaceum* x *halepense*.

The name *S. panicoides* is based on an unusual specimen with narrowly elliptic awnless sessile spikelets only 4–5 mm long, and thinner glumes than usual.

2. *S. bicolor* (L.) Moench (1794);

Holcus bicolor L. (1771) - type: Herb. Clifford 468 (BM lecto.).

H. saccharatus L. (1753), nom. confus.

Sorghum vulgare Pers. (1805).

S. cernuum Host (1809).

Andropogon subglabrescens Steud. (1854); *Sorghum subglabrescens* (Steud.) Schweinf. & Aachers. (1867) - type: Ethiopia, TU, Djeladjekanne, *Schimper* 623 (K iso.).

S. membranaceum Chiov. (1912) - types from Eritrea.

S. ankolib (Hack.) Stapf (1917) - type: Sudan/GD border, Gallabat, *Schweinfurth* 1530 (K iso.).

S. caudatum (Hack.) Stapf (1917) - type from Sudan.

S. durra (Forsk.) Stapf (1917).

S. roxburgii Stapf (1917).

S. dochna (Forsk.) Snowden (1935).

S. nigricans (Ruiz & Pavon) Snowden (1935).

Annual; culms robust, erect, up to 5 m high, the nodes glabrous or pubescent. Leaf-blades large, up to 90 cm long and 12 cm wide, usually ± glabrous. Panicle up to 60 cm long, open or often contracted, the primary branches whorled, ascending to spreading, stiff or pendulous, branched, the lower often almost as long as the panicle; racemes tough, with 1–5 spikelet-pairs. Sessile spikelets variable, 3–9 mm long, 2–5 mm wide at maturity, elliptic to oblong, glabrous to pilose; upper lemma usually with a short geniculate awn; grain large, usually exposed between the gaping glumes. Pedicelled spikelet linear-lanceolate, male or sterile, persistent or deciduous.

S. bicolor is the important tropical cereal sorghum, which originated in Africa but its cultivation for both grain and fodder spread throughout the tropics and subtropics of the Old World; it was introduced with the slave trade to America, including warm parts of the U.S.A. *Sorghum* was probably first domesticated in sub-Saharan Africa over 3000 years ago, and the savanna zone from Sudan to Chad is postulated as the probable centre of origin by Harlan (*Science* 174: 468–474, 1971).

The many forms of grain sorghum have been derived by human selection from wild *S. arundinaceum*, with which they are fully fertile. Snowden (1936) recognized 28 species of cultivated sorghum, but these represent no more than intergrading cultivars within the common pool of variation. Specific names listed by Cufodontis (*Enum.*: 1369) are cited above; details of the multiplicity of infraspecific epithets referable to these names can be found in Snowden (1936). Harlan and de Wet (1972) grouped the cultivated sorghums into 5 basic races distinguished by grain and panicle morphology. Race *kafir* is a southern African form, but the other 4 races are grown in Ethiopia and are distinguished as follows (from Stemler, Harlan & de Wet, *Evolutionary history of cultivated sorghums of Ethiopia*. In *Bull. Torrey Bot. Club* 102: 325–333, 1975):

Bicolor. Relatively small grain enclosed by the glumes; loose panicle with long branches. A primitive type grown infrequently in western and northern Ethiopia.

Guinea. Discoid grains twisted sideways with respect to the glumes; glumes long and gaping; loose panicle. A type favoured in higher rainfall areas; grown in Ethiopia only in Gamo Gofa.

Caudatum. Grains gibbous on the embryo side; compact panicle. The staple sorghum from Sudan westwards to Nigeria, extending into lowland areas of south and west Ethiopia and hot valleys dissecting the uplands; also in Kenya and Uganda.

Durra. Grains flat, obovate, bulging at the top with a narrow wedge-shaped base; glumes transversely creased; compact panicle. The most important race economically in Ethiopia, cultivated in the eastern and northern highlands; also in parts of the Sahel and in India.

A fifth type, durra-bicolor, is intermediate in characteristics between durra and bicolor. It is adapted to the moist cool conditions of the Ethiopian plateau, and is especially important in the southwestern highlands.

3. *S. purpureo-sericeum* (Hochst. ex A. Rich.) Aschers. & Schweinf. (1867);

Andropogon purpureo-sericeus Hochst. ex A. Rich. (1850) - type: Ethiopia, TU, Mt Walcha, Schimper 1551 & Mareb R., Quartin Dillon & Petit (both K isosyn.).

A. purpureo-sericeus Hochst. ex A. Rich. var. *calomelas* Hack. in DC., *Monogr. Phan.* 6: 525 (1889) - type: Ethiopia, TU, Dschadacha, Schimper 1417 (P holo., K iso.).

A. purpureo-sericeus Hochst. ex A. Rich. var. *pallidior* Hack., l.c.: 525 (1889) - type: Sudan/GD border, Gallabat, Schweinfurth 1033 (K iso.).

A. pappii Gand. (1920) - type: Eritrea, Medri-od-Tesfa, Pappi 6735 (LY holo.).

Annual; culms erect, solitary or tufted, 40–150 cm high, bearded at the nodes with a conspicuous circlet of spreading hairs. Leaf-blades 9–50 cm long, 2.5–10 mm wide, pubescent. Panicle 6–35 cm long, the branches whorled, simple, flexuously ascending, each tipped by a fragile raceme with 2–5 spikelet-pairs; rhachis-internodes and pedicels conspicuously ciliate with whitish, golden-brown or rufous hairs. Sessile spikelet 8–10 mm long; callus bearded with long hairs surrounding the spikelet base; lower glume lanceolate-oblong, hard, dark brown to purplish-black at maturity, glossy, thinly brown-hispid near the margins and tip; awn 3–6 cm long. Pedicelled spikelet linear-lanceolate, 6.5–10 mm long, green. Fig. 120:1, 2.

Grassland and open woodland, and as a weed of tef on black clay, 1100–2000 m, EW TU GD SU GG SD; westwards to Nigeria and southwards through Uganda and Kenya to Tanzania. *De Wilde* 7881; *Gilbert & Sebsebe* 8667; *Gilbert & Thulin* 371.

A handsome species showing some variation in panicle colour. The immature racemes are pale, but the sessile spikelets generally turn blackish at maturity, the surrounding hairs flushing reddish or golden-brown.

4. *S. versicolor* Anderss. (1863);

Andropogon serratus Thunb. var. *versicolor* (Anderss.) Hack. (1889) - type: Mozambique, Peters (whereabouts uncertain, not B).

Annual or short-lived perennial; culms, solitary or tufted, 25–150 cm high, bearded at the nodes with a conspicuous circlet of spreading hairs. Leaf-blades 10–30 cm long, 3–10 mm wide. Panicle 5–25 cm long, the branches whorled, simple, loosely ascending, each tipped by a fragile raceme with 3–7 prominent awns; rhachis-internodes and pedicels ciliate with pallid or brownish hairs. Sessile spikelet 5–7 mm long; callus bearded with long pallid to rufous hairs; lower glume elliptic-oblong, hard, reddish-brown to black at matur-

ity, glossy, glabrous to loosely pilose; awn 2.5–4 cm long. Pedicelled spikelet linear to lanceolate, 3–5 mm long, green.

Deciduous bushland and open woodland on black clay, 1400 m. SD; Kenya southwards to South Africa. *Gilbert* 3349.

S. versicolor differs from *S. purpureo-sericeum* in little more than its slightly smaller spikelets, but has a more southern distribution and they reportedly do not cross (*Garber in Univ. California Publ. Bot.* 23:317, 1950). A very few specimens from southern Ethiopia have sessile spikelets at the top end of the variation range for *S. versicolor*, but are otherwise indistinguishable from *S. purpureo-sericeum* and are very doubtfully placed here under *S. versicolor*.

131. SORGHASTRUM Nash (1991)

Annuals or perennials; leaf-blades linear, ligule scarious. Inflorescence a terminal panicle, the primary branches branched, flexuous, bearing short fragile racemes, or these reduced to a single triad (appearing as a single sessile spikelet); rhachis-internodes and pedicels filiform, ciliate. Sessile spikelet dorsally compressed, its callus obtuse to pungent, bearded; lower glume coriaceous, convex with rounded flanks, 2-keeled only at the tip; lower floret reduced to an empty hyaline lemma; upper lemma hyaline, bidentate, a straight or geniculate awn arising from the sinus, rarely awnless. Pedicelled spikelet absent, its slender pedicel somewhat shorter than the sessile spikelet.

A relative of *Sorghum* distinguished by its barren pedicels.

About 16 species in Africa and Tropical America.

1. Plant annual; awns 25–40 mm long; all spikelets accompanied by 2 barren pedicels.

1. *S. bipennatum*

– Plant perennial; awns up to 15 mm long; most spikelets accompanied by only 1 barren pedicel.

2. *S. stipoides*

1. *S. bipennatum* (Hack.) Pilg. (1938);

Andropogon bipennatus Hack. (1885); *Sorghum bipennatum* (Hack.) Kuntze (1891) - type: Sudan, Schweinfurth 2486 (K iso.).

Loosely tufted annual; culms 30–300 cm high, often decumbent and rooting at the lower nodes; leaf-blades 10–60 cm wide. Panicle narrowly lanceolate, 10–40 cm long, the peduncles capillary and glabrous or with a few hairs near the discoid tip; racemes reduced to a single sessile spikelet accompanied by 2 barren pedicels. Spikelets narrowly ovate, 4–5.5 mm long; callus rounded; lower glume becoming dark brown at maturity, pilose with white, grey or yellowish hairs; awn of upper lemma 2.5–4 cm long, bigeniculate, puberulous along the spiral.



Figure 120. *SORGHUM PURPUREO-SERICEUM*: 1 - base of plant and inflorescence x 3/4; 2 - spikelet pair x 5. *CLEISTACHNE SORGHOIDES*: 3 - base of plant and inflorescence x 3/4; 4 - portion of panicle branch x 3; 5 - spikelet x 5. 1 from *Frits et al.* 3329; 2 from *Gilbert et al.* 371; 3-5 from *Siegenthaler* 1583. Drawn by Eleanor Catherine.

Wooded grassland; 1300 m. SD; tropical Africa and Madagascar. *Yoseph* s.n. (ETH).

The racemes are reduced to the terminal sessile spikelet only, which is therefore accompanied by 2 pedicels.

2. *S. stipoides* (Kunth) Nash (1912);

Andropogon stipoides Kunth (1816) - type: Colombia, *Humboldt & Bonpland* (P, holo.).

Tufted perennial arising from a short rhizome; culms 90 cm to 2 m high. Leaf-blades often rolled, 15–50 cm long, 3–7(–12) mm wide. Panicle linear to narrowly lanceolate, 15–40 cm long, with capillary peduncles; racemes composed of 1–4 sessile spikelets, each accompanied by a barren pedicel. Spikelets lanceolate, 4–6(–6.5) mm long; callus rounded, shortly bearded; lower glume coriaceous, shining, without visible nerves, glabrescent to loosely hairy with white or grey hairs; awn geniculate, (0–)4–13(–25) mm long.

Seasonally marshy places; c 1800 m. KF; tropical Africa and tropical South America. *De Wilde* 6976 (ETH).

132. *CLEISTACHNE* Benth. (1882)

Tall annual; leaf-blades linear; ligule scarious. Inflorescence a large terminal panicle with elongate central axis, bearing many short primary branches, sometimes with a few secondary branches near the base; each primary branch raceme-like, bearing pedicellate spikelets along its length; spikelets single, falling from the expanded crateriform tip of the slender pedicels. Spikelets narrowly lanceolate, dorsally compressed; callus very short, rounded; lower glume coriaceous, glossy, the flanks rounded; lower floret reduced to an empty hyaline lemma; upper lemma linear, bidentate with a bigeniculate, glabrous awn from the sinus.

One species in tropical Africa and India.

The inflorescence appears to be composed of many racemes with single pedicellate spikelets arranged along their length. Actually each spikelet is thought to represent a unispiculate raceme, and hence the supporting pedicel is really a peduncle. This is the ultimate stage in the reduction of a raceme; an intermediate stage where the raceme is reduced to the terminal triad of one sessile and two pedicelled spikelets can be seen in *Chrysopogon*.

In *Cleistachne* the pedicelled spikelets of the normal paired arrangement typical of the tribe *Andropogoneae* are completely missing. This can cause difficulty for beginners, but the spikelets are so similar to those of *Sorghum* that the two genera must be closely related.

C. sorghoides Benth. (1882);

- type: Mozambique, *Kirk* (K holo.).

Coarse annual; culms robust, erect, up to 2.5 m high, often supported by stilt roots. Leaf-blades cauline, up to 90 cm long, 4–15 mm wide, hispid, narrowed to the

midrib towards the ligule and sometimes falsely petiolate, acuminate; leaf-sheaths hispid. Panicle narrowly oblong, up to 40 cm long, the branches 4–8 cm long, branches and pedicels pilose. Spikelets 4–5 mm long, golden brown becoming blackish; lower glume stiffly pubescent with fulvous or pallid hairs; lower lemma margins fulvously ciliate upwards; awn 1.5–3.5 cm long. Fig. 120:3–5.

Moist grassland and old cultivations, especially near rivers; 1200–1400 m. GJ WG KF; eastern Africa from Sudan to Transvaal. *Mesfin Tadesse & Kagnew* 2242; *Parker* 365; *Siegenthaler* 1583.

133. *CHRYSOPOGON* Trin. (1822), *nom. conserv.*

Tufted perennials; leaf-blades linear; ligule ciliate or a membranous rim. Inflorescence a terminal panicle with whorled branches spaced along an elongate central axis; the branches filiform, flexuous, each with an expanded ciliate tip supporting a raceme reduced to a single deciduous triad of one sessile and two pedicelled spikelets; pedicels linear, bearded, shorter than the sessile spikelet. Sessile spikelet laterally compressed, linear-oblong, its callus elongate, acute to pungent, obliquely inserted at the branch-tip; lower glume firm, the back convex with strongly inturred flanks; upper glume keeled, usually awned; lower floret reduced to a sterile hyaline lemma; upper lemma stipitiform, entire or emarginate, a geniculate awn arising from the tip. Pedicelled spikelets male or sterile, dorsally compressed with a very small truncate callus articulated at the pedicel-tip, narrowly elliptic, chartaceous, the glumes sometimes awned.

26 species in tropical and warm temperate regions of the Old World, especially Asia and Australia; one species in Florida and the West Indies.

Chrysopogon as a genus is easy to recognize with its distinctive deciduous triads at the tips of the long, flexuous panicle-branches. However, the species are both variable and intergrading, and the taxonomy of the genus remains to be finalised. It reaches its maximum development in India, where variation is as yet very incompletely understood. The panicles are often attractively coloured, with brown spikelet-hairs contrasting with the pallid sessile spikelets and large purple pedicelled spikelets.

1. Pedicelled spikelets 2-awned, the awns plumose.

1. *C. plumulosus*

- Pedicelled spikelets usually 1-awned, the awn glabrous.

2. *C. aucheri*

1. *C. plumulosus* Hochst. (1847);

Aristida chrysopila Steud. (1840), *nom. nud.*; *Andropogon aristidoides* Steud. (1854) - type: Saudi Arabia, Jedda or Mecca, *Schimper* s.n. (P iso.).

Chrysopogon quinqueplumis A. Rich. (1850); *Andropogon quinqueplumis* (A. Rich.) Steud. (1854); *A. aucheri* Boiss. var. *quinqueplumis* (A. Rich.) Hack. in DC., *Monogr. Phan.* 6: 561 (1889);



Figure 121. *CHRYSOPOGON PLUMULOSUS*: 1 - inflorescence $\times 3/4$; 2 - spikelet triad and branch tip $\times 4$. Source not recorded. Drawn by Eleanor Catherine.

Chrysopogon aucheri (Boiss.) Stapf var. *quinqueplumis* (A. Rich.) Stapf in *Kew Bull.* 1907: 211 (1907) - type: Ethiopia, TU, Dscheladscheranne, Schimper 726 (K iso.).

Loosely tufted perennial from a short stout rootstock; culms thin, hard, fasciculately branching and bushy above the base, 20–80 cm high. Leaf-blades 5–15 cm long, 1.5–4 mm wide, often tough and glaucous, glabrous or pubescent, usually also with tubercle-based setae, subacute to finely acute. Panicle 6–12 cm long, the branches fulvously ciliate at the tip; pedicels fulvously bearded, $(1/3)$ – $1/2$ – $3/4$ the length of the sessile spikelet; sessile spikelet callus 1–2.5 mm long, fulvous. Sessile spikelet 3.5–6 mm long; lower glume linear-oblong, obtuse; upper glume tipped with a plumose awn 7–15 mm long; upper lemma emarginate, its geniculate awn puberulous, 2–3 cm long. Pedicelled spikelets male, 4–8 mm long, both glumes tipped with fine plumose awns (occasionally the hairs short and sparse upwards or the

awn plumose only at the base); lower glume awn (3–)6–16 mm long, upper glume awn a little shorter. Fig. 121.

Stony or black clay soils in semi-desert grassland and open *Acacia* bushland; 400–1600 m. EW TU SU AR SD HA; East Africa, Sudan, Niger, Egypt and Arabia. Ash 1241; Burger 294; Friis et al. 3187.

C. plumulosus can be recognized by its five plumose awns arising from each triad. However, it is a variable species with weakly defined population trends apparent in some parts of the country. Specimens from Harerge and the Awash area mostly have tough, glaucous, glabrous leaf-blades and fully plumose awns, though occasional specimens with pubescent leaf-blades do occur. Pubescent-leaved forms are commoner in Sidamo, but here the condition is usually associated with a thinning or partial loss of the plumose hairs on the awns, which may only be plumose at the base. These scantily-plumose forms are identical to *C. plumulosus* in other respects, and probably arise from introgression in the southern parts of Sidamo from *C. serrulatus*, a species occurring from East Africa southwards to South Africa, and also in Pakistan, India and eastwards to Burma.

C. serrulatus Trin. belongs to the same group of species as *C. plumulosus*, but is generally more vigorous with the culms arising from a basal tuft of distinctly keeled leaf-sheaths and lacking conspicuous fascicles of branches above ground level; also the pedicels are shorter ($1/4$ – $1/3$ the length of the sessile spikelet).

2. *C. aucheri* (Boiss.) Stapf (1907);

Andropogon aucheri Boiss. (1844) - type: Iran, Aucher 5465 (K iso.).

Tough, tufted perennial; culms up to 60 cm high, branching but not forming bushy fasciculate clusters. Leaf-blades up to 25 cm long, 2–4 mm wide, glaucous, densely pubescent, usually also tuberculate-setose on the margins, acute to acuminate. Panicle 5–10 cm long, the branch-tips pallidly or fulvously ciliate; pedicels and callus pallidly or fulvously bearded, the pedicels $1/3$ – $2/5$ the length of the sessile spikelet, sessile spikelet callus 1–1.5 mm long. Sessile spikelet 5–8 mm long; lower glume narrowly elliptic-oblong, shortly ciliate at the tip; upper glume ciliate at the top of the keel, tipped with an awn 1.5–10 mm long; upper lemma emarginate, its geniculate awn pubescent, 2.5–4 cm long. Pedicelled spikelets (4–)7–10 mm long, the lower glume tipped with a fine awn 4–7 mm long, the upper glume usually awnless.

Dry stony slopes, usually in semi-desert areas; 1300 m. SD; Somalia, Arabia, Egypt, Iran, Afghanistan and N India. Gilbert 3438.

C. aucheri and *C. plumulosus* represent different aspects of the same species complex, and the characters used to distinguish them are rather variable and of doubtful significance. *C. aucheri* is characterized by densely pubescent leaf-blades coupled with glabrous awns, a combination which does not occur in *C. plumulosus*; in addition the pedicelled spikelets are usually

only 1-awned and the culms are not obviously bushily branched above the ground as in *C. plumulosus*.

134. *CAPILLIPEDIUM* Stapf (1917)

Annuals or perennials; leaf-blades linear, flat; ligule membranous. Inflorescence an open panicle with elongate central axis and capillary, subdivided branches, each tipped by a short raceme of up to 5(-8) spikelet-pairs, often reduced to triads, basal homogamous spikelets absent; rhachis-internodes and pedicels slender with a median translucent line. Sessile spikelet dorsally compressed, its callus very short, obtuse; lower glume cartilaginous, broadly convex to shallowly concave with rounded flanks, not pitted; lower lemma reduced to a small hyaline scale; upper lemma stipitiform with a glabrous or puberulous awn from the entire tip. Pedicelled spikelet similar to the sessile or smaller, herbaceous.

About 14 species in tropical Asia and Australia, one extending to eastern tropical Africa.

Capillipedium is a homogeneous genus, distinguished from *Bothriochloa* by the combination of an elongate inflorescence and few-spiculate racemes.

C. parviflorum (R. Br.) Stapf (1917);

Holcus parviflorus R. Br. (1810); *Andropogon parviflorus* (R. Br.) Domin (1915); *Bothriochloa parviflora* (R. Br.) Ohwi (1942); *Dichanthium parviflorum* (R. Br.) de Wet (1967) - type: N Australia, Brown s.n. (K iso.).

Andropogon quartinianus A. Rich. (1850); *Sorghum quartinianum* (A. Rich.) Schweinf. (1867); *Andropogon micranthus* Kunth var. *quartinianus* (A. Rich.) Hack. in DC, *Monogr. Phan.* 6: 490 (1889) - type: Ethiopia, TU, Beless, *Quartin Dillon* s.n. (K fragment).

Tufted perennial; culms 50-150 cm high, the nodes bearded. Leaf-blades 10-30 cm long, 2-7 mm wide, scaberulous or pubescent, often also hispid, tomentose at the sheath junction, finely acuminate. Panicle loosely oblong with untidily flexuous branches, central axis 8-25 cm long; racemes purple, reduced to a triad of one sessile and 2 pedicelled spikelets, or occasionally with an additional spikelet-pair below the triad; rhachis-internodes and pedicels shortly ciliate on the inner margin. Sessile spikelet 2.8-4 mm long; lower glume narrowly oblong, pubescent, the back 2-nerved, shallowly concave between the nerves, marginally keeled and pectinate near the narrow tip; awn of upper lemma 10-15 mm long. Pedicelled spikelets lanceolate, equalling the sessile and often male, or reduced and sterile.

Fig. 122.

Upland grassland with *Themeda* and *Hyparrhenia*. EW, TU; Sudan to Mozambique; Oman (Dhofar); tropical Asia to Australia. *Baldrati* 2868; *Pappi* 2214, 2289.

Apparently very local in Ethiopia.



Figure 122. *CAPILLIPEDIUM PARVIFLORUM*: 1 - inflorescence x 3/4; 2 - spikelet triad x 11. 1 from Jackson 465; 2 from Vesey-FitzGerald 2314. Drawn by Eleanor Catherine.

In Asia and Australia the species is more variable, with a slender to robust habit and hairy or glabrous leaves and culms. Introgression from *Bothriochloa bladhii* frequently leads to intermediates with several spikelet-pairs in each raceme.

135. *BOTHRIOCHLOA* Kuntze (1891)

Amphilophis Nash (1901)

Perennials; leaf-blades linear, flat; ligule membranous. Inflorescence terminal, usually of digitate or subdigitate racemes, or if borne on an elongate central axis the racemes with more than 8 spikelet-pairs, homogamous spikelets absent or inconspicuous; rhachis-internodes and pedicels slender with a median translucent line. Sessile spikelet dorsally compressed, its callus short, obtuse; lower glume usually cartilaginous with herbaceous tip, broadly convex to slightly concave with abruptly rounded flanks, sometimes with 1-3 circular pits, tip subacute; lower lemma sterile without a palea; upper lemma stipitiform with a glabrous awn from the

entire tip. Pedicelled spikelet similar to the sessile or smaller, herbaceous.

About 35 species throughout the tropics.

The pedicels and rhachis-internodes of the closely related genera *Bothriochloa*, *Capillipedium* and *Euclasta* are unique and most distinctive, giving an easy spot character for the group. The central cells, between the thickened margins, are translucent and frequently purple-pigmented. *Dichanthium* also belongs to this group of genera but has normal, solid pedicels and rhachis-internodes. Circular pitted glands on the lower glume are another remarkable feature of some species of *Bothriochloa* and *Dichanthium*.

1. Inflorescence with a long central axis. 1. *B. bladhii*
- Inflorescence subdigitate or with an axis not usually exceeding 2.5 cm. 2
2. Lower glume of sessile spikelet cartilaginous and glossy, with a deep circular pit. 2. *B. insculpta*
- Lower glume of sessile spikelet chartaceous, not glossy and not pitted. 3. *B. radicans*

1. *B. bladhii* (Retz.) S.T. Blake (1970);

Andropogon bladhii Retz. (1781); *Dichanthium bladhii* (Retz.) W.D. Clayton (1977) - type: China, *Bladh* s.n. (LD holo.).

Andropogon pertusus (L.) Willd. var. *vegetior* Hack. in DC., *Monogr. Phan.* 6: 481 (1889); *Amphilophis insculpta* (A. Rich.) Stapf var. *vegetior* (Hack.) Stapf in *Fl. Trop. Afr.* 9: 177 (1917); *Bothriochloa insculpta* (A. Rich.) A. Camus var. *vegetior* (Hack.) C.E. Hubb. in *Kew Bull.* 1934: 109 (1934) - type: Ethiopia, GD, Matamma, *Schweinfurth* 1024 (K iso.).

Tufted perennial; culms erect, fairly robust, (50-)100-180 cm high, the nodes pubescent to bearded. Leaf-blades 10-55 cm long, 2-12 mm wide, tapering to a long fine tip. Inflorescence of many racemes arranged in loose whorls on an elongate central axis 4-20 cm long, the axis usually longer than the lowest raceme, sometimes paniculate with branched peduncles; racemes 2-5 cm long, not obviously hairy; rhachis-internodes and pedicels thinly ciliate, bearded at the tip with short hairs c 1 mm long. Sessile spikelet 3-4 mm long; lower glume narrowly elliptic, usually herbaceous but sometimes glossy, glabrous to pubescent, pitted or not, acute; awn of upper lemma 10-25 mm long. Pedicelled spikelet similar to the sessile, with 0-3 pits.

Sandy soil bordering rivers; 700-1550 m. GD/Sudan KF GG HA; Old World tropics, including Australia. *Ash* 3620; *Fukui* 1196.

Bothriochloa bladhii hybridizes easily and frequently with some other members of the genus *Bothriochloa* and also with *Capillipedium parviflorum* and *Dichanthium annulatum*, blurring the boundaries between these genera, which are consequently sometimes all united under the name *Dichanthium*. In its typical form it is a fairly robust erect plant, lacking the stolons

frequently occurring in *B. insculpta*, and with longer, broader leaf-blades, and an inflorescence axis longer than the racemes which are short and only inconspicuously hairy. *B. bladhii* appears to be much rarer than *B. insculpta* in Ethiopia, but nevertheless intermediates will be encountered e.g. *Burger & Getahun* 363 (from HA), which has an elongate inflorescence but the spikelet characteristics of *B. insculpta*.

2. *B. insculpta* (Hochst. ex A. Rich.) A. Camus (1931);

Andropogon insculptus Hochst. ex A. Rich. (1850); *A. pertusus* (L.) Willd. var. *insculptus* (A. Rich.) Hack. in DC., *Monogr. Phan.* 6: 482 (1889); *Andropogon pertusus* (L.) Willd. subvar. *trifoveolatus* Hack. l.c.: 483 (1889); *Amphilophis insculpta* (Hochst. ex A. Rich.) Stapf (1917); *Dichanthium insculptum* (Hochst. ex A. Rich.) W.D. Clayton (1977); - type: Ethiopia, TU, Mt Sholoda [Selleuda], *Schimper* 80 (K iso.).

Andropogon pertusus (L.) Willd. subvar. *hirtus* Chiov. in *Ann. Ist. Bot. Roma* 8: 283 (1908); *B. insculpta* (Hochst. ex A. Rich.) A. Camus var. *hirta* (Chiov.) Cuf., *Enum.*: 1390 (1970) - types: Eritrea, Dongollo, *Pappi* 3825 & Alighede R., *Pappi* 5134 (both FT syn.).

Bothriochloa pertusa sensu Fröman & Persson, *Ill. Guide. Grasses Eth.*: 33 (1974) & Cufodontis, *Enum.*: 1390 (1970), non (L.) A. Camus.

Perennial forming a spreading tussock, the basal shoots compressed; culms tough, geniculately ascending, sometimes stoloniferous, 30-150 cm high, the nodes bearded. Leaf-blades 9-25 cm long, 2-7 mm wide, acuminate. Inflorescence aromatic, composed of 3-15 subdigitate, shortly pedunculate racemes on an axis up to 2.5 cm long; racemes 4-10 cm long, silvery-green or often purplish, sometimes with 1-2 pairs of homogamous spikelets; rhachis-internodes and pedicels ciliate, bearded at the tip with silky hairs 1.5-3.5 mm long. Sessile spikelet 3-4.7 mm long; lower glume narrowly elliptic-oblong, glossy with a single pit above the middle, cartilaginous and often pilose below the pit, herbaceous with keeled scabrid margins above; awn of upper lemma 15-25 mm long. Pedicelled spikelet often slightly longer than the sessile, lanceolate with 0-4 pits. Fig. 123:1-4.

Scrubland, degraded *Acacia* woodland, and overgrazed grassland on various soils from black clays to sand or gravel, or often on rocky slopes; 900-2400 m. EW TU WU SU AR KF GG SD BA HA; tropical and South Africa; also in Arabia. *De Wilde* 7810; *Gilbert & Jefford* 4619; *Mooney* 8597.

Bothriochloa insculpta is a widespread apomictic species, varying considerably both in habit and inflorescence characters. The pits on the pedicelled spikelet are shallower than that on the sessile spikelet, and are very similar to the spotted glands sometimes found on

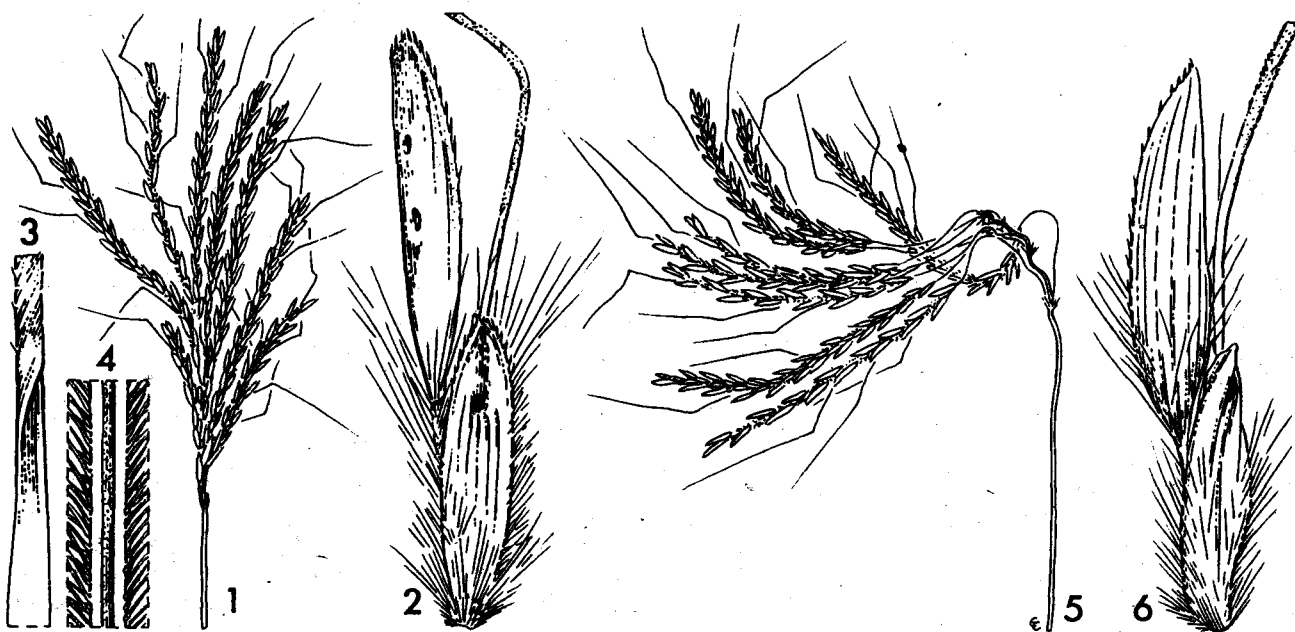


Figure 123. *BOTHRIOCHLOA INSCULPTA*: 1 - inflorescence x 3/4; 2 - spikelet pair x 9; 3 - awn base x 20; 4 - detail of rhachis-internode x 20. *EUCLASTA CONDYLOTRICHA*: 5 - inflorescence x 3/4; 6 - spikelet pair x 9. 1-4 from *De Wilde* 7810; 5 from *McCallum Webster* T188; 6 from *Faulkner* 2608. Drawn by Eleanor Catherine.

the peduncles and inflorescence axis and also below the nodes. Their number is variable, even within a single raceme.

B. pertusa (L.) A. Camus is a very similar Asiatic species, scarcely distinguishable morphologically from *B. insculpta*, but the two are reported not to interbreed (*de Wet & Higgins* in *Fyton* 20: 205-211, 1963).

3. *B. radicans* (Lehm.) A. Camus (1931);

Andropogon radicans Lehm. (1833); *A. ischaemum* L. var. *radicans* (Lehm.) Hack. in DC., *Monogr. Phan.* 6: 476 (1889); *Amphilophis radicans* (Lehm.) Stapf (1917); *Dichanthium radicans* (Lehm.) W.D. Clayton (1977) - type: cultivated in Hamburg from seed from South Africa (no type at HBG).

Perennial forming loose tussocks, much branched and densely leafy above ground level; culms slender, many-noded, ascending, 25 cm to 1 m high, the nodes bearded. Leaf-blades flat, 6-20 cm long, 2-5 mm wide, smooth, glabrous except for some scattered stiff setae, finely acuminate. Inflorescence a cluster of 3-12 silvery-grey, silky-hairy racemes, only slightly aromatic; racemes 3-7 cm long, subdigitate or on a short axis up to 5 cm long; rhachis-internodes and pedicels ciliate, bearded at the tip with silky hairs 3-4 mm long. Sessile spikelet 2.5-4 mm long; lower glume narrowly elliptic-oblong, chartaceous, flat or shallowly concave, pilose in the lower half, not glossy, not pitted; awn of upper lemma 10-20 mm long. Pedicelled spikelet similar to the sessile in size.

Dry open bushland; 600-1900 m; AF EW TU SU (Awash), AR SD HA; Sudan, Somalia and southwards

to South Africa. *Aweke & Gilbert* 702; *de Wilde* 10637; *M.G. & S.B. Gilbert* 2420.

136. *EUCLASTA* Franch. (1895)

Annuals; leaf-blades linear, flat; ligule membranous. Inflorescence terminal and axillary, of slender, single or subdigitate, pedunculate racemes with 1-3 basal pairs of homogamous spikelets; rhachis-internodes and pedicels linear with a median translucent line, ciliate. Sessile spikelet dorsally compressed, its callus short, obtuse; lower glume chartaceous to cartilaginous, flat with rounded flanks, not pitted, the tip herbaceous, obtuse; upper glume unawned; lower lemma empty, hyaline; upper lemma stipitiform, with a glabrous or pubescent awn from the entire tip. Pedicelled spikelet larger than the sessile, herbaceous, many-nerved.

2 species, one widespread in Africa and tropical America, extending to India; the other in India and Oman (Dhofar).

Euclasta is an annual offshoot from the perennial genus *Bothriochloa*, distinguished also by the presence of large herbaceous homogamous spikelets.

E. condylotricha (Hochst. ex Steud.) Stapf (1917);

Andropogon condylotrichus Hochst. ex Steud. (1854); *Dichanthium condylotrichum* (Hochst. ex Steud.) Roberty (1960) - type: Ethiopia, TU, Dscheladscheranne, *Schimper* 2011 (P holo.).

Slender annual; culms solitary or tufted, erect with stilt roots or often rambling, 15 cm to 2 m high, the nodes bearded. Leaf-blades cauline, 5-25 cm long, 2-10 mm wide, pilose on the lower surface. Inflorescence nodding, of 2-15 corymbose racemes on filiform, flexuous peduncles, the axillary subtended by slightly inflated

sheaths with reduced blades; racemes loose, 2–5 cm long, with 1–2 pairs of homogamous spikelets. Sessile spikelet 3–4 mm long; lower glume narrowly elliptic-oblong, thinly cartilaginous, glossy, pilose and finely nerved below the middle, glabrous with prominent nerves above, tip with keeled scabrid margins; lower lemma reduced to a small triangular scale; awn of upper lemma 2–4 cm long, its column pubescent. Pedicelled spikelet lanceolate, 4–6 mm long, pilose, acute. Fig. 123:5, 6.

Deciduous bushland and open woodland; 700–1600 m. TU GD/Sudan GG HA; tropical Africa and America; also in India. *Burger* 835; *Gereau* 1296.

The median line down the rhachis-internode and pedicel is often conspicuously purple-pigmented, contrasting with the silky-white marginal hairs. This line, and the weak annual habit and obvious homogamous spikelets, are the best means of recognizing *E. condylo-tricha*.

137. *DICHANTHIUM* Willemet (1796)

Eremopogon Stapf (1917)

de Wet & Harlan in *Bol. Soc. Arg. Bot.* 12: 206–227 (1968) & *Evolution* 24: 270–277 (1970).

Perennials, rarely annual; leaf-blades linear, often cauline; ligule membranous. Inflorescence of single or subdigitate racemes, terminal or also axillary and sometimes supported by spatheoles; racemes usually with basal homogamous spikelet-pairs; rhachis-internodes and pedicels slender, solid, bearded. Sessile spikelet dorsally compressed, its callus short, obtuse; lower glume chartaceous to cartilaginous, broadly convex to slightly concave, rounded on the flanks becoming keeled upwards, tip obtuse; upper glume unawned; lower lemma sterile without a palea; upper lemma stipitiform, with a glabrous or puberulous awn from the entire tip. Pedicelled spikelet similar in size to the sessile.

About 20 species in the Old World tropics.

Dichanthium closely resembles *Andropogon* in facies, but if an awn is gently pulled out and the lemma at its base examined with a lens, it will be seen to be narrow and scarcely distinguishable from the awn, whereas in *Andropogon* the awn arises from between 2 hyaline teeth. Additionally, homogamous spikelets and pitted glumes are very rare in *Andropogon*.

1. Racemes solitary; lower glume of sessile spikelet with a median pit. 1. *D. foveolatum*
- Racemes 3–9, subdigitate; lower glume not pitted. 2. *D. annulatum*

1. *D. foveolatum* (Del.) *Roberty* (1960);

Andropogon foveolatus Del. (1812); *Eremopogon foveolatus* (Del.) Stapf (1917); Fröman & Persson, *Illustr. Guide Grasses Eth.*: 63 (1974) - type: Egypt, *Delile* s.n. (K iso.).

A. foveolatus Del. var. *plumosus* Terracc. in *Ann. Ist. Bot. Roma* 5: 94 (1894) - types: Eritrea, Anfile Bay, Haressan, *Terracciano* 1618 & Midir, *Terracciano* 1617 (both FT syn.).

Slender, densely tufted perennial; culms thin, wiry, ascending up to 60 cm high, many-noded and branching, the nodes bearded. Leaf-blades 1–8 cm long, 1–3 mm wide, narrowly linear to convolute, green or glaucous, densely papillose especially on the upper surface. Inflorescence a solitary raceme borne on a slender peduncle exerted from a tightly cylindrical spatheole; racemes axillary, single or in loose clusters, 2–4.5 cm long, with 0–2 basal pairs of homogamous spikelets; internodes and pedicels ciliate with long silky hairs. Sessile spikelet 2.5–4 mm long; lower glume narrowly oblong with a circular pit above the middle, cartilaginous, pallid and glossy in the lower 2/3, membranous and reddish above, 1-nerved on either side of the pit; awn of upper lemma 12–18 mm long. Pedicelled spikelet chartaceous with a median nerve, pitted or not. Fig. 124:1, 2.

Semi-desert plains and thin dry bushland, on sandy or loose stony soils; sea level–700 m. EE AF EW SD; Somalia, Kenya, Tanzania; extending to N Africa and westwards in arid areas to Mauretania; Arabia, Iran, India and Sri Lanka. *Bally* 6905; *Gilbert, Ensermu & Vollesen* 7591; *Hemming* 1136.

The pitted glumes recall *Bothriochloa insculpta*, but *D. foveolatum* lacks the pedicels and rhachis-internodes with a median translucent line characteristic of *Bothriochloa*.

2. *D. annulatum* (Forssk.) *Stapf* (1917);

Andropogon annulatus Forssk. (1775) - type: Egypt, *Forsskål* s.n. (C holo.).

Tussocky perennial; culms ascending, up to 1 m high, the nodes bearded. Leaf-blades flat, 6–25 cm long, 2–6 mm wide, often glaucous, glabrous or stiffly pilose above with firm, smooth margins, acuminate. Inflorescence terminal, subdigitate, composed of 2–9(–15) suberect racemes; racemes 3–8 cm long, with 0–6 pairs of homogamous spikelets; internodes and pedicels narrowly linear, silky-villous. Sessile spikelet 3–4 mm long; lower glume elliptic-oblong, usually slightly concave, firmly chartaceous to thinly cartilaginous, 7-nerved across the back, pubescent to villous in the lower half, provided with long, spreading, tubercle-based hairs above, tip membranous; awn of upper lemma 15–27 mm long. Pedicelled spikelet many-nerved, villous with spreading tubercle-based hairs. Fig. 124:3, 4.

The species is divided into two varieties based on hairiness of the sessile spikelet. Whilst there is some morphological overlap elsewhere, there is seldom difficulty in distinguishing the two types in Ethiopia. They are reported to have different ploidy levels [Mehra in *Fyton* 17: 157–166 (1961) & in *Caryologia* 17: 545–556 (1964)] and different ecological preferences.

var. annulatum

Racemes not obviously hairy; lower glume of sessile spikelet shortly pubescent to pilose below the middle, the tubercle-based hairs above rather sparse, mostly confined to the margins. Culms slender and decumbent to suberect. Diploid, $2n=20$ (confined to India) or tetraploid, $2n=40$ (widespread).

Dry open places. Eritrea AF HA; East Africa; western N Africa eastwards through the Middle East and India to China and Indonesia; introduced to tropical areas elsewhere. *Burger* 2163; *Taddesse Ebba* 829; *Edwards* 621 (ETH).

var. papillosum (*Hochst. ex A. Rich.*) *de Wet & Harlan* in *Bol. Soc. Arg. Bot.* 12: 212 (1968); *Pilg.* in *Willdenowia* 1: 269 (1954), sine relat. nom.; *Andropogon papillosus* *Hochst. ex A. Rich.* (1850); *A. annulatus* *Forssk.* var. *papillosus* (*A. Rich.*) *Hook. f.*, *Fl. Brit. Ind.* 7: 197 (1896); *Dichanthium papillosum* (*A. Rich.*) *Stapf* (1917) - type: Ethiopia, TU, Shire, Tschogarti, *Schimper* 526 (K iso.).

Racemes conspicuously hairy; lower glume of sessile spikelet appressed-pilose to villous below the middle, with long, spreading, tubercle-based hairs in an arc along the upper margins and across the tip. Culms often erect, relatively robust. Hexaploid, $2n=60$.

Acacia woodland on black soil, favouring marshy depressions; 1555–1800 m. TU GG SD; southwards to South Africa. *Gilbert & Thulin* 376; *Gilbert & Jefford* 4503; *Schimper* 320.

Var. *papillosum* is an apomictic hexaploid derivative of var. *annulatum* (*de Wet & Harlan*, 1968). It tends to have a more robust habit with somewhat larger spikelets (c 4 mm in Ethiopia).

138. ARTHRAXON *P. Beauv.* (1812)

Van Welzen in *Blumea* 27: 255–300 (1981).

Annuals or perennials; culms slender, often trailing. Leaf-blades lanceolate, cordate or amplexicaul, often pectinate-ciliate on the margins; ligule a fimbriate membrane. Inflorescence subdigitate, composed of slender racemes terminal on the culms and branches, the uppermost leaf spatheole-like; internodes filiform. Sessile spikelet linear to narrowly lanceolate, asymmetrical in side view, its callus very short, truncate; lower glume chartaceous to coriaceous, convex, several-nerved, scaberulous to muricate or spinulose; upper glume chartaceous around the keel, acuminate to mucronate; lower lemma sterile without a palea; upper lemma entire with a subbasal, geniculate awn. Pedicelled spikelet variable, often reduced, sometimes absent.

About 10 species in the Old World tropics, especially in India; introduced to America.

Arthraxon is a rather isolated genus with no obvious close relatives, distinguished from the other awned *An-*



Figure 124. *DICHANTHIUM* spp.: *D. FOVEOLATUM*: 1 - habit x 3/4; 2 - spikelet pair x 9. *D. ANNULATUM*: 3 - inflorescence x 3/4; 4 - spikelet pair x 9. 1 & 2 from *Hemming* 1136; 3 & 4 from *Burger* 2163. Drawn by Eleanor Catherine.

dropogoneae by its broad amplexicaul leaf-blades on slender culms, coupled with an entire, subbasally awned fertile lemma.

The genus is very homogeneous vegetatively and spikelet characters often seem to vary independently of each other, leading to ill-defined specific boundaries. Consequently there are large differences of opinion as to how many species should be recognized, and how they may best be delimited. The situation is a great deal more complicated in India than in Africa (delimitation of the 4 Ethiopian taxa presents few problems), but leads to nomenclatural difficulties throughout the whole range of the genus. The most recent study, that by Van Welzen (1981), takes a very broad view, recognizing only seven mostly very variable species, often divided into a number of varieties. A more traditional standpoint is adopted here, but where there is a divergence from Van Welzen's paper, this is indicated in the text.

If the basal parts are missing it is not always possible to determine whether the habit is annual or perennial, but there is a correlated spikelet character. In the annuals the lower glume of the sessile spikelet is uniformly convex with flat margins, but in the perennials the lower glume is laterally keeled with inflexed margins.

1. Tufted perennial with silky scales at base; sessile spikelet pectinate-spinose on the lateral keels; anthers 3.
 1. *A. prionodes*
- Slender, straggling annuals; sessile spikelet scabrid to muricate, not keeled; anthers 2. 2
2. Sessile spikelet muricate, 5-6 mm long; racemes silky-villous with hairs up to 3 mm long.
 2. *A. cuspidatus*
- Sessile spikelet scabrid, 2.3-5 mm long. 3
3. Sessile spikelet lanceolate, 3-5 mm long; upper glume acute; pedicel and pedicelled spikelet reduced to a subulate stump up to 1.5 mm long.
 3. *A. micans*
- Sessile spikelet linear, 2.3-3.2 mm long; upper glume with a mucro 0.5-1.3(-4) mm long; pedicel and pedicelled spikelet often present (at least at raceme tips).
 4. *A. lancifolius*

1. *A. prionodes* (Steud.) Dandy (1956);

Andropogon prionodes Steud. (1854); *A. serrulatus* A. Rich. (1850) non Link (1827); *Arthraxon serrulatus* (A. Rich.) Hochst. (1856); *A. lanceolatus* (Roxb.) Hochst. var. *serrulatus* (Hochst.) Th. Dur. & Schinz, *Consp. Fl. Afr.* 5:704 (1895); *A. lanceolatus* (Roxb.) Hochst. var. *genuinus* subvar. *serrulatus* (A. Rich.) Hack. in DC., *Monogr. Phan.* 6: 348 (1889) - types: Ethiopia, TU, Adua [Adoua], *Quartin Dillon* s.n. (P syn.) & *Schimper* 1117 (P syn., K isosyn.).

Arthraxon lanceolatus var. *genuinus* subvar. *serrulatus* forma *puberula* Chiov. in *Ann. Ist. Bot. Roma* 8: 278 (1908) - types: Eritrea, *Tellini* 637 & *Pappi* 4679, 4902, 149, 459 (FT syn.) & forma *gla-*

berrima Chiov., l.c. (1908) - types: Eritrea, *Tellini* 979 & *Pappi* 3849, 4912, 4558, 299, 1865 (FT syn.).

Loosely tufted, wiry perennial from a knotty, silky-villous base; culms stiff and brittle, often straggling, up to 80 cm long. Leaf-blades narrowly ovate, tough, 3-6 cm long, 0.5-2 cm wide, glabrous or pubescent, base cordate, tip setaceously acuminate, margins cartilaginous, pectinate-setose. Racemes 3-11, each 5-8 cm long, ± erect; rhachis-internodes and pedicels ciliate to pilose, the hairs increasing to 2-3 mm around the tip, internode filiform, pedicel about half as long, linear. Sessile spikelet linear, 5.5-7 mm long; lower glume chartaceous, strongly convex with inflexed margins, pectinate-spinose on the keels, often also muricate on the back, sometimes pubescent; anthers 3; awn of upper lemma 10-13 mm long. Pedicelled spikelet narrowly lanceolate, male, 4-5.5 mm long. Fig. 125:5.

Rocky slopes and stream banks in light shade; occasionally an arable weed; 1200-2100 m. EW TU GD SU AR KF GG SD BA; Sudan, East Africa and eastwards through Arabia and India to E Asia and Indonesia. *Gilbert & Getachew* 2970; *Gilbert & Thulin* 384.

Van Welzen (1981) has reduced *A. prionodes* to synonymy under *A. lanceolatus* (Roxb.) Hochst. The name *A. lanceolatus* as hitherto circumscribed applies to a species of limited distribution in southern India. It is traditionally separated from the much more widespread *A. prionodes* by the lower glume of its sessile spikelet which is flat across the back and prominently nerved. *A. prionodes* in Ethiopia always has a strongly convex, obscurely nerved lower glume.

2. *A. cuspidatus* (Hochst. ex A. Rich.) Hochst. ex Hack. (1889);

Andropogon cuspidatus Hochst. ex A. Rich. (1850); *Arthraxon cuspidatus* Hochst. (1856), nom. nud. - type: Ethiopia, TU, Djeladgeranne, *Schimper* 1438 (K iso.).

Slender annual; culms loosely ascending, up to 60 cm high. Leaf-blades lanceolate, 4-7 cm long, 8-13 mm wide, thinly hispid, the margins pectinate-setose around the amplexicaul base, tip sharply acuminate. Inflorescence composed of 5-9 silky-pilose, flexuous racemes each 4-5 cm long; rhachis-internodes filiform, villous with hairs increasing to 2-3 mm around the tip; pedicel a little shorter. Sessile spikelet linear-lanceolate, 5-6 mm long; lower glume subcoriaceous, strongly convex, muricate on the nerves, becoming spinulose towards the tip; upper glume acuminate-mucronate; anthers 2; awn of upper lemma 13.5-16 mm long. Pedicelled spikelet sterile, vestigial at the base of the raceme, increasing to 2-3 mm towards the tip. Fig. 125:6.

Wet rocky banks; 1200-1700 m. TU GD; Oman (Dhofar). *De Wilde & Gilbert* 137; *Tewelde B.G.E.* 878 (ETH).



Figure 125. *ARTHRAKON* spp.: *A. MICANS*: 1 - habit x 3/4; 2 - section of raceme x 7; 3 - upper lemma and awn x 9. *A. LANCIFOLIUS*: 4 - section of raceme x 7. *A. PRIONODES*: 5 - lower glume of sessile spikelet x 9. *A. CUSPIDATUS*: 6 - lower glume of sessile spikelet x 9. 1-3 from Friis et al. 2262; 4 from De Wilde 7034; 5 from Friis et al. 3175; 6 from De Wilde & Gilbert 237. Drawn by Eleanor Catherine.

Van Welzen (1981) includes *A. cuspidatus* (and also *A. micans*) within the Asiatic species *A. hispidus* (Thunb.) Makino. However, in Ethiopia the two taxa are strikingly different, *A. cuspidatus* being clearly distinguishable from *A. micans* by its much hairier racemes of closer packed spikelets, muricate lower glume, longer awn and especially by the presence of pedicelled spikelets.

It shows more similarities with *A. lancifolius*, including a preference for wet, rocky habitats, but differs from that species by the larger size of all its parts, as well as its muricate lower glume.

3. *A. micans* (Nees) Hochst. (1856);

Batratherum micans Nees (1835); *Andropogon micans* (Nees) Steud. (1854); *Arthraxon cuspidatus* (A. Rich.) Hack. var. *micans* (Nees) Hack. in DC., *Monogr. Phan.* 6: 353 (1889) - type: Bangladesh, Royle s.n. (K iso.).

Alectoridia quartiniana A. Rich. (1850) & Atlas t. 99; *Andropogon alectoridia* Steud. (1854); *Pleuroplitis quartiniana* (A. Rich.) Regel (1866); *Arthraxon ciliaris* P. Beauv. subsp. *quartinianus* (A. Rich.) Hack. and var. *quartinianus* (A. Rich.) Hack. in DC., *Monogr. Phan.* 6: 356 (1889); *Arthraxon quartinianus* (A. Rich.) Nash (1912); *A. hispidus* (Thunb.) Makino var. *quartinianus* (A. Rich.) Back., *Hand. Fl. Java* 2: 75 (1928) - type: Ethiopia, TU, Adua [Adoua], *Quartin Dillon & Petit* s.n. (P holo.).

Lucaea major Hochst. ex Steud. (1855); *Arthraxon major* (Hochst. ex Steud.) Hochst. (1856); *Pleuroplitis major* (Hochst. ex Steud.) Regel (1866) non Miq. (1855) - type: Ethiopia, TU, Cojetan Mts., *Schimper* 1829 (P holo.).

Arthraxon coloratus Hochst. (1856); *A. ciliaris* P. Beauv. var. *coloratus* (Hochst.) Hack. in DC., *Monogr. Phan.* 6: 357 (1889) - type: Ethiopia, TU, Dschadscha, coll. 1853, *Schimper* in Herb. Buchinger 1532 (STR holo.), not same collection as syntype specimen of *Pleuroplitis quartiniana* var. *tenella*.

Pleuroplitis quartiniana (A. Rich.) Regel var. *tenella* Regel in *Bull. Acad. Petersb.* 10: 377 (1866) - types: Ethiopia, *Schimper* 202 (LE syn.) & Lögga, coll. 1854, *Schimper* 1532 (LE syn., P isosyn.).

Pleuroplitis quartiniana (A. Rich.) Regel var. *caespitosa* Regel l.c. (1866) - types: Ethiopia, *Schimper* 1829 & India, *Schmidt* s.n. (both LE syn.).

Arthraxon hispidus sensu Cufodontis, *Enum.* (1970), non (Thunb.) Makino (1912).

Slender annual; culms trailing, shortly stoloniferous, up to 50 cm high. Leaf-blades lanceolate to narrowly ovate, 2.5–6 cm long, 5–15 mm wide, thinly hispid, base amplexicaul, tip acuminate, margins firm, scabrid, pectinate-setose especially around the base. Inflorescence a fascicle of 2–12 loose, flexuous racemes, each 2–4 cm long; rhachis-internodes filiform, shortly ciliate with

hairs 0.5(–1) mm long; pedicel reduced to an inconspicuous, subulate stump 0.1–1.5 mm long. Sessile spikelet narrowly lanceolate, 3–5 mm long; lower glume chartaceous, the back convex, not keeled, granular below becoming scabrid upwards; upper glume acute; anthers 2; awn of upper lemma 7–10 mm long. Pedicelled spikelet absent. Fig. 125:1–3.

Grassland and woodland, often in light shade from taller grasses and shrubs; also as an arable and roadside weed; 1700–2500 m. EW TU GD GJ SU IL KF GG SD HA; tropical Africa, extending eastwards to SE Asia; introduced to America. *Mooney* 6049; *M.G. & S.B. Gilbert* 1889; *Friis* et al. 1054, 2262.

A. micans is a very misleading member of the tribe *Andropogoneae* as the typical paired spikelet arrangement is obscured through the extreme reduction of the pedicelled spikelet, so that the spikelets appear single. The minute pedicel-stump (which is all that remains of the pedicelled spikelet) is easiest to find at the base of spikelets towards the tips of the racemes, as it generally increases in length slightly up the raceme.

Van Welzen (1981) regards *A. micans* as conspecific with *A. hispidus* (Thunb.) Makino, an Asiatic species characteristically with glabrous rhachis-internodes and spinulose-hispid spikelets.

4. *A. lancifolius* (Trin.) Hochst. (1856);

Andropogon lancifolius Trin. (1832); *Pleuroplitis lancifolius* (Trin.) Regel (1866); *Arthraxon microphyllus* (Trin.) Hochst. var. *lancifolius* (Trin.) Hack. in DC., *Monogr. Phan.* 6: 352 (1889) - type: Nepal (LE lecto.).

Psilopogon schimperi Hochst. ex A. Rich. (1850); *Andropogon multicaulis* Steud. (1854) non *A. schimperi* A. Rich. (1850); *Arthraxon minor* Hochst. (1856), nom. superfl.; *Pleuroplitis schimperi* (Hochst. ex A. Rich.) Regel (1866) - types: Ethiopia, TU, Beless, *Quartin Dillon* s.n. (P syn.) & Adua [Adoua], *Schimper* 96 in part (K isosyn. - plants with pedicelled spikelets).

Lucaea schimperi Steud. (1854); *Arthraxon schimperi* (Steud.) Hochst. - type: Ethiopia, TU, Adua [Adoua], *Schimper* 96 in part (K iso. - plants without pedicelled spikelets).

Delicate, loosely tufted annual; culms very slender, up to 30 cm high. Leaf-blades thin and flaccid, lanceolate-oblong, held horizontally, 1.5–4 cm long, 4–8 mm wide, pectinate-setose around the amplexicaul base, tip setaceously acuminate. Inflorescence a fascicle of 5–8 slender racemes each 1–2 cm long; rhachis-internodes filiform, ciliate with silky hairs increasing to (1–)1.5–2.5 mm around the tip; pedicel about half as long or absent. Sessile spikelet linear, 2.3–3.2 mm long; lower glume chartaceous, strongly convex, smooth and shiny below, scaberulous with visible nerves towards the bidentate tip; upper glume extended into an awnlet 0.5–1.5(–4) mm long; anthers 2; awn of upper lemma 7–14

mm long. Pedicelled spikelet sterile, narrowly elliptic, 1.5–2 mm long, but frequently absent or present only at the tips of the racemes. Fig. 125:4.

Steep rocky banks and rock crevices in damp, often shady situations; 600–2100 m. EE EW TU GD SU KF; tropical Africa and extending eastwards through Arabia and India to SE Asia. *Gilbert & Thulin* 912, 952; *De Wilde* 7034; *Gereau* 1216.

A. lancifolius is often confused with *A. micans* when the pedicelled spikelets are absent (a frequent condition in Ethiopia). However, besides the key characters, it also differs in its more delicate habit, with generally smaller, thinner, more finely pointed, horizontally held leaf-blades, and shorter, softer racemes of smaller, more closely overlapping spikelets. The sessile spikelets are narrower than in *A. micans*, with the lower glume often smooth and shiny below and with a clearly bidentate tip held clear of the upper glume.

A. lancifolius appears to have a stronger preference than *A. micans* for wet rocky situations.

139. THELEPOGON *Roem. & Schult.* (1817)

Annual; leaf-blades broadly linear, ligule membranous. Inflorescence terminal, a subdigitate cluster of shortly pedunculate racemes; rhachis-internodes inflated upwards; pedicels flattened, strap-shaped, lacking a spikelet. Sessile spikelet lightly dorsally compressed, the short rounded callus inserted into the internode tip; lower glume convex, crustaceous, ornamented, not keeled or winged; upper glume saccate at the base; lower floret male, well developed with a palea; upper lemma bifid, a geniculate awn arising from the sinus. Pedicelled spikelet absent or represented by a minute vestige.

One species in tropical Africa and Asia.

Thelepogon is an offshoot from *Ischaemum* in which the pedicelled spikelet has been lost.

T. elegans *Roem. & Schult.* (1817);

- type: India, *Heyne* s.n. (B holo., destr.).

Andropogon princeps A. Rich. (1850) & Atlas t. 102; *Jardinea abyssinica* Steud. (1854), nom. superfl.; *Rhytachne princeps* (A. Rich.) Th. Dur. & Schinz (1895) - type: Ethiopia, Tacazze R., *Quartin Dillon & Petit* s.n. (P holo.).

Coarse annual; culms often stout, supported at the base by stilt roots, 0.5–1.5 m high. Leaf-blades lanceolate, papery, 7–20 cm long, 1–3.5 cm wide, cordate to amplexicaul, margins finely pectinate, tip acute. Inflorescence a cluster of 2–17 racemes, the lowest digitate, the upper on a short axis; racemes 5–15 cm long, very fragile; rhachis-internodes and pedicels glabrous, the internodes linear-oblong broadened into an infundibular tip, green-striped, the pedicels slightly overtopping the sessile spikelet. Sessile spikelet 6–13 mm long; lower glume narrowly ovate, rostrate, covered in large warts,

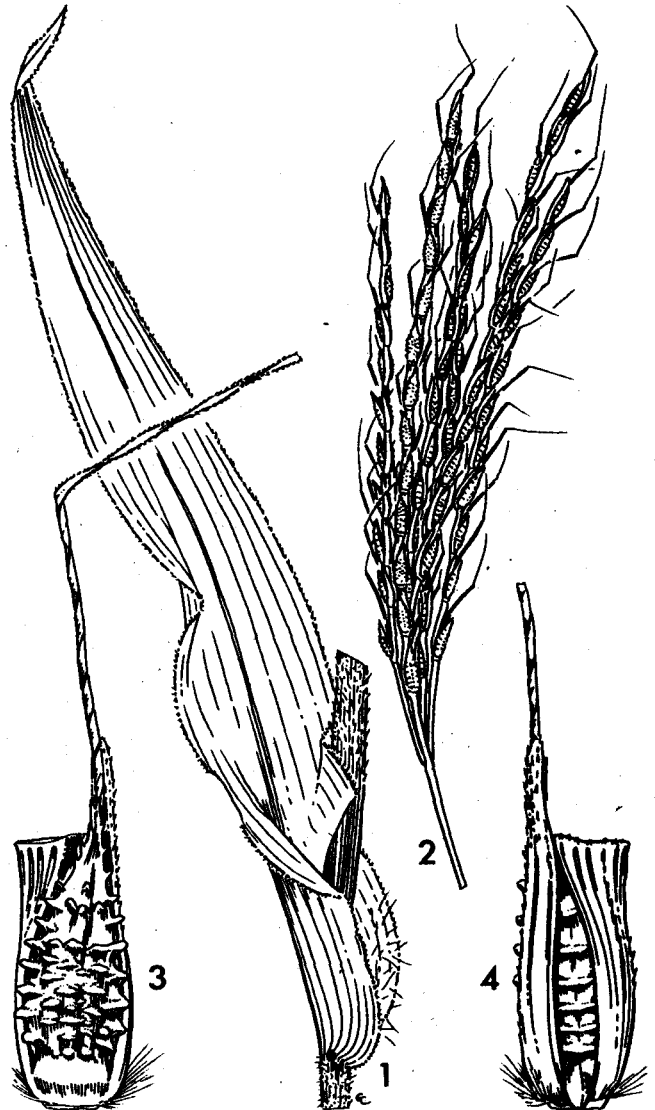


Figure 126. *THELEPOGON ELEGANS*: 1 - leaf x 3/4; 2 - inflorescence x 3/4; 3 - sessile spikelet, internode and pedicel from front x 4; 4 - the same from back x 4. 1 from *Schweinfurth* 1044; 2–4 from *Sherif* A4008. Drawn by Eleanor Catherine.

these forming transverse or semicircular ridges, becoming outstanding and spinous upwards; upper glume coarsely transversely ridged along the midline, rostrate; upper lemma awn 1.5–2.5 cm long. Fig. 126.

Weedy places on black clay soils. EW TU GD; mainly tropical Africa but extending eastwards to India, Burma and Indonesia. *Parker* E85; *Schweinfurth* 1044.

A distinctive species on account of its conspicuously ornamented sessile spikelets and barren pedicels.

140. ISCHAEMUM *L.* (1753)

Perennials or sometimes annual; leaf-blades linear, narrowed to the ligule and sometimes falsely petiolate; ligule membranous; sheath-auricles often present. Inflorescence terminal (sometimes also axillary outside Ethiopia), of paired or subdigitate racemes, when paired

often locked back to back and appearing as one; rhachis-internodes and pedicels stoutly linear to clavate and inflated. Sessile spikelet dorsally compressed, its callus obtuse and inserted into the top of the internode; lower glume chartaceous to coriaceous, convex or flat across the back (concave in *I. afrum*), sometimes rugose, the flanks inflexed, rounded or keeled, sometimes winged; upper glume awned or not; lower floret male, well developed with a palea; upper lemma bifid, a geniculate awn arising from the sinus. Pedicelled spikelet about as large as the sessile (or sometimes much smaller outside Ethiopia), often male, dorsally or laterally compressed.

About 65 species throughout the tropics but concentrated in Asia.

Ischaemum can be difficult to distinguish from *Andropogon*, the main difference being the presence of a well developed male lower floret in *Ischaemum*.

1. Lower glume of sessile spikelet concave across the back and sharply laterally keeled along its whole length. 1. *I. afrum*
- Lower glume of sessile spikelet convex across the back, the inturning margins rounded in the lower part. 2
2. Robust clump-forming perennial 1.5–3 m high; awn 2–4.5 cm long. 2. *I. amethystinum*
- Lax perennial to 1.5 m high, often prostrate at the base; awn 0.5–1.5 cm long. 3. *I. fasciculatum*

1. *I. afrum* (J.F. Gmel.) Dandy (1956);

Andropogon afer J. F. Gmel. (1791) - type: GD/Sudan border, figure in Bruce, *Travels* 5: 47 (1790), based on specimen from Ras el Feel (near Gallabat).

Andropogon brachyatherus Hochst. (1844); *Ischaemum brachyatherum* (Hochst.) Hack. (1889) - type: Sudan, Kotschy 368 (TUB holo.).

Andropogon matteodanum Chiov. (1907) - type: Eritrea, Ocule Cusai, Pappi 1388 (FT holo.).

Tufted perennial with rhizomes; culms up to 1.5 m high, slender, branched. Leaf-blades linear, rather tough and glaucous, 20–40 cm long, 4–8 mm wide, tapering to a long setaceous tip. Racemes 2–3(–5), subdigitate, 9–20 cm long; rhachis-internodes and pedicels inflated, yellowish, almost glabrous to copiously ciliate with white or purplish hairs, internodes clavate, pedicels broadly oblong-cuneate. Sessile spikelet 7–8 mm long with a short, shallowly inserted callus; lower glume lanceolate-oblong with narrowed tip, keeled near the margins along its length, scaberulous and often ciliate on the keels, shallowly to deeply concave across the back, often hirsute; upper glume scabrid to ciliate on the median keel; upper lemma awn 8–20 mm long. Pedicelled spikelet 3–6 mm long, usually sterile and unawned, but occasionally resembling the sessile spikelet. Fig. 127:1–4.

Dry *Acacia* bushland or savannah on clay soils; 600–1500 m. AF EW TU GD GJ SU SD HA; west-

wards to Nigeria and southwards to South Africa; also in India. *Fris* et al. 3178; *IECAMA* I-23; *Mooney* 8119.

2. *I. amethystinum* J.-P. Lebrun (1966);

- type: Chad, *Audru* 1311 (K iso.).

I. hirsutum Peter (1936) non Spreng. (1825).

Coarse, clump-forming perennial, the basal sheaths tomentose; culms stout, erect, 1.5–3 m high, the nodes bearded, appressed-villous below the inflorescence. Leaf-blades linear, 30–70 cm long, 9–14 mm wide, hispid, the margins scabrid, tip filiform. Inflorescence of 3–5 stout, stiff, subdigitate racemes 12–20 cm long; rhachis-internodes and pedicels linear, copiously villous with violet hairs. Sessile spikelet 8–11 mm long with a bearded, conical callus c 1 mm long, yellowish; lower glume lanceolate-oblong, coriaceous, the back lightly convex, villous, obscurely many-nerved, the margins rounded for most of their length, keeled and winged near the tip, the wings green, herbaceous with free acute tips; upper glume obtuse; upper lemma awn 2–4.5 cm long. Pedicelled spikelet dorsally compressed, green, similar to the sessile but chartaceous and unawned. Fig. 127:6.

Wooded grassland; 1200–1500 m. SU KF (near Omo R.); most frequent in West Africa but also in Cameroon, Chad, Burundi and Tanzania. *Fröman* 3344; *Gereau* 1238.

A large and handsome grass with colourful violet, yellow and green racemes. The little pointed green wings at the tip of the lower glume of the sessile spikelet are characteristic.

3. *I. fasciculatum* Brongn. (1831);

Andropogon fasciculatus (Brongn.) Steud. - type: Mauritius, *d'Urville* s.n. (P holo.).

Spodiopogon arcuatus Nees (1841); *Andropogon arcuatus* (Nees) Steud. (1854); *Ischaemum fasciculatum* Brongn. var. *arcuatum* (Nees) Hack. in DC., *Monogr. Phan.* 6: 235 (1889); *Ischaemopogon arcuatus* (Nees) Jacks. (1893); *Ischaemum arcuatum* (Nees) Stapf (1917).

Rhizomatous perennial; culms prostrate or straggling at the base, ascending to 1.5 m high. Leaf-blades broadly linear, 5–25 cm long, 3–20 mm wide, shortly acuminate to a setaceous tip. Inflorescences mostly terminal, composed of 2–5(–8) subdigitate racemes 3–15 cm long, sometimes purple-flushed; rhachis-internodes and pedicels linear, pilose with silky-white hairs. Sessile spikelet 4–7 mm long including an oblong callus 1–1.5 mm long; lower glume lanceolate, chartaceous to thinly coriaceous, the back convex with incurving margins, glabrescent to villous, laterally keeled and sometimes winged towards the usually bidentate tip; upper glume thinly coriaceous and shiny, cuspidate-aristulate; upper lemma awn 5–15 mm long. Pedicelled spikelet laterally compressed, the glumes cuspidate to aristulate, geniculate-awned from the upper lemma. Fig. 127:5.



Figure 127. *ISCHAEMUM* spp.: *I. AFRUM*: 1 - habit x 3/4; 2 - inflorescence x 3/4; 3 - spikelet pair x 3; 4 - lower glume of sessile spikelet x 7. *I. FASCICULATUM*: 5 - lower glume of sessile spikelet x 7. *I. AMETHYSTINUM*: 6 - lower glume of sessile spikelet x 7. *SEHIMA* spp.: *S. NERVOSUM*: 7 - inflorescence x 3/4; 8 - spikelet pair x 3; 9 - lower glume of sessile spikelet x 7. *S. ISCHAEMOIDES*: 10 - lower glume of sessile spikelet x 7. 1 from *Fritis et al.* 3178; 2-4 from *IECAMA* I-23; 5 from *De Wilde et al.* 6018; 6 from *Fröman* 3344; 7-9 from *Ash* 3625; 10 from *Schweinfurth* 1023. Drawn by Eleanor Catherine.

Damp stream banks in light shade; 2300 m. SU; southern tropical and South Africa, less frequent in Tanzania, Zaire and West Africa; also India and Indo-China. *De Wilde* 6018.

A less robust species than *I. amethystinum* with smaller spikelet parts and laterally compressed, awned pedicelled spikelets. It appears to be very rare in Ethiopia.

141. *SEHIMA* Forssk. (1775)

Annuals or perennials; leaf-blades linear; ligule ciliate. Inflorescence a solitary terminal raceme, well exerted from the uppermost leaf-sheath; rhachis-internodes and pedicels linear, subinflated, densely silky-ciliate along both margins. Sessile spikelet narrow, compressed between the internode and pedicel, its callus rounded, inserted into the crateriform internode-tip; lower glume coriaceous, narrowed to an extended, scarious, bidentate to bifid tip, prominently nerved but lacking a midnerve, 2-keeled with the keels lateral upwards, converging dorsally below the scarious portion or the flanks rounded, the back here concave or grooved; upper glume navicular, tipped by a fine straight awn, a small wing or pectinate crest just below the awn-insertion; lower floret well-developed with a palea, male; upper lemma bifid, a geniculate awn arising from the sinus, its column ciliolate along the spiral. Pedicelled spikelet large and conspicuous, male or sterile, awnless; lower glume lanceolate, flat, prominently nerved, a midnerve present, lateral nerves adjacent to the submarginal keels, ciliate to villous along the margins.

5 species in dry areas of the Old World tropics.

Sehima is a segregate from *Ischaemum* distinguished by its ciliate ligule, and especially by its sessile spikelets with characteristic coriaceous body and extended scarious tip, and by the large, prominently nerved, pedicelled spikelets.

1. Perennial; lower glume of sessile spikelet with a scarious bidentate tip 1/4–1/3 the glume length.
 1. *S. nervosum*
- Annual; lower glume of sessile spikelet with an elongate, scarious, deeply bifid tip 1/2 the glume length.
 2. *S. ischaemoides*

1. *S. nervosum* (Rottler) Stapf (1917);

Andropogon nervosus Rottler (1803) - type: India, Rottler s.n. (K. holo.).

Ischaemum macrostachyum A. Rich. (1850); *Andropogon tacazensis* Steud. (1854) nom. superfl.; *Andropogon macrostachyus* (A. Rich.) Schweinf. (1867) - type: Ethiopia, Tacazze R., Schimper 1705 (K. iso.).

Tussocky perennial; culms thin, wiry, 50–120 cm high. Leaf-blades linear, 10–40 cm long, 3–6 mm wide, glaucous, tough and scaberulous, tapering to a filiform tip. Raceme 7–13 cm long, gently curved; rhachis-internodes and pedicels stoutly linear. Sessile spikelet 7–10

mm long; lower glume narrowly oblong, firm with 6–8 thick, prominent, laterally placed nerves, keeled along the outermost, the keels becoming dorsal downwards and the back here medianly grooved, the inner nerves anastomosing towards the tip, tip scarious, bifid, equalling 1/4–1/3 glume length; upper glume awn 11–16 mm long; upper lemma awn 3–4.5 cm long, with a brown column and pallid limb. Pedicelled spikelet lanceolate, 8–12 mm long, often colourfully flushed with purple; lower glume conspicuously 7-nerved, the margins ciliate. Fig. 127:7–9.

Bushland, open woodland (often *Acacia - Commiphora*) and grassland on dry, stony hillsides; 700–1900 m. EW TU/GD WU SU KF GG SD HA; Sudan, Somalia and East Africa, Malawi and Mozambique; S Arabia, India, eastwards to China and southwards to Australia. *Burger* 905; *Ash* 1229; *Gilbert & Phillips* 9126.

The large, colourful pedicelled spikelets, with their distinctive, thick, scaberulous nerves, are much more prominent than the sessile spikelets and, coupled with the solitary terminal raceme, are a good aid to recognition.

2. *S. ischaemoides* Forssk. (1775);

Ischaemum sehima Spreng. (1825) nom. superfl.; *Andropogon sehima* Steud. (1854) nom. superfl. - type: Yemen, Hadie, Forsskål s.n. (whereabouts uncertain, not C).

Sehima inscalptum Hochst. (1844); *Ischaemum inscalptum* (Hochst.) A. Rich. (1850); *Andropogon lineatus* Steud. (1854) non *A. insculptus* A. Rich. (1850); *A. inscalptus* (Hochst.) Schweinf. (1867) nom. illegit.; *Ischaemum laxum* R. Br. var. *inscalptum* (Hochst.) Hack. in DC., *Monogr. Phan.* 6: 245 (1889) - type: Ethiopia, Gopdia, Schimper 739 (K. iso.).

Slender annual; culms solitary or tufted, 20–60 cm high, erect or ascending. Leaf-blades linear, 10–20 cm long, 2–4 mm wide, tough, glaucous, scaberulous, tapering to a filiform tip. Raceme up to 15 cm long, villous; rhachis-internodes and pedicels linear. Sessile spikelet 9–18 mm long; lower glume linear, thinly coriaceous in the lower half, the keels here rounded and flaring inwards over the nerves, separated dorsally by a deep groove, the upper half narrowed and scarious with lateral keels, asymmetrically bifid; upper glume awn 2 cm long; upper lemma awn 4–7 cm long, the column dark glossy brown, the limb pallid. Pedicelled spikelet lanceolate or linear-lanceolate, 7–15 mm long, scaberulous; lower glume with 5 main nerves, shortly pilose dorsally, the margins villous. Fig. 127:10.

Arid grassland. GD/Sudan border, TU; westwards to Mali; Somalia, Kenya, Tanzania, southern tropical Africa and Namibia; Yemen, Pakistan (Sind) and India. *Schimper* 2278; *Schweinfurth* 1023.

S. ischaemoides has only infrequently been collected in Ethiopia. It is present in northern Kenya and is to be

expected in southern Sidamo and also in eastern Harerge.

142. DIHETEROPOGON (Hack.) Stapf (1922)

Andropogon sect. *Diheteropogon* Hack. (1889)

Clayton in *Kew Bull.* 20: 73-76 (1966).

Annuals or perennials; leaf-blades linear, sometimes cordate at the base. Inflorescence of paired racemes, terminal or gathered into a scanty spathate panicle; raceme-bases terete, not deflexed, bearing 1 to many pairs of homogamous spikelets; rhachis-internodes and pedicels linear. Sessile spikelet subterete, oblong, its callus acute to pungent, deeply inserted into the cupular internode-tip; lower glume coriaceous, dorsally 2-keeled with a deep nerveless median groove, the keels rounded, each 2-7-nerved, tip bidentate; lower lemma sterile without a palea; upper lemma bifid, a puberulous to hirsute geniculate awn arising from the sinus. Pedicelled spikelet much larger than the sessile, male, herbaceous.

5 species; tropical and South Africa.

A small genus of savanna grasses, barely separable from *Andropogon*.

D. amplexans (Nees) Clayton (1966);

Andropogon amplexans Nees (1841); *Cymbachne amplexans* (Nees) Roberty (1960) - type: South Africa, Drège s.n. (whereabouts uncertain).

Perennial with short scaly rhizomes; culms 30-200 cm high. Leaf-blades 15-30 cm long, mostly basal, the cauline leaves parallel-sided, not or inconspicuously rounded at the base which is 2-7 mm wide. Inflorescence a scanty spathate panicle; racemes 4-9 cm long, 1 pair of homogamous spikelets at the base of the lower raceme only. Sessile spikelet compressed between pedicel and internode; callus acute to pungent, 1-2 mm long; lower glume 5-7 mm long, keels 4-7-nerved; geniculate awn 2.5-7 cm long, pubescent. Pedicelled spikelet 8-13 mm long, acute or tipped with a bristle up to 8 mm long. Fig. 128.

Poor stony or sandy soils in deciduous bushland. SD; southwards to South Africa. Riva 522 (1263).(FT)

Var. *catangensis* (Chiov.) Clayton differs from the typical variety, described above, by its mainly cauline leaf-blades which taper from a broad cordate base 7-25 mm wide. It occurs in Sudan, Zaire, and from Tanzania to South Africa.

143. SCHIZACHYRIUM Nees (1829)

Annuals or perennials; culms delicate to robust; leaf-blades linear. Racemes solitary, slender, axillary and gathered into a spathate false panicle or rarely terminal (axillary in Ethiopian species); rhachis-internodes and pedicels linear to clavate, glabrous to ciliate or villous. Sessile spikelet linear to lanceolate, its callus obconical, obtuse, inserted into the cupuliform inter-

node-tip, this scarious and lobed; lower glume chartaceous to coriaceous, convex with inflexed margins, often keeled near the margins, several-nerved across the back (nerves sometimes very obscure); upper glume cuspidate to mucronate; lower lemma sterile without a palea; upper lemma bifid, a geniculate awn arising from the sinus. Pedicelled spikelet male or sterile, usually smaller than the sessile, sometimes much reduced.

About 60 species throughout the tropics, especially in savannah.

Schizachyrium is very closely related to *Andropogon*, differing mainly in its single racemes. The convex lemma of the sessile spikelet and scarious, cup-like internode-tip are additional features characteristic of *Schizachyrium*.

1. Leaf-blades obtuse; delicate trailing annual; sessile spikelet lanceolate, 2.5-4.5 mm long.
 1. *S. brevifolium*
- Leaf-blades acute; tufted annuals or perennial; sessile spikelet linear, 4.5-8 mm long. 2
2. Tussocky perennial; rhachis-internodes and pedicels ciliate; pedicelled spikelet male.
 2. *S. sanguineum*
- Annuals; rhachis-internodes and pedicels glabrous to villous; pedicelled spikelet sterile. 3
3. Rhachis-internodes slender, <1 mm wide at tip, villous; awn of pedicelled spikelet 4-10 mm long.
 3. *S. exile*
- Rhachis-internodes stout, 2 mm wide at tip, ± glabrous; awn of pedicelled spikelet 1.2-2.5 mm long.
 4. *S. urceolatum*

1. *S. brevifolium* (Sw.) Büse (1854);

Andropogon brevifolius Sw. (1788) - type: Jamaica, Swartz s.n. (S holo.).

Andropogon flaccidus A. Rich. (1850); *A. brevifolius* Sw. var. *flaccidus* (A. Rich.) Hack. in DC., *Monogr. Phan.* 6: 364 (1889); *Schizachyrium brevifolium* (Sw.) Büse var. *flaccidum* (A. Rich.) Stapf in *Fl. Trop. Afr.* 9: 188 (1917) - type: Ethiopia, Belen, Quartin Dillon s.n. (P holo.).

Slender annual; culms loosely tufted or trailing and mat-forming, 5-50 cm long. Leaf-blades flat or folded, 1-6 cm long, 2-6 mm wide, obtuse, constricted at the base. Racemes 1-2.5 cm long, borne along most of the length of the culm, usually several filiform, flexuous peduncles arising from each leaf-axil; spatheole narrow, enclosing the raceme base; rhachis-internodes and pedicels slender, inflated upwards, glabrous to villous. Sessile spikelet 2.5-4.5 mm long; lower glume narrowly lanceolate, subcoriaceous, glabrous to thinly pilose, indistinctly 2-4-nerved across the back, keeled only towards the bidentate tip; upper lemma bifid almost to the base, its awn 7-10 mm long. Pedicelled spikelet sterile, <1 mm long with a fine straight awn 3-5 mm long. Fig. 129:1, 2.



Figure 128. *DIHETEROPOGON AMPLEXANS*: 1 - habit x 4/5; 2 - portion of raceme x 2½; 3 - spikelet pair x 5; 4 - sessile spikelet with callus and rachilla-internode x 8; 5 - tip of upper lemma and base of awn x 8. All from Glover, Gwynne & Samuel 1529. Drawn by Ann Davies. (Reproduced from *Fl. Trop. E. Afr. Gramineae* 3: Fig. 182, with permission of the Editors).

Roadsides and open glades in forest on moist soils; 1200–2200 m. TU WG SU IL KF GG SD; throughout the tropics. Friis et al. 1749; Gilbert 4130; Mooney 6021.

Although the racemes are usually glabrous, plants with hairy racemes are also quite common in Africa and may be separated as var. *flaccidum*. However, they grade into the main body of the species through intermediate forms.

This delicate annual species with short, blunt leaf-blades is unlike most other African species of *Schizachyrium*. *S. platyphyllum* (Franch.) Stapf has a similar trailing habit and blunt leaf-blades, but is less delicate with longer thicker culms (60–120 cm long), broader leaf-blades (3–10 mm wide), more prominently nerved sessile spikelets and longer anthers (2–3 mm). It occurs in Sudan (Equatoria Province) and in Uganda, and is to be expected in low-lying, swampy areas of western Ethiopia.

2. *S. sanguineum* (Retz.) Alst. (1931);

Rottboellia sanguinea Retz. (1783); *Andropogon sanguineus* (Retz.) Merrill (1917) - type: China, Bladh s.n. (LD holo.).

Tussocky perennial, the whole plant often suffused with a reddish tinge; culms erect, 75 cm to 1.8(–3) m high. Leaf-blades linear, flat, glabrous to villous, acute. Racemes 4–12 cm long; rhachis-internodes and pedicels clavate, ciliate with hairs to 2 mm long or sometimes glabrous. Sessile spikelet linear, 5–8 mm long; lower glume coriaceous, convex with inflexed margins, keeled near the margins to the middle or below, glabrous to villous, narrowly winged near the bidentate tip; upper lemma bifid for 4/5 its length, its awn 10–20 mm long. Pedicelled spikelet male, lanceolate, 3–7 mm long, acuminate or with an awn-point up to 3.5 mm long.

Grassland and open bushland on dry or moist soils; up to 2000 m. KF GG; throughout the tropics. Gereau 1239; M.G. & S.B. Gilbert 1589; Gilbert & Phillips 9002.

3. *S. exile* (Hochst.) Pilg. (1917);

Andropogon exilis Hochst. (1844) - types: Sudan, Kotschy 19, 370 (both K isosyn.).

A. petitianus A. Rich. (1850); *A. exilis* Hochst. var. *petitianus* (A. Rich.) Hack. in DC., *Monogr. Phan.* 6: 366 (1889) - type: Ethiopia, without precise locality, Quartin Dillon & Petit s.n. (P holo.).

A. fragillimus Steud. (1854) - type: Ethiopia, TU, Djeladjeranne, Schimper 2057 (P holo.).

Tufted annual; culms erect or ascending, 20 cm to 1 m high. Leaf-blades linear, flat or folded, 2–15 cm long, 1–4 mm wide, acute. Racemes 3–5 cm long, not or only slightly exerted from the spatheole; rhachis-internodes and pedicels broadly linear, usually villous with spreading white hairs 2 mm long. Sessile spikelet linear, 4.5–6 mm long; lower glume coriaceous, almost cylindrical and usually villous for most of its length,

thinner, glabrous and keeled near the bidentate tip; upper lemma bifid for 3/4–4/5 its length, its awn 10–25 mm long. Pedicelled spikelet sterile, 1–2 mm long with an awn 4–10 mm long. Fig. 129:3–5.

Bushland, often on poor, dry soils; up to 1500 m. EE TU GD SU; tropical Africa, India, Thailand. Gilbert & Thulin 951; Schimper 1055; Hemming 1019.

S. exile is a widespread species, but apparently not common in Ethiopia. The racemes are reddish-tinged, usually with a conspicuous tuft of white spreading hairs from each joint. Elsewhere in Africa there is some variability, with the internodes and pedicels occasionally uniformly pubescent, or sometimes the entire raceme glabrous [*S. glabrescens* (Rendle) Stapf from southern Africa].

4. *S. urceolatum* (Hack.) Stapf (1917);

Andropogon urceolatus Hack. (1885) - type: Ethiopia (Sudan border), GD, Metema [Matamma], Schweinfurth 1031 (W holo.).

Slender tufted annual; culms erect, wiry, up to 30 cm high. Leaf-blades linear, flat or folded, 3–5 cm long, 1.5–2 mm wide, acute. Racemes 3–5 cm long, barely exerted from the spatheole; rhachis-internodes and pedicels glabrous (or only inconspicuously villous or ciliate on the inner edge), stout, broadly oblong to clavate with a scarious, flared tip 2 mm wide enclosing the base of the joint above, the callus hairs protruding from it; pedicels broadly linear. Sessile spikelet linear, 6–7.5 mm long; lower glume chartaceous, glabrous, minutely granular, keeled and narrowly winged above the middle, tip bidentate; upper lemma bifid for 3/4 its length, its awn 12–16 mm long. Pedicelled spikelet sterile, 3–4.5 mm long with an awn-point 1.2–2.5 mm long.

Shallow stony soils; 1000 m. GD (Sudan border); westwards to Senegal.

A Sahel zone species, reaching the eastern limit of its range in western Ethiopia.

144. **ANDROPOGON** L. (1753)

Atholophis (Trin.) Chiov. (1917)
as "*Artholophis*", nom. superfl.

Clayton in Hook., *lc. Pl.* 37, t. 3644 (1967).

Annuals or perennials, sometimes robust; leaf-blades linear, not aromatic. Racemes usually paired, occasionally single or digitate, terminal or axillary and gathered into a spathate false panicle; raceme-bases not deflexed, without homogamous spikelets; rhachis-internodes and pedicels filiform, linear or clavate, inflated or not, ciliate to plumose. Sessile spikelet dorsally or laterally compressed, its callus short, blunt, inserted into the cupuliform or crateriform internode-tip; lower glume membranous to coriaceous, lanceolate with lateral keels, these sometimes narrowly winged, flat or shallowly depressed between the keels and with or without intercarinal nerves, or linear with dorsal keels and a



Figure 129. *SCHIZACHYRIUM* spp.: *S. BREVIFOLIUM*: 1 - habit x 3/4; 2 - spikelet pair x 9. *S. EXILE*: 3 - habit x 3/4; 4 - spikelet pair x 9; 5 - upper lemma and awn base x 9. 1 & 2 from Mooney 6021; 3-5 from Gilbert & Thulin 951. Drawn by Eleanor Catherine.

male, 6–7 mm long, narrowly lanceolate, both glumes with mucros up to 1 mm long.

Dry stony soils in bushland; 390–1500 m. HA; N and C Somalia. *Burger* 3010, 3331; *M.G. & S.B. Gilbert* 2064.

A very distinctive species on account of its shrubby, much-branched habit. It has been placed in *Schizachyrium* because of its single racemes, but differs from that genus by its concave lower glume, nerveless along the midline.

2. *A. laxatus* Stapf (1919);

- type: Zimbabwe, *Mundy* s.n. (K lecto.).

Slender tufted perennial, sometimes with rhizomes; culms 30–90 cm high. Leaf-blades folded, pale green, 2–3 mm wide, abruptly acute; leaf-sheaths keeled. Inflorescences terminal and also axillary; racemes 2(–5), 3–5 cm long, loose with spaced spikelet-pairs, copiously silky-villous; rhachis-internodes and pedicels filiform with spreading hairs 3–8 mm long. Sessile spikelet 4–5 mm long including a truncate, bearded callus; lower glume linear-lanceolate, depressed and nerveless between the dorsal keels; upper glume acute to mucronate; upper lemma bifid in the upper third, its awn fine, weakly geniculate, 1–2 cm long. Pedicelled spikelet sterile, much reduced, up to 2.5 mm long (sometimes suppressed), acuminate or shortly awned.

Marshy places; up to 2000 m. KF; westwards to Cameroon and southwards through East Africa to South Africa. *Stewart* 91.

A. laxatus can easily be distinguished from the other Ethiopian species of *Andropogon* by its paired, fluffy white racemes of very loosely arranged spikelets. However, it is sometimes confused with *A. eucomus* Nees, an East African species which differs by its smaller sessile spikelets (2–3 mm), totally suppressed pedicelled spikelets and digitate inflorescences of 3–6 racemes.

3. *A. lima* (Hack.) Stapf (1919);

A. amethystinus Steud. var. *lima* Hack. in DC., *Monogr. Phan.* 6: 464 (1899) - type: Cameroon Mt., *Monn* 2084 (K iso.).

A. amethystinus Steud. var. *breviaristatus* Hack., l.c. 6: 464 (1899) - type: Ethiopia, GD, Mt Bachit, *Schimper* 95 (K iso.).

Eulalia hydrophila Chiov. (1940) - types: GD, Debarek, *Chiovenda* 917 & Cera, *Chiovenda* 985 (both FT syn.).

E. hydrophila Chiov. var. *filiformis* Chiov. in *Atti Reale Accad. Ital. Mem. Cl. Sci. Fis. Math. Nat.* 11: 63 (1940) - type: Ethiopia, GD, Vulkefit to Debarek, *Chiovenda* 3125, cited as "3135" (K iso.).

Perennial forming dense tussocks; culms stiffly erect, 35–115 cm high. Leaf-blades tough, erect, 1.2–2 mm wide with a conspicuous, broad white midrib, the margins harshly scabrid. Racemes terminal, paired, 5–15 cm long; rhachis-internodes and pedicels slender, linear, ciliate. Sessile spikelet 7–8.5 mm long including a

1 mm long, cuneate, bearded callus; lower glume narrowly elliptic, thinly coriaceous, flat or slightly concave and several-nerved across the back between the lateral keels, inconspicuously winged upwards, asymmetrically bidenticulate; upper glume with an awn 2–4 mm long; upper lemma bifid to the middle, its awn 10–15 mm long, strongly geniculate. Pedicelled spikelet 5–8 mm long, the lower glume with a mucro or short awn up to 3.5 mm long. Fig. 130:1.

Montane grassland; 3000–3700 m. GD SU BA; Sudan (Imatong Mts.); southwards through East Africa to Malawi; Cameroon Mt. *De Wilde* 9787; *Mooney* 7181; *Edwards* 52 (ETH).

A. lima is common and sometimes dominant in grassland on the East African mountains, but appears to be only occasional in Ethiopia. Its harsh, narrow leaf-blades with a broad white midrib are the easiest means of distinguishing it from other upland *Andropogon* species.

4. *A. greenwayi* Napper (1963);

- type: Tanzania, *Greenway & Turner* 10165 (EA holo., K iso.).

Mat-forming, shortly rhizomatous perennial; culms wiry, 30–80 cm high. Leaf-blades mainly basal, flat, 2–10 cm long and 1–4 mm wide, glaucous, shortly and stiffly pilose, margins firm. Racemes 2(–3), terminal, slender, pallid, 3–7 cm long; rhachis-internodes and pedicels filiform, ciliate. Sessile spikelet 7–10.5 mm long, including a callus 0.5 mm long; lower glume narrowly lanceolate, coriaceous with a nerveless median groove in the lower half, membranous with green nerves above and here laterally keeled and narrowly winged, bidenticulate; upper glume with a mucro 0.3–4 mm long; upper lemma bifid to the middle, its awn 13–25 mm long. Pedicelled spikelet linear-lanceolate, 5–8 mm long, acute or mucronulate.

Short open grassland; 1000–2000 m. SD HA; S Kenya and N Tanzania; N Somalia; N Yemen. *Bally* 10036; *Gillett* 14360; *IECAMA* I-22.

East African *A. greenwayi* occurs on volcanic soils in the Serengeti region (*Gillett* 14360 was also collected on lava at Mega), whereas populations from Harerge eastwards across northern Somalia grow on calcareous soils, especially gypsum. East African plants tend to be more robust with leaf-blades 3–4 mm wide (1.5–2.5 mm in Harerge and Somalia), slightly longer sessile spikelets (8.5–10.5 mm long as against 7–9 mm), and have an awnlet 1.5–4 mm long on the upper glume instead of a mucro 0.3–1.2 mm long.

5. *A. distachyos* L. (1753);

- type: Europe, *Burser* s.n. (UPS holo.).

A. distachyos L. var. *hirtus* Chiov. in *Nuov. Giorn. Bot. Ital.*, n.s. 19: 416 (1912) - type: Eritrea, Hamasen, *Fiori* 1220 (FT holo.).

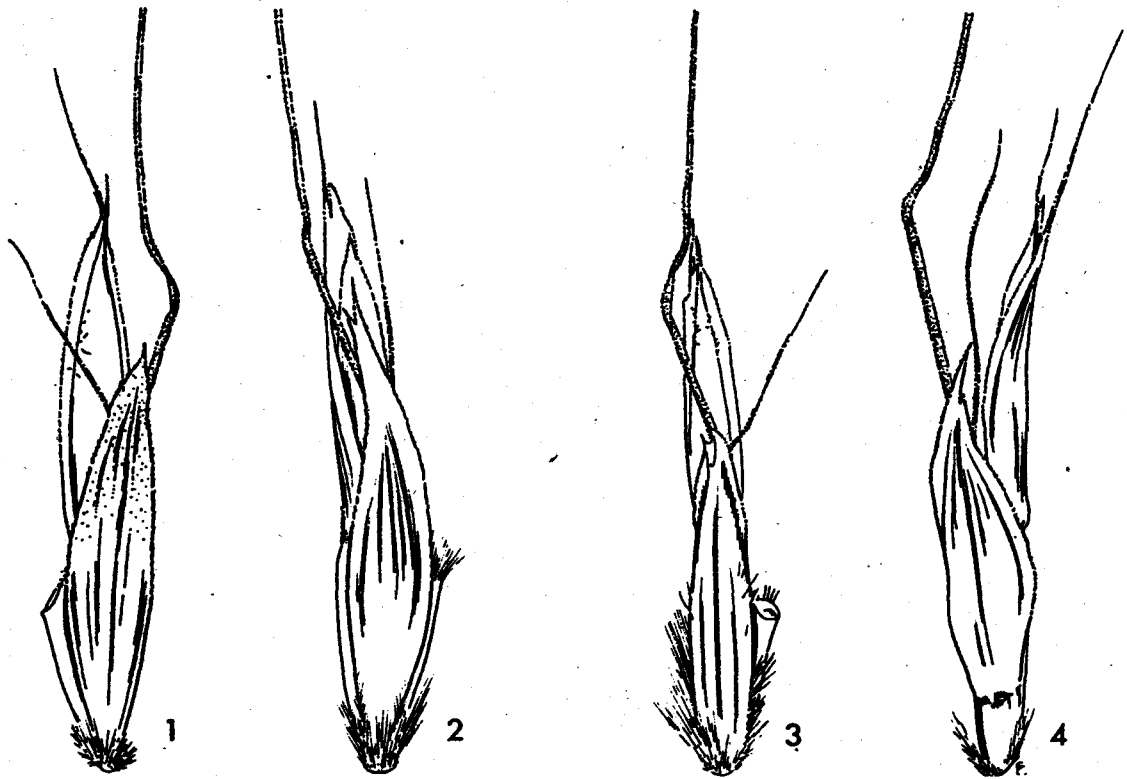


Figure 130. *ANDROPOGON* spp.: spikelet pairs x 7. 1 - *A. LIMA*; 2 - *A. DISTACHYOS*; 3 - *A. AMETHYSTINUS*; 4 - *A. ABYSSINICUS*. 1 from Mooney 7181; 2 from Renvoize 1310; 3 from Mooney 5185; 4 from Gillett 5052. Drawn by Eleanor Catherine.

Loosely tufted perennial, the basal sheaths silky-pubescent below; culms slender, 25 cm to 1 m high. Leaf-blades 1–4 mm wide, glabrous or pilose. Racemes terminal, paired, erect or only slightly divergent, 3–10 cm long; rhachis-internodes and pedicels ciliate, internodes slender to stoutly linear, broadening to a cupuliform lobed tip, pedicels somewhat inflated, oblong to subclavate. Sessile spikelet 8–14 mm long including an oblong callus 1–1.5 mm long; lower glume narrowly lanceolate, flat and (7–)11–13-nerved between the lateral keels, glabrous, puberulous or hispidulous, keels winged except near the base, the wings confluent to a membranous, slightly falcate, bidentate tip; upper glume with an awn 5–8 mm long; upper lemma bifid to the middle, its awn 18–27 mm long. Pedicelled spikelet narrowly elliptic-oblong, 6–11 mm long with an awn 2.5–7 mm long. Fig. 130:2.

Dry rocky slopes in upland grassland; 1700–3100 m. EW TU GD SU GG SD; southwards through East Africa to Zimbabwe and South Africa, Sudan (Jebel Marra), Cameroon Mt.; shores of the Mediterranean; Arabian Peninsula; Thailand. *Burger* 1014; *Friis* et al. 1310; *Gilbert & Getachew* 2710.

A. distachyos is sometimes confused with *A. amethystinus* but, although sometimes straggling, is not usually rhizomatous. The sessile spikelets have noticeably more nerves between the keels, which are more obviously winged and confluent to a characteristically falcate tip. The expanded, cupuliform and lobed internode-tip is also lacking in *A. amethystinus*.

6. *A. amethystinus* Steud. (1854);

- type: Ethiopia, GD, Semien, Mt Bachit, *Schimper* (P hol.).

A. humilis Hochst. ex A. Rich. (1850) - type: Ethiopia, GD, Dschenousa, *Schimper* 850 (K iso.).

A. pratensis Hochst. ex Hack. (1889) - type: Ethiopia, GD, Debra Eski, *Schimper* s.n. (B hol., destr.).

A. pratensis Hochst. ex Hack. subvar. *pilosus* Hack. in DC., *Monogr. Phan.* 6: 463 (1889) - type: Ethiopia, GD, Debra Eski, *Schimper* 1001 (P hol., K iso.).

A. pratensis Hack. var. *pseudoabyssinicus* Chiov. in *Ann. Ist. Bot. Roma* 8: 282 (1908) - types: Eritrea, Asmara, *Pappi* 2222 & Addi Cajé, *Pappi* 1916 (both FT syn.).

A. polyatherus A. Rich. var. *plagiopus* (Steud.) Hack. subvar. *intermedius* Chiov., l.c. (1908) p.p. - type: Eritrea, Ad Rassi, *Pappi* 4978 (FT).

A. pilosellus Stapf (1919) - type: Eritrea, At-Zien, *Pappi* 5285 (K hol.).

A. homogamus Stapf (1919) - type: Ethiopia, SU, Ankober, *Roth* 15 (K hol.).

Tufted perennial, sometimes with wiry rhizomes; culms erect to laxly ascending, 10–50 cm high. Leaf-blades flat, 2–3 mm wide, usually pilose, acute. Racemes terminal, paired, 3–8 cm long, often purplish; rhachis-internodes and pedicels slender, ciliate to villous, internode linear, pedicel linear-clavate. Sessile spikelet 5–8 mm long, including an oblong callus to 1 mm long;

lower glume narrowly elliptic, firmly membranous or papyraceous, glabrous to villous, flat or slightly concave and 5–7-nerved between the lateral keels, these narrowly winged upwards or occasionally wingless; upper glume with an awn 2–6 mm long; upper lemma bifid to the middle, its awn 9–18 mm long. Pedicelled spikelet narrowly elliptic-oblong, 4–8 mm long, lower glume with an awnlet up to 2.5(–4) mm long, upper glume sometimes with a mucro to 2 mm long. Fig. 130:3.

Upland and montane grassland, open places among *Erica* bushes and in rock crevices, often in moist situations; (2000–)2400–4100 m. EW GD GJ SU AR KF GG SD BA; southwards through East Africa to South Africa, also in Nigeria; N Yemen; S India. *Ash* 2619; *M.G. & S.B. Gilbert* 1934; *Mooney* 5681.

A. amethystinus is very variable, both in habit and spikelet details, but the variation appears to be continuous. The species is always perennial, typically loosely tufted with wiry rhizomes but may form dense tufts, particularly at high altitudes and the racemes vary from glabrous to densely villous, leading to striking differences in facies. The lower glume of the sessile spikelet is usually winged above the middle but may be wingless (especially at high altitudes), and the pedicelled spikelet usually has an awnlet on the lower glume only, but the upper glume often also has an inconspicuous mucro which may be prolonged to 2 mm or even more.

Specimens with villous racemes and 2-awned pedicelled spikelets can be difficult to distinguish from *A. abyssinicus* but, besides being annual, *A. abyssinicus* is generally more robust with taller culms and longer racemes (see also note under *A. abyssinicus*).

A. humilis is placed in synonymy here as the spikelets are typical of *A. amethystinus* (matching well those of *Thulin & Hunde* 3926). However, the weak annual habit, with a flowering branch arising from each node, is very anomalous. Only further collecting can clarify its status.

7. *A. abyssinicus* Fresen. (1837);

Sorghum abyssinicum (Fresen.) Kuntze (1891) - type: Ethiopia, GD, Semien [Simen], *Rüppell* s.n. (FR holo.).

A. polyatherus Hochst. ex A. Rich. (1850) - types: Ethiopia, Memsah, *Quartin Dillon* (P syn.) & *Ouodgerate, Petit* (P syn.) & *Adua* [Adoua], *Schimper* 290 (K isosyn.).

A. polyatherus A. Rich. (1850) var. *genuinus* subvar. *scabriglumis* Hack. in DC., *Monogr. Phan.* 6: 467 (1889) - type: Ethiopia, Mt Lötho, *Schimper* 476 (P holo., K iso.).

A. glabrescens Hochst. ex Steud. (1854); *A. polyatherus* A. Rich. var. *genuinus* subvar. *glabrescens* (Hochst. ex Steud.) Hack., l.c. (1889) - type: Ethiopia, TU, *Adua* [Adoa], *Schimper* 1115 (K iso.).

A. multinervius Hochst. ex Steud. (1854); *A. polyatherus* A. Rich. var. *genuinus* subvar. *multi-*

nervis (Hochst. ex Steud.) Hack., l.c. (1889) - type: Ethiopia, TU, *Gapdia*, *Schimper* 805 (K iso.).

A. plagiopus Hochst. ex Steud. (1854); *A. polyatherus* A. Rich. var. *plagiopus* (Steud.) Hack., l.c. (1889) - type: Ethiopia, *Schimper* 223a (whereabouts uncertain, not W, B).

A. polyatherus A. Rich. (1850) var. *plagiopus* (Steud.) Hack. subvar. *intermedius* Chiov. in *Ann. Ist. Bot. Roma* 8: 282 (1908) p.p. - type: Eritrea, Mt Saic Arà, *Pappi* 2009 (FT syn.).

Loosely tufted annual; culms ascending, 30–80 cm high. Leaf-blades flat, 1.5–5 mm wide. Racemes terminal, paired, 6–14 cm long; usually villous, pallid, often slightly flexuous; rhachis-internodes and pedicels stoutly linear, ciliate to villous, internode-tip subcrateriform with a triangular lobe. Sessile spikelet 6–11 mm long including a large oblong callus 1.3–3 mm long; lower glume elliptic to broadly elliptic, subcoriaceous, villous or occasionally ± glabrous, flat and (5–)6–8(–11)-nerved between the lateral keels, these winged from the middle or below; upper glume with an awn 4.5–9 mm long; upper lemma bifid from the middle, its awn 18–32 mm long. Pedicelled spikelet elliptic, 5–9 mm long, male (stigmas often also present) or sterile, usually both glumes awned; lower glume awn 2.5–8 mm long; upper glume awn (0–)1.5–5.5 mm long. Fig. 130:4.

Open grassland, disturbed ground and as a weed of pasture and arable land; 1800–2400 m. EW TU GD GJ SU AR KF GG HA; East Africa. *Burger* 1175; *Friis* et al. 485; *Mooney* 6267.

A. abyssinicus, a weedy annual mainly from ruderal habitats, can be confused with *A. distachyos* and *A. amethystinus*, but differs from both of these in its annual habit. The spikelets are similar in size to those of *A. distachyos*, but are generally hairier and lack the long curving tip to the sessile spikelet typical of that species. *A. abyssinicus* usually has conspicuously villous racemes but occasionally may be almost glabrous (*A. polyatherus*), and the typically 2-awned pedicelled spikelet may rarely only have one awn, especially when it is sterile. Such specimens may be distinguished from *A. amethystinus* by their broader, obviously winged sessile spikelets, larger callus and longer awns.

The pedicelled spikelet is usually male, but may occasionally be fertile, sometimes even with a geniculate awn (*A. plagiopus*, e.g. *Parker* 638, *Chiovenda* 2176).

8. *A. mannii* Hook. f. (1864);

- types: Fernando Po, *Mann* 654, 1475 (both K syn.).

Densely tufted perennial, the basal sheaths strongly compressed, papery, flabellate; culms erect, 10–60 cm high. Leaf-blades stiffly erect, tightly folded, 2–8 mm wide, the tip hooded. Inflorescence terminal, composed of (2–)3–10 subdigitate, purple racemes 2–7 cm long; rhachis-internodes and pedicels filiform, ciliate. Sessile

spikelet 4.5–8 mm long including a callus 0.5 mm long; lower glume narrowly lanceolate-oblong, cartilaginous, glabrous, flat or concave and obscurely 2–4-nerved between the lateral keels, wingless, bidenticulate; upper glume awnless or with an awn up to 5 mm long; upper lemma bifid for 1/4–1/2 its length, its awn 4–14 mm long. Pedicelled spikelet lanceolate, 5–8 mm long, male, the glumes sometimes mucronate.

Upland grassland; 2900 m. SD; scattered upland localities westwards to Sierra Leone and southwards to South Africa. *De Wilde* 8421.

9. *A. chrysostachyus* Steud. (1854);

- type: Ethiopia, without locality, *Schimper* s.n. (P holo.).

Tufted perennial from a tough, horizontal rootstock clothed in pale, subcoriaceous leaf-sheaths; culms 25–110 cm high. Leaf-blades flat, tough and often glaucous, 2–4 mm wide with a broad white midrib, glabrous or hispid, the margins harshly scabrid. Inflorescence terminal, composed of (2–)3–8 subdigitate, golden-brown racemes 4–14 cm long; rhachis-internodes and pedicels filiform, fulvously ciliate. Sessile spikelet 5.5–7.5 mm long including a callus up to 1 mm long; lower glume narrowly elliptic, coriaceous, fulvously villous, flat and 4–8-nerved between the lateral keels, wingless; upper glume awnless; upper lemma bifid for 1/3–1/2 its length, its awn 10–15 mm long. Pedicelled spikelet lanceolate, 5.5–7.5 mm long, male, acute to acuminate. Fig. 131:1–4.

Open grassland, sometimes dominant in overgrazed pastures; 1700–3100 m. GD SU AR SD BA HA; Kenya, Tanzania. *Burger* 1258; *M.G. Gilbert* 4089; *Mooney* 6374.

10. *A. gayanus* Kunth (1833);

- type: Senegal, *Gay* (K iso.).

A. squamulatus Hochst. in sched., *Schimp. It. Abyss.*, no. 715 (1842) & in *Flora* 27: 244 (1844); *A. gayanus* Kunth var. *squamulatus* (Hochst.) Stapf in *Fl. Trop. Afr.* 9: 263 (1919) - type: Ethiopia, TU, Ferrifera, *Schimper* 715 (K iso.).

Tufted perennial; culms robust, erect, 1.5–2.5 m high. Leaf-blades linear, flat, 5–20 mm wide, narrowed towards the base and sometimes falsely petiolate; ligule *c* 2 mm long, a narrow external ligule often also present. Racemes axillary, paired, 5–11 cm long, gathered into a spathate false panicle; rhachis-internodes and pedicels cuneate, densely ciliate. Sessile spikelet 6–8 mm long including a conspicuous, bearded, obtuse callus; lower glume narrowly oblong, ± flat across the back between the wingless lateral keels, many-nerved but with a shallow, nerveless median groove; upper glume acute or mucronate; upper lemma bifid in the upper third, its awn 1–3 cm long. Pedicelled spikelet male, elliptic-

oblong, 6–8 mm long; lower glume with an awn 1–10 mm long, upper glume sometimes also awned.

Grassland up to 2000 m. EW TU GD GJ WG; westwards to Senegal and south to South Africa. Introduced as a fodder crop elsewhere in the tropics. *Chiovenda* 2723; *Pappi* 358.

A. gayanus is a common and variable savannah grass in West Africa, where four varieties are distinguished [Clayton in *Fl. W. Trop. Afr.* ed. 2,3: 488 (1972)]. Only one of these varieties, var. *polycladus* (Hack.) Clayton (syn. var. *squamulatus*) extends to the rest of tropical Africa, including Ethiopia. It is distinguished from the other three West African varieties by its internodes and pedicels being ciliate on both edges (instead of only one) and by its glabrous (not villous) pedicelled spikelets.

11. *A. fastigiatus* Sw. (1788);

Diectomis fastigiata (Sw.) Kunth (1816) - type: Jamaica, *Swartz* s.n. (S holo.).

Andropogon hochstetteri Steud. (1854); *Heteropogon hochstetteri* (Steud.) Schweinf. (1867) - type: Ethiopia, without precise locality, *Schimper* 2013 (P holo.).

Tufted annual; culms erect, 15 cm to 2 m high. Leaf-blades linear, flat, 1–4 mm wide; ligule 5–7 mm long. Racemes axillary, single, 2–6 cm long, well exerted at maturity and aggregated into a spathate false panicle; rhachis-internodes and pedicels narrowly cuneate, densely ciliate. Sessile spikelet linear, 4–5 mm long including a short, obtuse callus; lower glume deeply depressed between the dorsal keels, sometimes villous in the upper half; upper glume glabrous or villous on the keel, with an awn 10–20 mm long; upper lemma bidentate, its awn 2.5–4 cm long. Pedicelled spikelets conspicuous, elliptic, 5–9 mm long, sterile, the lower glume papery with an awn 4–8 mm long, upper glume much smaller, shortly awned.

Dry bushland and grassland; *c* 1000 m. TU GD; throughout the tropics. *Schimper* 1019, 1445.

12. *A. chinensis* (Nees) Merr. (1917);

- type: China, Macau, *Vachell* 52 (CGE holo.).

A. schinzii Hack. (1889).

Tufted perennial from a knotty rootstock; culms stiffly erect, 60–100 cm high. Leaf-blades linear, flat, 3–4 mm wide, glabrous or pubescent, tip filiform; leaf-sheaths with triangular auricles. Racemes paired, axillary, exerted from linear spatheoles and forming a scanty false panicle; racemes 5–8 cm long, loose, the pedicelled spikelets lateral; rhachis-internodes and pedicels cuneate, inflated, densely villous. Sessile spikelet 6–7 mm long, including a short, shallowly inserted callus; lower glume linear, dorsally keeled, the keels almost meeting over a deep median groove; upper glume with an awn 2–9 mm long; upper lemma bifid in the upper



Figure 131. *ANDROPOGON* spp.: *A. CHRYSOSTACHYUS*: 1 - habit x 3/4; 2 - inflorescence x 3/4; 3 - spikelet pair from front x 4; 4 - spikelet pair from back x 4. *A. CHINENSIS*: 5 - habit x 3/4; 6 - inflorescence x 3/4; 7 - spikelet pair from back x 4. 1 from Phillips 4; 2-4 from Gillett 14361; 5-7 from Gilbert et al. 296. Drawn by Eleanor Catherine.

third, its awn 2.5–3 cm long. Pedicelled spikelet narrowly elliptic-oblong, 5–7 mm long, marginally scabrid or ciliolate, 2-awned, the longer awn 4–8 mm long. Fig. 131:5–7.

Stony hillsides in *Acacia* woodland; 1200–1600 m. GG SD; tropical and South Africa; N Yemen, India and China. Friis et al. 786; Gilbert 3380; Gilbert & Thulin 296.

13. *A. schirensis* Hochst. ex A. Rich. (1850);

- type: Ethiopia, TU, Shire [Chiré], Schimper 1807 (P holo.).

Andropogon dummeri Stapf (1919).

Densely tufted perennial, the basal leaf-sheaths often fibrous; culms slender, erect, 35–100 cm high. Leaf-blades flat, 2.5–7 mm wide, the margins scabrid with spaced teeth, tip filiform. Racemes paired, terminal or occasionally with 1–2 axillary pairs, often reddish, 5–10 cm long, strongly dorsi-ventral, the pedicelled spikelets imbricate on one side; rhachis-internodes and pedicels clavate, not inflated, thinly to densely ciliate. Sessile spikelet 5–6 mm long including a deeply inserted, obtuse callus; lower glume linear, dorsally keeled, the keels almost meeting over a deep median groove; upper glume awnless; upper lemma bifid in the upper third, its awn 2–3 cm long. Pedicelled spikelet narrowly lanceolate-oblong, 6.5–8 mm long, marginally ciliolate, sharply acute.

Grassland and open woodland, usually on dry soils; 800–2200 m. TU IL KF SD BA; tropical and South Africa. Friis et al. 806; Mooney 6085; Gillett 14371.

A. schirensis is a widespread African grass which, whilst fairly uniform in Ethiopia, shows much variation elsewhere in Africa. The size range extends to plants up to 2.5 m high with spikelets to 10 mm long and awns to 4 cm long. The keels of the sessile spikelet spread apart in some forms. There is also much variation in leaf width and hairiness of the racemes. Ethiopian plants are relatively short with a fibrous base (*A. dummeri*), but this form intergrades fully with the rest of the complex.

14. *A. perligulatus* Stapf (1908);

- type: Togo, Baumann 318 (K holo.).

Tufted perennial; culms 50–150 cm high, erect. Leaf-blades narrowly linear, often tomentellous; sheath-auricles and ligules 3–12 mm long. Inflorescence of paired racemes, mainly axillary and forming a loose false panicle; racemes 3–8 cm long; rhachis internodes and pedicels narrowly clavate, subinflated, 0.6–0.8 mm wide, shortly ciliate. Sessile spikelet 4–6 mm long including a short, blunt, shallowly inserted callus; lower glume linear, deeply grooved between the dorsal keels; upper glume acute or with a mucro to 3 mm long; upper lemma bifid in the upper third, its awn 1–2 cm long. Pedicelled spikelet narrowly lanceolate, 3.5–6 mm long, scaberulous on the nerves, marginally ciliolate, acute or mucronate.

Swampy areas, up to 2000 m. KF; southwards through East Africa to Angola and Zimbabwe; West Africa from Senegal to Nigeria. Stewart 87.

15. *A. canaliculatus* Schumach. (1827);

- type: Ghana, Thonning (whereabouts unknown, not C).

Tufted perennial; culms 25 cm to 2 m high, erect. Leaf-blades narrowly linear, softly hairy; sheath-auricles and ligules up to 2 mm long. Inflorescence of paired racemes, mainly axillary and forming a loose false panicle; racemes 3–9 cm long; rhachis-internodes and pedicels inflated, broadly clavate, c 1 mm wide, shortly ciliate. Sessile spikelet 4–6 mm long including a short, blunt, shallowly inserted callus; lower glume linear, deeply grooved between the dorsal keels; upper glume acute; upper lemma bifid almost to the middle, its awn 0.7–1.5 cm long. Pedicelled spikelet narrowly lanceolate, 3.5–6 mm long, scaberulous on the nerves, acute or mucronate.

Swampy grassland; 1800 m. SD; East Africa and westwards to Mali; a few isolated records from southern tropical Africa. Mesfin, Sebsebe & Ensermu 3652 (ETH).

145. **CYMBOPOGON** Spreng. (1815)

Soenarko in *Reinwardtia* 9: 225–375 (1977).

Perennials or rarely annual, often tall and robust. Leaf-blades filiform to broadly linear with filiform tip, aromatic. Inflorescence a compound spathate panicle, often large and congested; each ultimate spatheole boat-shaped, ± enclosing a pair of short racemes on a short common peduncle; rhachis-internodes and pedicels linear, ciliate. Each raceme borne on a short flattened raceme-base, usually deflexed at maturity, lower raceme with one basal pair of homogamous spikelets, the lower raceme-base and pedicel of the homogamous pair sometimes inflated and adnate. Sessile spikelet dorsally compressed, its callus obtuse, inserted into the crateriform internode-tip; lower glume chartaceous, flat or concave between the keels, these sometimes winged upwards, with or without intercarinal nerves, often with oil streaks; upper glume awnless; lower lemma an empty hyaline scale; upper lemma bifid or rarely entire, a glabrous geniculate awn arising from the sinus, or occasionally awnless. Pedicelled spikelet narrowly lanceolate with a small callus, herbaceous, about as long as the sessile, acute.

About 40 species in the Old World tropics and subtropics, including Australia; introduced to tropical America.

Cymbopogon, with its inserted callus but frequently deflexed raceme-bases, provides a link between *Andropogon* and *Hyparrhenia*, although its aromatic leaves distinguish it from both these genera. *Hyparrhenia glabriuscula* in particular has the facies of *Cymbopo-*

gon, but is placed in *Hyparrhenia* as the callus of its sessile spikelet is fully exposed, not inserted into the internode-tip as in *Cymbopogon*.

Essential oils are present in all *Cymbopogon* species, and the aromatic flavour of the leaves when chewed is a useful distinguishing character for the genus. Several species are cultivated commercially for the oil which is distilled from their leaves and inflorescences. Chief among these is *C. citratus* (DC.) Stapf (lemon grass), which is cultivated on a large scale in parts of South America and Asia for medicinal and culinary purposes. It is grown around houses in Ethiopia for its fragrant foliage, and can be recognized by the lemon scent of the leaves when crushed and by its awnless spikelets. *C. nardus* (L.) Rendle (citronella), cultivated mainly in Sri Lanka and the West Indies, has been recently introduced on an experimental basis. Flowers are seldom seen on the cultivated species due to repeated harvesting.

Cymbopogon is divided into several species complexes, within which the individual species are both variable and intergrading, and often based on rather ill-defined characters. There is as yet no general consensus as to the most appropriate level within this variation for the definition of species.

1. Lower glume of sessile spikelet flat to shallowly concave with a slit-like median groove below the middle (appearing as a line, or a keel on the inside), laterally winged. 2
- Lower glume of sessile spikelet almost flat to deeply concave with the depression uniformly rounded; not winged. 4
2. Lower glume of sessile spikelet firm throughout; perennial. 3
- Lower glume of sessile spikelet with 2 translucent brown oil streaks, intercarinal nerves obvious; annual. 1. *C. nervatus*
3. Leaf-blades up to 8(-10) mm wide; ligule 1-5 mm long; culms slender, often rambling, up to 1.2 m high. 2. *C. caesius*
- Leaf-blades over 8 mm wide; ligule seldom exceeding 1 mm long; culms robust, erect, 1-3 m high. 3. *C. giganteus*
4. Lower glume of sessile spikelet with keels sharp throughout; awn scarcely geniculate with ill-defined column. 4. *C. schoenanthus*
- Lower glume of sessile spikelet with keels rounded in lower half; awn clearly geniculate with well-defined column. 5
5. Lowermost pedicel straight-sided, linear to oblong. 5. *C. pospischilii*
- Lowermost pedicel inflated, barrel-shaped. 6. *C. commutatus*

1. *C. nervatus* (Hochst.) Chiov. (1909);
Andropogon nervatus Hochst. (1844); *A. schoenanthus* (L.) Spreng. var. *nervatus* (Hochst.) Hack. in DC., *Monogr. Phan.* 6: 611 (1889) - type: Sudan, Kordofan, *Kotschy* 374 (K iso.).

C. nervatus (Hochst.) Chiov. var. *aerythraeum* Chiov., *Int. Gram. Essenze*: 11 (1909) - types: Eritrea, *Pappi* 6304, 6626, 7207 (FT syn.).

Annual; culms solitary or tufted, erect, 50-150 cm high. Leaf-blades broadly linear, pale green, thin, 15-40 cm long, 6-12 mm wide, smooth, glabrous, rounded at the base; ligule white, scarious, 2-3 mm long. Spathate panicle narrowly oblong, congested, pale green; rhachis-internodes and pedicels ciliate with hairs 0.5-2 mm long; lower raceme-base and pedicel of homogamous pair inflated, adnate; upper raceme-base often also somewhat inflated. Sessile spikelet 3.2-4.6 mm long, narrowly elliptic; lower glume flat or slightly concave with a median groove below the middle (appearing as a line, or a keel on the inside), 2 obvious intercarinal nerves flanked by brown translucent oil streaks, keels broadly winged above the middle; upper lemma deeply bifid; awn 1.5-2 cm long. Pedicelled spikelet 3.6-5.4 mm long. Fig. 132:2.

Plains, on clay soils; 800-1600 m. EW; Sudan. *Benedictis* 162; *Pappi* 7690.

The broad brown oil streaks on the lower glume of the sessile spikelet are an obvious feature of this species. The annual habit, thin leaf-blades and pale green coloration throughout are also characteristic.

2. *C. caesius* (Hook. & Arn.) Stapf (1906);
Andropogon caesius Hook. & Arn. (1838); *A. schoenanthus* L. var. *caesius* (Hook. & Arn.) Hack. in DC., *Monogr. Phan.* 6: 610 (1889) - type: India, *Wight* 1700 (K holo.).
Andropogon connatus Hochst. ex A. Rich. (1850), p.p.; *Cymbopogon connatus* (Hochst. ex A. Rich.) Chiov. (1909) - types: Ethiopia, TU, Mt Scholoda [Selleuda], *Schimper* 411 (K isosyn.) & Shire [Chiré], *Quartin Dillon* s.n. (P syn.).
C. connatus (Hochst. ex A. Rich.) Chiov. var. *muticus* Chiov., *Int. Gram. Essenze*: 14 (1909) - type: Ethiopia, TU, Mt Cojetanus, *Schimper* 1828 (P iso.).

Tufted perennial from a knotty rootstock; culms wiry, often rambling, 40-120 cm high. Leaf-blades 20-35 cm long, 3-8(-10) mm wide, glaucous, tough, smooth and glabrous, rounded or narrowed at the base; ligule brown, 1-5 mm long. Spathate panicle narrowly oblong, congested, 5-20 cm long, often purplish; rhachis-internodes and pedicels silky-ciliate with hairs up to 3 mm long; lower raceme-base and pedicel of homogamous pair inflated, barrel-shaped, adnate. Sessile spikelet 3-4 mm long, elliptic-oblong; lower glume flat, firmly membranous with a median groove below the middle (appearing as a line, or a keel on the inside), 2 indistinct intercarinal nerves above, keels narrowly winged in the upper half; upper lemma deeply bifid, the lobes filiform, twining about the awn base; awn 1-2 cm long. Pedicelled spikelet 3.5-5 mm long. Fig. 132:1.

A variety of habitats from stony limestone hillsides to open woodland or grassy plains on black clay, some-

times growing through bushes; 1300–2300 m. TU GD GJ SU AR KF GG SD BA HA; Sudan and southwards down the eastern side of Africa; Yemen; S India and Sri Lanka. *Gillett* 14372; *Gilbert & Phillips* 8941; *M.G. & S.B. Gilbert* 1416.

The tussocky form of this grass, prevalent in southern Africa, is often separated as *C. excavatus* (Hochst.) Stapf.

3. *C. giganteus* Chiov. (1909);

Andropogon giganteus Hochst. (1844), non Tenore (1811) - type: Sudan, Kordofan, *Kotschy* 250 (K iso.).

Cymbopogon connatus (Hochst. ex A. Rich.) Chiov. var. *benearmatus* Chiov., *Int. Gram. Essenze*: 14 (1909) - type: Eritrea, Amasen, Mt. *Lesä*, *Pappi* 4708 (FT holo.).

Loosely tufted perennial from a tough basal rootstock; culms robust, 1–3 m high, erect, sometimes supported by stilt roots. Leaf-blades broadly linear, up to 60 cm long, 8–30 mm wide, firm, smooth, green or glaucous, base cordate to amplexicaul; ligule a truncate rim usually <1 mm long. Spathate panicle narrow, 20–70 cm long, green or brownish; rhachis-internodes and pedicels ciliate; lower raceme-base and pedicel of homogamous pair inflated and adnate. Sessile spikelet 3–4.5 mm long, narrowly elliptic; lower glume firmly membranous, flat with a median groove below the middle (appearing as a line, or a keel on the inside), 2 indistinct intercarinal nerves above, keels winged; upper lemma deeply bifid; awn 1–1.7 cm long (sometimes absent in West Africa). Pedicelled spikelet 3.5–5 mm long.

Tall grassland; c 700–2000 m. EW GG; tropical Africa. *Fukui* 1315; *Pappi* 4895.

C. caesius and *C. giganteus*, although of very different habit in their typical form, intergrade completely. Tall, robust, broad-leaved *C. giganteus* is common in southern Sudan and penetrates into lowland southwestern Ethiopia. Two shorter, slender collections from Eritrea (*Pappi* 4708, 4895) have leaves at the upper end of the size range for *C. caesius*, and the short truncate ligule of *C. giganteus*.

4. *C. schoenanthus* (L.) Spreng. (1815);

Andropogon schoenanthus L. (1753) - type: without locality, *Plukenet* (BM holo.).

Densely tufted perennial; culms erect, 60–130 cm high, enclosed at the base by tight bundles of old sheaths. Leaf-blades narrowly linear to filiform, up to 30 cm long, 1–3 mm wide, glaucous, asperulous. Spathate panicle oblong, 10–40 cm long; racemes 1–3 cm long; rhachis-internodes and pedicels conspicuously white-woolly with hairs 3–4 mm long; pedicel of homogamous pair inflated, barrel-shaped, the lower raceme-base very short, about 1/3 as long as the pedicel.

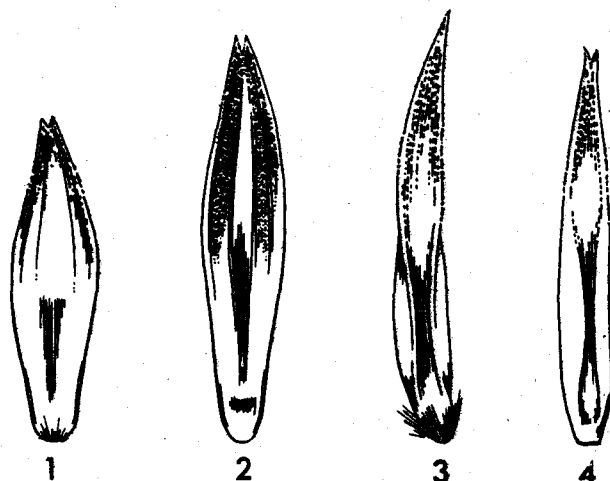


Figure 132. *CYMBOPOGON* spp.: lower glume of sessile spikelet x 10: 1 - *C. CAESIUS*; 2 - *C. NERVATUS*; 3 - *C. SCHOENANTHUS*; 4 - *C. COMMUTATUS*. 1 from *Gilbert & Phillips* 8941; 2 from *Dept. Agric. For.* 222/669B; 3 from *Pappi* 7643; 4 from *Ash* 1227. Drawn by Eleanor Catherine.

Sessile spikelet narrowly lanceolate, 4–7 mm long; lower glume chartaceous, concave between the keels, glabrous or pubescent, keels convergent below the middle but sharp throughout, unwinged; upper lemma bidentate, the lobes up to 1/3 length of lemma body; awn 4.5–9 mm long, scarcely geniculate, the column weakly defined. Pedicelled spikelet 4–7 mm long. Fig. 132:3.

subsp. *proximus* (Hochst. ex A. Rich.) Maire & Weiller, *Fl. Afr. Nord* 1: 287 (1952);

Andropogon proximus Hochst. ex A. Rich. (1850); *A. jwarancusa* Jones var. *proximus* (Hochst. ex A. Rich.) Hack. in DC., *Monogr. Phan.* 6: 601 (1889); *Cymbopogon sennarensis* (Hochst.) Chiov. var. *proximus* (Hochst. ex A. Rich.) Chiov., *Int. Gram. Essenze*: 16 (1909); *Cymbopogon proximus* (Hochst. ex A. Rich.) Stapf, *Andropogon schoenanthus* L. var. *proximus* (A. Rich.) A. Chev., *Expl. Bot. Afr. Occ. Fr.* 1: 719 (1920); *A. schoenanthus* L. subsp. *proximus* (Hochst. ex A. Rich.) Maire in *Bull. Soc. Hist. Nat. Afr. Nord* 30: 368 (1939) - types: Ethiopia, TU, Djeladjeranne, *Schimper* 1792 (K iso-syn.) & Shire [Chiré], *Quartin-Dillon* s.n. (P syn.).

Lower glume of sessile spikelet usually pubescent between the keels; spatheoles 1–2 cm long; panicle densely congested with numerous reddish-brown racemes <2 cm long.

Semi-desert bushland; EW TU; westwards to Mauretania, Kenya, Egypt. *Hemming* 1070; *Pappi* 7643; *Schweinfurth & Riva* 462.

The congested, reddish-brown inflorescence with contrasting white woolly hairs imparts a distinctive

facies to this subspecies. Some specimens from West Africa have this facies, but the rounded keels and basal swelling to the lower glume of the sessile spikelet typical of *C. commutatus*.

Subspecies *schoenanthus* occurs in N Africa, the Arabian peninsula, and in Somalia and Djibouti. It is to be expected in the eastern part of the country, and differs by its glabrous lower glume of the sessile spikelet and looser inflorescence with fewer, longer spatheoles (2–3 cm) and longer racemes (>2 cm).

5. *C. pospischilii* (K. Schum.) C.E. Hubb. (1949);
Andropogon pospischilii K. Schum. (1897) -
type: Kenya, *Pospischil* s.n. (B holo.).

Densely tufted perennial; culms slender, erect, up to 1 m high, enclosed at the base by tight bundles of old sheaths. Leaf-blades narrowly linear, 15–30 cm long, 1–4 mm wide, green or glaucous. Spathate panicle narrow, loose, 10–30 cm long; upper raceme with 7–8 spikelet-pairs; rhachis-internodes and pedicels ciliate with hairs c 3 mm long; pedicel of homogamous pair narrow, straight-sided, equalling or slightly shorter than the lower raceme-base and free from it. Sessile spikelet narrowly lanceolate, 4–6.5 mm long; lower glume chartaceous, concave between the keels, keels rounded below the middle, sharp above, unwinged; upper lemma bifid to near the middle; awn geniculate with a well-defined column, 1–2 cm long. Pedicelled spikelet 4–7 mm long.

Dry rocky slopes in bushland and cleared woodland, and on dry grassy plains; c 2400 m. EW; Somalia and southwards through eastern Africa to Mozambique; Yemen. *Gilbert & Getachew* 2727; *Ryding* 1401.

C. pospischilii is very close to *C. commutatus* and the two intergrade. The only definitive difference is the lack of a swollen pedicel in the homogamous pair in *C. pospischilii*.

C. plurinodis (Stapf) Burtt-Davy from southern Africa, which has shorter racemes with only 5 spikelet-pairs, intergrades with *C. pospischilii* and is sometimes regarded as conspecific.

6. *C. commutatus* (Steud.) Stapf (1907);
Andropogon commutatus Steud. (1854) - type:
Ethiopia, without locality, *Schimper* 1801 (K iso.).
Andropogon floccosus Schweinf. (1894); *Cym-*
bopogon floccosus (Schweinf.) Stapf (1919) - type:
Eritrea, Ghinda [Ginda], *Schweinfurth* 156, 162,
183, 412, 484 (whereabouts uncertain, not B or K).
Andropogon commutatus Steud. var. *flavicundus*
Hochst. ex Chiov. in *Ann. Ist. Bot. Roma* 8: 286
(1907) - type: Ethiopia, TU, Djeladjeranne, *Schim-*
per 685 (whereabouts uncertain, not FT K P TUB).
Andropogon commutatus Steud. var. *violaceus*
Chiov., l.c.: 286 (1907) - types: Eritrea, Ghinda,
Pappi 4492 (FT syn.) and 5 other syntypes.

Densely tufted perennial; culms erect, 50–120 cm high, enclosed at the base by tight bundles of old sheaths. Leaf-blades linear to filiform, green or glaucous, 10–50 cm long, 2–5 mm wide, smooth or asperulous. Spathate panicle oblong, 10–35 cm long, loose, open, usually pale green; racemes 2–3 cm long; rhachis-internodes and pedicels ciliate; pedicel of homogamous pair inflated, barrel-shaped; lower raceme-base variable, equalling or shorter than the pedicel, oblong or also inflated, free or partially to completely adnate with the pedicel. Sessile spikelet narrowly lanceolate, 4–7.3 mm long; lower glume chartaceous, glabrous or pubescent, shallowly to deeply concave between the keels, keels rounded and convergent below the middle, sharp above, unwinged, nerveless between the keels or with 2–3 short nerves below the tip, sometimes with a swelling at the base; upper lemma bifid to the middle; awn 1–2 cm long, clearly geniculate with a well-defined column. Pedicelled spikelet 4.2–9 mm long. Figs. 132:4; 133.

Deciduous bushland and semi-desert grassland; 900–2500 m. AF EW TU SU SD HA; westwards to Mauretania; Somalia, Uganda, Kenya, Tanzania; through Arabia to Iraq and N India. *Ash* 2988; *Gilbert & Getachew* 3094; *Friis et al.* 3084.

A polymorphic species with weakly defined geographical variants. In Kenya the pedicel is usually free from the adjacent oblong raceme-base, as in some Ethiopian specimens e.g. *M.G. & S.B. Gilbert* 2331. Specimens from eastern Ethiopia and Somalia are generally rather slender with pedicel and lower raceme-base both barrel-shaped and completely adnate, and a long, slender upper raceme-base e.g. *Burger* 611. The name *C. floccosus* is often misapplied to this variant; *C. floccosus* is in fact based on Eritrean material, probably representing the same variant as *A. commutatus* var. *violaceus*. In other variants the raceme-base may be much shorter than the pedicel, but these differences are uncorrelated with other variable characters such as leaf width or concavity and pubescence of the lower glume, and do not provide a sufficiently stable means of partitioning the species.

The degree of convergence of the keels of the lower glume of the sessile spikelet over the concave glume back is very variable. Specimens where the keels approach closely over a deep concavity may be confused with *C. caesius*, but this species has a broader, flat-backed, marginally winged glume, the median groove appearing only as a thin line.

C. commutatus, *C. schoenanthus* and *C. pospischilii* form a close knit complex (series *Cymbopogon*), all being both variable and intergrading. The series is characterised by a dense tufted habit with tight bundles of old sheaths around the culm bases, narrow leaves, often a loose open panicle, and a concave wingless lower glume to the sessile spikelet. The racemes are waxy, with white deposits often accumulating in the concavity of the lower glume.

146. **MONOCYMBIUM** Stapf (1919)

C. E. Hubbard in *Kew Bull.* 4: 375 (1949).

Tufted perennials; leaf-blades linear to lanceolate; ligule membranous. Inflorescence a spathate compound panicle, the spatheoles cymbiform, reddish, cradling a single raceme; raceme densely spiculate with the rachis-internodes obscured, without homogamous pairs; internodes and pedicels slender, ciliate. Sessile spikelet elliptic, dorsally compressed, its callus short, rounded, bearded, inserted obliquely with its tip exposed; lower glume shallowly convex with rounded flanks, coriaceous to crustaceous, shiny, glabrous or villous, green-nerved with scaberulous to spinulose margins towards the tip; upper glume awned; lower floret reduced to a hyaline sterile lemma; upper lemma bifid, a geniculate glabrous awn arising from the sinus. Pedicelled spikelet male, resembling the sessile but unawned, its callus elongate.

3 species in tropical and South Africa, one widespread and the other two confined to West Africa.

Monocymbium is recognized by its conspicuous reddish spatheoles, each enclosing a single raceme of softly hairy, elliptic spikelets.

M. ceresiiforme (Nees) Stapf (1919);

Andropogon ceresiiformis Nees (1841) as "*ceresiaeformis*"; *Hypogynium ceresiiforme* (Nees) Roberty (1960) - type: "South Africa, Drège s.n. (K S iso.).

Slender perennial; culms 30–130 cm high, tall, leafy and laxly ascending, varying to shorter, densely tufted plants with fibrous old leaf-sheaths. Leaf-blades linear, often reddish, 5–25 cm long, 2–5 mm wide, glabrous or thinly setose to hirsute, acuminate. Compound panicle linear, open; spatheoles 2–4 cm long, sharply acuminate, reddish-brown; raceme 6–8-awned. Sessile spikelet 3–4 mm long, the callus hairy on sides and base; lower glume crustaceous, softly pilose to villous, narrowly truncate; upper glume awn 2–6 mm long; upper lemma awn 6–20 mm long. Pedicelled spikelet with a callus 0.5–1 mm long. Fig. 134.

Grassy hillsides; 1300 m. WG; westwards through Sudan to West Africa, Zaire, Tanzania and southwards to South Africa. *Mogk* 361.

M. ceresiiforme is very variable vegetatively, but constant in spikelet characters. The densely tufted habit is absent from West Africa but becomes increasingly common southwards.

147. **HYPERTHELIA** W.D. Clayton (1966)

Tall annuals or perennials; leaf-blades linear; ligule scarious, sometimes with adnatè sheath-auricles. Inflorescence composed of paired racemes subtended by spatheoles and gathered into a compound spathate panicle. Raceme-pairs 2-awned (occasionally more outside Ethiopia), the racemes each reduced to a single triad of



Figure 133. *CYMBOPOGON COMMUTATUS*: 1 - base of plant x 3/4; 2 - inflorescence x 3/4; 3 - homogamous spikelet pair with rachis-internode and inflated pedicel. 1 from M.G. & S.B. Gilbert 1222; 2 from Burger 464; 3 from Burger 611. Drawn by Eleanor Catherine.



Figure 134. *MONOCYBIUM CERESIFORME*: 1 - habit x $\frac{2}{3}$; 2 - spatheole and raceme x $\frac{2}{5}$; 3 - spikelet pair x 9; 4 - upper lemma with awn x 10. 1 from Bullock 2755; 2-4 from Milne-Redhead & Taylor 9416. Drawn by Ann Davies. (Reproduced from *Fl. Trop. E. Afr. Gramineae 3*: Fig. 190, with permission of the Editors).

one sessile fertile spikelet and 2 pedicelled male spikelets; raceme-bases terete, deflexed or not, oblique at the tip and extended into a long scarios appendage, one pair of homogamous spikelets at the base of the lower; internodes and pedicels linear, ciliate. Sessile spikelet subterete; callus pungent; lower glume coriaceous with a median longitudinal groove, rounded on the sides, the tip scarios; upper glume sometimes awned; lower floret reduced to a hyaline empty lemma; upper lemma bidentate, awned from the sinus; awn stout, geniculate with a pubescent column. Pedicelled spikelet linear-lanceolate, herbaceous, acute to aristulate; callus conical, up to 1 mm long.

6 species in tropical Africa; *H. dissoluta* is a widespread perennial, the other five species are annuals confined to southern Sudan and the Central African Republic.

Hyperthelia is one of the small satellite genera around *Hyparrhenia*, segregated mainly on account of the grooved lower glume to the sessile spikelet and the very long raceme-base appendages. These appendages indicate a relationship with *Hyparrhenia* sect. *Hyparrhenia* (*H. confinis* and *H. coleotricha* in Ethiopia), where shorter raceme-base appendages are present and 2-awned raceme-pairs are also frequent. However, the deeply grooved sessile spikelet and definite callus to the pedicelled spikelet of *Hyperthelia* are not found in *Hyparrhenia*.

H. dissoluta (Steud.) Clayton (1966);

Anthistiria dissoluta Steud. (1854); *Hyparrhenia dissoluta* (Steud.) C.E. Hubb. (1936) - type: tropical Africa [probably Ghana], in Herb. Lindley s.n. (CGE holo.).

Hyparrhenia ruprechtii (Hack.) Fourn. (1886).

Tufted perennial; culms erect, 1-3 m high. Leaf-blades up to 30 cm long, 3-6 mm wide, scabrid. Inflorescence narrow, composed of 4-6 successive fastigiate clusters of spatheoles and subtended raceme-pairs; spatheoles narrowly lanceolate, 5-7 cm long, glabrous or hirsute, becoming reddish; peduncle shorter than the spatheole, white-pilose or infrequently glabrous. Racemes 2-3 cm long, 2-awned per pair; raceme-bases glabrous, not deflexed, the upper 2-3 mm long, the appendage linear-lanceolate, 4-11 mm long. Homogamous spikelets narrowly lanceolate-oblong, 8-15 mm long, glabrous. Sessile spikelet narrowly oblong, 10-14 mm long (including callus), yellow, the scarios tip bifid; callus 3-6 mm long, white-bearded; awn 5-10 cm long, yellowish. Pedicelled spikelets linear-lanceolate, 9-14 mm long, green, glabrous, acute or tipped with an awnlet up to 6 mm long; callus 0.3-0.8 mm long. Fig. 135.

Deciduous bushland, woodland and grassland, especially pastures, field margins and other disturbed places on light soils; 700-2100 m. KF GG SD; tropical and South Africa; Madagascar; introduced to tropical America. Ash 3624; M.G. & S.B. Gilbert 1584; Gillett 14521.

This is the only species in Ethiopia with a compound spathate panicle of raceme-pairs and a grooved lower glume to the sessile spikelet. The groove is deep and slit-like with the rounded glume margins on either side contiguous along its length, and should not be confused with the broader longitudinal dip or depression found exceptionally here and there in *Hyparrhenia*.

148. *HYPARRHENIA* Fourn. (1886)

Clayton in *Kew Bull., Addit. Ser.* 2, 196 pp. (1969).

Tufted perennials, infrequently annual, rarely rambling; culms often tall and robust. Leaf-blades linear, flat, tapering to an acuminate tip (linear-lanceolate in *H. mobukensis*); ligule scarios. Inflorescence a compound spathate panicle, each ultimate spatheole subtending a peduncle bearing a pair of short racemes; spatheoles linear to ovate, often navicular and brightly coloured; peduncle shorter or longer than the spatheole, included within it or exerted at maturity, often bearded with spreading white or yellow hairs below the racemes. Raceme-pairs 2- to many-awned, often deflexed at maturity; pedicels and internodes slender. At the base of each raceme is a short stalk termed a "raceme-base", the two raceme-bases of each raceme-pair are inserted at the peduncle tip and are termed upper and lower, these subequal or the upper longer, terete or flattened, sometimes setose and appendaged. 1-2 pairs of homogamous spikelets sometimes present on one or both racemes below the fertile spikelet pairs, these generally lanceolate, flat, resembling the pedicelled spikelets. Sessile spikelets lanceolate to linear; callus obtuse to pungent, bearded, its tip exposed; lower glume usually coriaceous, convex with rounded incurving margins, keeled only towards the tip, 9-11-nerved, glabrous to pubescent or villous; upper glume awnless; upper lemma bidentate, passing between the lobes into a geniculate awn with hairy column (glabrous in *H. mobukensis*). Pedicelled spikelets male or barren, narrowly lanceolate, slightly longer than the sessile, acute to aristulate; pedicel-tip sometimes extended into a triangular or subulate tooth.

55 species, mainly confined to tropical Africa; one species in the Mediterranean and Middle East. *H. rufa* is introduced elsewhere as a forage grass.

Hyparrhenia is characteristically a genus of tall perennial grasses of the African savanna, although a few have adapted to ruderal or more specialized habitats. A small group of closely related species (Nos 28-30) are more or less confined to the Ethiopian highlands.

Hyparrhenia as a genus is easy to recognize, with its paired racemes grouped into a spathate panicle, exposed sessile spikelet callus and hairy awns. However, the delimitation into species presents great taxonomic difficulty due to extensive introgression, and in very few cases are species clearly delimited from their neighbours. The difficulty is exacerbated by the fact that the important diagnostic characters are often small and not

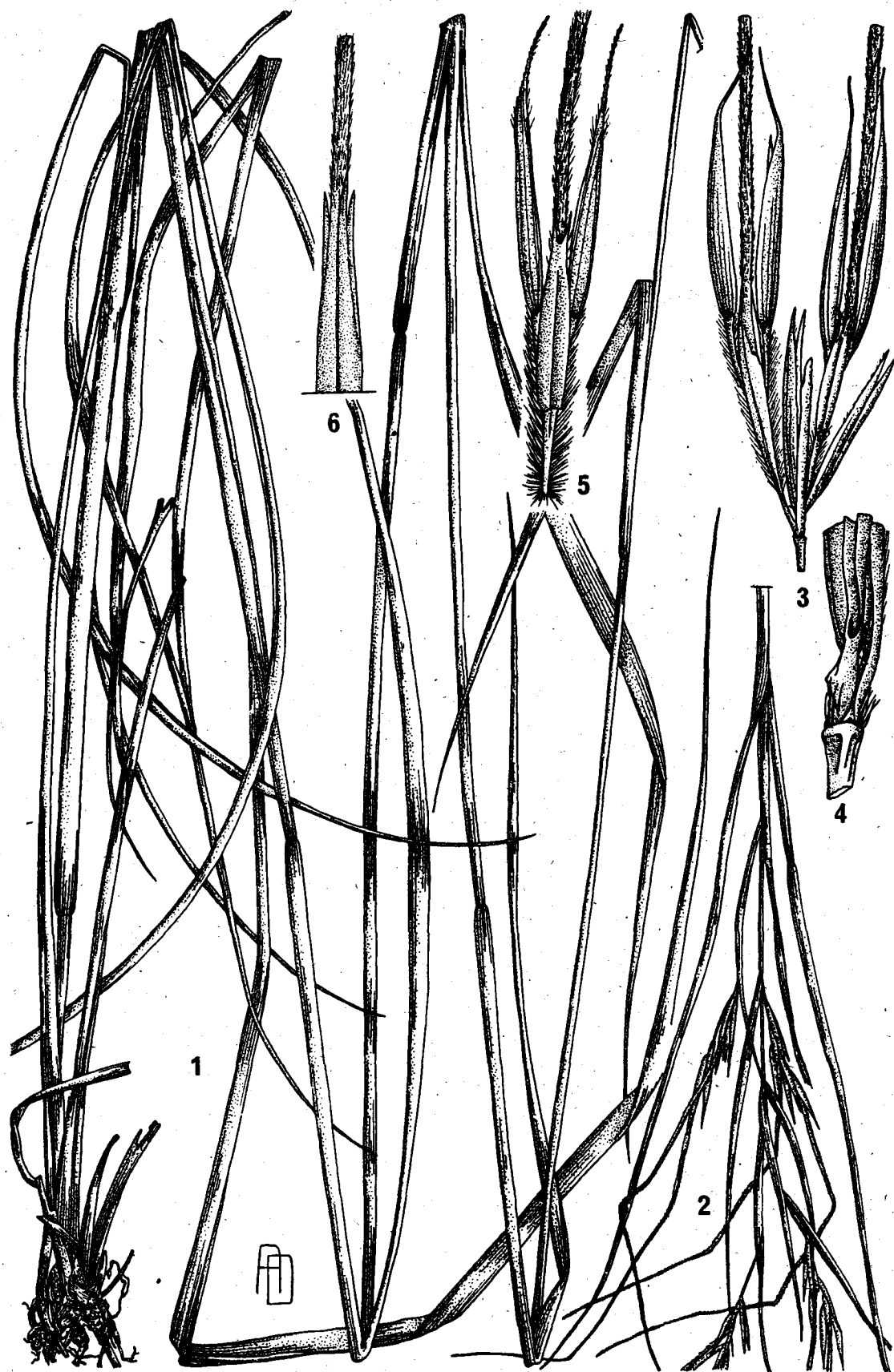


Figure 135. *HYPERTHELIA DISSOLUTA*: 1 - habit x $2/3$; 2 - part of compound panicle x $2/3$; 3 - raceme-pair x $2\frac{1}{2}$; 4 - raceme-bases x 9; 5 - upper raceme x $2\frac{1}{2}$; 6 - tip of upper lemma and base of awn x 8. 1, 4-6 from Milne-Redhead & Taylor 1647; 2 & 3 from Rees 35. Drawn by Ann Davies. (Reproduced from *Fl. Trop. E. Afr. Gramineae* 3: Fig. 183, with permission of the Editors).

easy to interpret without practice. Clayton's monograph (1969) has done much to bring order to the chaos; his sectional classification has been informally followed in the key here, with some grouping where few species are present in our area. The descriptions have in most cases been drawn up to cover variation as it occurs in Ethiopia, and thus do not necessarily account for extremes found elsewhere. Where possible, additional notes on recognition are given below each species, as a complement to the characters used in the key.

A correct interpretation of the structure of the raceme-bases is fundamental to a successful identification (see Fig. 136). The distinction between slender terete raceme-bases and the generally shorter, flatter ones is usually not difficult; in doubtful cases the presence of long stiff bristles will serve to exclude a specimen from Group 1 (but see no. 4. *H. rufa*). In Group 1 the lower base may occasionally be connate with the lower portion of the upper. It should also be noted that the raceme-bases are almost always pubescent in the fork; pubescence characteristics refer to the outer face. The number of awns per raceme-pair is most easily counted where they protrude from an immature spatheole, before any have been shed.

1. Callus of sessile spikelet broadly rounded, semi-circular; spikelets glabrous; raceme-bases unequal, the upper 1.5–3 mm long. 2
- Callus of sessile spikelet acute to pungent (rarely obtuse or truncate, but then the spikelets hairy or raceme-bases subequal). 3

2. Robust tufted perennial; leaf-blades narrowly linear, up to 30 cm long. 1. *H. glabriuscula*
- Slender trailing perennial; leaf-blades linear-lanceolate, 4–9 cm long. 2. *H. mobukensis*

3. Raceme-bases clearly unequal, the upper slenderly terete to filiform, 1.5–8 mm long, almost always lacking setae or an apical lobe. 5

GROUP 1 5

- Raceme-bases flattened, usually subequal, the upper up to 3 mm long but usually shorter. 4

4. Homogamous spikelets at the base of the lower raceme only; raceme-bases setose. GROUP 2 13

- Homogamous spikelets at the base of both racemes. GROUP 3 28

GROUP 1

5. Spikelets hairy with brown or golden hairs (callus hairs sometimes white). 6

- Spikelets glabrous or hairy with white hairs. 9

6. Callus of sessile spikelet obtuse to truncate, 0.2–0.8 mm long; sessile spikelet hirtellous with stiff rufous hairs. 7

- Callus of sessile spikelet acute to pungent, 0.8–2 mm long; sessile spikelet sometimes densely golden-pubescent. 8

7. Racemes 6–9-awned per pair; spatheoles 2–3.5 cm long, narrowly lanceolate, embracing the racemes at maturity. 3. *H. dichroa*

- Racemes 9–17-awned per pair; spatheoles 3–5 cm long, linear-lanceolate, with at least some racemes exserted. 4. *H. rufa*

8. Racemes 9–18-awned per pair; basal leaf-sheaths hairy; upper raceme-base 2–3.5 mm long; sessile spikelets densely golden-pubescent. 5. *H. nyassae*

- Racemes 4–7-awned per pair; basal leaf-sheaths glabrous; upper raceme-base 3.5–7 mm long. 6. *H. poecilotricha*

9. Upper raceme-base with 0–1 pairs of homogamous spikelets. 10

- Upper raceme-base with 2 pairs of homogamous spikelets. 12

10. Spikelets glabrous to shortly hispidulous; 2–6-awned per pair; pedicelled spikelets tipped with a bristle 2–5 mm long. 7. *H. finitima*

- Spikelets villous; 6–15-awned per pair; pedicelled spikelets acute. 11

11. Racemes, or some of them, deflexing at maturity. 8. *H. quarrei*

- Racemes never deflexed. 9. *H. hirta*

12. Racemes 4–6-awned per pair; awns 2.5–4 cm long; awn column pubescent with hairs 0.3–0.6 mm long; callus 1.2–1.8 mm long. 10. *H. anamesa*

- Racemes 2(–4)-awned per pair; awns 4–5.5 cm long; awn column hirsute with hairs 0.7–1.2 mm long; callus c 2 mm long. 11. *H. filipendula*

GROUP 2

13. Raceme-bases unappendaged or tipped only with a short scarious rim (if a lobe to 1 mm, then spatheoles <3.5 mm long or awns exceeding 6 per pair). 14

- Raceme-bases extended into a scarious lobe 1–4 mm long. 26

14. Pedicelled spikelets glabrous (rarely thinly pilose). 15

- Pedicelled spikelets villous. 21

15. Annual to 1.5 m high; awns 3–5 cm long. 12. *H. anthistirioides*

- Perennials, often tall with stilt roots; awns 0–3 cm long. 16

16. Culms erect, usually robust; peduncles 1/3–1/2 spatheole length, usually included, white-bearded. 17

- Culms slender, rambling, up to 1.5 m high; peduncles 3/4 spatheole length or more, exserted at maturity, yellow-bearded. 20

17. Spatheoles <2 cm long, ovate; awns 0–1.8 cm long; callus 0.2–0.4 mm long, broadly rounded. 14. *H. cymbaria*

- Spatheoles mostly >2 cm long (if shorter, awns only 2–5 per raceme-pair). 18

18. Awns 0.8–1.8 cm long; racemes 6–8-awned per pair. 15. *H. formosa*

- Awns 1.8–3 cm long. 19

19. Awns 2–5 per raceme-pair; spatheoles 1.4–2.4 cm long. 16. *H. variabilis*

- Awns 6-8 per raceme-pair; spatheoles 2.5-3.2 cm long; raceme-base tipped with a scariosus lobe 0.5-1 mm long. 17. *H. schimperii*
- 20. Spatheoles 2-3 cm long; awns 0.7-1.7 cm long; racemes 4-8-awned per pair. 18. *H. pilgeriana*
- Spatheoles 4-7 cm long; awns 2.5-3 cm long; racemes 7-15-awned per pair. 19. *H. papillipes*
- 21. Base of plant conspicuously tomentose; awns 3.4-3.7 cm long. 13. *H. claytonii*
- Base of plant glabrous (if inconspicuously pubescent awns <3 cm long). 22
- 22. Spatheoles few, 4-7 cm long, the peduncle long-exserted near the tip; culms slender, bushily branching, up to 1 m high. 19. *H. papillipes*
- Spatheoles 2.5-5 cm long, the peduncle included or shortly exserted near the middle; culms robust, 1-3 m high (if less, not bushily branched). 23
- 23. Awns 9-19 per raceme-pair; plant densely caespitose. 20. *H. dregeana*
- Awns 4-8 per raceme-pair. 24
- 24. Awns 1.3-2.5 cm long; pedicelled spikelets with a mucro 0-2 mm long; culms not usually exceeding 1.5 m high. 25
- Awns (2.2-)3-4 cm long; pedicelled spikelets with a bristle up to 6 mm long; culms usually 2-3 m high. 23. *H. rudis*
- 25. Caespitose perennial; culms robust, >3 mm in diameter at the base. 21. *H. tamba*
- Loosely tufted perennial from a short rhizome; culms slender, <3 mm in diameter at the base. 22. *H. collina*
- 26. Awns 2 per raceme-pair. 24. *H. confinis*
- Awns 4-8 per raceme-pair. 27
- 27. Peduncle beard yellow; sessile spikelet glabrous; ligule 1 mm long, truncate, pallid. 25. *H. neglecta*
- Peduncle beard white; sessile spikelet usually pubescent, often densely so; ligule 3-4.5 mm long, rounded, brown. 26. *H. coleotricha*

GROUP 3

- 28. Homogamous spikelets scabrid on the margin; raceme-bases not setose; culms 2-3 m high. 27. *H. diplandra*
- Homogamous spikelets pectinate-ciliate on the margin; raceme-bases hispid with yellow setae; culms up to 1 m high. 29
- 29. Margins of homogamous spikelets pectinate but lacking tubercles; callus of sessile spikelet 0.8-1.3 mm long, acute; awn 2.5-4 cm long with hairs 0.3-0.5 mm long. 28. *H. arrhenobasis*
- Margins of homogamous spikelets pectinate-setose from encrusting tubercles; callus of sessile spikelet 1.7-3 mm long, pungent; awn 4.5-7 cm long with hairs 0.7-1.5 mm long. 30
- 30. Perennial; homogamous spikelets 10-11 mm long, tuberculate-hispid on the back. 29. *H. tuberculata*
- Annual; homogamous spikelets 7-8 mm long, glabrous on the back. 30. *H. multiplex*

- 1. *H. glabriuscula* (Hochst. ex A. Rich.) Stapf (1918); *Andropogon glabriusculus* Hochst. ex A. Rich. (1850); *Sorghum glabriusculum* (Hochst. ex A. Rich.) Kuntze (1891) - type: Ethiopia, TU, Shire [Chiré], *Schimper* 1805 (P holo., K iso.).

Densely tufted perennial; culms slender, stiffly erect, unbranched, 1-2 m high. Leaf-blades narrowly linear, up to 30 cm long, 3-5 mm wide, glabrous or hispidulous. Spathate panicle narrow, 15-30 cm long; spatheoles linear-lanceolate, 2-3.5 cm long, usually glabrous, turning russet; peduncle c 1/2 spikelet length, glabrous or infrequently shortly hairy, scarcely exserted at maturity. Racemes 5-7-awned per pair, often horizontally diverging at maturity, loosely spiculate with glabrous spikelets; raceme-bases unequal, flattened, glabrous or sparsely ciliate, the upper 2-3 mm long, the lower with one pair of homogamous spikelets. Sessile spikelets 5 mm long, prominently nerved, narrowed to the bidentate tip; callus c 0.5 mm long, broadly rounded to almost hemispherical, not bearded; awn 1.5-2.5 cm long, the column puberulous with hairs 0.1 mm long. Pedicelled spikelets 5-7.5 mm long, acuminate or tipped with a mucro up to 3.5 mm long.

Seasonally swampy soils and river plains. TU GJ; West Africa from Senegal to Nigeria; also isolated records from Tanzania, Mozambique and Malawi. *Schimper* 1805; *Bigazzi & Tardelli* 730 (FT).

An essentially West African species, distinctive on account of its short, broad callus which is easily visible on the loosely imbricate, glabrous sessile spikelets. It has the facies of a *Cymbopogon* species, but differs from that genus by its exserted callus and non-aromatic leaves.

- 2. *H. mobukensis* (Chiov.) Chiov. (1919); *Andropogon mobukensis* Chiov. (1907) - type: Uganda, *Duke of Abruzzi* s.n. (TO holo.).

Perennial; culms thin and wiry, trailing or scandent, branching, up to 1.5 m long. Leaf-blades linear-lanceolate, thin and flaccid, 4-9 cm long, 2-5 mm wide, horizontally divergent or deflexed, constricted at the base. Spathate panicle scanty, composed of up to 5 distant raceme-pairs (or racemes sometimes solitary); spatheoles linear, 3-5 cm long, green tinged with purple; peduncle filiform, scaberulous or pilose near the tip, exserted at the spatheole tip, sometimes long and flexuous. Racemes 7-15-awned per pair, not deflexing, very loosely spiculate with glabrous spikelets; raceme-bases unequal, slender, terete or flattened, glabrous, pilose or white-setose, the upper 1.5-3 mm long, the lower with one pair of homogamous spikelets. Sessile spikelets 3.5-4.5 mm long, scabrid upwards; callus c 0.5 mm long, broadly rounded to hemispherical; awn 7-8 mm long, glabrous. Pedicelled spikelets 4.5-6 mm long, acuminate.

Montane grassland and scrub, often scrambling through bushes; 2500 m. KF (Mt Maigudo); mountains



Figure 136. *HYPARRHENIA*: raceme-bases and homogamous spikelets $\times 7$. 1 - GROUP 1 (*H. anamesa*); 2 - GROUP 2, unappendaged (*H. pilgeriana*); 3 - GROUP 2, appendaged (*H. confinis*); 4 - GROUP 3 (*H. diplandra*). 1 from Gillett 15060; 2 from Gillett 15045; 3 from De Wilde & Gilbert 263; 4 from Fukui 613. Drawn by Eleanor Catherine.

and highland plateaux of East Africa south to Malawi (Nyika). Friis et al. 1516.

A very unusual species of *Hyparrhenia*, easily distinguished by its wiry scandent culms, the branches flowering sparsely at the tips. The occasional solitary racemes, glabrous awns and the semicircular callus of the sessile spikelet are all unusual in the genus. *H. pilgeriana* is the only other species with a similar trailing habit, but this has a yellow-bearded peduncle and longer (10–17 mm) pubescent awns.

On the East African mountains (e.g. Mt Elgon, Mt Kilimanjaro) *H. mobukensis* occurs from the margins of the montane forest through the bamboo zone into the lower levels of Erica scrub, and is to be expected in similar habitats in the mountains of Ethiopia.

3. *H. dichroa* (Steud.) Stapf (1919);

Andropogon bicolor Nees (1841), non Roxb. (1820); *Andropogon dichroos* Steud. (1854) - type: South Africa, Drège s.n. (LUB holo. destr., K iso.?)

Tufted perennial; culms robust, up to 3 m high. Leaf-blades rigid, up to 60 cm long and 8 mm wide. Spathate panicle 20–60 cm long, much branched; spatheoles narrowly lanceolate, 2–3.5 cm long, reddish at maturity; peduncle half as long to equalling the spatheole, glabrous or white-bearded. Racemes 6–9-awned per pair, not usually deflexed and scarcely exerted from the spatheole; raceme-bases unequal, the lower very short, the upper 1.5–2.5 mm long, glabrous, hirtellous or with a few stiff setae; 1 pair of homogamous spikelets, at the base of the lower or both racemes.

Sessile spikelets 4–5 mm long, glossy, scantily pubescent; callus 0.4–0.8 mm long, cuneate, obtuse; awn 2–3 cm long, the column rufously pubescent. Pedicelled spikelets 3–5 mm long, acute to mucronate.

2000 m. GD; southern tropical Africa from Tanzania to Natal; also in Sudan. Pichi-Sermolli 331, 332.

A tall savanna grass with a distribution centered further south, but with a few outliers occurring in Ethiopia and Sudan. It is a segregate from *H. rufa*, characterized by a tendency to shorter, broader spatheoles and fewer-awned racemes on barely exerted peduncles, imparting a different facies to the panicle.

There is some resemblance to species of section *Pogonopodia* (Group 2), particularly to *H. schimper* and *H. rudis* especially when the relatively short upper raceme-base bears a few bristles. The presence of rufous spikelet hairs is the easiest way to distinguish *H. dichroa* from these species.

4. *H. rufa* (Nees) Stapf (1918);

Trachypogon rufus Nees (1829); *Andropogon rufus* (Nees) Kunth (1833); *Sorghum rufum* (Nees) Kuntze (1891); *Cymbopogon rufus* (Nees) Rendle (1899) - type: Brazil, Martius s.n. (M holo.).

Andropogon altissimus Hochst. ex A. Braun (1841), non Raspail (1825) nec Colla (1836); *Hyparrhenia altissima* Stapf (1918) - type: Ethiopia, plants cultivated at Karlsruhe from seed collected by Schimper (K iso.).

Andropogon fulvicomus Hochst. in sched., Schimp., Iter Abyss. 2 (1842); Hochst. ex A. Rich.

(1850); *Hyparrhenia fulvicoma* (Hochst.) Anderss. (1867), nom. inval., publ. gen. ante; *Andropogon rufus* var. *fulvicomus* (Hochst.) Hack. in *Bol. Soc. Brot.* 5: 213 (1887); *Cymbopogon rufus* var. *fulvicomus* (Hochst.) Rendle, *Cat. Afr. Pl. Welw.* 2: 155 (1899); *Hyparrhenia rufa* var. *fulvicoma* (Hochst.) Chiov. in *Nuov. Giorn. Bot. Ital.* 26: 74 (1919) - type: Ethiopia, TU, Adoa, *Schimper* 1118 (K iso.).

A. fulvicomus var. *approximatus* Hochst. in sched., *Schimp., Iter Abyss.* 2 (1842) - type: Ethiopia, without locality, *Schimper* 928 (K iso.).

Andropogon rufus var. *glabrescens* Chiov. in *Ann. Ist. Bot. Roma* 8: 288 (1903) - type: Eritrea, Soyra Mts., *Pappi* 1242 (FT lecto.).

Hyparrhenia hirta (L.) Stapf var. *brachypoda* Chiov. in *Atti R. Acad. Ital., Mem. Cl. Sci. Fis. Math. Nat.* 11: 63 (1940) - type: Ethiopia, SU, Guder, *Piovano* s.n. (FT holo.).

Tufted perennial or rarely annual; culms slender to robust, up to 2.5 m high. Leaf-blades rigid, 30–60 cm long, 2–8 mm wide. Spathate panicle variable, lax to contracted; spatheoles linear-lanceolate, 3–5(–6) cm long, at length reddish and rolled; peduncle shorter or longer than the spatheole but usually flexuously exerted at least on the panicle periphery, glabrous or white-bearded. Racemes 9–17-awned per pair, rufous or less often golden, not usually deflexing; raceme-bases unequal, sometimes connate, glabrous or with a few setae, the upper 2–4 mm long; 1 pair of homogamous spikelets at the base of the lower raceme, occasionally also 1 pair on the upper. Sessile spikelets 3–4.5 mm long, glossy, typically with scanty, stiff, rufous hairs but sometimes glabrous or pubescent; callus 0.4–0.8 mm long, obtuse to rounded or narrowly truncate; awn 2–3 cm long, the column rufously pubescent. Pedicelled spikelets 3–5 mm long, acute; pedicel-tooth triangular, up to 0.3 mm long. Fig. 137:6.

Tall grassland, hill pasture and disturbed places, favouring seasonally moist situations; 1200–2100 m. EW TU GD GJ SU IL KF GG SD; widespread throughout tropical Africa; also in South and Central America where it is widely grown as a pasture grass. *Friis* et al. 1718; *Gilbert & Phillips* 9054; *Mooney* 5400.

H. rufa is one of the most variable species of *Hyparrhenia*, but can generally be recognized by the brown spikelet hairs, shiny texture of the sessile spikelet and short obtuse callus. Pubescence colour in the racemes is very variable, though typically a rich rufous brown. Commonly the callus beard and hairs around it on the pedicel and internode are white, and rarely the whole raceme may be almost completely white-hairy with only a hint of brown colouration here and there e.g. *de Wilde* 4862, 10440. The upper raceme-base is typically slenderly terete and glabrous, but may bear long white hairs similar to the setae of species in Group 2.

5. *H. nyassae* (Rendle) Stapf (1918);

Andropogon nyassae Rendle (1893); *Cymbopogon nyassae* (Rendle) Pilger (1917) - type: Malawi, *Buchanan* 1423 (K iso.).

Tussocky perennial, the basal sheaths appressed-pilose to tomentose; culms slender to robust, up to 2 m high. Leaf-blades rigid, up to 45 cm long and 2–5 mm wide. Spathate panicle loose and open, 15–45 cm long; spatheoles linear, 4–6 cm long, russet, finally rolled; peduncle longer than the spatheole, flexuous, exerted near the tip, white-bearded. Racemes 9–18-awned per pair, golden or grey-yellow with white hairs on the callus, internodes and pedicels (rarely almost completely white), tardily deflexing; raceme-bases unequal, sometimes connate, glabrous to pilose, the upper 2–3.5 mm long; one pair of homogamous spikelets at the base of the lower raceme, rarely one also on the upper. Sessile spikelets 4–5.5 mm long, typically densely golden-pubescent; callus 0.8–1.2 mm long, narrowly cuneate, acute; awn 2–4 cm long, the column pubescent. Pedicelled spikelets 5–6.5 mm long, acute; pedicel-tooth subulate, 0.2–0.7 mm long.

Wooded grassland; 2000–2400 m. GD SU KF HA; tropical Africa from Cameroon and Sudan southwards to Transvaal. *Chiovenda* 1581; *Mesfin & Kagnev* 1998; *Mooney* 6219.

Hyparrhenia nyassae is a segregate from *H. rufa*, best developed in eastern and southern tropical Africa where the characters distinguishing it are reasonably clear cut. There the basal sheaths are often conspicuously white-tomentose with dense, curly hairs. Additionally, the spikelets are often more densely hairy with a slightly lighter golden colour than the reddish-brown hairs of *H. rufa*. The elongate, acute callus and longer subulate pedicel-tooth are additional supporting characters.

In Ethiopia the distinction between *H. nyassae* and *H. rufa* is much more tenuous. No specimens with densely tomentose basal sheaths have been found, but the extreme base of the plant may be appressed-pilose. When such plants have a callus distinctly longer than broad, or are conspicuously golden-pubescent, they are best referred to *H. nyassae*. However, intermediates with a hairy base but otherwise typical of *H. rufa* will be encountered e.g. *Ash* 2752; *Friis* et al. 1598.

6. *H. poecilotricha* (Hack.) Stapf (1919);

Andropogon poecilotrachus Hack. (1885) - type: Angola, *Newton* s.n. (K iso.).

Perennial; culms 60 cm to 1.3 m high. Leaf-blades rigid, up to 30 cm long and 3 mm wide. Spathate panicle lax and open; spatheoles linear, 4–8 cm long, peduncles shortly exerted towards the spatheole tip, with or without a white or yellowish beard. Racemes 4–7-awned per pair, fulvous, not or only tardily deflexed; raceme-bases unequal, terete, the upper 3.5–7 mm long; 1 pair of homogamous spikelets at the base of the lower raceme and 1–2 at the base of the upper. Sessile spikelets 4–5.5 mm



Figure 137. *HYPARRHENIA* spp.: *H. HIRTA*: 1 - habit and inflorescence x 3/4; 2 - raceme pair x 2; 3 - sessile spikelet x 9. *H. FILIPENDULA*: 4 - spatheole and raceme pair x 2; 5 - sessile spikelet x 9. *H. RUF A*: 6 - sessile spikelet x 9. 1 & 2 from Gilbert 3487; 3 from Gilbert & Abati 3134; 4 from Ferguson 56; 5 from Gilbert 4114; 6 from Friis et al. 1718. Drawn by Eleanor Catherine.

long, pubescent with stiff rufous or yellow hairs; callus 1–2 mm long, acute to pungent; awn 2.5–4 cm long, the column pubescent with rufous hairs c 0.5 mm long. Pedicelled spikelets 4–7 mm long, usually tipped with a mucro up to 2 mm long; pedicel-tooth triangular, 0.2–0.4 mm long.

Wooded grassland; 1400 m. GG; eastern Africa from Sudan to Natal. *Fukui* 921.

The rufous spikelet hairs and glossy texture of the sessile spikelet ally *H. poecilotricha* to *H. rufa*, from which it can most readily be distinguished by its longer pointed callus and fewer awns. The relatively long upper raceme-base bearing 1–2 homogamous spikelet-pairs is a good supporting character.

7. *H. finitima* (Hochst.) Stapf (1919);

Andropogon finitimus Hochst. (1844); *Cymbopogon finitimus* (Hochst.) Thomson (1863) - type: Ethiopia, TU, Djeladjeranne, *Schimper* 1797 (K iso.).

Tufted perennial; culms fairly robust, up to 2.5 m high, sometimes with stilt roots. Leaf-blades up to 60 cm long and 9 mm wide. Spathate panicle much branched, contracted, up to 60 cm long; spatheoles linear-lanceolate, 2.5–4.5 cm long, pilose, reddish; peduncle short, 1/3–1/2 spatheole length and included within it at maturity, white-bearded. Racemes 2–6-awned per pair, not deflexing; raceme-bases unequal, the upper slenderly terete, 1.5–2.8 mm long, hirtellous to pilose; 1 pair of homogamous spikelets at the base of the lower or both racemes, their margins ciliate. Sessile spikelets 3.8–4.3 mm long, glabrous or hispidulous with white hairs; callus 1.2–1.5 mm long, acute to pungent; awn 3–4 cm long, the column pubescent with fulvous hairs 0.3–0.7 mm long. Pedicelled spikelets 5–6 mm long, glabrous or pilose, tipped with a bristle 2–5 mm long.

Wooded grassland and as a ruderal of disturbed sites; c 1200 m. TU GD; mainly southern tropical Africa and Uganda, but occurring in scattered localities on the eastern side of Africa southwards to Transvaal. *Chiovenda* 3221; *De Wilde & Gilbert* 243.

An uncommon species, not likely to be confused with other Ethiopian species with a slender upper raceme-base. The lack of rufous hairs distinguishes it from *H. rufa* and its allies; the short peduncle and raceme-base excludes it from *H. filipendula*; and the tall robust habit, fewer awns and inconspicuously hairy spikelets clearly separate it from *H. hirta*.

8. *H. quarrei* Robyns (1929);

- type: Zaire, *Quarré* s.n. (BR holo.).

Tussocky perennial; the basal leaf-sheaths usually white-pubescent; culms 1–2 m high. Leaf-blades up to 40 cm long, 5 mm wide, glaucous, harsh. Spathate panicle c 30 cm long, narrow, fairly dense; spatheoles linear, 3–5 cm long, russet coloured; peduncle slightly longer than the spatheole; racemes 6–10-awned per pair, white hairy, at least some of them deflexed; ra-

ceme-bases terete, the upper 2–3.5 mm long, hirsute, or sometimes glabrous or with a few setae; 1 pair of homogamous spikelets at the base of the lower or both racemes. Sessile spikelet pubescent to villous with white hairs; callus linear to slenderly cuneate, 0.7–1.2 mm long; awn 1.8–3.6 cm long, pubescent with hairs 0.2–0.5 mm long. Pedicelled spikelet pubescent to villous, acute.

EW; scattered throughout tropical and South Africa; N Yemen. *Schweinfurth & Riva* 1089.

A rather heterogeneous species linking *H. hirta* and *H. nyassae*, and probably comprising introgression products from these species and perhaps also *H. tamba*. It occurs mainly in southern tropical Africa where *H. nyassae* is more common. The single specimen known from our area is distinguished from *H. hirta* by its deflexed racemes.

9. *H. hirta* (L.) Stapf (1919);

Andropogon hirtus L. (1753); *Cymbopogon hirtus* (L.) Thomson (1863) - type: Italy, *Burser* I.119 (UPS holo.).

Andropogon podotrichus Hochst. (1844); *Hyparrhenia podotricha* (Hochst.) Anderss. (1867), nom. invalid. publ. gen. ante; *Andropogon hirtus* L. var. *podotrichus* (Hochst.) Hack. in DC., *Monogr. Phan.* 6: 620 (1889); *Hyparrhenia hirta* (L.) Stapf var. *podotricha* (Hochst.) Pic.-Serm. in *Miss. Stud. Lago Tana* 7, *Ricerche Bot.* 1: 174 (1951) - type: Ethiopia, without locality, *Schimper* 1056 (K iso.).

Slender tussocky perennial from a short rhizome, basal shoots compressed; culms wiry, rising above the basal leafy tussock, 40 cm to 1 m high. Leaf-blades narrowly linear, glaucous, 10–20 cm long, 1.5–3 mm wide, scabrid, glabrous or hispid downwards. Spathate panicle scanty, composed of 2–8 distant raceme-pairs; spatheoles linear, 5–8 cm long; peduncle flexuously exerted near the spatheole tip, pubescent or shortly white-bearded. Racemes 8–15(–20)-awned per pair, often greyish, softly white-villous, never deflexed; raceme-bases unequal, sometimes connate, pubescent, the upper slenderly terete, 2.5–5 mm long; 1 pair of homogamous spikelets at the base of the lower raceme, 0–1 pair (very rarely 2) on the upper. Sessile spikelets 3.5–4.5 mm long, white-villous; callus 0.8–1.5 mm long, acute or subpungent; awn 1.5–3.5 cm long, the column puberulous with white hairs 0.2–0.3 mm long. Pedicelled spikelets 4.5–8 mm long, villous, acute or tipped with a small mucro <0.3 mm long; pedicel-tooth subulate, 0.2–1.5 mm long. Fig. 137:1–3.

Open grassy or overgrazed places, dry hillsides and among rocks; 1100–2600 m. EW TU GD WU WG SU AR KF GG SD BA HA; the Mediterranean and eastwards through the Middle East to Arabia and Pakistan; South Africa; tropical East Africa and a few records from elsewhere in tropical Africa, Australia and Central America (probably introduced). *Burger* 932; *Gilbert & Thulin* 401; *Mooney* 5061.

H. hirta is a widespread variable species, and is the only member of the genus to have its main area of distribution outside tropical Africa, being centred on the Mediterranean and the winter-rainfall areas of South Africa. It penetrates into tropical Africa on higher ground and is common in Ethiopia, but crosses very easily with a number of neighbouring tropical species, giving rise to troublesome intermediates.

H. hirta grades imperceptibly into *H. filipendula*, another common species in Ethiopia. The core of both *H. hirta* and *H. filipendula* is easily recognizable, and many of the intermediates can be assigned to *H. anamesa* (no. 10). Anomalous specimens which do not key out easily will nevertheless still be encountered. Those with 4-7 rather hairy awns per raceme-pair but only 1 pair of homogamous spikelets on the upper raceme-base (e.g. *Beals* 349; *Gillett* 14445), and also specimens with more awns but 2 pairs of homogamous spikelets (e.g. *Mooney* 8000) are best regarded as peripheral members of *H. hirta*. *De Wilde* 10547 [60 km SW of Awash (AF)] is an exceptional specimen of *H. hirta* with 2 homogamous pairs at the base of both racemes.

10. *H. anamesa* *W. D. Clayton* (1969);

- type: Kenya, *Glover, Gwynne, Samuel & Tucker* 2145 (K holo., EA iso.).

Tussocky perennial; culms slender, 40 cm to 1.5 m high. Leaf-blades narrowly linear, concentrated in a basal tussock or sometimes mostly cauline, up to 40 cm long but usually less, 2-4 mm wide, glaucous. Spathate panicle 15-45 cm long, loose or the spatheoles sometimes gathered into fascicles; spatheoles linear, 3.5-6 cm long, reddish; peduncle filiform, flexuously exerted near the spatheole tip, sometimes white-pilose. Racemes 4-6-awned per pair, white-villous, not deflexing; raceme-bases very unequal, the upper filiform, 4-7 mm long; 1 pair of homogamous spikelets at the base of the lower raceme and 2 on the upper. Sessile spikelets 3-4.3 mm long, white-villous or infrequently merely pubescent; callus 1.2-1.8 mm long; acute to subpungent; awn 2.5-4 mm long; the column pubescent with white or fulvous hairs 0.3-0.6 mm long. Pedicelled spikelets 4.2-6.5 mm long, villous, acute or tipped with a mucro up to 1.5 mm long; pedicel-tooth subulate, 0.5-0.8 mm long.

Open grassland or pasture, and grassy glades in woodland; 1500-2400 m. TU SU KF GG SD HA; eastern Africa southwards to the Cape; also Sudan (Jebel Marra). *Gilbert & Jefford* 4661; *Gilbert & Phillips* 9041; *Mooney* 6029.

H. anamesa links *H. hirta* to *H. filipendula*, and merges into each at the ends of its variation range [see *Clayton in Kew Bull.* 30: 512 (1975)]. It is a species of convenience, comprising those specimens excluded from *H. hirta* by possessing too few awns (<8 per raceme-pair) and 2 homogamous pairs on the upper raceme-base; and also those specimens excluded from *H.*

filipendula by possessing more than 3 usually rather short and less hairy awns per raceme-pair. It is thus a rather heterogeneous mixture of introgression products, delimited by the combination of 4-7 awns per raceme-pair together with 2 pairs of homogamous spikelets on the upper raceme-base.

11. *H. filipendula* (*Hochst.*) *Stapf* (1918);

Andropogon filipendulus *Hochst.* (1846); *Sorghum filipendulum* (*Hochst.*) *Kuntze* (1891); *Cymbopogon filipendulus* (*Hochst.*) *Rendle* (1899) - type: South Africa, *Krauss* 28 (K iso.).

Andropogon filipendulus *Hochst.* var. *pilosus* *Hochst.* in *Flora* 29: 115 (1846) - type: South Africa, *Krauss* 164 (K iso.).

Hyparrhenia piovanii *Chiov.* (1950) - type: Ethiopia, SU, *Guder, Piovano* 66 (FT holo.).

Slender perennial forming a loose tussock from a short scaly rhizome; culms 60 cm to 2 m high, branching, yellow, smooth and shiny. Leaf-blades tough, 15-65 cm long, 2-8 mm wide. Spathate panicle 20-60 cm long with many slender spatheoles in crowded fascicles from each spathe; spatheoles very narrowly linear, 4.5-6.5 cm long, becoming reddish; peduncles filiform, flexuously exerted near the spatheole tip, glabrous or thinly white-bearded. Racemes 2(-3)-awned per pair, the awns often twisted together, not deflexing; raceme-bases very unequal, the lower short, the upper filiform, 5-8 mm long; 1 pair of homogamous spikelets at the base of the lower and 2 at the base of the upper raceme. Sessile spikelets 4.2-6 mm long, glabrous to white-villous; callus c 2 mm long, pungent; awn 4-5.5 cm long, the column hirsute with rufous hairs 0.7-1.2 mm long. Pedicelled spikelets 5-6.5 mm long, tipped with a bristle 1.5-3 mm long. Fig. 137:4, 5.

Savanna; 1200-1900 m. GD GJ SU WG KF GG SD; tropical Africa, rare west of Nigeria. *Gereau* 1241; *Gilbert & Phillips* 9275; *Mogk* 363.

H. filipendula is a common species of the African savanna, recognized by its combination of very slender, flexuous spatheoles and peduncles, few-awned raceme-pairs with a filiform upper raceme-base, and pungent callus. Specimens with villous sessile spikelets have been separated as var. *pilosa* in the past, but such forms often grow with glabrous-spiculate specimens and are of negligible taxonomic significance.

12. *H. anthistirioides* (*Hochst. ex A. Rich.*) *Stapf* (1918);

Andropogon anthistirioides *Hochst. ex A. Rich.* (1850); *Sorghum anthistirioides* (*Hochst. ex A. Rich.*) *Kuntze* (1891) - type: Ethiopia, TU, Shire [Chiré], *Schimper* 1822, 1832 (both K syn.) & *Quartin Dillon* s.n. (P syn.).

Anthistiria pseudocymbaria *Steud.* (1854); *Hyparrhenia pseudocymbaria* (*Steud.*) *Stapf* (1919) - type: Ethiopia, TU, Gennia, *Schimper* 923 (K iso.).



Figure 138. *HYPARRHENIA* spp.: *H. ANTHISTIRIOIDES*: 1 - base of plant x 3/4; 2 - inflorescence x 3/4; 3 - spikelet pair x 4. *H. CLAYTONII*: 4 - base of plant x 3/4; 5 - spikelet pair x 4. 1 & 3 from Burger 1085; 2 from Robertson 1212a; 4 & 5 from Ash 2693. Drawn by Eleanor Catherine.

Anthistiria quinqueplex Steud. (1854); *Hyparrhenia quinqueplex* (Steud.) Anderss. (1867), comb. inval., publ. gen. ante - type: Ethiopia, TU, Adua [Adoa], Schimper 1098 (K iso.).

Annual; culms solitary or tufted, slender to moderately robust, 50–150(–180) cm high, the lowest nodes sometimes with stilt roots. Leaf-blades 15–35 cm long, 4–8 mm wide, scaberulous to puberulous, often with scattered setae. Spathate panicle 20–30 cm long, ample with many spatheoles (fewer and less crowded on very slender plants); spatheoles lanceolate, 1.7–3(–4) cm long, thinly scarious, brightly striped with green, reddish-brown and yellow; peduncle 1/4–1/2 spatheole length and included within it at maturity, white-bearded below the tip. Racemes 3–5-awned per pair; raceme-bases subequal, *c* 1 mm long, flattened, setose with hairs 3–5 mm long, sometimes with a scarious lobe up to 0.3 mm long; lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 4–4.5 mm long, pubescent below the middle; callus narrowly cuneate, 0.5–1 mm long; awn 3–5 cm long, the column dark brown, hirtellous with pallid hairs 0.5–1.2 mm long. Pedicelled spikelets 6–7 mm long, glabrous, the margins ciliate, tipped with a fine bristle 3–6 mm long. Fig. 138:1–3.

Dry rocky slopes and volcanic rock outcrops, also open weedy places and as a weed of sorghum fields; 1200–2400 m. EW TU GD GJ SU AR KF HA; Sudan, N Somalia, Tanzania, N Zambia and Malawi. *Ash* 1272; *Mooney* 6101; *Robertson* 1212a.

H. anthistirioides is very variable in vigour, being strongly influenced by environment, the smallest plants occurring on thin rocky soils. The annual habit is the best means of distinguishing it from other species with a single homogamous pair and no obvious raceme-base appendage. The colourfully striped spatheoles and relatively long dark awns are also useful distinguishing characters.

13. *H. claytonii* S. M. Phillips (1994);

- type: Ethiopia, SU, Bole Canyon, *Ash* 2693 (K holo., US iso.).

Densely tufted perennial from a knotty rootstock, the basal buds conspicuously white-tomentose; culms slender, stiffly erect, *c* 1 m high. Leaf-blades linear, glaucous, 20–30 cm long, 6–8 mm wide, setose near the ligule. Spathate panicle *c* 25 cm long, loosely contracted; spatheoles lanceolate, 2.5–3 cm long, scarious, colourfully striped brown and yellow; peduncle 1/2 spatheole length and included within it at maturity, bearded with whitish hairs. Racemes 4-awned per pair, white-villous, deflexed at maturity; raceme-bases subequal, *c* 1 mm long, flattened, setose, tipped with an oblong lobe 1 mm long; lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 4.5 mm long, villous; callus 1 mm long, narrowly cuneate, acute; awn 3.4–3.7 cm long, the column dark brown, pubescent with fulvous hairs 0.3–0.4 mm long. Pedicelled

spikelets 7–8.5 mm long, villous, tipped with a fine bristle 4–5.5 mm long. Fig. 138:4, 5.

Grassy slopes in wooded grassland; 2100 m. SU; unknown elsewhere.

This distinctive species is at present known only from the type specimen. It closely resembles *H. anthistirioides*, but is easily distinguished by its most unusual tomentose base, and also differs by its villous spikelets.

14. *H. cymbaria* (L.) Stapf (1919);

Andropogon cymbarius L. (1771); *Cymbopogon elegans* Spreng. (1815), nom. superfl.; *Cymbopogon cymbarius* (L.) Thomson (1863) - type: "India", probably from Comoro Is., König s.n. (LINN holo.).

Andropogon lepidus Nees (1841); *Hyparrhenia lepida* (Nees) Cuf. (1970).

Andropogon lepidus Nees var. *viridis* Chiov. in *Ann. Ist. Bot. Roma* 8: 26 (1903) - type: Eritrea, Doda, Terracciano & Pappi 2066 (FT holo.).

Tall perennial; culms initially slender and rambling, then robustly erect from the slender base, supported by stilt roots, 2–3.5 m high. Leaf-blades broadly linear, 30–50 cm long, 8–30 mm wide, glabrous above, usually, thinly appressed-pilose below, margins scabrid. Spathate panicle ample, 20–30 cm long, much branched with numerous, crowded, small spatheoles; spatheoles inflated, ovate, 0.7–1.8 mm long, red at maturity; peduncle 1/4–1/2 spatheole length and included within it at maturity, white-bearded. Racemes 0–6-awned per pair; raceme-bases very short, flattened, setose with hairs 3–4 mm long, the tip with a narrow scarious rim; lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 3–4 mm long, pubescent; callus 0.2–0.4 mm long, as wide as long, broadly rounded; awn up to 1.5 cm long, sometimes abortive, the column puberulous. Pedicelled spikelets scaberulous to puberulous, 3.5–6.5 mm long, acute. Fig. 139.

Tall grassland, or sometimes straggling among bushes; 1300–2600 m. EW GD KF IL GG SD; southwards through eastern Africa to Natal, also in Cameroon and N Angola; Madagascar and Comoro Is. *Friis* et al. 121; *Gilbert & Phillips* 9231; *Mooney* 5438.

H. cymbaria is a common constituent of tall grassland. Whilst most often seen as a robust, erect grass, it is slender and rambling in the early stages of growth and may occasionally flower whilst still at this stage, mimicking *H. pilgeriana*. The numerous, small, inflated, red spatheoles coupled with short (even vestigial) awns and merely acute pedicelled spikelets are characteristic. However, in borderline specimens the very short, broad callus is the most important diagnostic feature.

H. cymbaria lies at the centre of an intergrading complex of forms subdivided, often rather arbitrarily, into seven species (nos 12–18). *H. anthistirioides* is reasonably distinct on account of its annual habit, and

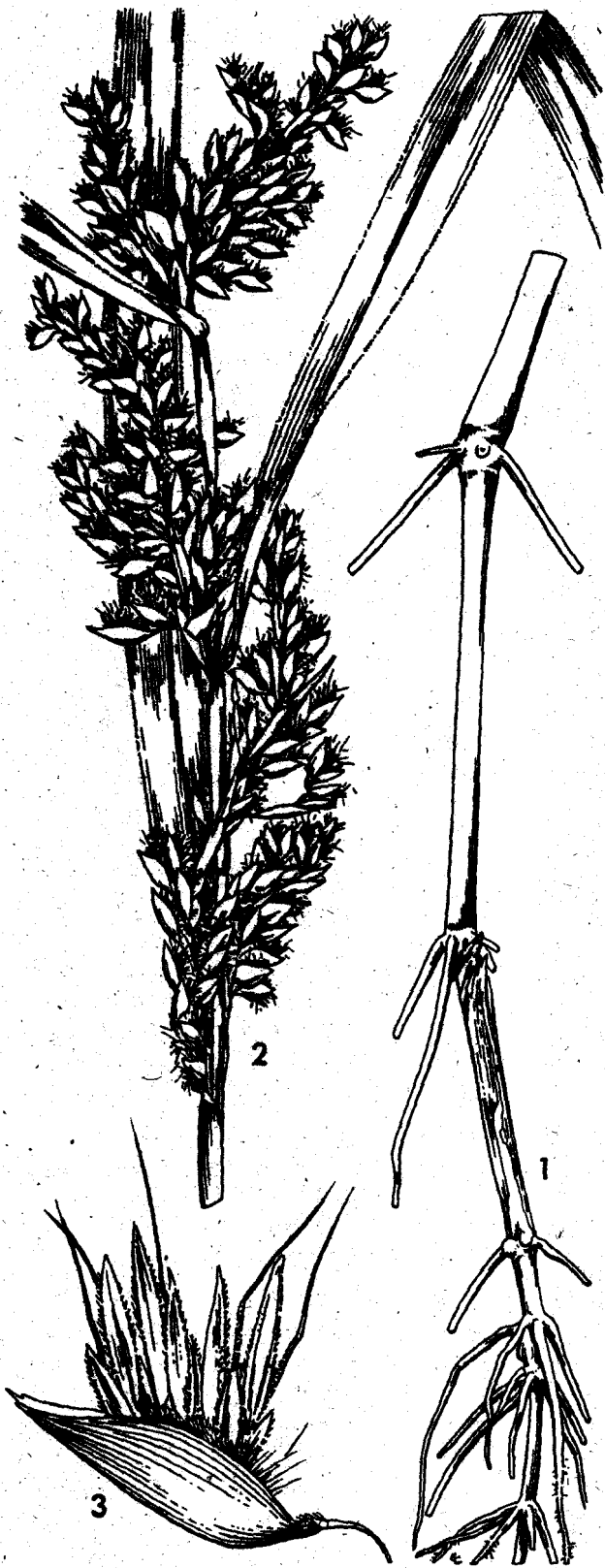


Figure 139. *HYPARRHENIA CYMBARIA*: 1 - base of plant x 3/4; 2 - inflorescence x 3/4; 3 - spatheole and raceme pair x 4. All from *Gersau* 1351. Drawn by Eleanor Catherine.

H. pilgeriana also has a recognizable facies and occupies a different ecological niche. The remaining four species, of which *H. cymbaria* itself is the commonest, are all grasses of tall savanna. The core of *H. cymbaria* is distinctive enough, but it grades imperceptibly into the other three, which probably represent chromosomal variants or the results of introgression and apomixis. The group of villous-spiculate species centred on *H. dregeana* are also closely related to the *H. cymbaria* complex, leading to further difficulties in identification.

Occasional specimens occur across Africa with the dimensions of *H. cymbaria* (or *H. formosa*) and possessing its short broad callus, but with villous spikelets. The name *H. umbrosa* (Hochst.) Clayton has been applied to these. However, the type of *H. umbrosa* (Schimper 1116 from Mt Scholoda, Tigre) has a shortly cuneate callus and appears closer to *H. tamba* (Steud.) Stapf. Such intermediate specimens are probably introgression products, scarcely worthy of separate specific status.

15. *H. formosa* Stapf (1919);

- type: Ethiopia, TU, Schimper 1009 (K holo.).

Robust, coarsely tufted perennial; culms c 2 m high. Leaf-blades up to 50 cm long and 12 mm wide. Spatheate panicle large, dense, 30–40 cm long; spatheoles lanceolate, 1.8–2.6 cm long, russet tinged with yellow and purple; peduncle up to 1/2 as long as the spatheole. Racemes 6–8-awned per pair, deflexed; raceme-bases subequal, 0.5 mm long, flattened, setose, lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 3.5–5 mm long, glabrous to pubescent; callus oblong to cuneate, rarely as long as wide, 0.5–1 mm long, rounded; awn 0.8–1.8 cm long. Pedicelled spikelets glabrous to puberulous, acuminate.

TU; southwards through East Africa to Malawi, Rwanda and E Zaire, Yemen.

H. formosa is represented in Ethiopia only by the type specimen. This has the robust habit, large crowded panicle and broad rounded callus of *H. cymbaria*. However, its longer spatheoles and awns cannot be accommodated within *H. cymbaria* without enlarging the circumscription of that species to a degree which would overlap excessively with the variation ranges of other species within the complex. It almost certainly represents no more than a chromosomal variant as a count of $2n=30$ has been obtained for a Kenyan specimen, whereas typical *H. cymbaria* is diploid ($2n=20$). Elsewhere in Africa the circumscription of *H. formosa* is broadened to include specimens with the dimensions of *H. cymbaria* but excluded from it because of a longer cuneate callus.

16. *H. variabilis* Stapf (1919);

- type: Zambia, Macaulay 62 (K lecto.).

Robust perennial; culms 1.5–3 m high from a decumbent base, supported by stilt roots. Leaf-blades up to 45

cm long and 20 mm wide, usually glabrous. Spathate panicle ample, much branched, 20–40 cm long with numerous crowded spatheoles; spatheoles lanceolate, 1.4–2.4 cm long, glabrous, red tinged with green and yellow at maturity, peduncle 1/3–1/2 spatheole length and included within it at maturity, white-bearded. Racemes 2–5-awned per pair; raceme-bases very short, flattened, setose, the tip with a scarious rim to 0.3 mm; lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 3.5–5 mm long, pubescent; callus cuneate, 0.5–1 mm long, narrowly obtuse; awn (1.4–) 1.8–3 cm long. Pedicelled spikelets 5–8 mm long, glabrous to puberulous, tipped with an awn-point 1–4 mm long.

Tall grassland; 1200–1800 m. GD SU; southwards through tropical eastern Africa to the Transvaal; Yemen. *Ash* 2239; *Pichi-Sermolli* 119.

H. variabilis intergrades with *H. cymbaria* and the two taxa occupy the same habitat and distribution range. *H. variabilis* tends to have longer spatheoles and awns, but the difference in callus shape is the most reliable distinguishing character (see Clayton in *Kew Bull.* 30: 517, 1975).

17. *H. schimperi* (Hochst. ex A. Rich.) Stapf (1919); *Andropogon schimperi* Hochst. ex A. Rich. (1850); *Cymbopogon schimperi* (Hochst. ex A. Rich.) Rendle (1899) - types: Ethiopia, TU, Shire [Chiré], *Quartin Dillon* s.n. (P syn.) & Mt Sholoda [Selleuda], *Schimper* 408 (K isosyn.).

Perennial; culms fairly slender to robust, over 1 m high. Leaf-blades up to 30 cm long, 4–6 mm wide, glabrous, scabrid. Spathate panicle 13–40 cm long, contracted (or the spatheoles fewer and loose on slender plants); spatheoles narrowly lanceolate, 2.5–3.2 cm long, turning reddish-brown; peduncle 1/3–1/2 spatheole length, often shortly exerted at maturity, bearded with tawny-white hairs. Racemes (5–)6–9-awned per pair; raceme-bases c 1 mm long, setose with hairs 3–4 mm long, usually with a scarious lobe 0.5–1 mm long at the tip; lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 3.2–5 mm long, glabrescent to pubescent; callus cuneate, 0.6–0.9 mm long, acute; awn 2–3 mm long, the column mid-brown, pubescent with hairs c 0.25 mm long. Pedicelled spikelets 5–7 mm long, glabrous to thinly pilose, the upper margins scabrid, tipped with a fine awnlet 0.5–3 mm long.

Habitat in Ethiopia unknown (savanna further south); c 1300 m. TU GD; southwards to Zimbabwe and Mozambique; Madagascar. *Chiovenda* 2601, 2702; *Schimper* 921, 1052.

Slender specimens approach *H. pilgeriana*, which has similar sized spatheoles and often 6 awns per raceme-pair, a resemblance heightened when the peduncles of *H. schimperi* are exerted. However, the culms of *H. schimperi* are never rambling, the beard on the peduncle is tawny-white not yellow, and the awns are longer. The scarious lobe at the raceme-base tip is often

longer in *H. schimperi* than in other species of the *H. cymbaria* group.

The boundary with *H. anthistirioides* is also not clear cut. *H. schimperi* generally has shorter awns, a longer scarious rim to the raceme-base and more uniformly red spatheoles, but in borderline cases its perennial habit is the decisive characteristic.

18. *H. pilgeriana* C.E. Hubb. (1928); based on *Cymbopogon stolzii* Pilg. (1917), non *Hyparrhenia stolzii* Stapf (1919) - type: Tanzania, *Stolz* 960 (K iso.).

Slender perennial; culms wiry, rambling, 50 cm to 1 m high. Leaf-blades 7–16 cm long, 3–6 mm wide, glabrous or thinly hispid. Spathate panicle 15–22 cm long, loose and open; spatheoles narrowly lanceolate, 2–3 cm long, green becoming reddish-brown; peduncle 1/2 as long to equalling the spatheole, often exerted and arching, yellow-bearded. Racemes 4–8-awned per pair, hairs in the raceme white; raceme-bases c 1 mm long, flattened, bearded with yellow setae to 4 mm long, finally deflexed, tipped by a scarious rim or infrequently with a lobe up to 0.5 mm long; lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 3.5–4.2 mm long, glossy, glabrous or thinly puberulous, scabrid towards the tip; callus shortly cuneate, 0.3–0.5 mm long, broadly obtuse; awn 1–1.7 cm long, the column dark brown, pubescent with hairs 0.2 mm long. Pedicelled spikelets 4–6 mm long, purple, glabrous, acuminate or with a mucro up to 2 mm long.

Moist positions in thickets, along forest fringes and in swampy clearings in forest, often scrambling through bushes; 1800–2600 m. WG KF GG SD BA; southwards through East Africa to Malawi, and infrequently further south to Natal. *Friis* et al. 1522; *Gillett* 14479; *Mooney* 7759.

H. pilgeriana has a clearly recognizable facies, with a slender straggling habit, long yellow-bearded peduncles usually exerted from near the tips of narrow spatheoles, and rather glossy sessile spikelets.

19. *H. papillipes* (Hochst. ex A. Rich.) Stapf (1919); *Andropogon papillipes* Hochst. ex A. Rich. (1850); *Cymbopogon papillipes* (Hochst. ex A. Rich.) Chiov. (1912) - types: Ethiopia, TU, Adua [Adoa], *Schimper* 1055 (K isosyn.) & Mai Gouagoua, *Quartin Dillon* s.n. (P syn.).

Slender tussocky perennial; culms wiry, erect at the base from a short rhizome, loosely ascending above and bushily branching, 50 cm to 1 m high. Leaf-blades short, up to 25 cm long, 2–6 mm wide. Spathate panicle scanty with 2–10 spaced, nodding raceme-pairs; spatheoles linear-lanceolate, 4–6 cm long, tightly encircling the peduncle at maturity; peduncle ± equalling the spatheole, exerted at or near the tip, flexuous, hirsute with pale yellow hairs. Racemes 7–15-awned per pair, at length deflexed, the spikelets usually white-villous; raceme-bases setose with hairs 4–5 mm long, the upper

sometimes almost cylindrical, 1–3 mm long, tipped with an oblong scarious purplish lobe to 1 mm long; lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 3.8–4.7 mm long; callus cuneate, 0.6–1 mm long, subacute; awn 2.5–3 mm long, the column dark brown, pubescent with hairs 0.3 mm long. Pedicelled spikelets 5–8 mm long, with a mucro 0–2 mm long; pedicel-tooth subulate, (0.2–)0.4–1 mm long.

Open woodland, sometimes scrambling among bushes; 1600–2300 m. TU GD SD; Kenya; N Yemen. *Chiovenda* 2007; *Friis* et al. 810; *Rippstein* 552.

Whilst *H. papillipes* usually has densely villous spikelets, there are glabrous variants in Ethiopia, which can lead to confusion with *H. pilgeriana* (*Gillett* 14239; *Rippstein* 666). Besides its longer spatheoles and awns, *H. papillipes* has a more densely branched, caespitose habit, and a more narrowly cuneate acute callus than *H. pilgeriana*. The pedicel-tooth of *H. papillipes* is an additional confirmatory character.

20. *H. dregeana* (*Nees*) *Stent* (1923);

Andropogon dregeanus *Nees* (1841) - types: South Africa, *Drège* s.n. (3 syntypes, whereabouts uncertain, 1 isosyn. at K).

Hyparrhenia elongata *Stapf* (1919) - type: Ethiopia, TU, without precise locality, *Schimper* 1006 (K lecto.).

Hyparrhenia phyllopoda *Stapf* (1919) - types: Ethiopia, Mukafilo, *Drake-Brockman* 151, 152 (both K syn.).

Hyparrhenia micrathera (*Pilg.*) *Pilg.* (1936).

Densely caespitose perennial, the base invested with old sheaths; culms robust, 1–3 m high. Leaf-blades up to 40 cm long, 4–10 mm wide, usually glabrous and scaberulous, rarely pilose, soft to stiffly erect. Spathate panicle narrow, 25–40 cm long, of many rather loose raceme-pairs; spatheoles narrowly lanceolate, 3.2–5 cm long, mauve-grey becoming russet-brown; peduncles 1/2 as long to ± equalling the spatheole, laterally long-exserted at maturity, sinuous, bearded with pale yellow hairs. Racemes 9–19-awned per pair, spikelets usually villous, infrequently only thinly or glabrous; raceme-bases 1–1.5 mm long, flattened, setose with white hairs c 4 mm long, the tip with a scarious lobe 0.5–0.8(–1.3) mm long; lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 3.5–4.5 mm long; callus oblong to cuneate, 0.7–1 mm long, obtuse to subacute; awn 0.8–2.7 cm long (rarely reduced), the column pubescent with hairs 0.3 mm long. Pedicelled spikelets 5–6.5 mm long, mucous or shortly mucronate (rarely 2–3 mm long). Fig. 140.

Open grassland and stony hillsides, often in seasonally damp depressions; 1700–3000 m. EW TU GD GJ WG KF SU AR SD BA HA; concentrated in Ethiopia and Kenya and in South Africa, less common in the intervening area; N Yemen. *Burger* 2350; *Mooney* 6104; *Thulin* 1680.



Figure 140. *HYPARRHENIA DREGEANA*: 1 - inflorescence x 1/2; 2 - spatheole and raceme pair x 2; 3 - lower glume of sessile spikelet x 14. All from *Thulin* 1680. Drawn by Eleanor Catherine.

H. dregeana is a common species in Ethiopia, best recognized by the combination of a robust tussocky habit, villous racemes exerted from the long (>3 cm) spatheoles, 9 or more awns per raceme-pair, and muticous pedicelled spikelets. Awn and spatheole dimensions overlap with *H. collina* and *H. tamba*, and glabrous-spiculate forms may approach *H. schimperii*. In such doubtful cases specimens with 9 or more awns per raceme-pair are best assigned to *H. dregeana*.

21. *H. tamba* (Steud.) Stapf (1919);

Andropogon tamba Steud. (1854); *A. lepidus* Nees var. *tamba* (Steud.) Hack. in DC., *Monogr. Phan.* 6: 625 (1889); *Cymbopogon tamba* (Steud.) Rendle (1911) - types: Ethiopia, TU, Gennia, Schimper 911 & Mt. Scholoda, Schimper 937 (both K isosyn.).

Caespitose perennial; culms robust, erect, c 1.5 m high, 4–5 mm in diameter at the base. Leaf-blades 25–35 cm long, 5–10 mm wide, glabrous. Spathate panicle narrow, 30–40 cm long, contracted; spatheoles narrowly lanceolate, 3–3.5 cm long, turning glaucous brown; peduncles 1/2–3/4 spatheole length, laterally exerted at maturity, bearded with pallid hairs. Racemes 5–8-awned per pair, the spikelets thinly to densely villous; raceme-bases up to 1 mm long, flattened, setose, tipped with a scariosus lobe 0.5–1 mm long; lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 3.5–4.8 mm long; callus cuneate, 0.4–0.7 mm long, subacute; awn 1.3–2.5 cm long. Pedicelled spikelets 5–6 mm long, muticous or with a mucro up to 2 mm long.

Grassy slopes; 1700–2000 m. EW TU GD SU GG; Sudan, Kenya, E Zaire and South Africa. *Chiovenda* 1828, 2368; *Gilbert* 4147; *Mooney* 7535.

H. tamba in Ethiopia comprises a few robust caespitose specimens differing from *H. dregeana* only by possessing less than 9 awns per raceme-pair. They almost certainly represent no more than a downward extension of the range of variation of *H. dregeana*. The species is retained here to avoid diluting the circumscription of *H. dregeana*, which is otherwise quite well defined, leading to difficulties in keying out neighbouring species. *H. tamba* is also very close to *H. schimperii*, but this has slightly shorter spatheoles and glabrous spikelets.

22. *H. collina* (Pilg.) Stapf (1919);

Andropogon collinus Pilg. (1910), non Lojac. (1909); *Cymbopogon collinus* Pilg. (1917) - types: Rwanda, *Expd. no.* 375 & Tanzania, *Volkens* 352 (both B syn., destr.).

Loosely tufted perennial from a short rhizome; culms slender, 30–130 cm high, erect or geniculately ascending, up to 3 mm in diameter at the base, lacking stilt roots. Leaf-blades up to 30 cm long, 2–5 mm wide, glabrous, scaberulous. Spathate panicle narrow, 14–40

cm long, rather scanty; spatheoles narrowly lanceolate, 2.5–3.5 cm long, turning reddish-brown; peduncle over 1/2 spatheole length, usually exerted at maturity, bearded with pallid hairs. Racemes 5–8-awned per pair, the spikelets villous; raceme-bases 1–1.5 mm long, flattened, setose, with a short scariosus rim; lower raceme-base with 1 pair of homogamous spikelets. Sessile spikelets 4–4.5 mm long; callus cuneate, 0.5–0.8 mm long, obtuse to subacute; awn 1.5–2.5 mm long. Pedicelled spikelets 4.5–6.5 mm long, with a mucro up to 2 mm long.

Grassy hillsides; 1400–2000 m. GD GG SD; the eastern side of Africa southwards to Natal, but concentrated in East Africa. *Fukui* 989; *Chiovenda* 2536; *Mooney* 5480.

There are no significant differences between the inflorescence and spikelets of *H. tamba* and *H. collina*, the two species being distinguished by habit and vigour. Although both occur throughout the eastern side of Africa, *H. collina* is centred on East Africa whilst *H. tamba* is concentrated in the northern and southern parts of the range.

23. *H. rudis* Stapf (1919);

- type: Angola, *Gossweiler* 4151 (K lecto.).

Coarsely tufted perennial; culms robust, 2–3 m high, often with stilt roots, up to 8 mm in diameter at the base. Leaf-blades 30–60 cm long, 3–18 mm wide, tough, scabrid, pale green or glaucous. Spathate panicle 30–50 cm long, of many loosely arranged raceme-pairs; spatheoles narrowly lanceolate, 3.5–4.5 cm long, sometimes glaucous, turning brown; peduncle very variable in length, sinuous and laterally exerted at maturity, bearded with whitish hairs. Racemes 4–8-awned per pair, loose with internodes 2–3 mm long, the spikelets silky-villous; raceme-bases 1–1.5 mm long, flattened, setose with hairs to 5 mm long, tipped with a scariosus lobe 0.2–0.8 mm long; lower raceme-base with one pair of homogamous spikelets. Sessile spikelets 4.2–5 mm long; callus cuneate, 0.5–1 mm long, narrowly obtuse to subacute; awn 3–4 cm long, the column pubescent with hairs 0.3 mm long. Pedicelled spikelets 6–8 mm long, muticous or with a bristle up to 6 mm long.

Upland grassland and deciduous bushland. GD HA; mainly southern tropical Africa; also in East Africa, Sudan (Jebel Marra), Nigeria and Cameroon; Madagascar. *Chiovenda* 2460, 2606; *IECAMA* F77, G39.

H. rudis is uncommon in Ethiopia, its main centre of distribution being further south. It is a tall robust species, distinguishable from the related villous-spiculate species (*H. dregeana*, *H. tamba*, *H. collina*) by its longer, stouter awns. Awn length in Ethiopian specimens lies at the upper end of the variation range, but further south there is some overlap between shorter-awned forms and *H. tamba*.

Specimens with rufously hairy spikelets belonging to *H. dichroa* (Steud.) Stapf (no. 3) may key out here.

24. *H. confinis* (Hochst. ex A. Rich.) Stapf (1918);

Andropogon confinis Hochst. ex A. Rich. (1850);
Sorghum confine (Hochst. ex A. Rich.) Kuntze
(1891) - type: Ethiopia, without locality, Schimper
1456 (K iso.).

H. confinis is a little known and seldom collected species, apparently confined to heavy clay soils in northern Ethiopia and Sudan. The variation has been consigned to 3 varieties, of which var. *nudiglumis* is the best defined on the basis of the meagre material available, but their true status is impossible to assess until more collections are to hand (Clayton in *Kew Bull.* 30: 515, 1975).

var. *confinis*

Annual; culms 1–2.5 m high, supported by stilt roots. Leaf-blades about 30 cm long and up to 15 mm wide, glabrous or shortly villous below, narrowed towards the base; leaf-sheaths glabrous; ligule up to 10 mm long, sometimes with adnate sheath-auricles. Spathate panicle narrow, loose, coarse; spatheoles 3–4.5 cm long, glabrous; peduncles white-bearded above. Racemes 2-awned per pair; raceme-bases white-setose, the tip with an oblong appendage 1–2 mm long, the lower with one pair of homogamous spikelets. Homogamous spikelets 9–13 mm long, glabrous or hispidulous, acute. Sessile spikelets narrowly oblong, 8–10 mm long, flat or slightly depressed, glabrous or sparsely hairy; callus 1.5–3 mm long; awn 4–9 cm long. Pedicelled spikelets 11–14 mm long, glabrous with a terminal bristle 10–17 mm long.

GD or TU? WG (near GJ border); unknown elsewhere. *Getahun* 401; *Quartin Dillon & Petit* 70; *Schimper* 1456.

var. *pellita* (Hack.) Stapf (1918);

Andropogon confinis var. *pellitus* Hack. in DC.,
Monogr. Phan. 6: 642 (1889) - type: Ethiopia,
GD/Sudan border, Matamma, *Schweinfurth* 1034 (K iso.).

Similar to var. *confinis*, but the pedicel and lower glume of the sessile spikelet densely villous with silky white hairs.

GD/Sudan border and neighbouring parts of Sudan. Known in Ethiopia only from the type collection.

A form of very limited distribution, with the lower part of the raceme-pair strikingly silky-villous, the glabrous pedicelled spikelets rising above.

var. *nudiglumis* (Hack.) W.D. Clayton in *Kew Bull.*,

Addit. Series 2: 139 (1969);

Andropogon confinis var. *nudiglumis* Hack. in DC., *Monogr. Phan.* 6: 641 (1889) - type: Ethiopia, GD/Sudan border, Matamma, *Schweinfurth* 1043 (K iso.).

Hyparrhenia petiolata Stapf (1918) - type: Ethiopia, GD, Atsegua, *Schimper* 748 (K holo.).

Culms 1–1.5 m high. Leaf-blades narrowed towards the base to the subterete midrib and often forming a false petiole, especially on blades towards the middle part of the culm; ligule 5–20 mm long. Raceme-bases with an elongate appendage 3–4 mm long. Homogamous spikelets 6.5–9 mm long; sessile spikelets 7–8.5 mm long, glabrous or pubescent; pedicelled spikelets 6–10 mm long.

GD; Sudan. *De Wilde & Gilbert* 263.

The long raceme-base appendages are a striking feature of this variety, which also has a more slender habit, smaller spikelets and a greater tendency to petiolate leaf-blades than the other varieties. However, even the very few specimens at present available show that it sometimes grows with var. *pellita*.

H. confinis, *H. neglecta*, and *H. coleotricha* are the Ethiopian representatives of *Hyparrhenia* sect. *Hyparrhenia* (syn. sect. *Bracteola* Pilg.), a section distinguished by the appendaged, setose raceme-bases.

25. *H. neglecta* S.M. Phillips (1994);

- type: Ethiopia, without locality, *Quartin Dillon & Petit* 66 (K holo.).

Slender annual; culms 45–55 cm high. Leaf-blades glabrous, 3–4 mm wide; ligule truncata, c 1 mm long, pallid, with adnate sheath-auricles. Spathate panicle loose, sparse, composed of 5–8 raceme-pairs; spatheoles narrowly lanceolate, 5–6 cm long; peduncle 1/3 spatheole length, arching at maturity, bearded with yellow hairs. Racemes 4-awned per pair, deflexed at maturity, laterally exerted; raceme-bases subequal, c 1.5 mm long, flattened, setose, tipped with an oblong lobe 1–1.5 mm long, the lower with 1 pair of homogamous spikelets. Homogamous spikelets 9–12 mm long, glabrous, the margins scabrid with spaced teeth. Sessile spikelets 5 mm long, coriaceous, glabrous, strongly ribbed; callus 2 mm long, pungent; awn 5 cm long, the column hirtellous with fulvous hairs 0.8 mm long. Pedicelled spikelets 7 mm long, glabrous, acuminate into a bristle 4–5 mm long; pedicel-tooth inconspicuous, 0.2 mm long.

Apparently endemic to northern Ethiopia (habitat and precise locality unknown).

H. neglecta is known only from the type collection, and is probably most closely related to the cluster of forms gathered together under *H. confinis*. However, it differs from that species by its 4-awned raceme-pairs and also by its yellow peduncle-beard, the firmer texture of its sessile spikelets, and shorter bristle on the pedicelled spikelet.

26. *H. coleotricha* (Steud.) W. D. Clayton (1969);

Andropogon comasus Hochst. ex A. Rich. (1850) non Spreng. (1819), nom. illegit.; *Andropogon coleotrichus* Steud. (1854); *Sorghum comasum* Kuntze (1891); *Hyparrhenia comasa* (Kuntze) Anders. ex

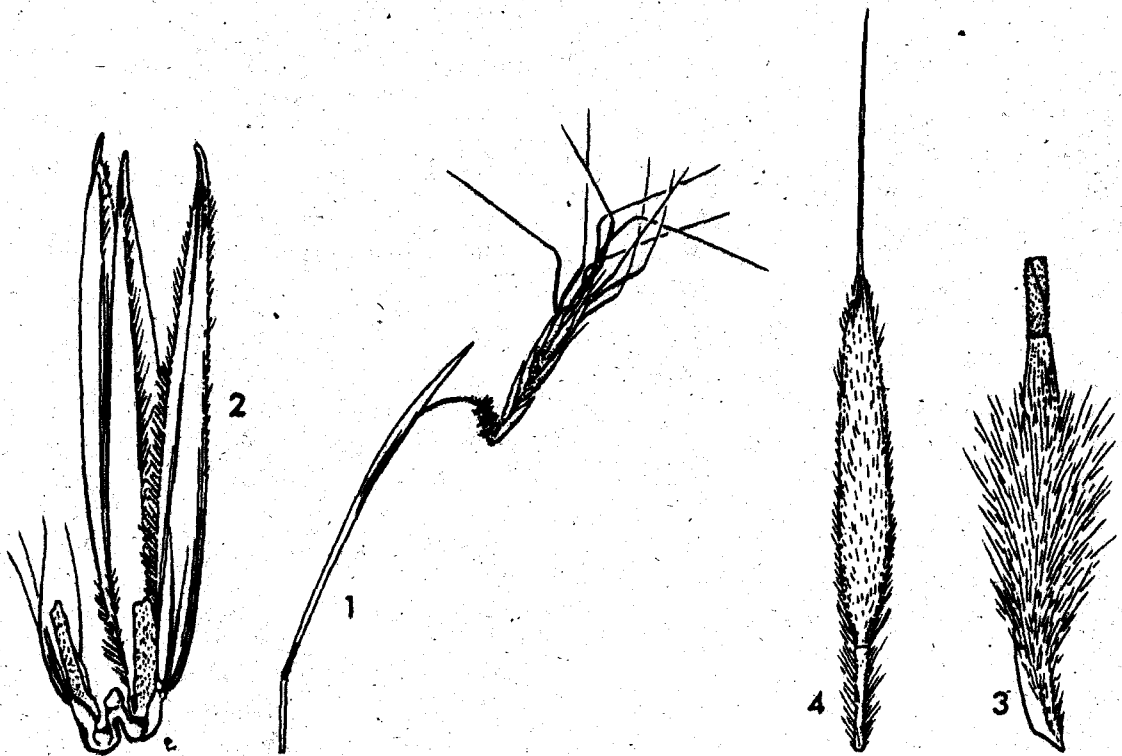


Figure 141. *HYPARRHENIA COLEOTRICHA*: 1 - spatheole and raceme pair x 3/4; 2 - raceme bases and pair of homogamous spikelets x 7; 3 - sessile spikelet with callus and base of awn x 4; 4 - pedicelled spikelet x 7. All from *Mercier* 2561. Drawn by Eleanor Catherine.

Stapf (1918) - type: Ethiopia, without locality, *Schimper* 1458 (K iso.).

Andropogon anthistrioides var. *procerus* Chiov. in *Ann. Ist. Bot. Roma* 8: 289 (1908) - types: Eritrea, Ocale Cusai, *Pappi* 1814, 1869 (both FT syn.) & 1506 (K isosyn.) & Dembelas, *Pappi* 6130 (K isosyn.).

Annual; culms solitary, erect from an ascending base supported by stilt roots, 0.5–2.5 m high. Leaf-blades broadly linear, 20–50 cm long, 7–15 mm wide, fairly thin, scaberulous; leaf-sheaths glabrous or hispid; ligule 3–4.5 mm long, brown, rounded, the collar stained purple. Spathate panicle narrow, loose; spatheoles linear, 6–7 cm long, becoming pinkish-brown; peduncles bearded with creamy-white hairs. Racemes 6–8-awned per pair; raceme-bases deflexed, white-setose, the tip with an oblong scarious appendage 1.5–2.8 mm long, the lower with one pair of homogamous spikelets. Homogamous spikelets 9–13 mm long, almost glabrous or thinly pubescent, acute. Sessile spikelets narrowly elliptic, 6–9 mm long, villous, sometimes densely, with short spreading hairs, glabrous near the tip; callus 1.5–2 mm long; awn 5–7.5 cm long, the column brown-pubescent. Pedicelled spikelets 8–12 mm long, pale pinkish-brown, softly pubescent, tipped with a bristle (5–)7–12 mm long; pedicel-tooth 0.2–1 mm long. Fig. 141.

Pathides, field-margins and old cultivations; 1200–2500 m. EW WU SU; N Yemen, S Sudan and Tanzania. *Ash* 2737A; *M.G. & S.B. Gilbert* 1890; *Pappi* 6130.

H. coleotricha can be recognized by its white-bearded peduncle, long raceme-base appendages and raceme-pairs with more awns than in most other related annual species. The bright brown ligule with purple collar is also characteristic. It is a species of variable vigour, specimens from the southern part of its range tending to be taller and more robust than Ethiopian plants.

27. *H. diplandra* (*Hack.*) *Stapf* (1919);

Andropogon diplandrus *Hack.* (1885); *Cymbopogon diplandrus* (*Hack.*) *De Wild.* (1919) - types: Sudan, *Schweinfurth* 2002, 2094 (both K isosyn.).

Coarse, tufted, sometimes glaucous perennial; culms 2–3 m high. Leaf-blades 20–60 cm long, 3–10 mm wide with a broad white midrib, usually glabrous, the tip filiform. Spathate panicle narrow, 20–40 cm long with brownish-red spatheoles and purplish racemes; spatheoles 3–4.5 cm long, narrowly lanceolate; peduncles 0.5–1.5 cm long, glabrous or shortly bearded above, scarcely exerted from the spatheole. Racemes 4–8-awned per pair; raceme-bases flattened, broadly to narrowly oblong, glabrous on the outer (lower face), the upper 1.5–3 mm long; typically 2 pairs of homogamous spikelets at the base of each raceme resembling an involucre. Homogamous spikelets 7–9 mm long, scabrid to subpectinate on the keels upwards. Sessile spikelets narrowly lanceolate-oblong, 5.5–7.5 mm long, glabrous or pubescent; callus 1–1.5 mm long, sharply acute; awn 2.5–4.5 mm long, the column with white hairs 0.2–0.5

mm long. Pedicelled spikelets 6–7.5 mm long, acute or tipped with a mucro up to 1.5 mm long.

Often in moist places on clay, but extending to dry stony hillsides; 1200–1600 m. WG KF GG SD; tropical Africa but rare west of Cameroon; also in SE Asia and Indonesia. *Fukai* 613; *Gilbert & Phillips* 9055; *Mooney* 8621.

Whilst *H. diplandra* typically has 2 pairs of homogamous spikelets at the base of each raceme, this character is not completely constant, and in Ethiopia it is fairly common for only one pair to be present on one or both racemes. The number present may vary even within the same inflorescence. Specimens with a single pair at the base of each raceme have been separated as *H. gossweileri* Stapf but, in Ethiopia at least, such specimens fall comfortably within the variation range of *H. diplandra*.

For differences between *H. diplandra* and *H. arrhenobasis*, see note under that species.

28. *H. arrhenobasis* (Hochst. ex Steud.) Stapf (1918);

Andropogon arrhenobasis ("arrhenobasis") Hochst. ex Steud. (1854); *Heteropogon arrhenobasis* (Hochst. ex Steud.) Anderss. (1867); *Sorghum arrhenobasis* (Hochst. ex Steud.) Kuntze (1891) - type: Ethiopia, TU, Schire, *Schimper* 1821 (K. iso.).

Andropogon papillipes var. *major* Hochst. ex Steud. (1854), in synonym. - type: Ethiopia, *Schimper* 1054 (P. holo.).

Tufted perennial; culms ascending, up to 1 m high. Leaf-blades 10–30 cm long, 3–5 mm wide, glaucous, tip acute to filiform. Spathate panicle rather sparse, seldom with more than 10 raceme-pairs; spatheoles lanceolate, 4–6 cm long, scarious, light green; peduncles arching from the spatheoles, bearded with yellow hairs. Racemes compact, frequently branched, 7- or more awned per pair (up to 30 when much branched); raceme-bases narrowly oblong, hispid with yellow bristles, not or only tardily deflexing, the upper 1.5–2(–3) mm long, often subterete, each with 1–2 pairs of homogamous spikelets. Homogamous spikelets 7–11 mm long, glabrous, puberulous or infrequently hirsute, pectinate along the length of the margins. Sessile spikelets 5.5–7 mm long, almost flat or sometimes slightly concave across the back, thinly pubescent or occasionally hirsute; callus 0.8–1.3 mm long, acute; awn 2.5–4(–5) cm long, the column pubescent with brown hairs 0.3–0.5 mm long. Pedicelled spikelets 7–9.5 mm long, acute or briefly mucronate (up to 0.5 mm). Fig. 142: 1–3.

Grassland, pastureland and stony hillsides; 2000–3000 m (exceptionally lower). TU GD GJ SU AR KF GG BA HA; endemic to the Ethiopian highlands. *Ash* 1278; *Gilbert & Phillips* 9293; *Tadesse & Kagnev* 1640.

H. arrhenobasis is a common species in the uplands, best recognized by the pectinate-margined homogamous

spikelets; the arching, yellow-bearded peduncle and often non-deflexing racemes are also characteristic. The racemes frequently branch, a phenomenon found exceptionally as an aberration elsewhere in *Hyparrhenia*, but occurring regularly in this species. Repeated branching leads to a dense bunch of spikelets and awns from each peduncle-tip e.g. *IECAMA* J51, *Mooney* 8622.

H. diplandra may be confused with *H. arrhenobasis* as it also has homogamous spikelets at the base of both racemes, and these may be subpectinate near the tip. However, they are never conspicuously pectinate along most of the length of the margins as in *H. arrhenobasis*. *H. diplandra* is a taller, more robust species found at lower altitudes, with non-exserted, glabrous or white-hairy peduncles and raceme-bases lacking yellow bristles.

H. arrhenobasis, *H. tuberculata* and *H. multiplex* form a close-knit group of related species (sect. *Arrhenopogonia* Clayton) almost confined to the Ethiopian highlands. The group is characterised by a scanty inflorescence of compact, often non-deflexing raceme-pairs forming wedge-shaped, pendant heads surrounded at the base by an involucre of conspicuously pectinate homogamous spikelets. The raceme-pairs are usually predominantly golden-brown with fulvous bristles on the raceme-bases, dark brown mature sessile spikelets, and brown-hairy awns.

29. *H. tuberculata* W. D. Clayton (1969);

- type: Ethiopia, SU, Mt Yerer, *Mooney* 6284 (K. holo.).

Tufted perennial; culms slender, 40–65 cm high. Leaf-blades 10–25 cm long, 2–4 mm wide, glaucous, the margins scabrid with spaced teeth. Spathate panicle sparse, composed of 1–5 pendant, wedge-shaped, golden-brown raceme-pairs; spatheoles narrowly lanceolate, 5–7 mm long; peduncles arching from the spatheoles, bearded with golden hairs. Racemes compact, 8–11-awned per pair; raceme-bases oblong, hispid with golden bristles, not deflexing, the upper c 2 mm long, each with 2 pairs of homogamous spikelets. Homogamous spikelets 10–11 mm long, flushed purple, conspicuously pectinate along the length of the margins with glassy bristles arising from encrusting tubercles, tuberculate-hispid on the back. Sessile spikelets 7–7.5 mm long, stiffly hispid; callus 1.7–2 mm long, pungent; awn (4–)4.5–5 mm long, the column with brown hairs 0.7–1.5 mm long. Pedicelled spikelets 8–10 mm long, pectinate on the margins and upper part of midnerve, acute. Fig. 142: 4, 5.

Upland grassland; among rocks and in grassy glades in *Erica* bushland and *Juniperus* woodland; 2400–3000 m. GJ SU; unknown elsewhere. *Ash* 2091; *Friis et al.* 1231; *Gilbert* 9301.



Figure 142: *HYPARRHENIA* spp.: *H. ARRHENOBASIS*: 1 - habit and inflorescence x 3/4; 2 - raceme pair (base of awns only shown) x 2; 3 - sessile spikelet with callus and base of awn x 7. *H. TUBERCULATA*: 4 - raceme pair (base of awns only shown) x 2; 5 - sessile spikelet with callus and base of awn x 7. 1-3 from *Mulvany* 44; 4 & 5 from *Mogk* 389. Drawn by Eleanor Catherine.

H. tuberculata is a local species, apparently almost confined to the highlands of Shewa. The panicle is distinctive, with just a few chunky, nodding, golden-brown and purplish raceme-pairs.

It is very closely related to *H. arrhenobasis*, and appears to represent an extreme form from the variation pool of that species, which has developed into a discrete and very uniform taxon, sufficiently distinct to merit specific rank. There is a different facies to the golden-brown, rather than greenish racemes, reinforced by the very obvious involucrel homogamous spikelets with unmistakable, fringing, tubercle-based setae. These distinctions are supported by a number of smaller differences listed in the key. A further small difference is the length of the lemma-lobes: 0.6–1.0 mm in *H. arrhenobasis* and 0.3–0.4 mm in *H. tuberculata*.

30. *H. multiplex* (Hochst. ex A. Rich.) Anderss. ex Stapf (1918);

Anthistiria multiplex Hochst. ex A. Rich. (1850);
Andropogon multiplex (Hochst. ex A. Rich.) Hack. (1889); *Sorghum multiplex* (Hochst. ex A. Rich.) Kuntze (1891) - type: Ethiopia, TU, Sana district, Bahara, Schimper 1637 (K iso.).

Hyparrhenia multiplex var. *leiopoda* Stapf in Prain, *Fl. Trop. Afr.* 9: 375 (1918) - type: Ethiopia, TU, Arba Fensasa, Schimper 349 (K holo.).

Slender tufted annual; culms erect, 5–35 cm high. Leaf-blades 2–20 cm long, 1–4 mm wide, acute. Spathate panicle sparse, composed of 1–4 raceme-pairs; spatholes inflated and green at first, becoming narrowly lanceolate or linear and reddish, terminating in a short blade up to 2 cm long; peduncles finally shortly exerted, glabrous or bearded. Racemes compact, 3–11-awned per pair; raceme-bases narrowly oblong, usually hispid with yellowish bristles but occasionally glabrous, not or only tardily deflexing, the upper 1.5 mm long, each with 2 pairs of homogamous spikelets. Homogamous spikelets 7–8 mm long, conspicuously tuberculate-pectinate with glassy bristles along the length of the margins and also on the midnerve near the tip, otherwise glabrous, mucronate. Sessile spikelets 6–8 mm long, hispidulous, the back ribbed or with a median groove; callus 2–3 mm long, pungent; awn 4.5–7 cm long, the column hirsute with brown hairs 1.5 mm long. Pedicelled spikelets up to 7 mm long, resembling the homogamous spikelets. Fig. 143.

Mountain slopes; c 3000 m. TU GD; Sudan (Jebel Marra). *Chiovenda* 1798; *Quartin Dillon & Petit* 1864; *De Wilde & Gilbert* 205.

H. multiplex is an unusually small, slender species of *Hyparrhenia*, the raceme-pairs with their stout hairy awns appearing rather incongruous on dwarfed specimens. It is the annual counterpart of *H. tuberculata*, with similar brown raceme-pairs and distinctive tubercle-based marginal setae on the homogamous spikelets. The lower glume of the sessile spikelet has a median longitudinal depression in some specimens (e.g. *Chiov-*



Figure 143. *HYPARRHENIA MULTIPLEX*: 1 - habit x 3/4; 2 - spathole and raceme pair x 3/4; 3 - sessile spikelet x 11. 1 from *Chiovenda* 1798; 2 & 3 from *Chiovenda* 2351. Drawn by Eleanor Catherine.

enda 2351; De Wilde & Gilbert 205), an anomalous feature in *Hyparrhenia* perhaps foreshadowing the deep median groove found in *Hyperthelia*.

149. *EXOTHECA* Anderss. (1856)

Clayton in *Kew Bull.* 20: 447 (1966).

Perennial; leaf-blades linear, ligule scarious. Inflorescence composed of a few raceme-pairs gathered into a scanty spathate compound panicle; peduncles long-exserted from the narrow spatheoles; raceme-bases very unequal, the upper as long as the lower raceme, so that the racemes sit end to end, not deflexing at maturity; homogamous spikelet-pairs at the base of both racemes forming a protective involucre. Homogamous spikelets male, lightly convex, chartaceous, many-nerved. Sessile spikelet terete, its callus elongate, pungent, obliquely inserted with a free tip; lower glume coriaceous with an extended, scarious, acute or emarginate tip; upper glume with a similar scarious tip, awnless; lower floret reduced to a hyaline lemma; upper lemma stipitiform, bidentate, passing between the teeth into a large, stout, bigeniculate awn. Pedicelled spikelets male, resembling the homogamous spikelets; pedicels slender.

1 species in eastern Africa; also in Vietnam.

Exotheca is an offshoot from the large genus *Hyparrhenia*, meriting generic rank principally because of the distinctive facies imparted by its combination of a very long upper raceme-base and conspicuous involucre of homogamous spikelet-pairs. The pronounced scarious tip to the fertile sessile spikelet is also noteworthy.

E. abyssinica (Hochst. ex A. Rich.) Anderss. (1857);

Anthistiria abyssinica Hochst. ex A. Rich. (1850); *Andropogon exothecus* Hack. (1889); non *Andropogon abyssinicus* Fresen. (1837); *Hyparrhenia abyssinica* (Hochst. ex A. Rich.) Roberty (1960) - types: Ethiopia, TU, Ocbasa, *Quartin Dillon* s.n. & *Ouodgerate*, *Pettit* s.n. & Mt Scholoda, *Schimper* 407 (all K isosyn.).

Andropogon monatherus A. Rich. (1850); *Hyparrhenia monathera* (A. Rich.) Schweinf. (1867), comb. invalid. ante publ. gen. - type: Ethiopia, TU, Shire [Chiré], *Quartin Dillon & Pettit* s.n. (P holo.).

Tussocky perennial; culms erect, up to 1.5 m high. Leaf-blades 10–50 cm long, 1–4 mm wide, glabrous or thinly pilose, scabrid on the upper surface, the tip setaceous; leaf-sheaths with auricles up to 2 cm long adnate to the scarious ligule. Spathate panicle scanty, sometimes reduced to only 1 or 2 raceme-pairs; spatheoles 8–14 cm long, linear; peduncles long, filiform, flexuous; raceme-bases glabrous, the lower 1–2(–5) mm long, the upper filiform, 10–25 mm long. Racemes each composed of 2 homogamous spikelet-pairs below a single deciduous triad of one awned, fertile, sessile spikelet supported by 2 male pedicelled spikelets. Homogamous

spikelets oblong, 12–20 mm long, often purple-tinged. Sessile spikelet 10–15 mm long (including a fulvously bearded callus c 2.5 mm long), glabrous or pubescent; awn 4–11 cm long, the column pubescent with fulvous or pallid hairs. Pedicelled spikelets narrowly lanceolate, 12–15 mm long, purplish, tipped with an awn-point up to 7 mm long; pedicels fulvously ciliate. Fig. 144.

A common constituent of upland grassland, penetrating up into *Erica* bushland; 1700–3100 m. EW TU GD GJ WG SU AR KF GG SD BA HA; Sudan (Imatong Mts.), East Africa, Zambia and Malawi. *Ash* 2234; *Mooney* 5182; *Gilbert & Phillips* 9221.

The end-to-end racemes of a pair mimic a single raceme with 2 large, stout awns. The conspicuous papery homogamous spikelets protect the developing fruit, remaining at the peduncle-tip after the fertile triad (including the awn) has been shed, and at this stage can be puzzling to beginners.

150. *THEMEDA* Forssk. (1775)

Tufted annuals or perennials, sometimes very tall; leaf-blades linear; ligule a ciliolate membrane. Inflorescence compound, the basic unit composed of a single short raceme embraced by a spatheole; spatheoles solitary or commonly gathered into wedge-shaped clusters on fine, flexuous branches, the clusters aggregated into a false panicle. Raceme few-spiculate, 2 pairs of homogamous spikelets at the base forming a conspicuous, persistent involucre; internodes and pedicels reduced to small oblique stumps. Homogamous spikelets large, herbaceous, lanceolate-oblong, flat, male. Sessile spikelets 1–2(–4), subterete; callus usually pungent; lower glume hard, coriaceous; upper glume awnless; lower floret reduced to a hyaline empty lemma; upper lemma stipitiform, entire, awnless or passing directly into a geniculate awn with hairy column. Pedicelled spikelets resembling the homogamous, larger than the sessile, awnless; callus elongate; resembling a pedicel.

18 species in the tropics and subtropics of the Old World, mainly in Asia.

The detailed structure of the racemes and spikelets of *Themeda* and *Heteropogon* is very similar and the two genera are closely related, despite the different facies of their inflorescences.

T. triandra Forssk. (1775);

- type: Yemen, *Forsskål* s.n. (C holo., destr.).

Anthistiria punctata A. Rich. (1850); *Themeda triandra* Forssk. var. *punctata* (A. Rich.) Stapf in *Fl. Trop. Afr.* 9: 419 (1919) - types: Ethiopia, TU, Mt Scholoda [Selleuda], *Schimper* 73 & *Doehli*, *Schimper* 1555 & *Memsah*, *Quartin Dillon* s.n. (all P syn., K isosyn.).

Themeda triandra Forssk. var. *hispida* Stapf in *Fl. Trop. Afr.* 9: 418 (1919).

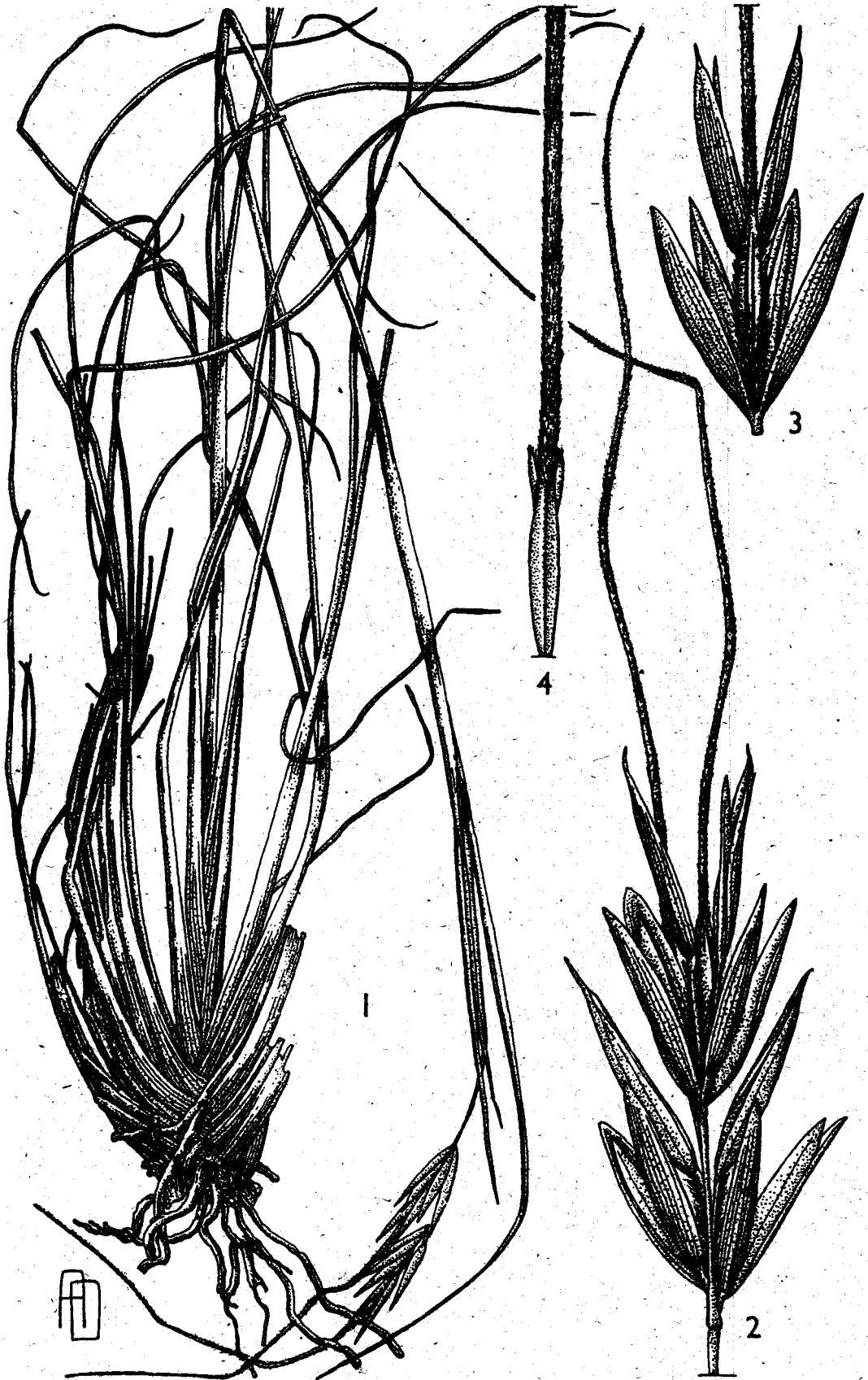


Figure 144. *EXOTHECA ABYSSINICA*: 1 - habit x $\frac{4}{5}$; 2 - raceme pair x $\frac{2}{5}$; 3 - lower raceme x $\frac{2}{5}$; 4 - upper lemma and base of awn x 5. 1 from Mwangangi 355; 2-4 from Grassl 46-13. Drawn by Ann Davies. (Reproduced from *Fl. Trop. E. Afr. Gramineae* 3: Fig. 188, with permission of the Editors).

T. triandra Forssk. var. *sublaevigata* Chiov. in *Webbia* 8: 61 (1951) - types: Ethiopia, SD, El Banno, *Corradi* 1153 (FT syn.) and many other syntypes.

Tough tussocky perennial from a short rootstock; basal sheaths compressed, finally fibrous; culms 30 cm to 1.5 (-2.5) m high. Leaf-blades flat or folded, 5-25 cm long, 2-6 mm wide, pale green or glaucous, scaberulous, glabrous or pilose, acute. Compound panicle lax and open with spaced, often nodding spathate clusters; spatheoles narrowly lanceolate, russet or purplish, glabrous or thinly to densely tuberculate-hispid; raceme composed of a triad of one sessile and two pedicelled spikelets above the two homogamous pairs. Homogamous spikelets all sessile, arising at the same level, 8-14 mm long from a bulbous base, pale green with lateral scarious wings, glabrous or hispid from prominent pallid or blackish tubercles. Sessile spikelet 4-6.5 mm long; lower glume usually dark brown at maturity, glossy, smooth except for the spinulose tip; callus 2-3 mm long, pungent, rufously bearded; awn 3.5-8 cm long, golden-brown to blackish. Pedicelled spikelets narrower than the involucral, 7-9 mm long, glabrous or tuberculate-hispid. Fig. 145.

Grassland; also grassy areas in bushland, disturbed open woodland and along pathsides; 700-2800 m. EW TU GD WU SU AR KF GG SD BA, HA; tropical and subtropical regions of the Old World. *M.G. & S.B. Gilbert* 1415; *Hemming* 1054; *Mooney* 5831.

Themeda triandra is a widespread polymorphic species, and a common or sometimes dominant constituent of grassland in Africa, especially in the east and south where it is a favoured pasture grass. It is often dominant in the South African veld ("Rooigras").

The species is predominantly apomictic with a range of ploidy levels, and a number of varieties have been described. These are based on differences in habit and in the hairiness of the spatheoles and spikelets, but are poorly correlated with chromosome number or geographical distribution and are of little significance. *T. triandra* is actually fairly uniform in Ethiopia, most plants being slender and of moderate height, with conspicuously hispid spatheoles and spikelets, the hairs arising from black tubercles (var. *punctata*). However, plants from Kaffa and adjoining parts of Gamo Gofa are mostly more robust, with stout, densely leafy culms up to 2.5 m high.

151. HETEROPOGON Pers. (1807)

Annuals or perennials; leaf-blades linear; ligule membranous, sometimes with a ciliate fringe. Inflorescence of solitary racemes, these terminal or gathered into a spathate panicle; peduncle included to long-exserted. Raceme dense with imbricate spikelets, 2 to several pairs of homogamous spikelets at the base; internodes and pedicels reduced to short oblique stumps obscured by hairs on the backside of the sessile spikelet callus.

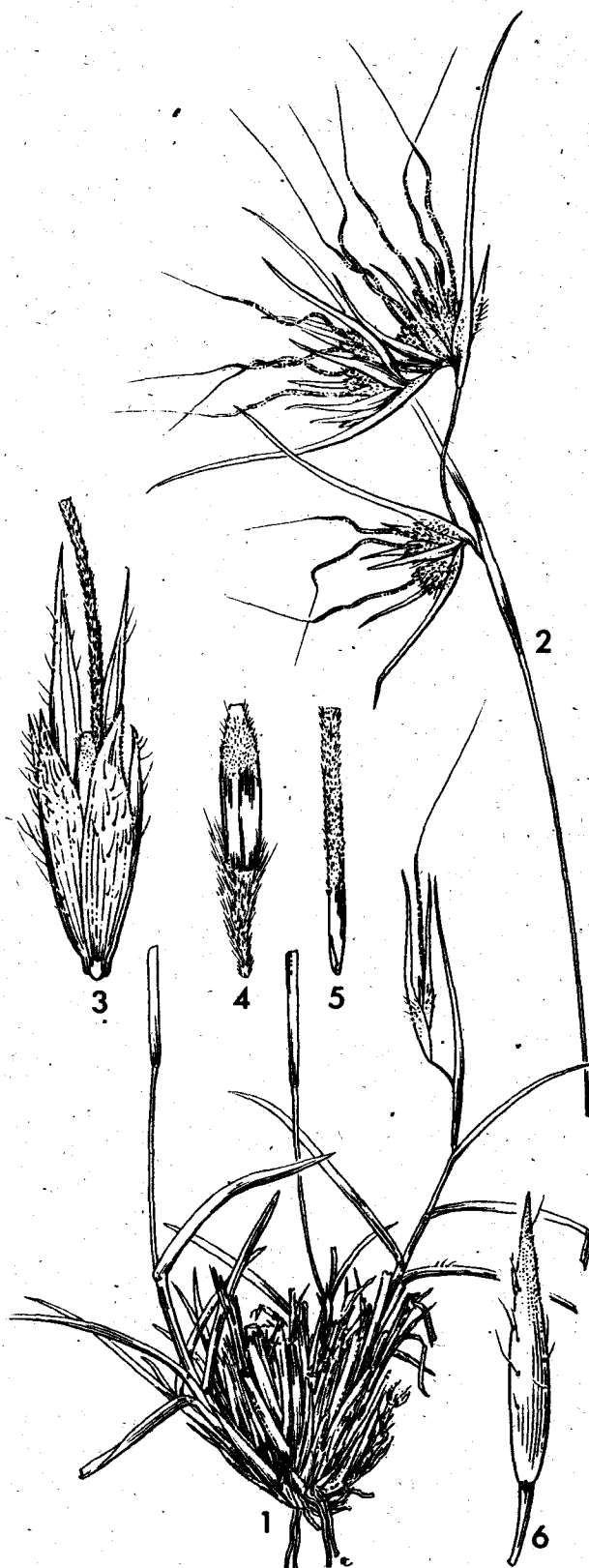


Figure 145. *THEMEDA TRIANDRA*: 1 - base of plant x 3/4; 2 - inflorescence x 3/4; 3 - raceme x 3; 4 - sessile spikelet and callus x 4 1/2; 5 - base of awn x 4 1/2; 6 - pedicelled spikelet x 4 1/2. 1, 3-6 from *Gillett* 14234; 2 from *Mooney* 6103. Drawn by Eleanor Catherine.

Homogamous spikelets herbaceous, flat, lanceolate-oblong. Sessile spikelets subterete; callus elongate, pungent; lower glume hard, coriaceous, convex, obtuse; upper glume awnless; lower floret reduced to a hyaline empty lemma; upper lemma stipitiform, the tip not lobed, passing directly into a stout geniculate awn with hairy column. Pedicelled spikelets male or sterile, resembling the homogamous, larger than the sessile spikelets, awnless; callus elongate, resembling a pedicel.

6 species throughout the tropics, extending to warm temperate regions.

1. Tufted perennial; homogamous and pedicelled spikelets not glandular. 1. *H. contortus*
- Annual; homogamous and pedicelled spikelets with pitted glands along the midline of the lower glume. 2. *H. melanocarpus*

1. *H. contortus* (L.) Roem. & Schult. (1817);
Andropogon contortus L. (1753) - type: India, illustration in Plukenet, Phyt., fig. 191/5 (1692).
Heteropogon hirtus Pers. (1807).
Heteropogon hispidissimus Hochst. ex A. Rich. (1850), in synon.; *Andropogon hispidissimus* Hochst. ex Steud. (1954) - type: Ethiopia, TU, Gafata, Schimper 1219 (K iso.).
Heteropogon contortus (L.) Roem. & Schult. var. *glaber* Hack. (1883).

Tufted perennial, the basal leaf-sheaths keeled; culms slender, erect or ascending, 40 cm to 1 m high. Leaf-blades flat or folded, 4–25 cm long, 3–6 mm wide, the tip obtuse or shortly acute to apiculate. Racemes mostly long-exserted, terminal or gathered into a scanty spathate panicle; spatheoles linear, tightly rolled round the peduncle, tipped with a reduced blade. Racemes narrowly cylindrical, 4–7 cm long, 8–10-awned, homogamous spikelet-pairs occupying the lower 1/4–2/3 of the raceme; homogamous spikelets resembling the pedicelled. Sessile spikelets 5.2–6.5 mm long, dark brown; callus 2–3 mm long, fiercely pungent, rufously bearded; lower glume linear, hispidulous; awn 5–10 cm long, dark brown, the column white-hirtellous, the tips of successive awns often twisting tightly together. Pedicelled spikelets 6–11 mm long, green with lateral, asymmetrical, scarious, yellow-brown wings, glabrous or sparsely to densely pilose or tuberculate-hispid or setose with white spreading bristles. Fig. 146.

Wooded grassland and bushland, on dry sandy soils or stony hillsides; sometimes the dominant undercover, 700–2400 m. EW TU WU SU AR KF GG SD BA HA; throughout the tropics and subtropics, extending to warm temperate regions. Burger 904; Edwards & Towns Berhan 3888; Gilbert & Getachew 2777.

The single, narrowly cylindrical racemes of overlapping green spikelets, with stout brown intertwining awns emerging from the upper part, are very characteristic of this species. The entangled awn-tips often cause the sessile spikelets to spring out in a splayed bunch,

exposing the needle-sharp calluses which effect dispersal.

The species is extremely polymorphic in habit, hairiness of the spikelets and also physiologically, different races being adapted phenologically to differing rainfall regimes [discussed by Tothill in *Bol. Soc. Arg. Bot.* 12: 188–201 (1968)]. It is known to be apomictic and to possess several different chromosome numbers.

2. *H. melanocarpus* (Ell.) Benth. (1881);
Andropogon melanocarpus Ell. (1816) - type: U.S.A., Georgia, Habersham s.n. (K iso.).
Andropogon polystictus Steud. (1854) as "polystichus"; *Heteropogon polystictus* (Steud.) Hochst. (1856) - type: Ethiopia, TU, Dscheladscheranne, Schimper 2012 (P hol.).

Erect annual; culms solitary, usually robust, 0.5–2.5 m high, supported below by stilt roots. Leaf-blades up to 50 cm long and 10 mm wide, acuminate; leaf-sheaths spotted with glands especially along the keel. Racemes gathered into a spathate panicle; spatheoles green, linear-lanceolate, glandular; peduncle c 1/2 as long as the spatheole, scarcely exserted. Racemes 3–6 cm long, 1–3 homogamous pairs at the base; homogamous spikelets resembling the pedicelled, acuminate. Sessile spikelets 5–7 mm long, blackish-brown; callus 3–4.5 mm long, sharply pungent, rufously bearded; lower glume narrowly oblong, hispidulous; awn 9–12 cm long with hirtellous column, blackish when mature. Pedicelled spikelets 15–25 mm long, green, glabrous, lanceolate-caudate, laterally asymmetrically winged, pitted with glands and transversely puckered along the midline.

Clearings in *Acacia-Commiphora* woodland and on bushy rocky slopes. 1100–1300 m. TU SD BA; tropical Africa, Oman to central India; tropical and warm temperate America. Friis et al. 2713; Gilbert & Sebsebe 8677; Gilbert, Sebsebe & Vollesen 8309.

Immediately recognizable by the large caudate pedicelled spikelets with a conspicuous median glandular band.

152. ELIONURUS Willd. (1806)

Renvoize in *Kew Bull.* 32: 665–675 (1978).

Tufted perennials or occasionally annual; leaf-blades flat or convolute; ligule a narrow ciliate membrane. Inflorescence a solitary flattened raceme, terminal or axillary and spathate, usually white-hairy; rhachis internodes and pedicels columnar to narrowly clavate, disarticulating very obliquely. Sessile spikelet with a large cuneate callus, the disarticulation scar oblique; lower glume narrowly lanceolate or elliptic, subcoriaceous, dorsally flattened and laterally keeled, conspicuously ciliate on the keels, the tip usually bifid; lower lemma sterile, without a palea, marginally 2-nerved, clasping the upper lemma; upper lemma entire, awnless, its palea absent or vestigial. Pedicelled spikelet well developed, a little smaller than the sessile spikelet.



Figure 146. *HETEROPOGON CONTORTUS*: 1 - habit x 1; 2 - 2 pairs of spikelets x $3\frac{1}{2}$; 3 - lower glume of sessile spikelet x $3\frac{1}{2}$; 4 - upper lemma and base of awn x $3\frac{1}{2}$. All from *Vesey-Fitzgerald 1232/5*. Drawn by D. Erasmus. (Modified from *Fl. Iraq* Vol. 9, *Gramineae*, pl. 203, with permission of the Editors).



Figure 147. *ELIONURUS* spp.: *E. ROYLEANUS*: 1 - habit x 3/4; 2 - spikelet pair x 7. *E. MUTICUS*: 3 - inflorescence x 3/4; 4 - spikelet pair x 7. 1 & 2 from *Baldrati* s.n.; 3 from *Pichi Sermolli* s.n.; 4 from *Mooney* 7745. Drawn by Eleanor Catherine.

15 species; tropical Africa and America, one species in Australia.

1. Tufted perennial; racemes solitary, terminal; lower glume keels of sessile spikelet evenly ciliate. 1. *E. muticus*

— Slender annual; racemes axillary, spathate; lower glume keels of sessile spikelet warty, the hairs tufted. 2. *E. royleanus*

1. *E. muticus* (*Spreng.*) *Kuntze* (1898);
Lycurus muticus *Spreng.* (1827) - type: Uruguay,
Sellow s.n. (whereabouts unknown).
Elionurus argenteus *Nees* (1841).

Andropogon caespitosus *A. Rich.* (1850); *Elionurus argenteus* *Nees* var. *caespitosus* (*A. Rich.*) *Hack.* in *DC., Monogr. Phan.* 6: 340 (1889) - type: Ethiopia, TU, Djeladjeranne [*Tchélatchékanné*], *Quartin Dillon* s.n. (P holo.).

Densely tufted perennial, the base clothed in the charred remains of old leaf-sheaths; culms erect, wiry, up to 90 cm high, usually simple, occasionally sparsely branched. Leaf-blades tough, convolute, mainly basal. Racemes 5–12 cm long, flexuous, conspicuously hairy with silky-white hairs; rhachis-internodes and pedicels densely silky-villous. Sessile spikelet narrowly lanceolate; lower glume 5–8 mm long, the keels evenly ciliate

and bordered by a brown oil-line, hirsute on the back, narrowed to a bifid tip; lower lemma shortly ciliate along the margins; upper lemma 3-nerved, similarly marginally ciliate. Pedicelled spikelet 4–7 mm long, thinly hairy, acuminate. Fig. 147:3, 4.

Dry, open wooded grassland, flowering after the annual burn; up to 2000 m. TU WG; tropical and South Africa; Yemen; tropical and subtropical America. *Moo-ney* 7745.

2. *E. royleanus* Nees ex A. Rich. (1850);

Andropogon elegantissimus Steud. var. *abyssinica* Steud., *Syn. Pl. Glum.*: 364 (1854) - type: Ethiopia, GD, left bank of Tacazze R., *Schimper* 795 (K iso.).

E. royleanus A. Rich. var. *albiflorus* Terrac. in *Ann. Ist. Bot. Roma* 5: 94 (1894) - type: Eritrea, Ras Morah, *Terracciano* 1555 (FT holo.).

E. royleanus A. Rich. var. *insularis* Terrac. in *Ann. Ist. Bot. Roma* 5: 94 (1894) - type: Eritrea, Haressan to Ferehan, *Terracciano* 1553 (FT holo.).

E. royleanus A. Rich. var. *niveus* Chiov. in *Nuov. Giorn. Bot. Ital.*, n.s. 19: 416 (1912) - type: Eritrea, Hamasen, Ghinda, *Fiori* 1211 (FT holo.).

Delicate tufted annual; culms very slender, 10–30 cm high, fasciculately branching at the upper nodes to produce clusters of racemes, each raceme partially enclosed within a reddish spathe. Leaf-blades narrowly linear, pubescent above, glabrous or with scattered setae on the lower surface. Racemes 3–5 cm long; rhachis-internodes and pedicels laterally bearded, the internodes with a conspicuous apical tuft of spreading hairs to 5 mm long, a scarios lobe surrounding the disarticulation scar. Sessile spikelet 11–14 mm long; lower glume body narrowly elliptic, the keels provided with a row of coarse warts, each wart bearing a tuft of hairs up to 4 mm long, glume back pallid, glabrous to villous, the tip deeply bifid, each tooth extended into a flattened, marginally ciliate tail 1.5–2 times the length of the glume body, warts and apical teeth reddish; lemmas glabrous, the upper 1-nerved. Pedicelled spikelet lacking warts, both glumes caudate. Fig. 147:1, 2.

Open places on dry, stony or sandy soils; sea level-1200 m. EE EW TU GD SU BA; N Uganda and Kenya; westwards to Mauretania and the Cape Verde Is.; eastwards through Arabia to NW India. *Bally* 6949; *Gilbert & Getachew* 3074; *Ruspoli & Riva* 1139 (592).

The tufts of white hairs borne on a row of large warts along the keels of the sessile spikelets are easily visible, and provide a good spot character for this species. Only two other species of *Elionurus* have hairs arranged similarly in tufts on warts, *E. elegans* Kunth and *E. hirtifolius* Hack. These are both West African (*E. hirtifolius* extends east to Sudan), and furthermore the lower glume tip is only produced into two short bristles, not long flattened lobes as in *E. royleanus*.

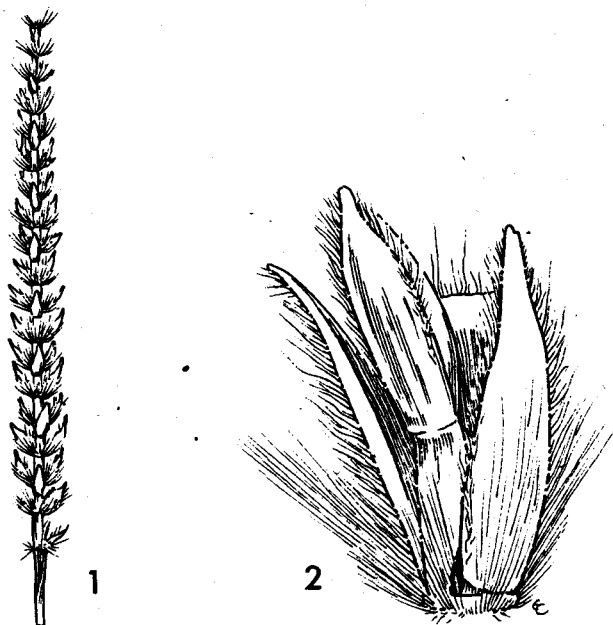


Figure 148. *LASIURUS SCINDICUS*: 1 - inflorescence x 3/4; 2 - spikelet triad x 9. 1 from *Burger* 3210; 2 from *Hemming* 1069. Drawn by Eleanor Catherine.

153. *LASIURUS* Boiss. (1859)

Cope in *Kew Bull.* 35: 451–452 (1980).

Perennial; leaf-blades linear; ligule shortly ciliate. Inflorescence a solitary, flattened, conspicuously villous raceme, terminal on the culms and branches, the spikelets usually arranged in triads of two sessile and one pedicelled at each node, the pedicel free but tightly erect, the two sessile spikelets projecting laterally (occasionally spikelets in pairs); rhachis internodes and pedicels columnar, flattened, disarticulating horizontally, the segments truncate at the base with a central peg, slightly widening to the shallowly cupuliform tip. Lower glume of sessile spikelet subcoriaceous, flattened, marginally 2-keeled, the tip shortly caudate and asymmetrically notched; florets similar, the lower male, lemmas entire, paleas equalling the lemmas. Pedicelled spikelet resembling the sessile but slightly smaller, male.

One species in subtropical, subdesert regions from Africa to NW India, extending southwards into Ethiopia, Somalia and tropical Arabia.

L. scindicus *Henr.* (1941);

- type: Pakistan, Sind, *Stocks* s.n. (L holo.).

L. hirsutus (Vahl) Boiss. (1859), comb. illegit. based on *Rottboellia hirsuta* Vahl (1790), nom. superfl.

Tough, glaucous perennial from a stout rhizome clothed in silky cataphylls; culms simple or much branched, up to 1 m high, sometimes suffrutescent and becoming woody at the base. Leaf-blades firm, flat or convolute, 3–6 mm wide, the margins cartilaginous. Racemes 6–12 cm long, silky-hairy; internodes shortly lanate laterally



Figure 149. *VOSSIA CUSPIDATA*: 1 - habit x 3/4; 2 - spikelet pair (sessile spikelet in front) x 3; 3 - spikelet pair (pedicelled spikelet in front) x 3. 1 from Meyer 7503; 2 & 3 from Bullock 436. Drawn by Eleanor Catherine.

along the edges, conspicuously ciliate around the outer border of the cupuliform tip with hairs to 6 mm long. Lower glume of sessile spikelet lanceolate, 6–9 mm long, densely ciliate on the keels. Pedicelled spikelet 4.8–6.8 mm long. Fig. 148.

A desert grass of dry, open plains, sometimes dominant and forming large hummocks which trap sand; sea level–500 m. EE AF; westwards to Mali, Somalia, Egypt, Arabia, Iraq, Pakistan and NW India. A valuable fodder grass in desert regions. *Bally* 6868; *Burger* 2159; *Hemming* 1069.

154. *VOSSIA* Wall. & Griff. (1836), *nom. conserv.*

Perennial; leaf-blades flat; ligule a short, ciliate membrane. Inflorescence terminal, composed of digitate racemes; racemes stout, rhachis internodes and pedicels thick, clavate, scabrid on the angles, disarticulating transversely, the segments rounded to subtruncate basally, without a central peg. Lower glume of sessile spikelet coriaceous, flattened, marginally 2-keeled, extended into a long, narrowly winged tail, scabrid on the keels and wing-margins; both florets similar, lemmas entire, paleas equalling the lemmas, the lower floret male. Pedicelled spikelet resembling the sessile, fertile.

One species in tropical Africa and India.

V. cuspidata (Roxb.) Griff. (1851);

Ischaemum cuspidatum Roxb. (1820) - type: Bangladesh (K icon).

Robust aquatic perennial; culms stout, spongy, several meters long, rooting below, trailing and floating, the inflorescences rising 1–2 m out of the water. Leaf-blades up to 1 m long, 5–20 mm wide with a broad, white midrib, acuminate; leaf-sheaths loose and papery, sometimes with irritant hairs. Inflorescence composed of 1–12 racemes 10–30 cm long. Lower glume of sessile spikelet with a narrowly ovate body 7–9 mm long, extended into a flattened tail 1–3 cm long. Pedicelled spikelet slightly narrower. Fig. 149.

Aquatic grass of lake margins, swamps and the open water of streams and rivers, forming dense stands and also floating mats; 1500–2000 m. AF WU SU; tropical Africa and in India. *Meyer* 7503; *Parker* E430; *Ensermu* 132 (ETH).

This grass flowers only infrequently.

155. *COELORHACHIS* Brogn. (1831)

Clayton in *Kew Bull.* 24: 309–314 (1970).

Perennials (rarely annual), often tall; leaf-blades usually linear, flat; ligule short, membranous. Inflorescence a single raceme, rarely terminal, usually axillary and many gathered into a spathate compound panicle. Racemes cylindrical or dorsi-ventral with imbricate spikelets, disarticulating horizontally; rhachis internodes shortly clavate, truncate at the base with a central peg, deeply cupuliform at the tip, shorter than the sessile

spikelet; pedicel free, clavate or foliaceous. Lower glume of sessile spikelet shallowly convex, crustaceous to thinly coriaceous, smooth or sculptured, laterally keeled, the keels winged towards the tip; lower lemma sterile without a palea; upper lemma entire. Pedicelled spikelet well developed or vestigial.

About 20 species occurring throughout the tropics.

C. afraurita (Stapf) Stapf (1917);

Rottboellia afraurita Stapf (1908) - type: Mali, *Chevalier* 232 (P holo.).

Robust perennial; culms erect, 1.3–4 m high, strongly compressed below, the base surrounded by imbricate, keeled leaf-sheaths. Leaf-blades linear, flat or folded, up to 100 cm long, 5–15 mm wide. Racemes 3–7 cm long, dorsiventral, numerous, fastigate in the upper leaf-sheaths, each enclosed basally by its spatheole; pedicel clavate with a narrow auricular extension on one side at the top. Sessile spikelet narrowly oblong, 3.5–4.5 mm long; lower glume smooth with conspicuous, rounded wings. Pedicelled spikelet well developed, 3–4.5 mm long, similar to the sessile but narrower, the lower glume winged only on one keel. Fig. 150.

Marshy grassland; up to 1700 m. SU KF; tropical Africa. *Friis* et al. 2079; *Gilbert* 3532.

C. afraurita can be distinguished from the other tall Andropogonoid grasses in Ethiopia with spathate, unawned inflorescences by its unique combination of a conspicuously winged lower glume and an auriculate pedicel.

156. *HEMARTHRIA* R. Br. (1810)

Perennials, often with procumbent, stoloniferous culms. Leaf-blades linear; ligule a narrow, ciliate membrane. Inflorescence composed of axillary racemes, these solitary or gathered into fascicles in the upper leaf-axils. Racemes flattened, dorsi-ventral; rhachis internodes stout, clavate, fused to the adjacent pedicel, articulation line usually oblique but racemes tough, not disarticulating. Sessile spikelet with a triangular callus; lower glume coriaceous, dorsally flattened, smooth, marginally 2-keeled, obtuse to caudate-acuminate; upper glume firm, adherent to the fused internode and pedicel; lower lemma sterile without a palea; upper lemma entire with a palea half its length. Pedicelled spikelet well developed, similar to the sessile spikelet but transversely inserted without a callus, its upper glume acuminate-caudate.

12 species in the Old World tropics and subtropics, also possibly native in America. In or near water. At first sight it is difficult to distinguish the sessile and pedicelled spikelets because they look very similar, and as the pedicel is fused to the rhachis internode, both spikelets are in effect sessile. However, only the sessile spikelet has a triangular callus and an oblique articulation line beneath it. The racemes are strongly



Figure 150. *COELORHACHIS AFRAURITA*: 1 - base of plant x 3/4; 2 - inflorescence x 3/4; 3 - section of raceme x 9; 4 - spikelet pair with pedicelled spikelet and rhachis-internode in front x 9. All from *Gilbert* 3532. Drawn by Eleanor Catherine.

bilateral, all the sessile spikelets lying on one side and all the pedicelled spikelets on the other. Only the sessile spikelets are important for distinguishing the two species present in Ethiopia.

1. Lower glume of sessile spikelet acute to acuminate; racemes usually in fascicles of 3–5, 4–6 cm long. **1. *H. natans***
- Lower glume of sessile spikelet obtuse with minute membranous wings at the tip; racemes single or paired, 5–10 cm long. **2. *H. altissima***

1. *H. natans* Stapf (1917);

– types: Malawi, Scott s.n. & Buchanan 1310 (both K syn.).

Procumbent, stoloniferous, dull purplish-green perennial; culms compressed, rooting at the lower nodes, up to 2.5 m long, the fertile shoots ascending to 50 cm. Leaf-blades flat, 2–5 mm wide. Racemes 4–6 cm long, gathered in fascicles of (1–)3–5 in the upper leaf-axils, usually scarcely exerted from the axillary sheath. Sessile spikelet elliptic-oblong, the lower glume 3.5–6 mm long, acute to acuminate or caudate-acuminate, sometimes minutely bifid; upper glume acute to acuminate. Pedicelled spikelet narrowly lanceolate, 4.5–7 mm long, acuminate. Fig. 151:3, 4.

Wet soil of river margins; 1000–1200 m. SU GG; southwards through East Africa to Malawi and Angola. Ash 2268; M.G. & S.B. Gilbert 1291.

H. natans is often a lower-growing species than *H. altissima*, with a tendency to shorter racemes which are commonly grouped in fascicles in the leaf-axils. The lower glume of the sessile spikelet varies from merely acute to long-acuminate, and may also be minutely notched, but is always definitely pointed, in contrast to the broad tip with rounded, narrow wings of *H. altissima*.

2. *H. altissima* (Poir.) Stapf & C.E. Hubb. (1934);

Rottboellia altissima Poir. (1789) – type: Algeria, Poiret s.n. (P holo.).

Stoloniferous, dull purplish-green perennial; culms decumbent and rooting at the lower nodes, compressed, up to 2.5 m long, eventually ascending up to 1.5 m high. Leaf-blades flat, 3–4 mm wide. Racemes 5–10 cm long, arising singly or in pairs from the upper leaf-axils. Sessile spikelet elliptic-oblong; lower glume 4.5–6 mm long, narrowed to an obtuse, often emarginate tip bordered by very narrow, rounded, membranous wings; upper glume obtuse to acute. Pedicelled spikelet narrowly lanceolate, 4.5–6 mm long, obtuse to acute. Fig. 151:5.

Wet soil of lake and river margins; up to 2000 m. SU KF; westwards to Senegal; Tanzania southwards to the Cape; shores of the Mediterranean; isolated records from SE Asia; introduced to tropical America. De Wilde 10932; Stewart 76.

157. HACKELOCHLOA Kuntze (1891)

Annuals; leaf-blades flat; ligule a narrow ciliate membrane. Racemes single, dorsio-ventral, axillary, gathered into a spathate compound panicle; rhachis internodes and adjacent pedicel fused, flattened, stoutly oblong; rhachis disarticulating horizontally, the segments obliquely truncate at the base with a prominent central peg, cupuliform at the tip. Lower glume of sessile spikelet globose, much broader than the internode, crustaceous, rugose and pitted; upper glume hyaline and partially adhaerent to the enclosing internode below, thickening upwards towards the crested tip; both lemmas hyaline without paleas, entire. Pedicelled spikelet narrowly ovate, readily disarticulating, herbaceous, both glumes keeled and winged, the florets much reduced and sterile.

2 species, one occurring throughout the tropics, the other confined to E Asia.

H. granularis (L.) Kuntze (1891);

Cenchrus granularis L. (1771) – type: “India orientalis” (LINN holo.).

Tufted annual; culms usually erect, up to 100 cm high. Leaf-blades linear-lanceolate, 4–20 cm long and 5–12 mm wide, subamplexicaul, coarsely hispid; leaf-sheaths slightly inflated. Racemes 1–2 cm long. Sessile spikelet pallid, 1–1.5 mm long; lower glume coarsely reticulate-rugose, the whole surface finely granular. Pedicelled spikelet 1.5–2.5 mm long; glumes with prominent green nerves and whitish wings, the lower asymmetric, laterally keeled with one keel winged, the upper with a median winged keel. Fig. 151: 1, 2.

Woodland, pathsides and as a weed of disturbed ground; 1200–2000 m. EW TU GD WG SU GG SD; throughout the tropics. Gilbert & Thulin 240, 661; Parker E251.

A readily recognizable species on account of its globose, wrinkled sessile spikelets.

158. ROTTBOELLIA L.f. (1779) nom. conserv.

Clayton in *Taxon* 29: 692 (1980).

Robust annuals; leaf-blades linear, flat; ligule a narrow membrane. Inflorescence composed of single racemes, terminal or axillary and gathered into a spathate compound panicle. Racemes narrowly cylindrical, readily disarticulating horizontally into short, stout segments; rhachis internodes stoutly oblong, deeply cupuliform at the tip, truncate at the base with a conspicuous central peg broadened into a flared eliosome; sessile spikelet sunk within the rhachis; pedicelled spikelet tightly erect, the pedicel broad and fused to the adjacent internode. Sessile spikelet oblong; lower glume coriaceous, smooth, shallowly convex, marginally 2-keeled; upper glume deeply convex,



Figure 151. *HACKELOCHLOA GRANULARIS*: 1 - habit x 3/4; 2 - raceme x 7. *HEMARTHRIA* spp.: *H. NATANS*: 3 - habit x 3/4; 4 - section of raceme x 7. *H. ALTISSIMA*: 5 - lower glume of sessile spikelet x 7. 1 & 2 from M.G & S.B. Gilbert 1609; 3 from De Wilde 10932; 4 & 5 from Parker 251. Drawn by Eleanor Catherine.

cartilaginous, obscurely winged on the keel upwards; lower lemma male, hyaline, its palea of equal length, thinly cartilaginous with hyaline flaps; upper floret hyaline, the lemma entire. Pedicelled spikelet of similar shape, male, the lower glume herbaceous.

4 species in the Old World tropics; introduced to America.

The delicate fertile floret is well protected deep within the tough box formed by the fused rhachis internode and pedicel, and closed by the lower glume of the sessile spikelet. The thickened palea of the lower floret provides an additional layer of protection. The eliosome at the base of each rhachis segment, revealed only when the raceme disarticulates at maturity, attracts ants which aid in dispersal (Davidse in *Grass systematics and evolution*, p. 149, 1987).

R. cochinchinensis (Lour.) Clayton (1981);

Stegosia cochinchinensis Lour. (1790) - type: Vietnam, Cochinchina, (whereabouts uncertain).

Rottboellia exaltata L.f. (1781), nom. illegit.; Simon in *Taxon* 31: 564 (1982), nom. cons. prop. & in *Taxon* 34: 659 (1985).

R. arundinacea A. Rich. (1850) - type: Ethiopia, TU, Djeladjeranne, Schimper 1459 (K iso.).

Coarse annual with stilt roots; culms erect, stout, 1–3 m high, branching above, the racemes axillary from the upper leaf-sheaths. Leaf-blades broadly linear, flat, up to 50 cm long and 2.5 cm wide, acuminate; lower leaf-sheaths coarsely hispid with stiff, irritant hairs. Racemes 6–15 cm long, stiff, pallid except for the green pedicelled spikelets, green and herbaceous with reduced spikelets towards the tip. Sessile spikelet 4–5.5 mm long; lower glume oblong, obtuse or emarginate. Pedicelled spikelet 4–6 mm long; lower glume keels scabrid and obscurely winged upwards, tip obtuse and emarginate or shortly bifid. Fig. 152:4, 5.

Disturbed situations in open grassland, roadsides and as a weed of cultivation; 700–1600 m. EW TU GJ SU IL KF GG; throughout the Old World tropics; introduced to America. *Ash* 2241; *Mooney* 8843; *Friis* et al. 3951 (ETH).

R. cochinchinensis has increased rapidly in recent years to become a widespread and serious arable weed in the tropics.

159. **OPHIUROS** Gaertn. (1805)

Annual or perennial; leaf-blades flat, linear to lanceolate; ligule a membranous rim. Inflorescence composed of single, spathate racemes gathered into fascicles in the upper leaf-axils to form a compound panicle; racemes narrowly cylindrical, pedicelled spikelets absent, sessile spikelets alternating on either side of the rhachis and sunk within it, pedicel fused to the adjacent rhachis-internode, often scarcely discernable; rhachis disarticulating horizontally, the base truncate with a prominent central peg, the tip cupuliform. Lower glume

of sessile spikelet oblong, laterally keeled, crustaceous, shallowly convex, smooth or pitted; upper glume thinly cartilaginous, free from the internode; lemmas entire, with paleas, the lower male or sterile.

4 species; NE tropical Africa, India to China, SE Asia and Australia.

O. papillosum Hochst. (1844);

Ophiurus aethiopicus Rupr. ex Steud. (1854), nom. superfl.; *Rottboellia papillosa* (Hochst.) Dur. & Schinz (1895) - type: Sudan, Sennaar, Kotschy 192 (K iso.).

Robust annual; culms stout, erect, 75–120 cm high. Leaf-blades and sheaths coarsely tuberculate-hispid; blades broadly linear, to 25 cm long and 15–25 mm wide, subcordate at the base, crinkled and pectinate-hispid along the margins. Racemes 6–8 cm long, numerous, spikelets pallid, rhachis internodes green. Lower glume of sessile spikelet 2–3 mm long, longitudinally grooved and pitted, sometimes rather indistinctly, obtuse and minutely emarginate. Fig. 152:1–3.

Open plains and as a weed of *Sorghum*, on clay soils; up to 1700 m. EW GD (Sudan border); E Sudan. *Pappi* 333; *Schweinfurth* 1100.

A grass of very local distribution, known only from east-central Sudan and adjacent parts of Ethiopia. Within this area it is often abundant, and is reported to be a troublesome weed of *Sorghum* fields in Sudan.

160. **ZEA** L. (1753)

Mangelsdorff, *Corn: its Origin, Evolution and Improvement* (1974); Galinat in Sprague, *Corn and Corn Improvement* (1977); Wilkes, *The Origin of Corn* (1977); Doebley and Iltis, *Taxonomy of Zea*, in *Amer. J. Bot.* 67: 982–993 & 994–1004 (1980).

Zea is a small genus comprising cultivated maize or corn, the widespread staple cereal of tropical regions, and its wild relatives (the teosintes). Maize was domesticated in antiquity in Central America from a wild teosinte. It was brought to Europe soon after the discovery of America, and its cultivation rapidly spread throughout the tropics of the Old World. It is now the world's third largest crop after wheat and rice, and is the main cereal in Africa. It is also extensively grown in tropical and warm temperate regions for forage and as a source of oil and syrup.

Z. mays L. (1753);

- type from America.

Robust annual; culms 1–3 m high depending on cultivar, often with stilt roots; leaf-blades large, broadly linear. Spikelets unisexual, separated into male and female inflorescences. Male inflorescence (the tassel) terminating the culm, composed of many digitate or paniculate racemes; racemes tough, the spikelets paired,



Figure 152. *OPHIUROS PAPILLOSUS*: 1 - base of plant x 3/4; 2 - inflorescence x 3/4; 3 - section of raceme x 7. *ROTTBOELLIA COCHINCHINENSIS*: 4 - upper part of inflorescence x 3/4; 5 - spikelet pair x 7. 1 from Sherif 4009; 2 & 3 from Ismail 3263; 4 & 5 from Ash 2241. Drawn by Eleanor Catherine.



Figure 153. *ZEA MAYS*: 1 - habit showing terminal male inflorescence and lateral female inflorescence x 1/5; 2 - part of male inflorescence x 4/5; 3 - infructescence with sheathing bracts x 2/5. All from living material, Kew. Drawn by D. Erasmus. (Reproduced from *Fl. Iraq* Vol. 9 *Gramineae*, pl. 215, with permission of the Editors).

one sessile and one on a slender pedicel, spikelets of a pair alike, chartaceous, awnless, 2-flowered with both florets male. Female inflorescence (the ear) axillary, composed of a thick axis bearing the spikelets in longitudinal rows (the cob), the whole enclosed in enveloping sheaths; spikelets paired, all sessile, partially sunk into the axis; 2-flowered with the lower floret sterile; glumes and lemmas chaffy, awnless; styles long and silky, projecting from the tip of the ear; mature grains plump, much larger than the spikelet scales, very variable in shape and colour. Fig. 153.

Maize was introduced to Ethiopia in the 16th century by the Portuguese, and there is much genetic diversity among the present Ethiopian genepool (Nigatu, Progress report on maize improvement program for moisture stress areas. Addis Ababa University, 1985). It is the major food crop in western and southern Ethiopia (WG IL KF GG SD) and is also grown extensively in other parts of the country, especially on silty loam soils at altitudes of 1000–2400 m.

161. *COIX* L. (1753)

Robust annuals or perennials; culms branching, solid; leaf-blades broad and flat; ligule membranous. Inflorescences many, axillary, each subtended by a hard, globose or elongated utricle (a modified leaf-sheath with a membranous prophyll within); each inflorescence composed of 2 racemes, a sessile female raceme enclosed within the utricle and a pedunculate male raceme subtended by the prophyll and exerted from the utricle mouth; female raceme of one sessile spikelet accompanied by 2 stout pedicels; male raceme of imbricate spikelets borne in pairs or triads, 1(–2)

sessile and 1 pedicelled. Female spikelet: glumes orbicular, membranous with a cartilaginous beak, the upper keeled; lower floret reduced to an orbicular membranous lemma; upper floret with membranous lemma and palea, the 2 stigmas exerted from the utricle. Male spikelet lanceolate to elliptic-oblong; lower glume flat across the back, marginally 2-keeled, the keels winged upwards; upper glume boat-shaped; both florets with membranous lemma and palea, lower floret as long as the spikelet, upper floret shorter. Grain globose, the embryo as long as the grain.

About 5 species in tropical Asia; one species introduced throughout the tropics.

C. lacryma-jobi L. (1753);

- type: Indies (LINN holo.).

Coarse tufted annual; culms erect, 1–3 m high. Leaf-blades cauline, linear-lanceolate, 10–45 cm long, 2–7 cm wide, cordate at the base. Utricle 5–15 mm long, typically globose-ovoid, bony, glossy, white, bluish or greyish-brown. Male raceme 3–5 cm long, the spikelets 7–8 mm long.

Native to marshes in Asia, but now distributed throughout the tropics (Job's Tears). The bony utricles are sometimes used as beads and it is occasionally cultivated in many parts of the tropics for this purpose. It is also sometimes grown as a fodder or grain crop (not in Ethiopia).

There is much variation in the size, shape, hardness and colour of the utricle (see Mimeur in *Rev. Bot. Appliq.* 31: 197, 1951). Only var *lacryma-jobi*, which has large, hard, ovoid utricles, is suitable as a source of beads.

A GLOSSARY OF BOTANICAL TERMS FOR POACEAE

- abaxial** - the side facing away from the axis; the lower surface of a leaf
- abortion** - the failure of a part to develop fully; suppression of a part usually present
- acicular** - needle-like; very narrow, stiff and pointed
- aculeate** - prickly
- acuminate** - with a tip that tapers gradually to a slender point
- acute** - with a tip that comes to a sharp point with straight-sided edges, not tapering
- adaxial** - the side facing the main axis; the upper surface of a leaf
- adnate** - when an organ or part is united to a different organ or part
- afro-alpine** - a distinct vegetation zone found above 3500-3800 metres on Tropical African mountains
- allopolyploidy** - the type of polyploidy found in organisms of hybrid origin with three or more sets of chromosomes derived from different taxa (for example *Triticum aestivum*, bread wheat)
- ample** - large, copious; usually referring to a panicle
- amplexicaul** - used for leaf-blades where the base clasps the stem
- anastomosis** - union of one vein with another, the connections forming a network
- androecium** - the male structures of a flower; the stamens
- anemophilous** - pollinated by wind
- annual** - a plant which completes its life cycle in one growing season and then dies; all the shoots bear inflorescences
- annular** - arranged in a circle or in a ring
- anther** - the part of the stamen producing the pollen, divided into pollen-sacs or pouches called *thecae*; in grasses borne on a stalk (filament)
- anthesis** - the time when the flower is open and pollination takes place
- anthocyanins** - water-soluble pigments giving pink, red, purple, violet or bluish colours to spikelets or vegetative parts of plants
- antrorse** - directed forwards, the opposite of retrorse
- apex** - the tip or end-point of a structure
- apical** - concerning or at the apex
- apiculate** - ending abruptly in a short sharp point
- apomixis (apomictic)** - the production of seeds without normal sexual fertilization
- appendage** - a part added or attached to another, usually larger, structure
- appressed** - lying close or pressed flat against a surface or axis
- approximate** - lying close together
- aquatic** - living in water
- arable** - referring to weeds of cultivated ploughed land
- arborescent** - attaining the size of a tree (bamboos)
- aristate** - with an awn
- aristulate** - diminutive of aristate
- aromatic** - fragrant due to essential oils in the plant tissues
- articulated** - with joints or nodes where a part will naturally separate at maturity
- ascending** - a shoot which curves obliquely upwards from the base before turning to grow upright
- asperulous** - slightly rough, with little hard points
- asymmetric** - without any symmetry
- attenuate** - gradually narrowed
- auricle** - an ear-like lobe or appendage, usually at the junction of leaf-sheath and blade
- auriculate** - with an auricle
- autopolyploidy** - the type of polyploidy found in organisms with three or more sets of chromosomes derived from the same taxon
- awn** - a bristle arising from a spikelet part: see also aristate
- awnless** - without an awn
- axil** - the upper angle formed between the axis and an organ or branch arising from it
- axillary** - in or arising from an axil
- axis** - the main stem or branch on which other organs are arranged
- barbellate** - armed with short stiff spines
- barren** - sterile, without functional male or female parts
- basal** - found at the base of a structure
- bearded** - with a tuft of long hairs
- bi-** - a prefix meaning "two" or "twice"
- biennial** - living for two growing seasons; usually producing only vegetative growth in the first season, and flowering and fruiting in the second
- bifid** - deeply divided into two parts
- bilateral** - when a structure has only one plane of symmetry; if cut along this plane the two halves are mirror images of each other
- binomial** - the scientific species-name composed of two words; the first is the generic name, the second the specific epithet
- biseriate** - having two series
- bisexual** - having both sexes and producing both male and female gametes. Bisexual florets have both functional stamens and pistils
- blade** - the flat part of a leaf; synonymous with lamina
- bloom** - whitish waxy covering on a surface
- bract** - a usually small structure modified from a leaf and associated with an inflorescence, including spathes, spatheoles, and spikelet scales
- bracteate** - having bracts
- bristle** - a stiff hair
- bristle-hair** - long glassy hairs among shorter indumentum in the spikelets of some *Digitaria*
- bud** - an undeveloped shoot that may give rise to a branch or a flower
- bulbous** - with a swollen base of a culm resembling a bulb
- bulliform cells** - relatively large, thin-walled, colourless cells of the adaxial epidermis of the leaf-blade, lying in the furrows between the ribs
- bundle-sheath** a ring of cells surrounding a vascular bundle; in grasses the sheath may consist of one or two cell layers; if double the inner consists of smaller, thick-walled cells
- burr** - a spiny cluster of spikelets which falls as a single unit.
- C₃** - photosynthesis in which atmospheric carbon is first fixed in 3-carbon chains; indicated anatomically by irregular chlorenchyma with four or more cells between adjacent bundle-sheaths. Characteristic of temperate and shade-loving grasses
- C₄** - photosynthesis in which carbon is first fixed in 4-carbon chains; indicated anatomically by only two to four chlorenchymatous cells between adjacent bundle-sheaths (Kranz anatomy). Characteristic of tropical grasses
- caducous** - falling off quickly
- caespitose** - forming a tussock
- calcareous** - alkaline soils and rock, such as limestone
- callus** - a hard projection at the base of a floret, spikelet or inflorescence segment, indicating a disarticulation point
- capillary** - hair-like
- capitate** - like the head of a pin
- capitellate** - diminutive of capitate
- cartilaginous** - hard and tough, gristly
- caryopsis** - a modified achene in which the seed and the ovary-wall (pericarp) have become united; characteristic of the grasses
- cataphyll** - scale-leaf, especially on rhizomes and at the base of the plant
- caudate** - abruptly ending in a long, narrow, tail-like tip
- cauline** - borne on or arising from the stem

- chartaceous** - with paper- or parchment like texture; thin and opaque
- chlorenchyma** - green assimilating tissue
- chromosome** - found in the nucleus; an organised structure composed of DNA, RNA and histones, carrying genes
- ciliate** - with a fringe of hairs along the margin
- ciliolate** - diminutive of ciliate
- cinereous** - a dark grey or ash-colour
- clasping** - used for leaf-bases that partly or completely enclose the stem
- clavate** - club-shaped, thickened at the end
- cleistogamous** - spikelets which do not open for pollination and are therefore obligately self-fertilizing
- climbing** - used to describe plants that use other plants or objects as a means of support but have their roots in the ground
- clone** - a population of plants all having the same genetic makeup, usually produced by vegetative reproduction or pseudosexual reproduction in which seeds are produced without sexual fertilization taking place - see apomixis
- coleoptile** - in monocotyledons, the sheath around the plumule of the embryo and emergent seedling
- coleorhiza** - in monocotyledons, the sheath around the radicle of the embryo
- collar** - pallid or purplish zone at the junction of leaf-sheath and blade
- column** - the lower twisted portion of a geniculate awn, or the part below the awn branching-point in *Aristidaea*
- compound** - referring to inflorescences made up of a number of small constituent inflorescences (as in some *Andropogoneae*), or a raceme or spike with some secondary branching
- compressed** - flattened or pressed together, either from side to side (laterally compressed) or from front to back (dorsally compressed)
- concave** - curving inwards, hollowed out
- congested** - crowded
- conical** - cone-shaped
- conjugate** - coupled (e.g. paired racemes in *Paspalum*)
- connate** - when parts of the same kind are united
- contiguous** - when neighbouring parts are touching
- contracted** - drawn together, narrowed
- convolute** - rolled up from one side, with one margin outside and the other at the centre of the roll
- cordate** - heart-shaped
- coriaceous** - with a thick and firm texture, similar to leather
- corymbose** - an inflorescence of racemes borne along a short axis but with their tips at the same level (e.g. *Euclasta*)
- cosmopolitan** - found throughout the world
- cotyledon** - the seed leaf, the first leaf produced by the germinating seed
- crateriform** - bowl-shaped
- cross fertilization, cross pollination** - where the ovules of one plant are fertilized by pollen from another plant with a different genetic make-up
- crustaceous** - hard, thin and brittle
- culm** - the flowering stem of a grass plant
- culm-sheath** - modified leaf on a young bamboo culm with an expanded sheath and much reduced blade, usually deciduous as the culm matures
- cultivar** - a variety of plant that has been developed under cultivation and selected by man
- cuneate** - wedge-shaped
- cupular** - cup-shaped
- cuspidate** - with the tip abruptly narrowed to a point
- deciduous** - falling off
- decumbent** - lying on the ground at the base and then curving upwards
- decurrent** - extended below the point of insertion, running down
- deflexed** - bent abruptly downward or outward; the opposite of inflexed, and often used as synonymous with reflexed
- deltoid (deltate)** - shaped like an equal-sided triangle
- dentate** - with a toothed margin, the teeth pointing outwards, not forward; compare serrate
- denticulate** - diminutive of dentate
- depressed** - pressed down or flattened from above
- di-** - a prefix meaning "two"
- diaspore** - a plant part that breaks away from the parent to develop into a new individual
- diffuse** - of branching that is open or loosely spreading
- digitate** - where the parts are attached to the same point, like the fingers of an outstretched hand
- dimorphic** - occurring in two forms
- dioecious (dioecious)** - plants with unisexual spikelets in which the male and female spikelets are not found on the same plant; the plants are either male or female but not both
- diploid (2n)** - having twice the basic (haploid) number of chromosomes
- disarticulate** - to separate at a joint
- discoid** - orbicular in outline with flattened sides
- disseminule** - a plant part that breaks away from the parent to develop into a new individual; synonymous with diaspore
- distal** - the part or end furthest away from the base or point of attachment; the opposite of proximal
- distant** when similar parts are widely spaced
- distichous** - arranged in two opposing ranks along the opposite sides of the stem
- distinct** - free and separate from other parts
- divaricate** - spreading apart widely and in different directions
- divergent** - spreading apart but not as widely as in divaricate
- divided** - separated almost to the base
- dormant** - a structure or organ which is not active
- dorsal** - the back or side away from the stem or central axis
- echinate** - covered with short spines or prickles
- effuse** - spreading widely
- elaiosome** - an outgrowth containing oil which is attractive to ants and aids in the dispersal of the seed
- ellipsoid** - an elliptical three-dimensional structure
- elliptic** - a two-dimensional shape broadest in the middle and rounded and equally narrowed at each end, with the length about twice the width
- emarginate** - with a notch at the apex
- embryo** - the initial stage in the development of a plant while still enclosed within the seed and made up of a radical (which will produce the roots), the plumule (which will produce the stem and leaves), and the cotyledon (seed leaf)
- endemic** - native to and confined to a particular geographic region; not found in other areas
- endosperm** - the food reserve tissue in the seed, arising from the female gametophyte and forming the bulk of the grass fruit
- entire** - with an even and continuous margin lacking lobes or teeth
- ephemeral** - a plant with a very short life cycle which is completed in a few weeks; typical of many weeds
- epidermis** - outermost layer of cells on an organ
- erect** - a plant which is quite upright, growing straight upwards
- erose** - having an irregularly toothed margin of gnawed appearance
- ex** - latin meaning "out of" when linking two authors names indicating that the specific epithet was proposed by the first author but published by the second
- ex-** - a prefix indicating the lack or absence of something
- excurrent** - going out beyond the margin of an organ (as a nerve going beyond the margin of a lemma)
- exserted** - projecting outside or beyond the edge

- extravaginal** - branching in which the young shoot breaks through the base of the leaf-sheath (opposite of intravaginal)
- facies** - general appearance of a plant
- falcate** - curved like a scythe or sickle
- falsely petiolate** - when the leaf-blade is narrowed towards the ligule, giving the appearance of a petiole
- fascicle** - a close cluster of structures arising from about the same point
- fasciculate** - borne in fascicles
- ferruginous** - rust-coloured, brownish red
- fertile** - containing an ovary which will produce a seed; the opposite of sterile
- fertilization** - the union of pollen and ovule to produce a seed
- fibrous** - composed of separable threads or fibres
- filament** - a thread-like structure; the slender stalk that supports the anther
- filiform** - thread-like
- flabellate** - fan-shaped or broadly wedge-shaped
- flaccid** - soft or weak, limp, wilted; the opposite of firm or stiff
- flank** - the side of an organ
- flexuous** - having a wavy form, bent alternately in opposite directions
- floret** - in grasses, the individual unit of a spikelet comprising a lemma and palea with enclosed reproductive organs (see Figure 1, p. xviii)
- foliaceous** - like a leaf
- fragile** - falling apart easily along a line of abscission
- free** - not united with or adherent to any other structure
- free threshing** - of cereals, when the grain is easily separated from the husk (lemma and palea)
- fruit** - ripened ovary, in grasses the grain or caryopsis
- fulvous** - tawny or dark yellow or yellowish-brown in colour
- furrowed** - with channels or grooves parallel with the long axis
- fuscous** - grey-brown or dark greyish-brown
- fusiform** - spindle-shaped, thick in the middle and narrowing at both ends
- fusion** - when two or more organs grow together
- geniculate** - bent like a knee
- genotype** - the genetic make-up of an individual
- germination flap** - a patch of thinner tissue at the base of some hardened lemmas (especially in *Panicaceae*), which allows the root of the germinating embryo to emerge
- gibbous** - bulging or inflated on one side
- glabrescent** - becoming glabrous; nearly hairless
- glabrous** - without hairs
- gland** - a secretory structure, usually found on the surface or sunk into the surface of an organ (leaf, inflorescence, etc.)
- glandular** - bearing or containing glands
- glaucous** - pale bluish-green, often due to a white waxy covering
- globose** - a spherical structure
- glomerate** - in a compact cluster or group of clusters
- glume** - one of a pair of empty scales at the base of a spikelet
- glutinous** - covered with a sticky or glue-like substance
- grain** - the caryopsis or naked fruit of a grass
- granular** - covered in little knobs or tubercles, less pronounced than tuberculate
- gregarious** - growing in colonies containing many individual plants
- gynoeceium** - the female part of the flower
- gynomonoecious** - used for a species which has both female and bisexual flowers on the same plant, no male flowers are present
- habit** - the overall appearance of a plant
- habitat** - the environment or plant-community in which the plant occurs
- halophyte** - a plant growing in and tolerating high concentrations of salt in the soil or in the air
- haploid (n)** - possessing a single set of chromosomes
- head** - an inflorescence of closely packed spikelets that is more or less round
- hemi-** - a prefix meaning "half"
- herbaceous** - when referring to texture, soft and thin
- hilum** - the scar on the caryopsis marking the site of attachment of the pericarp and testa. It is on the side opposite the embryo
- hirsute** - with rather coarse hairs, shaggy
- hirtellous** - minutely hirsute
- hispid** - stiffly hairy
- hispidulous** - with a covering of small stiff hairs
- homogamous pair** - in *Andropogoneae*, spikelet-pairs sometimes present at the base of the raceme which are alike in sex and appearance (male or sterile), in contrast to the usual arrangement in this tribe of spikelets of a pair of different sex and appearance
- homogamous spikelets** - in *Andropogoneae*, the spikelets of a homogamous pair, often resembling the pedicelled spikelets or assuming a protective involucre function
- homologous** - of the same origin; as bracts being homologous with leaves
- hyaline** - thin, colourless and almost transparent
- hybrid** - produced by crossing two different taxa of plants
- hygroscopic** - absorbing moisture from the air, for example in awns leading to a twisting movement
- icon** - latin meaning "illustration"
- imbricate** - overlapping like the tiles of a roof
- incanate** - hoary, of greyish-white appearance
- included** - not projecting beyond the rim
- incompatibility** - the inability of pollen to fertilize an ovule and form a seed
- incurved** - curving inward or bent inward
- indigenous** - native to a region, not introduced
- indurated** - hardened
- inflated** - swollen like a bladder
- inflexed** - turned sharply inwards
- inflorescence** - the flowering portion of a plant
- infra-** - a prefix meaning "below"
- infundibular** - funnel-shaped
- inserted** - borne or growing out from
- inter-** - a prefix meaning "between"; compare with intra-
- intercalary** - arising between the base and apex, often referring to a meristem occurring elsewhere than at an apex
- intercarinal** - between the keels
- internode** - the part of an axis between two adjacent nodes
- interrupted** - with broken continuity, applied to dense inflorescences with occasional gaps
- intra-** - a prefix meaning "within"; compare with inter-
- intravaginal** - branching in which the young shoot grows up inside the leaf-sheath, emerging at the sheath mouth (opposite of extravaginal)
- introduced plant** - a plant that has been brought in from another region and is not native to the region under discussion
- introgression** - a series of hybrid generations in which the hybrid individuals breed back into one parental species, hence introducing into that species characteristics of the other parental species, giving rise to intermediates
- involucre** - a series of structures of varying origin surrounding a fertile spikelet or cluster of spikelets, and either enhancing protection of the developing seed or aiding in its dispersal (e.g. the bristles in *Pennisetum*, the homogamous spikelets in *Themeda*)

- involucre-scar** - the scar remaining on the axis after an involucre has fallen away (e.g. in *Pennisetum*)
- involucre-stump** - a small stalk remaining after an involucre has fallen away
- involute** - with both edges rolled inwards: compare convolute
- keel** - a sharp fold or ridge running the length of the organ on the outer or under surface; like the keel or bottom of a boat
- keeled** (= carinate) - with a longitudinal ridge running along the under surface of a flat or convex structure
- Kranz anatomy** - the ring of bundle-sheath cells prominent and only 2-4 chlorenchymatous cells between adjacent sheaths. Indicative of the C4 photosynthetic pathway
- lacerate** - torn, deeply and irregularly divided
- lacinate** - slashed, cut into narrow tapering lobes
- lamina** - the flat part of a leaf, the blade
- lanate** - covered with long soft woolly hairs
- lanceolate** - with the shape of the end of a lance or spear, widest in the basal third and tapering to the tip, about three times longer than wide
- lateral** - on the side
- lax** - loose and not crowded together
- leaf-blade** - the distal expanded part of a grass leaf, the lamina (see Figure I, p. xiv)
- leaf-sheath** - the basal part of the grass leaf which normally encloses a culm-internode (see Figure I, p. xiv)
- lemma** - the lower of the two bracts enclosing the grass flower and together with the palea comprising a floret; also called the flowering glume (see Figure I, p. xiv)
- ligule** - a membrane or line of hairs on the inner (adaxial) side of the junction of the leaf-sheath and leaf-blade (see Figure I, p. xiv)
- limb** - the distal untwisted part of a geniculate awn above the column
- linear** - long and narrow with parallel edges, more than ten times longer than wide
- littoral** - found on the shore of a lake, sea, or ocean
- lobe** - a rounded area along the margin bounded by two indentations or sinuses
- lodicule** - small scale-like or fleshy structure at the base of the stamens in the floret of grasses, usually 2 in each floret. They become turgid at anthesis, causing the lemma and palea to gape open
- lyriform** - in the shape of a harp (lyre)
- membranous** - of a thin and translucent texture
- meristem** - an embryonic tissue present in all growing parts in plants; the cells can divide and produce new structures as well as producing cells capable of further division
- midrib** - the principal or central nerve or rib of a leaf
- monoecious** - when the male and female spikelets are borne on the same plant; the spikelets are unisexual but the plant is bisexual
- muco** - a short point, usually a continuation of the midrib and terminal on a spikelet part
- mucronate** - with a muco
- mucronulate** - diminutive of mucronate
- muricate** - with a rough surface covered with short hard projections or tubercles
- muticous** - without a muco or awn
- naturalized** - introduced from a foreign area and now established and growing successfully in the new area
- navicular** - shaped like a boat
- nerve** - in plants the word nerve is often used in place of vein or vascular bundle
- node** - the place on a stem where a leaf or bud arises
- non** - latin meaning "not"
- non-shattering** - applied to spikelets which remain entire at maturity and do not shed the grain (mainly cereals)
- ob** - a prefix meaning "inverse"
- oblong** - a plane shape longer than broad with nearly parallel sides, almost rectangular in outline but with rounded ends and with the length about twice the width
- obovate** - a plane shape with an egg-shaped outline but with the broadest part near the apex and the narrow side near the base
- obovoid** - egg-shaped but with the broadest part near the apex and the narrow part near the base; the solid or 3-dimensional form of obovate
- obsolete** - applied to an organ which is scarcely apparent or has not developed
- obtuse** - with a blunt or rounded end; compare acute
- opaque** - something that does not allow light to pass through, a surface that is dull and not lustrous or shiny
- orbicular** - a flat structure with an almost circular outline
- ovary** - the female part of the flower which contains the ovule and which will produce the fruit if pollination (and fertilization) takes place
- ovate** - a flat structure which is egg-shaped in outline with the broadest part near the base and the narrow part near the apex; compare elliptic and oblong
- ovoid** - egg-shaped with the broadest part near the base and the narrow part near the apex; the solid or 3-dimensional form of ovate
- ovule** - an organ which contains the embryo sac and the egg cell within the ovary; after fertilization it develops into the seed
- palea** - the upper and inner scale of the grass floret which encloses the stamens and ovary; usually 2-keeled
- pallid** - pale in colour
- panicle** - in grasses, an inflorescence in which the primary axis bears branched secondary axes with pedicellate spikelets (see Figure II, p. xv)
- pappilose** - covered with minute tubercles or papillae
- papyraceous** - papery
- patent** - widely spreading
- pectinate** - divided to form many parallel parts like the teeth of a comb
- pedicel** - the stalk of a single spikelet within an inflorescence
- pedicellate** - with a pedicel
- pedicel-tooth** - in *Hyparrhenia*, a tooth-like prolongation of the pedicel
- peduncle** - the stalk of a raceme or cluster of spikelets
- pendulous** - hanging down or drooping
- penicillate** - with a brush-like tuft of hairs
- perennating** - surviving from one growing season to the next; a structure or organ which enables a plant to survive a non-growing season
- perennial** - living for several years; distinguished from annual by the presence of old leaf-remains at the base, non-flowering shoots, and sometimes perennating buds organs such as rhizomes
- pericarp** - the wall of the ripened ovary or fruit; in grasses usually fused to the seed but free in a few genera (e.g. *Sporobolus*, *Eleusine*)
- periphery** - along the margin or on the outside
- persistent** - remaining attached to the plant and not falling off
- phenological** - referring to the visible or biological manifestation of the genotype
- phylogenetic** - classification which attempts to reflect the evolutionary history of taxa
- phylogeny** - the evolutionary history of an organism or group of organisms
- pilose** - with a loose covering of soft long simple hairs
- plano-convex** - an organ which is flat on one face and convex on the other
- plicate** - folded into pleats like a fan
- plumose** - feathery, fluffy

- pollination** - the transfer of pollen from the anther to the receptive stigma; this is usually carried out by the wind in grasses, but may occasionally be effected by insects or other animals, especially in forest grasses
- polymorphic** - with a diversity of varying forms
- polyploidy** - with more than two complete sets of chromosomes; compare diploid and haploid
- prickle** - a small sharp outgrowth from the surface
- pro parte (proparte)** - often abbreviated p.p., meaning "in part only"
- procumbent** - lying along the ground but not rooting at the nodes; compare stolon
- prophyll** - a scale-like modified leaf with two keels
- prostrate** - lying flat on the ground
- protandrous** - when the anthers discharge pollen before the stigma (in the same floret) is receptive; the usual state in grasses
- protogynous** - when the stigma is receptive before the anthers (in the same floret) have discharged their pollen (e.g. *Anthoxanthum*)
- protologue** - the printed matter accompanying the first description of a taxon
- pruinose** - covered with a whitish wax or very fine powder
- puberulous** - covered with very short fine hairs or slightly hairy
- pubescent** - with a covering of short soft hairs
- pulvinus** - an enlargement or swelling, shaped like a cushion or pad, round and flattened, usually found at the base of inflorescence branches or pedicels
- punctate** - marked with dots or small glands
- punctiform** - dot-like, reduced to a small dot
- pungent** - ending in a sharp stiff point
- pyramidal** - pyramid-shaped
- raceme** - an unbranched axis bearing pedicellate spikelets; racemes may be solitary, digitate or scattered (see Figure II, p. xv)
- raceme-base** - short stalk beneath the individual racemes of a pair in some *Andropogoneae*
- raceme-base appendage** - a lobe-like extension sometimes present at the tip of the raceme-base
- raceme-pair** - pairs of racemes supported by spatheoles in the compound panicles of some *Andropogoneae*
- racemelet** - diminutive of raceme
- racemose** - arranged like a raceme
- radical** - pertaining to the roots
- rank** - a vertical row
- recurved** - curved backwards
- reduced** - not properly developed or underdeveloped
- reflexed** - bent abruptly backward towards the base
- reticulate** - with many interconnections as in a net; applied to a surface being marked by a network of fine lines or ridges
- retorse** - pointing abruptly backwards or downwards
- rhachilla** - the central axis of the spikelet which bears the florets
- rhachilla-extension** - a prolongation of the rhachilla beyond the uppermost (or single) floret
- rhachilla-internode** - the section of rhachilla between the insertion of two successive florets
- rhachis** - the axis of a raceme or spike
- rhizome** - an underground stem; differing from a true root in the presence of buds, leaves, or scales
- rib** - a primary vein or prominently raised vein or nerve
- riparian** - growing along the margins of rivers and streams
- rootstock** - a short, vertical, underground stem, bearing roots
- rostrate** - with a beak or beak-like projection
- rotund** - with a shape between orbicular and broadly elliptic
- ruderal** - weedy plants growing in waste places
- rudimentary** - incompletely developed
- rufous** - rusty or brownish red
- rugose** - with wrinkles or ridges in the surface
- rugulose** - diminutive of rugose
- rupturing** - breaking open irregularly
- saccate** - bag-shaped or sack-shaped, pouched
- sagittate** - arrow-shaped; the base has two acute lobes that point backwards
- scaberulous** - diminutive of scabrid
- scabrid (scabrous)** - rough to touch, usually caused by the presence of very short stiff prickles
- scandent** - a general term for climbing
- scarious** - thin and dry, not green
- sclerenchyma** - thick-walled cells providing mechanical support
- scrub** - more or less dense vegetation of small shrubs (up to about 3 m high)
- secund** - one-sided; as when branches or spikelets are all attached along one side of an axis
- seed** - the ripened ovule containing the embryo
- sensu** - Latin, meaning "in the sense of"
- sericeous** - with silky hairs that are soft and straight.
- serrate (serrulate)** - with teeth like those of a saw, the teeth more or less regular and pointing forwards; compare with dentate
- sessile** - without a pedicel, meaning "seated"
- seta** - a bristle or stiff hair
- setaceous** - like a bristle
- setose** - with a covering of bristles, similar to hispid
- sheath (sheathing)** - a tubular structure, as in the lower tubular part of a grass leaf which encloses the stem
- shoot** - a stem axis together with its leaves
- silica-body** - pieces of silica found in the epidermal cells of the leaf-blade; those in cells overlying the vascular bundles often of characteristic shape and of some diagnostic value
- simple** - not divided
- sinuous** - strongly wavy; compare undulate
- sinus** - a depression between two projecting lobes or teeth; the space between two lobes
- spathate** - with spathes or spatheoles
- spathe** - a bract or modified bladeless leaf subtending the inflorescence or a component of it
- spatheole** - a secondary spathe within a compound inflorescence in some *Andropogoneae*
- spiciform** - spike-like
- spiculate** - with spikelets
- spike** - an unbranched axis bearing sessile spikelets; spikes may be solitary, digitate or scattered (see Figure II, p. xv)
- spikelet** - the basic unit of a grass inflorescence; usually composed of two glumes and one or more florets on a rhachilla (see Figure I, p. xiv)
- spikelet-pair** - the arrangement of one sessile and one pedicelled spikelet arising from the same node characteristic of the *Andropogoneae*
- spine** - a hard sharp-pointed structure, often long and narrow
- spinose** - having spines
- spinulose** - diminutive of spinose
- spongy** - light in weight, porous, and compressible
- spontaneous** - wild growing, the opposite of cultivated
- stand** - a pure association of many plants of the same kind
- sterile** - without functional male and female parts; a sterile floret does not produce either pollen or a seed; synonymous with "barren". Non-flowering leafy shoots are also sometimes described as sterile
- stigma** - the portion of the pistil which is receptive to pollen
- stilt root** - adventitious roots from the lower nodes of the culm which help to support the plant

- stipe** - a stalk or downward projection beneath an organ that is part of that organ and not of the axis bearing it
- stipitate** - with a stipe
- stipitiform** - resembling a stipe
- stolon** - a stem which grows over the ground (a runner) rooting at the nodes and giving rise to new plants
- striate** - marked with longitudinal parallel ridges, grooves, lines, or streaks
- strict** - standing stiffly upright and straight
- strigillose** - diminutive of strigose
- strigose** - with short stiff hairs that lie close to the surface
- styles** - the slender branches above the ovary which bear the stigmas
- subspecies** - a unit of classification below the rank of species above the rank of variety; often used for geographical variants of a species
- subtend** - to extend under another structure
- subulate** - awl-shaped, very narrow and tapering to a fine tip from a broader base
- suffrutescent** - with many hard branches giving the appearance of a small shrub
- sulcus (sulcate)** - a longitudinal furrow
- suppressed** - not developed; synonymous with obsolete
- sward** - a close grassy turf, lawn
- taxon** - a general term for any unit of classification such as genus, species, variety etc.
- terete** - round in cross section
- terminal** - found at the end, at the apex
- ternate** - arranged in a cluster of three
- testa** - the outer coat of a seed
- tiller** - a leafy non-flowering shoot
- tomentellous** - diminutive of tomentose
- tomentose** - covered with dense short matted hairs
- tough** - not disarticulating, the opposite of fragile
- translucent** - partially transparent
- transverse** - across or at right angles to the long axis
- triad** - a group of three spikelets borne together
- trigonus** - three-angled
- trimerous** - with three parts
- triploid** - having three times the basic number of chromosomes
- triquetrous** - with three sharp angles
- truncate** - with the apex flat as if cut across at the top
- tubercle** - a swelling, knob or thickened protuberance on a surface, sometimes found at the base of a stiff hair
- tuberculate** - having tubercles
- turgid** - inflated, swollen
- tussock** - a tough dense tuft of basal leaves found in perennial grasses (see caespitose)
- uncinate** - with a hook at the end, as an uncinat hair
- undulate** - wavy; compare sinuate
- uni-** - a prefix meaning "one" or "single"
- uniseriate** - arranged in a single row
- unisexual** - having either functional stamens or a functional ovary but not both; the opposite of bisexual
- urceolate** - shaped like a water pot or urn; with a rounded base and short broad tube that is narrowed above and slightly expanded at the very top
- utricle** - a bladder-shaped structure
- utriculate** - with a utricle
- variety** - a unit of classification below the level of a species; varieties are separated on the basis of form and colour but are usually not geographically separated and individuals of different varieties can freely interbreed
- vascular bundle** - a strand of xylem and phloem which carries water and nutrients; a vein or nerve
- vein** - a small strand of vascular tissue; a nerve of leaf or spikelet scale
- venation** - the arrangement of the vascular bundles (veins, nerves)
- verrucose** - having a surface with raised projections or warts
- verticillate** - having parts arranged in whorls
- vestigial** - undeveloped or poorly developed, or a trace or mark left by a structure no longer developed but present in ancestral forms
- villous** - with a covering of long weak hairs, shaggy
- viscid** - sticky or glue-like
- viviparous** - when the seeds germinate to form seedlings on the parent plant
- whorl** - when several branches arise from the same node
- wing** - any flat or thin extension of an organ
- xerophytic** - able to live under very dry conditions and having structural adaptations for this

Adapted for *Poaceae* from the glossary in *Flora of Ethiopia*, Volume 3 (1989), with the addition of specialized grass terms mainly from Gibbs Russell et al., *Grasses of Southern Africa* (1990).

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VERNACULAR NAMES FOR THE GRASSES (214. POACEAE)*

Introduction

In the compilation and arrangement of the vernacular names for the grasses here in Volume 7, the same procedure has been used as was applied in Volume 3 with some modifications. In this volume, the languages are divided between two main groups. The first group comprises languages mainly from the north and central parts of the country where Ge'ez (Ethiopic) letters have been and are still in use. The second group consists of languages mainly spoken in the southern and central parts of the country where for some languages Latin (Roman) letters have already been in use for some time, while the others plan to use Latin script in the near future. Both Ge'ez and Latin scripts have been used in writing the vernacular names of the first group of languages while only Latin has been used for the names of the second group.

Names in Ge'ez script

There is some variation among languages in the way that the Ge'ez script is normally used to represent sounds. An effort has been made to avoid the possible use of a Ge'ez letter (FIDEL) in more than one way. This has been found desirable for ease of reading the names in the various languages without having to keep being constrained by the identity of the language. To make this possible, the following conventions and simplifications have been adopted throughout.

Consistency of the first form of a FIDEL: The first forms of the FIDELS ሀ, ሐ, ኀ, ለ, ዐ are usually read as if they were the fourth forms, ሃ, ሐ, ኃ, ላ, ዓ, and not in a consonant-vowel combination consistent with the other FIDELS ለ, መ, ጸ, በ, ከ, etc. as contrasted with ላ, ማ, ዳ, ባ, ከ, etc. There has been a recent tendency to disregard this old convention and to treat the five FIDELS ሀ, ሐ, ኀ, ለ, ዐ as if they were like the rest. This convention has been adopted here throughout. The FIDEL ሀ (he) is thus read the way ኸ is normally read in Amharinya, and ኂ is often forced to double in being read in Tigrinya, and the FIDEL ለ now replaces ኸ in Amharinya and the second use of ኂ in Tigrinya. This frees the FIDEL ኸ to be used exclusively as it is used in Tigrinya.

Avoidance of redundancy: In some of the Semitic languages of Ethiopia (Amharinya and Guragenya), the typical Semitic guttural sounds (ሐ, ኸ, ዐ) and one

palatal sound (ቸ) have been dropped. In Ge'ez, it is believed that the FIDEL ኀ was what is now written in Tigrinya and the other Semitic languages, which retain the guttural sounds, as ኸ. It is also believed that the Ge'ez ሀ was what has now come to be written as ኸ. For the sake of the cross-language consistency, the presumed old Ge'ez sounds of these FIDELS have been adopted here with ሀ being replaced by ኸ, and ኀ by ኸ. The FIDEL ሀ has thus been totally dropped, though ኀ has been retained as standing for the sound that is redundantly used for in Amharinya, i.e. as ሀ, but only in the diphthong form ኃ. Of the two identical sounding FIDELS, ኸ and ዐ, the second has been used.

Long and short vowels: In many of the Ethiopian languages, there are long and short vowels. It has not been possible to represent FIDELS to be read with long vowels as distinct from those read with short vowels.

Stress: In the Ge'ez script, no effort has been made to distinguish stressed from non-stressed FIDELS, though the usual doubling of consonants has been adopted to represent this in the Roman script. In ignoring to show stress in the Ge'ez script, the prevalent convention has been followed though this is not to be taken to mean that we belittle the useful convention of making stressed FIDELS through placing points over them. We have not adopted this useful system because we could not consistently apply it to all FIDELS.

Correspondence between the Ge'ez FIDELS and the Roman script: A number of sounds found in Ethiopian languages are often represented by combinations of Roman letters when this is done with a European readership in mind, for example she (ኸ), che or tche (ቸ or ጠ). Some transliteration letters are often used for more than one Ethiopian sound, particularly a (ላ, ዓ), ha (ሃ, ሐ, ኸ), ka (ከ, ቃ, ቆ). To avoid ambiguities, the equivalents given below have strictly been followed.

Vowels: The sixth forms of the Ge'ez glottal stops, ለ and ዐ, are represented by ' and ' respectively. The sixth forms of all other FIDELS are each represented by the consonant or the group of consonants in the case of sh (ኸ) standing for the sound without a vowel following it. The other forms are each represented by the appropriate consonant followed by -e for the first, -u for the second, -i for the third, -a for the fourth, -ie for the fifth, and -o for the seventh forms. The two glottal stops ለ and ዐ, when varying their forms, are represented by the former

* compiled by Mirutse Giday and edited by the staff of the National Herbarium

ARRANGED ALPHABETICALLY BY SCIENTIFIC NAMES

(with page number(s) to the main text)

- Acrachne racemosa* (137): BOLOIC (Arbore)
- Andropogon abyssinicus* (324): BAALLAMII (Orom.); ተራን ሳፊ QERAN SA'RI (Tya.); YELAMI SAR (Wel.)
- Andropogon amethystinus* (323): ተራን ሳፊ QERAN SA'RI (Tya.)
- Andropogon distachyos* (322): ጋሻ GASHA (Amh.); ተራን ሳፊ QERAN SA'RI (Tya.)
- Andropogon gayanus* (325): ጋሻ GAJA (Amh.); GAMBA GRASS (Eng.); ጋሻ GASHA (Tya.)
- Andropogon schirensis* (327): BAALLAMII (Orom.)
- Andropogon* spp. (319): ጋጋ GAGA, ጎመጎጎ GOMEጎ, ተቻ ሳር TUCA SAR (Amh.)
- Anthephora pubescens* (281): HAMASHLEH (Som.)
- Aristida adoensis* (80): MOUNTAIN NEEDLE GRASS (Eng.); ኢምብያ DMBYA (Tya.)
- Aristida adscensionis* (78): OS GARDA (Som.); THREE AWN GRASS (Eng.); ተምብያ ZUMBYA (Tya.)
- Aristida funiculata* (81): BIRREH (Som.)
- Aristida hordeacea* (81): ተምብያ ZUMBYA (Tya.)
- Aristida kelleri* (81): BIRRI (Som.)
- Aristida somalensis* (77): SADDEH ELI (Som.)
- Aristida* spp. (76): ፀጉሪ ሀበይ SEGURI HBEY (Tya.)
- Arthraxon prionodes* (310): DAGGAH GOR, HORRAJAR (Som.)
- Arundinaria alpina* (3): ጎጫ GOጫ' (Ge'ez); ላርታይ ARQAY (Tya.); CHINATO (Kef.); LEMMANNA (Orom.); መታ MEQA, ተርካሃ QERKEHA (Amh.); MOUNTAIN BAMBOO (Eng.); SHIKARO, SHINATO (Kef.); SHMALA (Orom.); WEYSHA (Gam.); WEYSHA (Wel.)
- Arundo donax* (66): GIANT REED (Eng.); LEMMANNA (Orom.); መታ MEKA (Amh.); REED GRASS (Eng.); SHAMBAKO (Kef.); SHAMBAKO (Orom.); ሸምባቶ SHEMBAQO (Tya.); ሸንባቶ SHENBEQO, ሸምባቶ SHEMBEKO (Amh.); SHEMBEQO (Wel.); ተጫጫ TEBISA (Ge'ez); YABELO (Orom.)
- Avena abyssinica* (35): ABYSSINIAN OAT (Eng.); AJANBILA (Orom.); ETHIOPIAN WILD OAT (Eng.); ጋሻ ጋሻ GAJA GACA, ጎጎጎ GNC (Amh.); ሳጎፊ SAK (Tya.); ሳር SINAR (Amh.)
- Avena fatua* (37): WILD OAT (Eng.)
- Avena sativa* (37): AJANBILA (Orom.); COMMON OAT (Eng.); ጎረጎ GEREMA (Amh.); OATS (Eng.); ሳጎፊ SAK (Tya.)
- Avena* spp. (33): ላኒናጎል ADNAWAL (Ge'ez)
- Avena sterilis* (37): ፋጎ FAA (Tya.)
- Avena vaviloviana* (35): ABYSSINIAN OAT (Eng.); ETHIOPIAN WILD OAT (Eng.)
- Bothriochloa insculpta* (306): DOMAR (Som.); SUTTO (Orom.)
- Bothriochloa radicans* (307): BAR BIYALEH, GEREB (Som.); SCEPELLA (Shan.); SUMARO (Orom.)
- Bothriochloa* spp. (305): ተራን ሳፊ QERAN SA'RI (Tya.)
- Brachiaria brizantha* (222): PALISADE GRASS (Eng.)
- Brachiaria deflexa* (228): ESHAT (Me.)
- Brachiaria jubata* (221): MINOR PALISADE GRASS (Eng.)
- Brachiaria lata* (229): ጠልጎ MELVESA (Agew)
- Brachiaria leersioides* (225): AGAR, WAILA SIDDEH (Som.)
- Brachiaria ovalis* (227): BULDORLE AGAR (Som.)
- Brachiaria ramosa* (228): ሮግጊ ROMADI (Tya.)
- Brachiaria semiundulata* (227): DURCETA (Orom.); ቶራቶጎ DURACET (Amh.); LAALUNCAA (Orom.)

- Brachiaria serrifolia* (225): ሳፊሪ ምሽብ ምሽብ SA'RI MSHELA QWELLA (Tya.)
- Brachiaria* spp. (218): ወርቁ ወርቁ WERQI WERQO (Tya.)
- Bromus leptoclados* (54): ተገም GONCO, ገም GOZO (Tya.); WOVILLO (Orom.)
- Bromus pectinatus* (54): BROME GRASS (Eng.)
- Cenchrus ciliaris* (276): ARUS (Som.); AFRICAN FOXTAIL (Eng.); ለይቤት AYBET (Tigre); BUFFEL GRASS (Eng.); CHAL GULFA (Orom.); DOGAREIC (Geleb); GABACABUDO, GARAW, GUWCHUFI (Som.); KULIZAN (Arbore); LAKACHALI (Bodi); OS DEMER, OS GERET (Som.); SCIUDI (Shan.); ምሽብ YADAB (Tigre)
- Cenchrus pennisetiformis* (278): CHAL GULFA (Orom.)
- Cenchrus setigerus* (278): BIRDWOOD GRASS (Eng.); AGAR, GARBI (Som.); PILA (Orom.)
- Chloris barbata* (168): ግሳላ MAKKAÉ (Tigre)
- Chloris gayana* (169): CHOQQORSSA, DAALACHA, DUMBALO (Orom.); ሓገ ሓገ ስላሪ ስላሪ (Tya.); MUTOBOKA (Orom.); RHODES GRASS (Eng.); ሳፊሪ ምሽብ SA'RI WAZA (Tya.); SCIUDDI (Shan.)
- Chloris pycnothrix* (169): FALSE STAR GRASS (Eng.)
- Chloris roxburghiana* (168): ARO ANE (Som.); SCIOHO (Shan.); AUS DOMAIR (Som.)
- Chloris* spp. (166): ምረቆለድ MRESELY, ሳፊሪ ወርቁት SA'RI MERAT (Tya.)
- Chloris virgata* (168): ብፊሪ ወርቁት B'RI MERAT (Tya.); BUSCKA (Shan.); MUTUBOKA (Orom.); OS ANOLE (Som.); ሳፊሪ ምሽብ SA'RI WAZA (Tya.)
- Chrysopogon aucheri* (304): SUMARO (Orom.)
- Coelachyrum poiflorum* (134): DOMAR, HUBNALI (Som.); MARGA HILLESSA, MARGA HILESSA (Orom.); ምሽብ ሳር YEJNCHEL SAR (Amh.)
- Cymbopogon caesioides* (328): ወርቁ ሳፊሪ ምሽብ SA'RI, ሳፊሪ ምሽብ SA'RI GAGYA (Tya.)
- Cymbopogon citratus* (328): CHITA SHBK HUSSEN (Orom.); LEMON GRASS (Eng.); MASARATA (Orom.); ምሽብ ሳር IBJ SAR (Amh.)
- Cymbopogon commutatus* (330): ስምሰላት SEMBELIET (Amh.); ስምሰላት ሳፊሪ SEQWAR SA'RI (Tya.)
- Cymbopogon nardus* (328): CITRONELLA GRASS (Eng.)
- Cymbopogon schoenanthus* subsp. *promixus* (329): ሳፊሪ ምሽብ SA'RI GAGYA (Tya.); ተረገት TRIHITO (Amh.)
- Cynodon dactylon* (175): BERMUDA GRASS (Eng.); CHOQQORSSA (Orom.); COMMON STAR GRASS, DOGS TOOTH GRASS (Eng.); DOMAR, DOMAR MEDU (Som.); DOOB GRASS (Eng.); SARDOO (Orom.); SCUTCH GRASS (Eng.); ሳፊሪ ተረገት SA'RI TEHAG, ተረገት TEHAG (Tya.); XIRRATE (Arbore)
- Cynodon nlemfuensis* (175): BERMUDA GRASS, STAR GRASS (Eng.); WARATHI (Orom.)
- Cynodon plectostachyus* (175): SCIUDI, SCIUDI ZARSI (Shan.)
- Cynodon* spp. (174): JERIBO (Som.); ተገም TEHAG (Ge'ez); ስርዶ ስርዶ (Amh.)
- Dactylis glomerata* (19): COCKSFOOT, ORCHARD GRASS (Eng.)
- Dactyloctenium aegypticum* (135): ለደግሀላ ADEGHELA (Tya.); AOS (Som.); ሳገለ DAGELLE (Tya.); EDANTEBELLEC (Arbore); HORBONOLE (Som.); MAKAWALLA (Orom.); SADDEH HO, SUDAHO (Som.); ተገለ TEKLE (Tigre)
- Dactyloctenium scindicum* (135): DOHIO, DOJO, DUIN, JADDOHO, OS HURBONADA (Som.); SADAHO, SADDEH HO (Som.); SCIOHO (Shan.); SUDAHO, SUDEH (Som.)

- Dichanthium annulatum* (308):
AJA MACCARE (Som.); AYA MUKKARE (Som.)
- Dichanthium foveolatum* (308):
MACHEN, SAREM, SAREN (Som.)
- Digitaria abyssinica* (252):
ABYSSINIAN COUCH GRASS, BLUE COUCH GRASS (Eng.); CHOQQORSSA (Orom.); GURTA (Som.); POTA (Wel.); URRÄ (Orom.); ጥርፍት WARIAT (Amh.)
- Digitaria ciliaris* (256): CRAB GRASS (Eng.); SCIUDDI (Shan.)
- Digitaria longiflora* (249):
YEBI OKI (Som.)
- Digitaria ternata* (248): HUFFEBH (Orom.); HUFFEBH (Som.); MAKAWALLA (Orom.); ተላግ TENAG (Tya.)
- Digitaria velutina* (254):
BULDORLE AGAR (Som.); SHUBBO (Orom.); VELVET CRAB GRASS (Eng.)
- Dinebra retroflexa* (105): ጥርፍላ BARCAO (Tya.)
- Drake-brockmania somalensis* (109): INASA (Geleb)
- Echinochloa colona* (212): አይቡድ AYBUD (Tigre); BARNYARD GRASS (Eng.)
- Echinochloa crus-galli* (213): አፍሲሶ AFSISSO (Tya.); አሳገላጥ ASSANDAWA (Amh.); BARNYARD GRASS (Eng.); OS SUGUL (Som.)
- Echinochloa haploclada* (212):
KERI (Bodi)
- Echinochloa pyramidalis* (213): አሰገላሶ ASENDABO (Amh. & Tya.); GARGARO (Orom.); GHIFTA (Shan.); GHIFTEN, GHIFTI, GHIFTIN (Arbore)
- Echinocloa* spp. (210): ASO (Som.)
- Echinochloa stagnina* (215): አሰገላሶ ASENDABO (Amh. & Tya.); SILIDE (Geleb)
- Ehrharta erecta* var.
abyssinica (12): GUSOMADOBEYE (Som.)
- Eleusine coracana* (139):
AFRICAN FINGER MILLET (Eng.); BARANCIA (Kon.); BARANIKA, DAGUJJAA (Orom.); ጥገሳ DAGUSA (Amh.); ጥገሻ DAGUSHA (Saho); ጥገሻ DAGUSHA (Tigre); ጥገሻ DAGUSHA, ጥገሻ ዐሊፆ DAGUSHA SELIM (Tya.); DAUCHO (Kef.); FINGER MILLET (Eng.); UEMBE, UEMBO (Som.)
- Eleusine floccifolia* (141):
AKRIMA (Orom.); አክርግ AKRMA (Amh. & Tya.); DAGOO (Orom.); GARRGORR (Som.); HITITI (Wel.); ርገሀ RGEHE (Tigre & Tya.)
- Eleusine indica* (141): ጥገሻ አድጊ DAGUSHA ADGI, ጥገሻ ከሊሊ DAGUSHA KEBBI, ጥገሻ ፆድሬ DAGUSHA MDRI (Tya.); HITITI (Orom.); HITITI (Wel.); WILD FINGER MILLET (Eng.)
- Eleusine jaegeri* (142): አርገሄ 'RGEHIE (Ge'ez); AKRIMA (Orom.); አክርግ AKRMA (Amh. & Tya.); CHOQQORSSA, DAGOO, TITIMA (Orom.)
- Eleusine multiflora* (139):
ITALIAN MILLET (Eng.)
- Eleusine* spp. (138): ርገሀ RGEHE (Tigre & Tya.)
- Enteropogon barbatus* (172): AUS GORUN, AUS KHASA (Som.)
- Enteropogon macrostachyus* (172): DAREMO (Som.)
- Enteropogon rupestris* (172):
GAUWADERI (Som.)
- Eragrostis aethiopica* (126):
SCIUDI (Shan.)
- Eragrostis aspera* (114): BOLOIC (Arbore); SCIUDDI (Shan.); ጥፍ ጥፍ ጥፍ JAF ZAGROY (Tya.)
- Eragrostis braunii* (116): ጥፍ ጥፍ JAF JAF (Tya.)
- Eragrostis cilianensis* (119):
GARAGHEIC, GHIFTE (Arbore); HARFO, HARFO SOMAL (Som.)

- Eragrostis ciliaris* (113):
 ERIOROD (Som.); NARCI (Shan.);
 OS GHELUFEI (Som.)
- Eragrostis japonica* (114):
 SCIOHO (Shan.)
- Eragrostis longifolia* (117):
 ብጉሻ አንጭጭ DAGUSHA ANĆWA (Tya.)
- Eragrostis papposa* (122):
 SARREN (Som.); ጣፍ ጣፎ JAF JAFU
 (Tya.)
- Eragrostis superba* (112):
 ARRANN (Shan.)
- Eragrostis tef* (125): AYLU,
 BASHIE (Gam.); ባህራ ጣፍ BAZRA JAF,
 ጫንገር ጣፍ ĆENGER JAF (Tya.);
 GASHIE (Gam.); GASHO (Kef.);
 GEESHEE (Wel.); ግኛ ጠላላ (Amh.);
 MESO (Orom.); ሲሶ ጣፍ SISO JAF, ጣፍ
 JAF (Tya.); ጣራ JAFI (Saho); ጣፍ
 ወሊይ JAF WEFY (Tya.); TAFFI,
 TAFFI GURACHA (Orom.); ጣፍ ኣጋይ
 JAF ስገላጋ (Tya.); TEF (Eng.); ጤፍ
 ባህራ JEF BAZRA, ጤፍ ነጭ JEF NEĆ,
 ጤፍ ጥቁር JEF IQUR, ጤፍ ሰርገኛ JEF
 SERGEŃA (Amh.); SOLO (Gam.); ጤፍ
 JEF (Amh.); ጣእፍ JA'F (Ge'ez)
- Eragrostis tenella* (113): ጣፍ
 ጣፎ JAF JAFU, ጣፍ ላገራ JAF ZAGRA
 (Tya.)
- Eragrostis tenuifolia* (122):
 አሹሊህ ASHUFFEH, ግካን ጎሳ MAKAN GOSSA
 (Amh.); TAFFI QAMALEE (Orom.);
 ጣፍ ላገራይ JAF ZAGROY (Tya.)
- Eriochloa fatmensis* (218):
 SCIOHO (Shan.)
- Exothea abyssinica* (353):
 ጭግራ ንሶት ĆMARA GWASOT, ጭግራ ባዕሪ
 ĆMARA SA'RI (Tya.)
- Festuca abyssinica* (24): GARBU
 DADDE (Orom.)
- Festuca macrophylla* (25): ቋላ
 QWASSA (Tya.)
- Hackelochloa granularis*
 (363): ወርቂ ወርቆ WERQI WERQO
 (Tya.)
- Harpachne schimperi* (129): ጫንር
 ባዕሪ ĆEGWAR SA'RI (Tya.)

- Helictotrichon elongatum*
 (31): ባዕሪ ሀበይ SA'RI HBEY (Tya.)
- Heteropogon contortus* (356):
 AUS GUDUD, BURI GUDUD (Som.);
 ጭግራ ንሶት ĆMARA GWASOT (Tya.);
 HAARAN, KAATA (Shan.)
- Hordeum vulgare* (59): አደላሎ
 ADELAU (Saho); BARLEY (Eng.);
 GARRBUU (Orom.); ገብስ GEBE, ገብስ
 ስድስት ፈረስ GEBE SDST FERES, ገብስ ጥቁር
 ሁለት ፈረስ GEBE IQUR HULET FERES, ገብስ
 ሁለት ፈረስ GEBE HULET FERES, ገብስ ሰነፍ
 ቆሎ GEBE SENEFOLO (Amh.); ሰገም ገዕዳ
 ጉናሃ SGEM SA'DA GUNAZA (Tya.); ገብስ,
 አላሳ ጋወናኒላ GEBE ALSA GAWNANIA, ገብስ
 አንድ ራስ GEBE AND RAS, ገብስ አራት ፈረስ
 GEBE ARAT FERES, ገብስ ባርጅ ስታት GEBE
 BARJSETTAT, ገብስ ልግ አላኩስ GEBE LĀ
 ALKUS, ገብስ ግርፍ ጎር GEBE MARIAN SAR,
 ገብስ አጎሊሊ ጠመጅ GEBE AGOFFEDE JEMEJ,
 ገብስ ግርሊ GEBE MAROE, ገብስ ጠመጅ GEBE
 JEMEJ, ነጭ ገብስ NEĆGEB (Amh.); ሳእሳእ
 SA'SA' (Ge'ez); SAMARETA
 (Orom.); ስቻእር SCA'R (Tigre);
 ሰገም ደግሰተፋ SGEM DAMASTEFFA, ሰገም
 ታርደላች SGEM TARDELAC, ሰገም ጋገሪ SGEM
 GAGERE, ሰገም ፀሊጥ ጉናሃ SGEM SELIMO
 GUNAZA, ሰገም ፈረስ አንገደ SGEM FERES
 ANGEDE, ሰገም ገብነሽ SGEM GEBNESH, ሰገም
 ጥነሳ SGEM WANEDA, ሰገም ደግሶስ SGEM
 DOMOKOS, ሰገም ሳሊበሳ SGEM LALIBELLA,
 ሰገም ደላ SGEM DOA, ሰገም አንድኛ SGEM
 ANDCEDA, ሰገም አተፍ SGEM ATONA, ሰገም
 ገዕዳ SGEM SA'DA, ሰገም SGEM (Tya.);
 SHEKO (Kef.); ጠመጅ JEMEJ, ጠመጅ
 ሰነፍ ቆሎ TEMEJ SENEFOLO (Amh.)
- Hyparrhenia anthistiriodes* (341): ጫጫጥ
 ĆĆEWA (Tya.); ጎመጭ GOMEĆ, ቋያ QWAYA,
 ቋያ ጎር QWAYA SAR (Amh.); O'AA (Orom.)
- Hyparrhenia cymbaria* (343): ቋያ QWAYA
 (Amh.); WARIQEE (Orom.)
- Hyparrhenia hirta* (340): DAGALLA, DELAN
 (Orom.); DELAN (Som.); DINQA (Gam.);
 ባዕሪ ቆጃስ SA'RI OQWAH, ተራን ባዕሪ QERAN
 SA'RI, ባዕሪ አጥሊኖ SA'RI AWALD (Tya.);
 ሰግሰሊጥ SEMBELIET (Amh.)
- Hyparrhenia rufa* (337): ቋያ QWAYA, ቋያ ጎር
 QWAYA SAR, ሰግሰሊጥ SEMBELIET, ሰርሰራ
 SERSERA (Amh.)

- Hyparrhenia schimperi* (345): ጋጋይ GAGAY, ሳጋይ SAGAY (Tya.)
- Hyparrhenia* spp. (333): ሰምበሌጥ SEMBELIET (Amh.)
- Hyparrhenia variabilis* (344): ቋያ QWAYA, ቋያ ሳር QWAYA SAR, ሰምበሌጥ SEMBELIET (Amh.)
- Hyperthelia dissoluta* (333): HARRAN (Shan.)
- Lasiurus scindicus* (359): DARIF (Som.)
- Leptochloa obtusiflora* (102): AUS URUN, BULDORLE (Som.)
- Leptochloa* spp. (100): ጨጋር ሳዕሪ ĈEGWAR SA'RI (Tya.)
- Lolium multiflorum* (18): ANNUAL RYE GRASS, ITALIAN RYE GRASS (Eng.)
- Lolium temulentum* (17): ክርጎድ KRDAD (Tya.); DARNEL (Eng.); እንክርጎድ 'NKR DAD (Amh.); MACHESSAA (Orom.)
- Loudetia simplex* (288): ድቻግ ገሶት DCAMA GWASOT, ድቻግ ገሶት DCOMARA GWASOT, ድሽ ገሶት DSH GWASOT (Tya.)
- Melinis ambigua* (187): MARGA DIMU (Orom.); ቋያ QWAYA (Amh.)
- Melinis repens* (186): DALIFA (Orom.); HARAROO (Orom.); ሎፍቺፍ LOFCIEF (Amh.); ተይሕ ሳዕሪ QEYĤSA'RI (Tya.); RAMMAS BUR (Som.); ሳር SAR (Amh.)
- Microchloa indica* (172): ጨጋሪ ሊረሰ ĈEGURI FERES (Tya.); MARGGA DIMUU, WEETU (Orom.)
- Microchloa kunthii* (174): MARGGA DIMUU, WEETU (Orom.)
- Ochthochloa compressa* (108): GARAMO, HABRA LEGGIT, HRI HARI (Som.)
- Oplismenus hirtellus* (192): KASI (Orom.)
- Oropetium minimum* (100): MARRA, MARRO (Shan.)
- Oryza longistaminata* (10): ሱጊሂ SUMIHI (Amh.)
- Oryza sativa* (10): RICE (Eng.); ፍዝ RUZ (Amh.); ፍዝ RUZ (Tya.)
- Oxytenanthera abyssinica* (6): አርታይ ARQAY (Tya.); ሆላ HOLL (Tigre); ቀርካሃ QERKEHA (Amh.); SHIMALA (Wel.); SHIMALA (Orom.); ሽመላ SHMEL (Amh.)
- Panicum atrosanguineum* (204): ግፍ ሳዕሪ JAF SA'RI (Tya.)
- Panicum coloratum* (201): BALDORLI, GURTA (Som.)
- Panicum deustum* (202): UARRE (Shan.)
- Panicum maximum* (198): ALPATA (Shan.); BALDORLI, BALLOLE, BULDORLEH, DABASSALE (Som.); GUINEA GRASS (Eng.); IBASHIGASHU (Bodi); OBBALA (Shan.); ቻግ ሳዕሪ QĈA SA'RI (Tya.); SCIUDI (Shan.); SIF (Orom.); ሳር SAR (Amh.)
- Panicum repens* (202): OS LA, OS ROVADI (Som.)
- Panicum turgidum* (199): DUNGARA, DUNGARR, DUNGARRE (Som.)
- Paspalidium geminatum* (243): GARGARI, GARGARO (Som.); ታታ TATTA (Tya.)
- Paspalum conjugatum* (234): SIGNAL GRASS (Eng.)
- Paspalum scrobiculatum* (233): DITCH MILLET (Eng.)
- Paspalum vaginatum* (234): DAAT, DEHI (Som.)
- Pennisetum clandestinum* (264): KIKUYU GRASS (Eng.); ሮግዲ ROMADI (Tya.); SARDOO (Orom.)
- Pennisetum glaucifolium* (272): ጥሪ ቸፋ ĈRA COFFU, ጥሽ ኮፋ SH KOFFU (Tya.)
- Pennisetum glaucum* (263): ቡላታቸ BULDUC (Tigre); BULRUSH MILLET (Eng.); ቡላታቸ BULTUB, ቡላታግ BULTUG (Tigre)
- Pennisetum longistylum* (264): ሽንኮር SHONKOR (Tya.)
- Pennisetum macrourum* (271): BULTUK (Orom.); ግጋ ፍባ MAGA RUBA (Tya.); QAMATE (Orom.)
- Pennisetum mezianum* (269): GARRAU (Som.)
- Pennisetum nubicum* (275): MUJJAA (Orom.)
- Pennisetum petiolare* (275): አፍ ሕጎ AF ስጎ, ደምባ DEMBA, ታምባ TAMBA, ሳዕሪ ደምባ SA'RI DEMHELA, ሳዕሪ ደምባ አፍ ሕጎ SA'RI DEMHELA AF ስጎ (Tya.)
- Pennisetum setaceum* (265): አሉላ ALULA, ኡሉላ ULULA (Tya.); SCIUDE (Shan.)
- Pennisetum sphacelatum* (272): DUPA (Wel.); GARRGGARAA (Orom.); ጉባ GUBA, ጉባ GUBO (Amh.); MERN (Orom.); ገታ GETA (Amh.); METCHICHA (Sid.); METCHICHA (Orom.); ሰበዝ SEBEZ (Amh.); ሰርዲ SERDI, ሰላሕ ኩርኩር SELAĤKURKUR (Tya.); ሰንደዶ

- SNDEDO (Amh.); WIRE GRASS (Eng.); ውሻ ስንደዶ WUSHA SNDEDO (Amh.)
- Pennisetum* spp. (259): ሳዕሪ ኩላ SA'RI KUSA, ቀላላ ሀሌላ (Tya.)
- Pennisetum thunbergii* (269): ጉባ GUBA (Amh.); MIGIRA, MIGRA SARE (Orom.); ሰርጺ SERDI, ሳዕሪ ኡሽ SA'RI USH (Tya.); ውሻ ስንደዶ WUSHA SNDEDO (Amh.)
- Pennisetum uliginosum* (271): MURII (Orom.)
- Pennisetum villosum* (265): BOYIE, DABALLE (Orom.); DOMAR (Som.); HABABOO, HANFAROO (Orom.); ሰላሕ ኩርኩር SELAḥ KURKUR (Tya.); SHESHU (Orom.)
- Phragmites australis* (64): ሸምባቆ SHEMBAQO (Tya.)
- Phragmites mauritianus* (65): COMMON REED (Eng.); ሸምባቆ SHEMBAQO (Tya.)
- Poa annua* (20): ANNUAL MEADOW GRASS (Eng.)
- Polypogon viridis* (44): SARDOO (Orom.)
- Rottboellia cochinchinensis* (365): ITCH GRASS (Eng.)
- Saccharum officinarum* (292): MAKKA (Wel.); SUGAR CANE (Eng.); ሸንኮራ SHENKORA, ሸንኮር ላገገ SHENKOR AGEDA, ጥንትሽ ገንባሽ (Amh.)
- Secale cereale* (58): RYE (Eng.)
- Setaria nervosum* (316): AUS GUDUD (Som.); KUZIZI (Bodi)
- Setaria acromelaena* (238): DAGMGNO (Som.)
- Setaria megaphylla* (242): KOMBO (Orom.)
- Setaria pumila* (238): ሆገ ሆገ HOGG HOGGO, ሆገ HOGGO, ሆኮ HOKKO (Tya.); ጸዙላዎ JAZZUAZO (Tigre); MAXXANNEE (Orom.); ወሰጥሶ WESWASSO (Tya.)
- Setaria sphacelata* (238): GOLDEN TIMOTHY (Eng.); ሆገ HOGGO, ሆኮ HOKKO, ሆገ ሆገ HOGGE HOGGO, ወሰጥሶ WESWASSO (Tya.)
- Setaria* spp. (234): ላሰንገብ ASENDABO (Amh. & Tya.); QANA DUBA (Orom.); QANA DUBA, WUSHEWA (Wel.)
- Setaria verticillata* (236): AUS MARABOB (Som.); በገቲ ፈገገሊ BEGETTI FEDDAUI (Tya.); BRISTLY FOXTAIL (Eng.); ሆሽኪቶ HESHKITO (Tigre); LOVE GRASS (Eng.); MARABOB, MEUREF (Som.); ግርቦ MARBO (Amh.)
- Snowdenia polystachya* (257): ምግዳግ MGWYA (Tya.); ሙገዚያሁ MUGZIYAHU (Ge'ez); ሙጽ MUJA (Amh.); MUJJAA (Orom.); ተራገ ሳዕሪ QERAN SA'RI (Tya.); ቶንደራጤስ QONDERAJIS (Ge'ez)
- Sorghum arundinaceum* (299): WILD SORGHUM (Eng.); DAAPHOO (Orom.); MACADEI (Som.)
- Sorghum bicolor* (299): ግሽላ MASHLA (Amh.); BISINGA (Kef.); BOBEE (Orom.); BROOMCORN, GUINEA CORN (Eng.); MISSINGA (Som.); SHANGO (Kef.); SORGHUM, WHITE SORGHUM (Eng.); ጥንትሽ ገንባሽ ገንባሽ, ሸንጋገ ZENGADA (Amh.)
- Sporobolus africanus* (149): LOIA (Orom.); ሙራ MURIE (Amh.); MURII (Orom.); ግፍ ግፍ ገፍ ገፍ JAF JAF (Tya.)
- Sporobolus angustifolius* (153): ግፍ ግፍ ገፍ ገፍ JAF JAF (Tya.)
- Sporobolus discosporus* (144): ሳዕሪ ሰረኸው-ራኸው SA'RI BEREKWRAKW (Tya.)
- Sporobolus festivus* (155): AIUSS, BUIO (Som.); DEDAN (Arbore); GASCIU SCIUDI (Shan.); MARGO HARO (Orom.); SCIUDDI (Shan.)
- Sporobolus helvolus* (151): DABRO, DAIDO, GERBO (Som.)
- Sporobolus natalensis* (149): ግፍ ግፍ ገፍ ገፍ JAF JAF (Tya.)
- Sporobolus nervosus* (153): RAMASS (Som.)
- Sporobolus panicoides* (145): ፈኸዌኮት FEKWEKOT (Tya.)
- Sporobolus pellucidus* (150): HADIGO (Som.)
- Sporobolus pyramidalis* (148): KERI (Bodi); MURII (Orom.); PYRAMID DROPSEED (Eng.)
- Sporobolus spicatus* (151): DEBO WELODLE, GARO, RISS (Som.)
- Stenotaphrum secundatum* (244): ST. AUGUSTINE GRASS (Eng.)
- Stipagrostis hirtigluma* (86): HARFO, MARDSWEIDLEH, SAREN (Som.)
- Stipagrostis uniplumis* (86): BOLOIC (Arbore); MARDWEIDLEH (Som.)
- Tetrapogon bidentatus* (161): AUS KHASA (Som.)
- Tetrapogon cenchrififormis* (159): GEBBIN (Som.)

Tetrapogon villosus (161): AYA MUKARRE,
BURI WENA, IYA MAKARAI (Som.)

Themeda triandra (353): DABASHABEL
(Som.); ቁግራ ገሰት ĊMARA GWASOT (Tya.);
KABECHA, QAICHA (Orom.); SIGIN (Bodi);
ቋያ QWAYA, ደጋ ስፖሰሌጥ DEGA SEMBELIEጥ
(Amh.); MAXXAJJII (Orom.); ሳዕሪ ጉረ ገግዶ
SA'RIGURE GEMAY, ሳዕሪ አጥልድ SA'RI
AWALD, ወሰጥሶ WESWASSO (Tya.); ስገሰሌጥ
SENBELIEጥ (Amh.)

Tragus berteronianus (178): BUSCA (Shan.);
MAXXANNEB (Orom.); SCINDI (Shan.)

Tricholaena teneriffae (191): BULDORLE
AGARE, FORDALE (Som.); ሳዕሪ ቆጃሕ SA'RI
QOQWAጥ (Tya.)

Triticum aestivum (63): አጃ AJA (Amh.);
BREAD WHEAT, COMMON WHEAT (Eng.);
CORN (Eng.); MATA JJABOO (Orom.);
QAMADO, QAMADI (Orom.); ሲራ SIRA
(Saho); ስገዶ SNDIE (Amh.); ስገገዶ SNDAY,
ሰርናዶ SRNAY (Tya.)

Triticum dicoccon [not *Triticum dicoccum*
L. which is a different species not found
in Ethiopia.] (61): አጃ AJA (Amh.); አለሰ
ALES (Ge'ez); ግረስ ለጆ (Tya.); EMMER
WHEAT (Eng.); ሃለሰ HALES (Ge'ez); MATA
DABOO (Orom.); TEBBO (Kef.); ጠመጅ ስገዶ
TEMEJ SNDIE (Amh.)

Triticum durum (62): ABYSSINIAN HARD
WHEAT (Eng.); ግረሰይታ ለጆSEYTA (Tya.);
አጃ ግዶ ACO MAY (Tigre); ቡር BURR
(Amh.); DURUM WHEAT, HARD WHEAT
(ENG.); ሰርናዶ SRNAY (Tya.); ስጃቸና አርትግ
SCOCENA ARTG (Tigre)

Triticum monococcum (61): EINKORN WHEAT,
SMALL SPELT (Eng.)

Triticum polonicum (61): ፈላሲቶ FELASITO
(Tya.); POLONICUM WHEAT, POLISH WHEAT
(Eng.)

Triticum spelta (62): DINKEL WHEAT (Eng.);
HOMBORRI, QAMADI (Orom.); SPELT
WHEAT (Eng.)

Triticum spp. (59): ነጭ ስገዶ NEĊSNDIE
(Amh.); QAMADI (Orom.); WHEAT (Eng.)

Triticum turgidum (62): CONE WHEAT,
POLLARD WHEAT, RIVET WHEAT (Eng.)

Urochloa panicoides (230): LAALUNCAA
(Orom.); OS GALIM UENIS (Som.)

Urochloa setigera (231): SCIOOHO (Shan.)

Urochondra setulosa (157): DARIF (Som.)

Vetiveria zizanioides: MARGA URG (Orom.)

[Although not treated in the main body
of this volume, this species is known to
have been introduced and planted
successfully several times through soil
conservation projects. One place is
Jimma-Melko Agricultural Research
Station.]

Zea mays (365): ዕፋግ 'FUN (Tigre); ዕፋግ
'FUN (Tya.); BARO (Kef.); BADALIA
(Orom.); BADALIA, BADALLA (Kon.); ግሀር
ግሽላ BAHR MASHLA (Amh.); BEDALA,
BEDELA (Gam.); በቆሎ BEQOLO (Amh.);
BOQOLLOO (Orom.); CORN (Am. Eng.);
DIKO (Kef.); ጉልቡብ GULBUB (Tigre); ጌልቦ
ILBO (Tya.); INDIAN CORN, INDIAN MEAL,
MAIZE (Eng.); ፖሽላ ግሽላ MSHELA BAጠRI
(Tya.); TEEA (Gam.); ፖሀር ግሽላ YEBÄHR
MASHLA (Amh.)

**ETHIOPIAN GRASS NAMES
FOR LANGUAGES USING GE'EZ SCRIPT**
(with page number(s) to the main text)

እንክርጻድ 'NKR DAD (Amh.) - *Lolium temulentum* (17)

እርገሄ 'RGEHIE (Ge'ez) - *Eleusine jaegeri* (142)

ዕፋጉ 'FUN (Tigre & Tya.) - *Zea mays* (365)

እኛ ግይ ACO MAY (Tigre) - *Triticum durum* (62)

እደግሀላ ADEGHELA (Tya.) - *Dactyloctenium aegypticum* (135)

አደላኦ ADELAU (Saho) - *Hordeum vulgare* (59)

አድናዋል ADNAWAL (Ge'ez) - *Avena* spp. (33)

እፍ ሕጎ AF ስጎ (Tya.) - *Pennisetum petiolare* (275)

እፍሊሶ AFSISSO (Tya.) - *Echinochloa crus-galli* (213)

እጃ AJA (Amh.) - *Triticum dicoccon* (61) [not *Triticum dicoccum* L. which is a different species not found in Ethiopia.]

እክርግ AKRMA (Amh. & Tya.) - *Eleusine floccifolia* (141), *Eleusine jaegeri* (142)

እለለ ALES (Ge'ez) - *Triticum dicoccon* (61) [not *Triticum dicoccum* L. which is a different species not found in Ethiopia.]

እሉላ ALULA (Tya.) - *Pennisetum setaceum* (263)

እርቃይ ARQAY (Tya.) - *Arundinaria alpina* (3), *Oxytenanthera abyssinica* (6)

እሰገሳሶ ASENDABO (Amh. & Tya.) - *Echinochloa pyramidalis* (213), *Echinochloa stagnina*, *Setaria* spp. (234)

እጃረሀ ASHUFFEH (Amh.) - *Eragrostis tenuifolia* (122)

እሳገሳዋ ASSANDAWA (Amh. & Tya.) - *Echinochloa crus-galli* (213)

አይቤት AYBET (Tigre) - *Cenchrus ciliaris* (276)

አይቡድ AYBUD (Tigre) - *Echinochloa colona* (212)

ግረስ ARES (Tya.) - *Triticum dicoccon* (61) [not *Triticum dicoccum* L. which is a different species not found in Ethiopia.]

ግረሰይታ ARESEYTA (Tya.) - *Triticum durum* (62)

ብዕሪ ጦርግት B'RIMERAT (Tya.) - *Chloris* spp. (166)

ባሀር ግሽላ BAHR MASHLA (Amh.) - *Zea mays* (365)

ባርቻኦ BARCAO (Tya.) - *Dinebra retroflexa* (105)

ባህራ ግፍ BAZRA JAF (Tya.) - *Eragrostis tef* (125)

ባገቲ ሊገፍኢ BEGETTI FEDDAUI (Tya.) - *Setaria verticillata* (236)

ባቆሎ BEQOLO (Amh.) - *Zea mays* (365)

ቡላቶች BULDUC (Tigre) - *Pennisetum glaucum* (263)

ቡላተብ BULTUB (Tigre) - *Pennisetum glaucum* (263)

ቡላተግ BULTUG (Tigre) - *Pennisetum glaucum* (263)

ቡር BURR (Amh.) - *Triticum durum* (62)

ጨፍ ርጅዌላ ĆĆEWA (Tya.) - *Hyparrhenia anthistirioides* (341)

ጨጉሪ ሊረስ ĆĆGURI FERES (Tya.) - *Microchloa indica* (172)

ጨጌር ገዕሪ ĆĆGWAR SA'RI (Tya.) - *Cymbopogon caesius* (328), *Harpachne schimperii* (129), *Leptochloa* spp. (100)

ጨገር ግፍ ĆĆNGER JAF (Tya.) - *Eragrostis tef* (125)

ጭግራ ገሰት ĆMARA GWASOT (Tya.) - *Exotheca abyssinica* (353),

- Heteropogon contortus** (356),
Themeda triandra (353)
 ቅግራ ሳዕሪ ĊMARA SA'RI (Tya.) -
Exothea abyssinica (353)
 ቅራ ቾሩ ĊRA COFFU (Tya.) -
Pennisetum glaucifolium
 (272)
- ታገሰ DAGELLE (Tya.) -
Dactyloctenium aegypticum
 (135)
- ታገሳ DAGUSA (Amh.) - **Eleusine**
coracana (139)
- ታገሻ DAGUSHA (Saho, Tigre & Tya.) -
Eleusine coracana (139)
- ታገሻ ለድጊ DAGUSHA ADGI (Tya.) -
Eleusine indica (141)
- ታገሻ ለገጭጭ DAGUSHA ANĊWA (Tya.) -
Eragrostis longifolia (117)
- ታገሻ ሸሌቤ DAGUSHA ŌELBI (Tya.) -
Eleusine indica (141)
- ታገሻ ምድሪ DAGUSHA MDRI (Tya.) -
Eleusine indica (141)
- ታገሻ ፀሊጦ DAGUSHA ŌELIM (Tya.) -
Eleusine coracana (139)
- ድቻግ ጓሰት DCAMA GWASOT (Tya.) -
Loudetia simplex (288)
- ድቻግ ጓሰት DCOMARA GWASOT (Tya.) -
Loudetia simplex (288)
- ደጋ ሰምበሊጥ DEGA SEMBELIEጥ (Amh.) -
Themeda triandra (353)
- ደምባ DEMBA (Tya.) - **Pennisetum**
petiolare (275)
- ደምብያ DMBYA (Tya.) - **Aristida adoensis** (80)
- ደሽ ጓሰት DSH GWASOT (Tya.) -
Loudetia simplex (288)
- ዱራቸት DURACET (Amh.) - **Brachiaria**
semiundulata (227)
- ፋግ FAA (Tya.) - **Avena sterilis**
 (37)
- ፈክጫት FEKWEKOT (Tya.) -
Sporobolus panicoides (145)
- ፈላሲቶ FELASITO (Tya.) - **Triticum**
polonicum (61)
- ጋጋ GAGA (Amh.) - **Andropogon** spp.
 (319)
- ጋጋይ GAGAY (Tya.) - **Hyparrhenia**
schimperii (345)
- ጋሽ GAJA (Amh.) - **Andropogon**
gayanus (325)
- ጋሽ ጋቻ GAJA GACA (Amh.) - **Avena**
abyssinica (35)
- ጋሻ GASHA (Amh.) - **Andropogon**
distachyos (322)
- ጋሻ GASHA (Tya.) - **Andropogon**
gayanus (325)
- ገብስ GEBS (Amh.) - **Hordeum vulgare**,
 (59)
- [The following are names of
 some of the very many landraces
 of *Hordeum vulgare*]
- ገብስ ለጎረደ ጠጦጅ GEBS AGOFFEDE ጅጄጄጅ
 (Amh.) - **Hordeum vulgare** (59)
- ገብስ ለሌላ ጋጫጎጎጎጎ GEBS ALSA GAWNANIA
 (Amh.) - **Hordeum vulgare** (59)
- ገብስ ለገድ ራስ GEBS AND RAS (Amh.) -
Hordeum vulgare (59)
- ገብስ ለራት ፈረስ GEBS ARAT FERES (Amh.) -
Hordeum vulgare (59)
- ገብስ ባርጅ ሰታት GEBS BARJ SETTAT
 (Amh.) - **Hordeum vulgare** (59)
- ገብስ ሁለት ፈረስ GEBS HULET FERES (Amh.)
 - **Hordeum vulgare** (59)
- ገብስ ልግ ለላኩስ GEBS LĊA ALKUS (Amh.) -
Hordeum vulgare (59)
- ገብስ ግርግ ሳር GEBS MARIAN SAR (Amh.) -
Hordeum vulgare (59)
- ገብስ ግርኢ GEBS MAROB (Amh.) -
Hordeum vulgare (59)
- ገብስ ስድስት ፈረስ GEBS SDST FERES (Amh.)
 - **Hordeum vulgare** (59)
- ገብስ ሰነፍ ቶሎ GEBS SENEFOOLO (Amh.) -
Hordeum vulgare (59)
- ገብስ ጠጦጅ GEBS ጅጄጄጅ (Amh.) -
Hordeum vulgare (59)
- ገብስ ጥቁር ሁለት ፈረስ GEBS IQUR HULET FERES
 (Amh.) - **Hordeum vulgare** (59)
- ገረግ GEREMA (Amh.) - **Avena sativa**
 (37)
- ገታ GETA (Amh.) - **Pennisetum**
sphacelatum (272)
- ገገጭ GNĊ (Amh.) - **Avena**
abyssinica (35)
- ገጫጎ GOĊA' (Ge'ez) - **Arundinaria**
alpina (3)
- ገጫጎ GOMEĊ (Amh.) - **Andropogon**
 spp. (319), **Hyparrhenia**
anthistirioides (341)

- ገገግ GONÇO (Tya.) - *Bromus leptoclados* (54)
- ገገግ GOZO (Tya.) - *Bromus leptoclados* (54)
- ገገግ GUBA (Amh.) - *Pennisetum sphacelatum* (272),
Pennisetum thunbergii (269)
- ገገግ GUBO (Amh.) - *Pennisetum sphacelatum* (272)
- ገገግ GULBUB (Tigre) - *Zea mays* (365)
- ገገግ HALES (Ge'ez) - *Triticum dicoccon* (61) [not *Triticum dicoccum* L. which is a different species not found in Ethiopia.]
- ሀሽከት HESHKITO (Tigre) - *Setaria verticillata* (236)
- ሀገሀገ HOGGE HOGGO (Tya.) - *Setaria pumila* (238), *Setaria sphacelata* (238)
- ሀገ HOGGO (Tya.) - *Setaria pumila* (238), *Setaria sphacelata* (238)
- ሀኮ HOKKO (Tya.) - *Setaria pumila* (238), *Setaria sphacelata* (238)
- ሀላ HOLL (Tigre) - *Oxytenanthera abyssinica* (6)
- ሓሃ ሓሃ ስላገ ስላገ (Tya.) - *Chloris gayana* (169)
- ገገግ ILBO (Tya.) - *Zea mays* (365)
- ገገግ JAZZUAZO (Tigre) - *Setaria pumila* (238)
- ክርገግ KRDAD (Tya.) - *Lolium temulentum* (17)
- ሎፍቼፍ LOFCIEF (Amh.) - *Melinis repens* (186)
- ገገግ ገገግ MAKAN GOSSA (Amh.) - *Eragrostis tenuifolia* (122)
- ገገግ ገገግ MAGA RUBA (Tya.) - *Pennisetum macrourum* (271)
- ገገግ MAKKAE (Tigre) - *Chloris barbata* (168)
- ገገግ MAÑA (Amh.) - *Eragrostis tef* (125), with especially high quality white grain
- ገገግ MARBO (Amh.) - *Setaria verticillata* (236)
- ገገግ MASHLA (Amh.) - *Sorghum bicolor* (299)
- ሜታ MEKA (Amh.) - *Arundinaria alpina* (3), *Arundo donax* (66)
- ሜሊላ MELVESA (Agew) - *Brachiaria lata* (229)
- ገገግ MGWYA (Tya.) - *Snowdenia polystachya* (257)
- ገገግ MRESLEY (Tya.) - *Chloris* spp. (166)
- ገገግ MSHELA BA'IRI (Tya.) - *Zea mays* (365)
- ሜላ MUJA (Amh.) - *Snowdenia polystachya* (257)
- ሜላ MUGZIYAHU (Ge'ez) - *Snowdenia polystachya* (257)
- ሜላ MURIE (Amh.) - *Sporobolus africanus* (149)
- ገገግ ገገግ NEÇGEBE (Amh.) - *Hordeum vulgare* (59)
- ገገግ ገገግ NEÇSNDIE (Amh.) - *Triticum* spp. (59)
- ገገግ QAÇA SA'RI (Tya.) - *Panicum maximum* (198)
- ገገግ QERAN SA'RI (Tya.) - *Andropogon abyssinicus* (324), *Andropogon amethystinus* (323), *Andropogon distachyos* (322), *Bothriochloa* spp. (305), *Hyparrhenia hirta* (340), *Snowdenia polystachya* (257)
- ገገግ QERKEHA (Amh.) - *Arundinaria alpina* (3), *Oxytenanthera abyssinica* (6)
- ገገግ QEYËSA'RI (Tya.) - *Melinis repens* (186)
- ገገግ QONDERATIS (Ge'ez) - *Snowdenia polystachya* (257)
- ገገግ QWASSA (Tya.) - *Festuca macrophylla* (25)
- ገገግ QWAYA (Amh.) - *Hyparrhenia anthistirioides* (341)

- Hyparrhenia cymbaria (343),
 Hyparrhenia rufa (337),
 Hyparrhenia variabilis
 (344), Melinis ambigua(187),
 Themeda triandra (353)
ጳጳ ሳር QWAYA SAR (Amh.) -
 Hyparrhenia anthistirioides
 (341), Hyparrhenia rufa
 (337), Hyparrhenia
 variabilis (344)
- ርግጻ ROMADI** (Tya.) - Brachiaria
 ramosa (228), Pennisetum
 clandestinum (264)
ርገሀ RGEHE (Tya. & Tigre) -
 Eleusine floccifolia (141),
 Eleusine spp. (138)
ሩህ RUZ (Amh. & Tya.) - Oryza
 sativa (10)
- ሳዕሪ ለጥልድ SA'RI AWALD** (Tya.) -
 Hyparrhenia hirta (340),
 Themeda triandra (353)
ሳዕሪ በረኽው-ራኽው SA'RI BEREKWRAKW
 (Tya.) - Sporobolus
 discosporus (144)
ሳዕሪ ደግሀላ SA'RI DEMHELA (Tya.) -
 Pennisetum petiolare (275)
ሳዕሪ ደግሀላ ለፍ ስጎ SA'RI DEMHELA AF ስጎ
 (Tya.) - Pennisetum
 petiolare (275)
ሳዕሪ ጋገያ SA'RI GAGYA (Tya.) -
 Cymbopogon caesius (328),
 Cymbopogon schoenanthus
 subsp. promixus (329)
ሳዕሪ ጉረ ገገያ SA'RI GURE GEMAY (Tya.) -
 Themeda triandra (353)
ሳዕሪ ሀበይ SA'RI HBAY (Tya.) -
 Helictotrichon elongatum
 (31)
ሳዕሪ ኩላ SA'RI KUSA (Tya.) -
 Pennisetum spp. (259)
ሳዕሪ መርግት SA'RI MERAT (Tya.) -
 Chloris spp. (166)
ሳዕሪ ግሽላ ግዕላ SA'RI MSHELA QWELLA
 (Tya.) - Brachiaria
 serrifolia (225)
ሳዕሪ ገጃሕ SA'RI QOQWAH (Tya.) -
 Hyparrhenia hirta (340),
 Tricholaena teneriffae (191)
- ሳዕሪ ተላግ SA'RI TEጩG** (Tya.) -
 Cynodon dactylon (175)
ሳዕሪ ኡሽ SA'RI USH (Tya.) -
 Pennisetum thunbergii (269)
ሳዕሪ ጥሃ SA'RI WAZA (Tya.) - Chloris
 gayana (169), Chloris
 virgata (168)
ሳላሳ SA'SA' (Ge'ez) - Hordeum
 vulgare (59)
ሳግዕ SAK (Tya.) - Avena
 abyssinica (35), Avena
 sativa (37)
ሳጋይ SAGAY (Tya.) - Hyparrhenia
 schimperii (345)
ሰጽላር SCA'R (Tigre) - Hordeum
 vulgare (59)
ሰጽጥና ላርትግ SCOCENA ARTG (Tigre) -
 Triticum durum (62)
ሰበህ SEBEZ (Amh.) - Pennisetum
 sphacelatum (272)
ሰላሕ ኩርኩር SELAጩKURKUR (Tya.) -
 Pennisetum sphacelatum
 (272), Pennisetum villosum
 (265)
ሰጽበሌግ SEMBELIET (Amh.) -
 Cymbopogon commutatus (330),
 Hyparrhenia hirta (340),
 Hyparrhenia rufa (337),
 Hyparrhenia spp. (333),
 Hyparrhenia variabilis
 (344), Themeda triandra
 (353), and other large
 grasses used for thatching
ሰገደደ SENDEDO (Amh.) - Pennisetum
 sphacelatum (272)
ሰርጻ SERDI (Tya.) - Pennisetum
 sphacelatum (272),
 Pennisetum thunbergii (269)
ሰርዶ SERDO (Amh.) - Cynodon spp.
 (174)
ሰርሰራ SERSERA (Amh.) - Hyparrhenia
 rufa (337)
ሰገጽ SGEM (Tya.) - Hordeum vulgare
 (59)
ሰገጽ ለትና SGEM ATONA (Tya.) -
 Hordeum vulgare (59)
ሰገጽ ደግሰታፋ SGEM DEMASTEFFA (Tya.) -
 Hordeum vulgare (59)
ሰገጽ ዶላ SGEM DOA (Tya.) - Hordeum
 vulgare (59)

- ስገፍ ለጥኮስ SGEM DOMOKOS (Tya.) -
 Hordeum vulgare (59)
 ስገፍ ረረስ እንገደ SGEM FERES ANGEDE
 (Tya.) - Hordeum vulgare (59)
 ስገፍ ገገረ SGEM GAGERE (Tya.) -
 Hordeum vulgare (59)
 ስገፍ ገብነሽ SGEM GEBNESH (Tya.) -
 Hordeum vulgare (59)
 ስገፍ ላሊበላ SGEM LALIBELLA (Tya.) -
 Hordeum vulgare (59)
 ስገፍ ገዕፍ SGEM SA'DA (Tya.) - Hordeum
 vulgare (59)
 ስገፍ ገዕፍ ጉናዛ SGEM SA'DA GUNAZA (Tya.)
 - Hordeum vulgare (59)
 ስገፍ ፀሊፍ ጉናዛ SGEM SELIMO GUNAZA
 (Tya.) - Hordeum vulgare (59)
 ስገፍ ታርደላች SGEM TARDELAC (Tya.) -
 Hordeum vulgare (59)
 ስገፍ ጥነፍ SGEM WANEDA (Tya.) -
 Hordeum vulgare (59)
 ሲኖር SINAR (Amh.) - Avena
 abyssinica (35)
 ሲሩ SSIRA (Saho) - Triticum
 aestivum (63)
 ሲሶ ጣፍ SISO JAF (Tya.) - Eragrostis
 tef (125)
 ስንገደ SNDAY (Tya.) - Triticum
 aestivum (63)
 ስንደደ SNDEDO (Amh.) - Pennisetum
 sphacelatum (272)
 ስንደ SNDIE (Amh.) - Triticum
 aestivum (63)
 ስርናይ SRNAY (Tya.) - Triticum
 aestivum (63), Triticum
 durum (62)
 ስጅር ሳዕሪ SEQWAR SA'RI (Tya.) -
 Cymbopogon commutatus (330)
 ሱጊሂ SUMIHI (Amh.) - Oryza
 longistaminata (10)
- ፀጉሪ ሀበይ ሄግሪ HBEY (Tya.) -
 Aristida spp. (76)
- ሸገግቶ SHEMBAQO (Tya.) - Arundo
 donax (66), Phragmites
 australis (64), Phragmites
 mauritanus (65)
 ሸንቦቶ SHENBEQO (Amh.) - Arundo
 donax (66)
- ሸንኮራ SHENKORA (Amh.) - Saccharum
 officinarum (292)
 ሸግላ SHMEL (Amh.) -
 Oxytenanthera abyssinica (6)
 ሸንኮር SHONKOR (Tya.) - Pennisetum
 longistylum (264)
 ሸንኮር ላገፍ SHENKOR AGEBA (Amh.) -
 Saccharum officinarum (292)
- ታጥባ TAMBA (Tya.) - Pennisetum
 petiolare (275)
 ታታ TATTA (Tya.) - Paspalidium
 geminatum (243)
 ተቢሳ TEBISA (Ge'ez) - Arundo donax
 (66)
 ተገገ TEHAG (Ge'ez) - Cynodon spp.
 (174)
 ተሓገ TEHAG (Tya.) - Cynodon
 dactylon (175), Digitaria
 ternata (248)
 ተክለ TEKLE (Tigre) -
 Dactyloctenium aegypticum
 (135)
 ትሪኒት TRIHITO (Amh.) - Cymbopogon
 schoenanthus subsp. promixus
 (329)
 ትጽ ሳር TUCA SAR (Amh.) - Andropogon
 spp. (319)
- ጣእፍ JA'F (Ge'ez) - Eragrostis
 tef (125)
 ጣፍ JAF (Tya.) - Eragrostis tef
 (125)
 ጣፍ ሓገይ JAF HAGAY (Tya.) -
 Eragrostis tef (125)
 ጣፍ ጣፍ JAF JAFO (Tya.) -
 Eragrostis braunii (116),
 Eragrostis papposa (122),
 Eragrostis tenella (113),
 Sporobolus africanus (149),
 Sporobolus angustifolius
 (153), Sporobolus natalensis
 (149)
 ጣፍ ሳዕሪ JAF SA'RI (Tya.) - Panicum
 atrosanguineum (204)
 ጣፍ ወረይ JAF WEFAY (Tya.) -
 Eragrostis tef (125)
 ጣፍ ሃገሪ JAF ZAGRA (Tya.) -
 Eragrostis tenella (113)

- ጣፍ ሳገሮይ ገላፍ ZAGROY (Tya.) -
Eragrostis aspera (114),
Eragrostis tenuifolia (122)
- ጣሊ ገላፍ (Saho) - Eragrostis tef
(125)
- ጣጅ ሳር ገገገ SAR (Amh.) - Cymbopogon
citratus (328)
- ጣጅ ገገገ ገገገ (Amh.) - Hordeum
vulgare (59)
- ጣጅ ሰገገ ገገገ SNDIE (Amh.) -
Triticum dicoccon (61) [not
Triticum dicoccum L. which is
a different species not found
in Ethiopia.]
- ጣጅ ሰገገ ገገገ ገገገ SENEፍ QOLO (Amh.)
- Hordeum vulgare (59)
- ጣፍ ገገፍ (Amh.) - Eragrostis tef
(125)
- ጣፍ ገገፍ ገገፍ BAZRA (Amh.) -
Eragrostis tef (125)
- ጣፍ ገገፍ ገገፍ NEፍ (Amh.) -
Eragrostis tef (125)
- ጣፍ ሰርገፍ ገገፍ SERGEፍ (Amh.) -
Eragrostis tef (125)
- ጣፍ ገገፍ ገገፍ IQUR (Amh.) -
Eragrostis tef (125)
- ጥገገገ ገገገ (Amh.) - Saccharum
officinarum (292), Sorghum
bicolor (299)
- ጥገገገ ገገገ KOFFU (Tya.) -
Pennisetum glaucifolium
(272)
- ሉሉሉ ULULA (Tya.) - Pennisetum
setaceum (265)
- ዑላላ ሲላላ (Tya.) - Pennisetum
spp. (259)
- ጥርፍጥፍ WARIAT (Amh.) - Digitaria
abyssinica (252)
- ጠገገገ WESWASSO (Tya.) - Setaria
pumila (238), Setaria
sphacelata (238), Themeda
triandra (353)
- ጠርፍ ጠርፍ WERQI WERQO (Tya.) -
Brachiaria spp (218),
Hackelochloa granularis
(363)
- ጠገገገ WUSHA SNDEDO (Amh.) -
Pennisetum sphacelatum
(272), Pennisetum thunbergii
(269)
- ያላላ YADAB (Tigre) - Cenchrus
ciliaris (276)
- የላላ ገገገ YEBAHR MASHLA (Amh.) - Zea
mays (365)
- የገገገ ሳር YEፍNCEL SAR (Amh.) -
Coelachyrum poiflorum (134)
- ገገገገ ZENGADA (Amh.) - Sorghum
bicolor (299)
- ገገገገ ZUMBYA (Tya.) - Aristida
adscensionis (78), Aristida
hordeacea (81)

**ETHIOPIC AND ENGLISH NAMES ARRANGED ALPHABETICALLY
FOR LANGUAGES USING LATIN SCRIPT**

- ABYSSINIAN COUCH GRASS (Eng.)** - *Digitaria abyssinica* (252)
- ABYSSINIAN HARD WHEAT (Eng.)** - *Triticum durum* (62)
- ABYSSINIAN OAT (Eng.)** - *Avena abyssinica* (35), *Avena vaviloviana* (35)
- ABUS (Som.)** - *Cenchrus ciliaris* (276)
- AFRICAN FINGER MILLET (Eng.)** - *Eleusine coracana* (139)
- AFRICAN FOXTAIL (Eng.)** - *Cenchrus ciliaris* (276)
- AGAR (Som.)** - *Brachiaria leersioides* (225), *Cenchrus setigerus* (278)
- AIUSS (Som.)** - *Sporobolus festivus* (155)
- AJA MACCARE (Som.)** - *Dichanthium annulatum* (308)
- AJANBILA (Orom.)** - *Avena abyssinica* (35), *Avena sativa* (37)
- AKRIMA (Orom.)** - *Eleusine floccifolia* (141), *Eleusine jaegeri* (142)
- ALPATA (Shan.)** - *Panicum maximum* (198)
- ANNUAL MEADOW GRASS (Eng.)** - *Poa annua* (20)
- ANNUAL RYE GRASS (Eng.)** - *Lolium multiflorum* (18)
- AOS (Som.)** - *Dactyloctenium aegypticum* (135)
- ARO ANE (Som.)** - *Chloris roxburghiana* (168)
- ARRANN (Shan.)** - *Eragrostis superba* (112)
- ASO (Som.)** - *Echinochloa* spp. (210)
- AUS DOMAIR (Som.)** - *Chloris roxburghiana* (168)
- AUS GORUN (Som.)** - *Enteropogon barbatus* (172)
- AUS GUDUD (Som.)** - *Heteropogon contortus* (356), *Sehima nervosum* (316)
- AUS KHASA (Som.)** - *Enteropogon barbatus* (172), *Tetrapogon bidentatus* (161)
- AUS MARABOB (Som.)** - *Setaria verticillata* (236)
- AUS URUN (Som.)** - *Leptochloa obtusiflora* (102)
- AYA MUKARRE (Som.)** - *Tetrapogon villosus* (161)
- AYA MUKKARE (Som.)** - *Dichanthium annulatum* (308)
- AYLU (Gam.)** - *Eragrostis tef* (125)
- BAALLAMII (Orom.)** - *Andropogon schirensis* (327)
- BADALIA (Kon. & Orom.)** - *Zea mays* (365)
- BADALLA (Kon.)** - *Zea mays* (365)
- BALAMI (Orom.)** - *Andropogon abyssinicus* (324)
- BALDORLI (Som.)** - *Panicum coloratum* (201), *Panicum maximum* (198)
- BALLOLE (Som.)** - *Panicum maximum* (198)
- BAR BIYALEH (Som.)** - *Bothriochloa radicans* (307)
- BARANCIA (Kon.)** - *Eleusine coracana* (139)
- BARANIKA (Orom.)** - *Eleusine coracana* (139)
- BARLEY (Eng.)** - *Hordeum vulgare* (59)
- BARNYARD GRASS (Eng.)** - *Echinochloa colona* (212), *Echinochloa crus-galli* (213)
- BARO (Kef.)** - *Zea mays* (365)
- BASHIE (Gam.)** - *Eragrostis tef* (125)
- BEDALA (Gam.)** - *Zea mays* (365)
- BEDELA (Gam.)** - *Zea mays* (365)
- BERMUDA GRASS (Eng.)** - *Cynodon dactylon* (175), *Cynodon nlemfuensis* (175)
- BIRDWOOD GRASS (Eng.)** - *Cenchrus setigerus* (278)

- BIRREH (Som.) - Aristida**
funiculata (81)
- BIRRI (Som.) - Aristida kelleri**
(81)
- BISINGA (Kef.) - Sorghum bicolor**
(299)
- BLUE COUCH GRASS (Eng.) -**
Digitaria abyssinica (252)
- BOBBE (Orom.) - Sorghum bicolor**
(299)
- BOLOIC (Arbore) - Acrachne**
racemosa (137), *Eragrostis*
aspera (114), *Stipagrostis*
uniplumis (86)
- BOQOLLOO (Orom.) - Zea mays** (365)
- BOYIE (Orom.) - Pennisetum**
villosum (265)
- BREAD WHEAT (Eng.) - Triticum**
aestivum (63)
- BRISTLY FOXTAIL (Eng.) - Setaria**
verticillata (236)
- BROME GRASS (Eng.) - Bromus**
pectinatus (54)
- BROOMCORN (Eng.) - Sorghum**
bicolor (299)
- BUFFEL GRASS (Eng.) - Cenchrus**
ciliaris (276)
- BUIO (Som.) - Sporobolus**
festivus (155)
- BULDORLE (Som.) - Leptochloa**
obtusiflora (102)
- BULDORLE AGAR (Som.) - Brachiaria**
ovalis (227), *Digitaria*
velutina (254)
- BULDORLE AGARE (Som.) -**
Tricholaena teneriffae (191)
- BULDORLEH (Som.) - Panicum**
maximum (198)
- BULRUSH MILLET (Eng.) -**
Pennisetum glaucum (263)
- BULTUK (Orom.) - Pennisetum**
macrourum (271)
- BURI GUDUD (Som.) - Heteropogon**
contortus (356)
- BURI WENA (Som.) - Tetrapogon**
villosus (161)
- BUSCA (Shan.) - Tragus**
berteronianus (178)
- BUSCKA (Shan.) - Chloris virgata**
(168)
- CHAL GULFA (Orom.) - Cenchrus**
ciliaris (276), *Cenchrus*
pennisetiformis (278)
- CHINATO (Kef.) - Arundinaria**
alpina (3)
- CHITA SHEK HUSSEN (Orom.) -**
Cymbopogon citratus (328)
- CHOQQORSSA (Orom.) - Chloris**
gayana (169), *Cynodon*
dactylon (175), *Digitaria*
abyssinica (252), *Eleusine*
jaegeri (142)
- CITRONELLA GRASS (Eng.) -**
Cymbopogon nardus (328)
- COCKS FOOT (Eng.) - Dactylis**
glomerata (19)
- COMMON OAT (Eng.) - Avena sativa**
(37)
- COMMON REED (Eng.) - Phragmites**
mauritanus (65)
- COMMON STAR GRASS (Eng.) - Cynodon**
dactylon (175)
- COMMON WHEAT (Eng.) - Triticum**
aestivum (63)
- CONE WHEAT (Eng.) - Triticum**
turgidum (62)
- CORN (Eng.) - Triticum aestivum**
(63)
- CORN (Am. Eng.) - Zea mays** (365)
- CRAB GRASS (Eng.) - Digitaria**
ciliaris (256)
- DAAGUJAA (Orom.) - Eleusine**
coracana (139)
- DAALACHA (Orom.) - Chloris**
gayana (169)
- DAAPHOO (Orom.) - Sorghum**
arundinaceum (299)
- DAAT (Som.) - Paspalum vaginatum**
(234)
- DABALLE (Orom.) - Pennisetum**
villosum (265)
- DABASHABEL (Som.) - Themeda**
triandra (353)
- DABASSALE (Som.) - Panicum**
maximum (198)
- DABRO (Som.) - Sporobolus**
helvolus (151)
- DAGALLA (Orom.) - Hyparrhenia**
hirta (340)

- DAGGAAH GOR (Som.) - *Arthraxon prionodes* (310)
- DAGMGNO (Som.) - *Setaria acromelaena* (238)
- DAGOO (Orom.) - *Eleusine floccifolia* (141), *Eleusine jaegeri* (142)
- DAIDO (Som.) - *Sporobolus helvolus* (151)
- DALIFA (Orom.) - *Melinis repens* (186)
- DAREMO (Som.) - *Enteropogon macrostachyus* (172)
- DARIF (Som.) - *Lasiurus scindicus* (359), *Urochondra setulosa* (157)
- DARNEL (Eng.) - *Lolium temulentum* (17)
- DAUCHO (Kef.) - *Eleusine coracana* (139)
- DEBO WELODLE (Som.) - *Sporobolus spicatus* (151)
- DEDAN (Arbore) - *Sporobolus festivus* (155)
- DEHI (Som.) - *Paspalum vaginatum* (234)
- DELAN (Orom. & Som.) - *Hyparrhenia hirta* (340)
- DIKO (Kef.) - *Zea mays* (365)
- DINKEL WHEAT (Eng.) - *Triticum spelta* (62)
- DINQA (Gam.) - *Hyparrhenia hirta* (340)
- DITCH MILLET (Eng.) - *Paspalum scrobiculatum* (233)
- DOGAREIC (Geleb) - *Cenchrus ciliaris* (276)
- DOGS TOOTH GRASS (Eng.) - *Cynodon dactylon* (175)
- DOHIO (Som.) - *Dactyloctenium scindicum* (135)
- DOJO (Som.) - *Dactyloctenium scindicum* (135)
- DOMAR (Som.) - *Bothriochloa insculpta* (306), *Coelachyrum poiflorum* (134), *Cynodon dactylon* (175), *Pennisetum villosum* (265)
- DOMAR MEDU (Som.) - *Cynodon dactylon* (175)
- DOOB GRASS (Eng.) - *Cynodon dactylon* (175)
- DUIN (Som.) - *Dactyloctenium scindicum* (135)
- DUMBALO (Orom.) - *Chloris gayana* (169)
- DUNGARA (Som.) - *Panicum turgidum* (199)
- DUNGARR (Som.) - *Panicum turgidum* (199)
- DUNGARRE (Som.) - *Panicum turgidum* (199)
- DUPA (Wel.) - *Pennisetum sphacelatum* (272)
- DURCETA (Orom.) - *Brachiaria semiundulata* (227)
- DURUM WHEAT (Eng.) - *Triticum durum* (62)
- EDANTEBILLEC (Arbore) - *Dactyloctenium aegypticum* (135)
- EINKORN WHEAT (Eng.) - *Triticum monococcum* (61)
- EMMER WHEAT (Eng.) - *Triticum dicoccon* (61) [not *Triticum dicocum* L. which is a different species not found in Ethiopia.]
- ERIOROD (Som.) - *Eragrostis ciliaris* (113)
- ESHAT (Me.) - *Brachiaria deflexa* (228)
- ETHIOPIAN WILD OAT (Eng.) - *Avena abyssinica* (35), *Avena vaviloviana* (35)
- FALSE STAR GRASS (Eng.) - *Chloris pycnothrix* (169)
- FINGER MILLET (Eng.) - *Eleusine coracana* (139)
- FLINT WHEAT (Eng.) - *Triticum durum* (62)
- FORDALE (Som.) - *Tricholaena teneriffae* (191)
- GABACABUDO (Som.) - *Cenchrus ciliaris* (276)
- GAMBA GRASS (Eng.) - *Andropogon gayanus* (325)
- GARAGHEIC (Arbore) - *Eragrostis cilianensis* (119)

- GARAMO (Som.) - *Ochthochloa compressa* (108)
- GARAW (Som.) - *Cenchrus ciliaris* (276)
- GARBI (Som.) - *Cenchrus setigerus* (278)
- GARBU DADDE (Orom.) - *Festuca abyssinica* (24)
- GARGARI (Som.) - *Paspalidium geminatum* (243)
- GARGARO (Som.) - *Echinochloa pyramidalis* (213),
Paspalidium geminatum (243)
- GARGGARAA (Orom.) - *Pennisetum sphacelatum* (272)
- GARO (Som.) - *Sporobolus spicatus* (151)
- GARRAU (Som.) - *Pennisetum mezianum* (269)
- GARRBUU (Orom.) - *Hordeum vulgare* (59)
- GARRGORR (Som.) - *Eleusine floccifolia* (141)
- GASCIU SCIUDI (Shan.) - *Sporobolus festivus* (155)
- GASHIE (Gam.) - *Eragrostis tef* (125)
- GASHO (Kef.) - *Eragrostis tef* (125)
- GAUWADERI (Som.) - *Enteropogon rupestris* (172)
- GEBBIN (Som.) - *Tetrapogon cenchriformis* (159)
- GEESHIE (Wel.) - *Eragrostis tef* (125)
- GERBO (Som.) - *Sporobolus helvolus* (151)
- GEREB (Som.) - *Bothriochloa radicans* (307)
- GHIFTA (Shan.) - *Echinochloa pyramidalis* (213)
- GHIFTE (Arbore) - *Eragrostis cilianensis* (119)
- GHIFTEN (Arbore) - *Echinochloa pyramidalis* (213)
- GHIFTI (Arbore) - *Echinochloa pyramidalis* (213)
- GHIFTIN (Arbore) - *Echinochloa pyramidalis* (213)
- GIANT REED (Eng.) - *Arundo donax* (66)
- GOLDEN TIMOTHY (Eng.) - *Setaria sphacelata* (238)
- GUINEA CORN (Eng.) - *Sorghum bicolor* (299)
- GUINEA GRASS (Eng.) - *Panicum maximum* (198)
- GURTA (Som.) - *Digitaria abyssinica* (252), *Panicum coloratum* (201)
- GUSOMADOBEYE (Som.) - *Ehrharta erecta* var. *abyssinica*. (12)
- GUWCHUFI (Som.) - *Cenchrus ciliaris* (276)
- HAARAN (Shan.) - *Heteropogon contortus* (356)
- HABABOO (Orom.) - *Pennisetum villosum* (265)
- HABRA LEGGIT (Som.) - *Ochthochloa compressa* (108)
- HADIGO (Som.) - *Sporobolus pellucidus* (150)
- HAMASHLEH (Som.) - *Anthephora pubescens* (281)
- HANFAROO (Orom.) - *Pennisetum villosum* (265)
- HARAROO (Orom.) - *Melinis repens* (186)
- HARD WHEAT (Eng.) - *Triticum durum* (62)
- HARFO (Som.) - *Eragrostis cilianensis* (119),
Stipagrostis hirtigluma (86)
- HARFO SOMAL (Som.) - *Eragrostis cilianensis* (119)
- HARRAN (Shan.) - *Hyperthelia dissoluta* (333)
- HITITI (Orom. & Wel.) - *Eleusine indica* (141)
- HITITI (Wel.) - *Eleusine floccifolia* (141)
- HOMBORRI (Orom.) - *Triticum spelta* (62)
- HORBONOLE (Som.) - *Dactyloctenium aegypticum* (135)
- HORRAJAR (Som.) - *Arthraxon prionodes* (310)
- HRI HARI (Som.) - *Ochthochloa compressa* (108)

- HUBNALI (Som.) - *Coelachyrum poiflorum* (134)
- HUFFEH (Orom. & Som.) - *Digitaria ternata* (248)
- IBASHIGASHU (Bodi) - *Panicum maximum* (198)
- INASA (Geleb) -
Drake-brockmania somalensis (109)
- INDIAN CORN (Eng.) - *Zea mays* (365)
- INDIAN MEAL (Eng.) - *Zea mays* (365)
- ITALIAN MILLET (Eng.) - *Eleusine multiflora* (139)
- ITALIAN RYE GRASS (Eng.) - *Lolium multiflorum* (18)
- ITCH GRASS (Eng.) - *Rottboellia cochinchinensis* (365)
- IYA MAKARAI (Som.) - *Tetrapogon villosus* (161)
- JADDOHO (Som.) - *Dactyloctenium scindicum* (135)
- JERIBO (Som.) - *Cynodon* spp. (174)
- KAATA (Shan.) - *Heteropogon contortus* (356)
- KABECHA (Orom.) - *Themeda triandra* (353)
- KASI (Orom.) - *Oplismenus hirtellus* (192)
- KERI (Bodi) - *Echinochloa haploclada* (212), *Sporobolus pyramidalis* (148)
- KIKUYU GRASS (Eng.) - *Pennisetum clandestinum* (264)
- KOMBO (Orom.) - *Setaria megaphylla* (242)
- KULIZAN (Arbore) - *Cenchrus ciliaris* (276)
- KUZIZI (Bodi) - *Sehima nervosum* (316)
- LAALUNCAA (Orom.) - *Brachiaria semiundulata* (227), *Urochloa panicoides* (230)
- LAKACHALI (Bodi) - *Cenchrus ciliaris* (276)
- LEMMANNA (Orom.) - *Arundinaria alpina* (3), *Arundo donax* (66)
- LEMON GRASS (Eng.) - *Cymbopogon citratus* (328)
- LOIA (Orom.) - *Sporobolus africanus* (149)
- LOVE GRASS (Eng.) - *Setaria verticillata* (236)
- MACADEI (Som.) - *Sorghum arundinaceum* (299)
- MACHEN (Som.) - *Dichanthium foveolatum* (308)
- MACHESSAA (Orom.) - *Lolium temulentum* (17)
- MAIZE (Eng.) - *Zea mays* (365)
- MAKA (Wel.) - *Saccharum officinarum* (292)
- MAKAWALLA (Orom.) -
Dactyloctenium aegypticum (135), *Digitaria ternata* (248)
- MARABOB (Som.) - *Setaria verticillata* (236)
- MARDSWEIDLEH (Som.) -
Stipagrostis hirtigluma (86)
- MARDWEIDLEH (Som.) -
Stipagrostis uniplumis (86)
- MARGA HILLEESA (Orom.) -
Coelachyrum poiflorum (134)
- MARGA URGU (Orom.) - *Vetiveria zizanioides* [Although not treated in the main body of this volume, this species is known to have been introduced and planted successfully several times through soil conservation projects. One place is Jimma-Melko Agricultural Research Station.]
- MARGGA DIMUU (Orom.) - *Microchloa indica* (172), *Microchloa kunthii* (174)
- MARGO HARO (Orom.) - *Sporobolus festivus* (155)
- MARRA (Shan.) - *Oropetium minimum* (100)

- MARRO (Shan.) - *Oropetium minimum* (100)**
- MASARATA (Orom.) - *Cymbopogon citratus* (328)**
- MATA DABOO (Orom.) - *Triticum dicoccon* (61) [not *Triticum dicocum* L. which is a different species not found in Ethiopia.]**
- MATA JJABOO (Orom.) - *Triticum aestivum* (63)**
- MAXXAJJII (Orom.) - *Themeda triandra* (353)**
- MAXXANNEE (Orom.) - *Setaria pumila* (238), *Tragus berteronianus* (178)**
- MERN (Orom.) - *Pennisetum sphacelatum* (272)**
- MESO (Orom.) - *Eragrostis tef* (125)**
- METCHICHA (Orom. & Sid.) - *Pennisetum sphacelatum* (272)**
- MEUREF (Som.) - *Setaria verticillata* (236)**
- MIGIRA (Orom.) - *Pennisetum thunbergii* (269)**
- MIGRA (Orom.) - *Sporobolus africanus* (149)**
- MIGRA SARE (Orom.) - *Pennisetum thunbergii* (269)**
- MINOR PALISADE GRASS (Eng.) - *Brachiaria jubata* (221)**
- MISINGA (Orom.) - *Sorghum bicolor* (299)**
- MOUNTAIN BAMBOO (Eng.) - *Arundinaria alpina* (3)**
- MOUNTAIN NEEDLE GRASS (Eng.) - *Aristida adoensis* (80)**
- MUJJAA (Orom.) - *Pennisetum nubicum* (275), *Snowdenia polystachya* (257)**
- MURII (Orom.) - *Pennisetum uliginosum* (271), *Sporobolus africanus* (149), *Sporobolus pyramidalis* (148)**
- MUTOBOKA (Orom.) - *Chloris gayana* (169)**
- MUTUBOKA (Orom.) - *Chloris virgata* (168)**
- NARCI (Shan.) - *Eragrostis ciliaris* (113)**
- O'AA (Orom.) - *Hyparrhenia anthistirioides* (341)**
- OATS (Eng.) - *Avena sativa* (37)**
- OBBALA (Shan.) - *Panicum maximum* (198)**
- ORCHARD GRASS (Eng.) - *Dactylis glomerata* (19)**
- OS ANOLE (Som.) - *Chloris virgata* (168)**
- OS DEMER (Som.) - *Cenchrus ciliaris* (276)**
- OS GALIM UENIS (Som.) - *Urochloa panicoides* (230)**
- OS GARDA (Som.) - *Aristida adscensionis* (78)**
- OS GERET (Som.) - *Cenchrus ciliaris* (276)**
- OS GHELUFBI (Som.) - *Eragrostis ciliaris* (113)**
- OS HURBONADA (Som.) - *Dactyloctenium scindicum* (135)**
- OS LA (Som.) - *Panicum repens* (202)**
- OS ROVADI (Som.) - *Panicum repens* (202)**
- OS SUGUL (Som.) - *Echinochloa crus-galli* (213)**
- PALISADE GRASS (Eng.) - *Brachiaria brizantha* (222)**
- PILA (Orom.) - *Cenchrus setigerus* (276)**
- POLISH WHEAT (Eng.) - *Triticum polonicum* (61)**
- POLLARD WHEAT (Eng.) - *Triticum turgidum* (62)**
- POLONICUM WHEAT (Eng.) - *Triticum polonicum* (61)**
- POTA (Wel.) - *Digitaria abyssinica* (252)**
- PYRAMID DROPSEED (Eng.) - *Sporobolus pyramidalis* (148)**
- QAICHA (Orom.) - *Themeda triandra* (353)**

- QAMADI (Orom.) - *Triticum aestivum* (63), *Triticum spelta* (62), *Triticum* spp. (59)
- QAMADO (Orom.) - *Triticum aestivum* (63)
- QAMATE (Orom.) - *Pennisetum macrourum* (271)
- QANA DUBA (Orom. & Wel.) - *Setaria* spp. (234)
- RAMASS (Som.) - *Sporobolus nervosus* (153)
- RAMMAS BUR (Som.) - *Melinis repens* (186)
- REED GRASS (Eng.) - *Arundo donax* (66)
- RHODES GRASS (Eng.) - *Chloris gayana* (169)
- RICE (Eng.) - *Oryza sativa* (10)
- RISS (Som.) - *Sporobolus spicatus* (151)
- RIVET WHEAT (Eng.) - *Triticum turgidum* (62)
- RYE (Eng.) - *Secale cereale* (58)
- SADAHO (Som.) - *Dactyloctenium scindicum* (135)
- SADDEH ELI (Som.) - *Aristida somalensis* (77)
- SADDEH HO (Som.) - *Dactyloctenium aegypticum* (135), *Dactyloctenium scindicum* (135)
- SAMARETA (Orom.) - *Hordeum vulgare* (59)
- SARDOO (Orom.) - *Cynodon dactylon* (175), *Pennisetum clandestinum* (264), *Polypogon viridis* (44)
- SAREM (Som.) - *Dichanthium foveolatum* (308)
- SAREN (Som.) - *Dichanthium foveolatum* (308), *Stipagrostis hirtigluma* (86)
- SARREN (Som.) - *Eragrostis papposa* (122)
- SCEPELLA (Shan.) - *Bothriochloa radicans* (307)
- SCINDI (Shan.) - *Tragus berteronianus* (178)
- SCIOHO (Shan.) - *Chloris roxburghiana* (168), *Dactyloctenium scindicum* (135), *Eriochloa fatmensis* (218)
- SCIOOHO (Shan.) - *Eragrostis japonica* (114), *Urochloa setigera* (231)
- SCIUDDI (Shan.) - *Chloris gayana* (169), *Digitaria ciliaris* (256), *Eragrostis aspera* (114), *Sporobolus festivus* (155)
- SCIUDE (Shan.) - *Pennisetum setaceum* (265)
- SCIUDI (Shan.) - *Cenchrus ciliaris* (276), *Cynodon plectostachyus* (175), *Eragrostis aethiopica* (126), *Panicum maximum* (198)
- SCIUDI ZARSI (Shan.) - *Cynodon plectostachyus* (175)
- SCUTCH GRASS (Eng.) - *Cynodon dactylon* (175)
- SHAMBAKO (Kef. & Orom.) - *Arundo donax* (66)
- SHANGO (Kef.) - *Sorghum bicolor* (299)
- SHEKO (Kef.) - *Hordeum vulgare* (59)
- SHEMBEQO (Wel.) - *Arundo donax* (66)
- SHESHU (Orom.) - *Pennisetum villosum* (265)
- SHIEMALA (Orom.) - *Oxytenanthera abyssinica* (6)
- SHIKARO (Kef.) - *Arundinaria alpina* (3)
- SHIMALA (Wel.) - *Oxytenanthera abyssinica* (6)
- SHINATO (Kef.) - *Arundinaria alpina* (3)
- SHMALA (Orom.) - *Arundinaria alpina* (3)
- SHUBBO (Orom.) - *Digitaria velutina* (254)
- SIF (Orom.) - *Panicum maximum* (198)
- SIGIN (Bodi) - *Themeda triandra* (353)

- SIGNAL GRASS** (Eng.) - *Paspalum conjugatum* (234)
- SILIDE** (Geleb) - *Echinochloa stagnina* (215)
- SMALL SPELT** (Eng.) - *Triticum monococcum* (61)
- SOLO** (Gam.) - *Eragrostis tef* (125)
- SORGHUM** (Eng.) - *Sorghum bicolor* (299)
- SPELT WHEAT** (Eng.) - *Triticum spelta* (62)
- ST. AUGUSTINE GRASS** (Eng.) - *Stenotaphrum secundatum* (244)
- STAR GRASS** (Eng.) - *Cynodon nlemfuensis* (175)
- SUDAHO** (Som.) - *Dactyloctenium aegypticum* (135),
Dactyloctenium scindicum (135)
- SUDEH** (Som.) - *Dactyloctenium scindicum* (135)
- SUGAR CANE** (Eng.) - *Saccharum officinarum* (292)
- SUMARO** (Orom.) - *Bothriochloa radicans* (307), *Chrysopogon aucheri* (304)
- SUTTO** (Orom.) - *Bothriochloa insculpta* (306)
- TAFFI** (Orom.) - *Eragrostis tef* (125)
- TAFFI GURACHA** (Orom.) - *Eragrostis tef* (125)
- TAFFI QAMALBE** (Orom.) - *Eragrostis tenuifolia* (122)
- TEBBO** (Kef.) - *Triticum dicoccon* (61) [not *Triticum dicoccum* L. which is a different species not found in Ethiopia.]
- TEEA** (Gam.) - *Zea mays* (365)
- TEF** (Eng.) - *Eragrostis tef* (125)
- THREE AWN GRASS** (Eng.) - *Aristida adscensionis* (78)
- TITIMA** (Orom.) - *Eleusine jaegeri* (142)
- UARRE** (Shan.) - *Panicum deustum* (202)
- UEMBE** (Som.) - *Eleusine coracana* (139)
- UEMBO** (Som.) - *Eleusine coracana* (139)
- URRA** (Orom.) - *Digitaria abyssinica* (252)
- VELVET CRAB GRASS** (Eng.) - *Digitaria velutina* (254)
- WAILA SIDDEH** (Som.) - *Brachiaria leersioides* (225)
- WARATHI** (Orom.) - *cynodon nlemfuensis* (175)
- WARIQEE** (Orom.) - *Hyparrhenia cymbaria* (343)
- WEETU** (Orom.) - *Microchloa indica* (172), *Microchloa kunthii* (174)
- WEYSHA** (Gam. & Wel.) - *Arundinaria alpina* (3)
- WHEAT** (Eng.) - *Triticum spp.* (59)
- WHITE SORGHUM** (Eng.) - *Sorghum bicolor* (299)
- WILD FINGER MILLET** (Eng.) - *Eleusine indica* (141)
- WILD OAT** (Eng.) - *Avena fatua* (37)
- WILD SORGHUM** (Eng.) - *Sorghum arundinaceum* (299)
- WIRE GRASS** (Eng.) - *Pennisetum sphacelatum* (272)
- WOVILLO** (Orom.) - *Bromus leptoclados* (54)
- WUSHEWA** (Wel.) - *Setaria spp.* (234)
- XIRRATE** (Arbore) - *Cynodon dactylon* (175)
- YABELO** (Orom.) - *Arundo donax* (66)
- YEBI OKI** (Som.) - *Digitaria longiflora* (249)
- YELAMI SAR** (Wel.) - *Andropogon abyssinicus* (324)