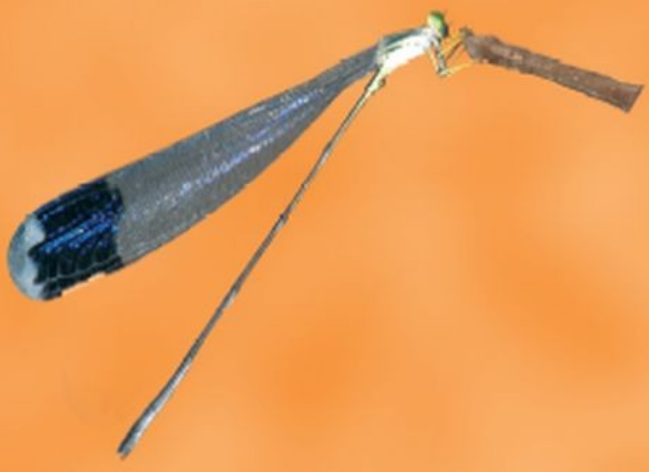
Encyclopedia of South American Aquatic Insects: *Odonata - Zygoptera*

Charles W. Heckman



Springer

ENCYCLOPEDIA OF SOUTH AMERICAN AQUATIC INSECTS: ODONATA - ZYGOPTERA

Encyclopedia of South American Aquatic Insects: Odonata - Zygoptera

Illustrated Keys to Known Families, Genera, and Species in South America

by

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Springer

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This book is dedicated to my son, Charles Heckman, on his graduation from the Universität Hamburg

Contents

Introduction

This work was begun to provide keys to the aquatic insect species known from Brazil. The original goal was to include all genera known from South America and all species from Brazil, but for most groups, the scope was expanded to encompass all species in South America, and, in some cases, to include terrestrial species of orders that include both terrestrial and aquatic taxa. In no case is a taxonomic revision of any group undertaken, although recommendations for such revisions are included where appropriate, and the probable synonymy of nominal species still treated as valid in the literature is noted.

Two different approaches will be employed according to the taxon being treated. For phylogenetic groups encompassing overwhelmingly or exclusively aquatic species, such as the orders Plecoptera and Ephemeroptera or the families Dytiscidae and Culicidae, keys are provided to distinguish all genera and species known to occur in South America. An effort has been made to include every identifiable species so that the user of the key can determine with reasonable certainty whether or not his specimen belongs to a species that has already been described or whether it is one that is not yet known to science. Where feasible, complete keys will be prepared for groups containing both aquatic and terrestrial species that do not encompass an extraordinarily large number of species. This has already been done for the order Collembola.

The second approach will be used for aquatic species belonging to predominantly terrestrial taxa, such as the order Lepidoptera or the families Curculionidae and Muscidae. In such cases, the number of terrestrial species involved is too great to deal with conveniently. For example, a work confined to aquatic insects cannot include a key to all of the approximately 45,000 weevil species (O'Brien and Wibmer, 1978) or even the portion of its enormous fauna inhabiting South America because only a small percentage of them live in or on aquatic plants. However, without such a comprehensive key, it becomes difficult for a person not specializing in the taxonomy of this group to be sure in which genus or subfamily his specimen belongs. For aquatic species in such groups, a descriptive approach is used. It is attempted to describe the morphology completely enough for the non-specialist to recognize his aquatic species. At the same time, descriptions or keys to higher taxa within these groups are provided as necessary so that the aquatic species can be distinguished from the terrestrial ones and phylogenetic affinities of the specimens can be recognized.

The geographical limitations of this work are not strictly maintained throughout. For some genera, keys are provided that include mention or descriptions of species still known only from Central America or Caribbean islands, while for others, the keys are strictly limited to the South American fauna. The choice of comprehensiveness was dictated mainly by convenience. For genera encompassing few species and those that have been revised by competent taxonomists, keys to most or all Neotropical species could easily be

provided. In the cases of other genera encompassing poorly described species, those which have not been reported south of Panama and the Antilles were not included in the keys.

In general, the ranges of the aquatic insect species are very poorly known. The reported occurrences indicate more the locations at which entomologists have worked than the actual distribution of the species. The type specimens of a great many South American species were collected during expeditions to individual regions of the continent, and systematic surveys of the fauna have only been undertaken for a few groups. Among the prominent early collectors was Charles Darwin. Larger expeditions were undertaken during the late 19th and early 20th century. Considerable numbers of species have been described after examination of the specimens collected in Patagonia and South Chile during the early part of the 20th century. In Brazil, Rio de Janeiro and Santa Catarina appear very frequently in the distribution reports due to the extensive collection in those states by F. Plaumann, while many other species were described from Amazonas because of the presence of a large research station, the Instituto Nacional de Pesquisas da Amazônia, at Manaus. Naturally, a great many species were described from specimens collected at São Paulo and Rio de Janeiro, where most of the Brazilian institutes of research are located. Reports from other Brazilian states are generally much rarer, so the ranges of Brazilian species can generally be expected to be much more extensive than indicated by the published reports. Notable research efforts in other parts of South America have resulted in large numbers of species being recorded for Surinam and the Amazon region of Peru. Knowledge of the fauna in other regions varies considerably from taxon to taxon, depending upon the efforts of talented individuals specializing in individual orders or families. Generally, the insect taxa with the greatest impact on public health and agriculture are the best known.

For some rarer species in neglected taxa, the ranges are scarcely defined at all. Specimens described during the last century were sometimes reported from "Brazil" or even "South America" without any more exact collecting data. The fact that the descriptions of such species are generally sketchy, at best, makes it doubtful whether they can be recognized again. There is mention in many of the review papers cited in this work about the confusion caused by falsely labelled specimens, incomplete collecting data, and doubt among the collectors about the names of the places from which their specimens originated. Names such as "Chapada" in Brazil frequently appear without mention of which Chapada is meant. This problem will continue to cause confusion in the future as it has in the past.

The problems encountered in systematic biology worldwide are especially pronounced in the Neotropical Region. This is due to the dearth of competent taxonomic studies on the regional fauna. Theoretically, the scientist who needs to know the correct name of a specimen can accomplish this by a procedure that assures a high probability of success, although a good deal of time and expense may be required. The first step in this procedure is the use of a comprehensive

key treating the higher taxon to which the specimen belongs. This process is much easier for a specialist familiar with the group than for a person who needs to know the identity of species being used in physiological experiments or surveyed in synecological studies. In most cases, after the specimens have been identified using the keys, original or revised descriptions listed by the author of the key should be consulted to confirm the identifications. If the available descriptions are so poor that the identity of the species remains uncertain, a comprehensive taxonomic review of the taxon it belong to must be consulted. If such a review has not yet been published, the specimen to be identified must be compared with type specimens of each species belonging to the higher taxon to which the specimen belongs. These should be found in museum collections.

According to taxonomic convention, the author of a published original description of a new species should designate one of his specimens as a holotype. This type then becomes the standard on which the identifications of all specimens collected in the future are based. The species to which the holotype belongs is then referred to by the name proposed by the author, at least when the same name has not previously been applied to another species.

In addition to the holotype, other specimens believed to be of the same species by the author are designated as paratypes. If a holotype is not available, a paratype can be examined to confirm identifications. If the holotype has been lost or extensively damaged, a specialist revising the taxonomy of the group may designate a lectotype apparently belonging to the species in question. This then replaces the holotype as a standard for recognizing the species, at least until the lost holotype or paratype is found.

Anyone wishing to take the trouble to identify a specimen beyond the shadow of a reasonable doubt should be able to follow this procedure. If his specimen is not the same species as any of the holotypes preserved in museums, he should prepare a description of his specimen and have it published with his proposed name for the new species or give it to a specialist who is interested in doing this.

Unfortunately, the procedures described above often fail to work, especially when South American insects are involved. First of all, keys to identify the species are seldom available, and when they are, they are generally out of date or incomplete for the region being studied. This leaves the researcher with the chore of collecting a large number of original descriptions to match with his specimens. These descriptions are sometimes very sketchy, leaving the reader with no reliable way of identifying his specimen from the available literature. Comparisons with type specimens may not only be difficult in many cases because the types were deposited in museums on other continents, they are often impossible because some authors have failed to mention the name of the museum in which they intended to place their type specimens or because the specimen cannot be found again due to war damage or sloppiness by the curators of the museum in question. Even when the type can be found, it often proves to be in very poor condition, and relatively few paratypes of South American species have been designated that can be examined in the absence of a usable holotype.

Using established procedures for identifying South American insects is made even more problematic by the practice of some authors of describing new species on the basis of only one life stage. Not only have many species been described by taxonomists who examined only adults, some are known only from larvae. Furthermore, countless species are known only from adults of one sex. While the description of an adult may provide a legitimate basis for establishing a new species, it is difficult to find justification for naming a species based only on larvae. Some authors have designated larvae as the types of species congeneric with others known only as adults. These individuals seemed to be in such a hurry to publish that they deliberately left the arduous task of matching larvae with adults to other researchers.

In practice, convention should dictate which gender and life stage should be chosen as the holotype. For example, adult male chironomids are presently those on which species descriptions should be based. Earlier descriptions of female adults are generally useless for determining a species unless someone has taken the trouble to match the female to a described male. In an ideal system of nomenclature, descriptions of adults of both sexes and of the larval stages should be provided. However, the state of the art still requires specimens to be identified according to partial descriptions of one stage and often one sex. Therefore, before fully workable systems for identifying South American species will be possible, an enormous number of revisions and supplemental descriptions will be necessary. This work is meant as a first step in the process: providing keys as reliable as the available publications permit.

Finally, it is necessary to note that no keys to taxa higher than family are provided in this work. Keys to the insect orders are difficult to prepare and use because of the many exceptions to the general morphological characteristics, such as wingless dipterans and heteropterans as well as ephemeropterans that lack legs. Descriptions of the orders can be found in any number of textbooks on entomology or invertebrate zoology, and most specimens can be quickly assigned to the correct higher taxon by browsing the volumes of this series and comparing them to the illustrations. With a little experience, anyone can learn to recognize the order of an insect almost at a glance.

An appeal for quality in taxonomic work

This appeal is addressed to two groups, the first consisting of those responsible for deciding who obtains what portion of the available research funds and the second being the taxonomists themselves.

It has long been recognized by experienced ecologists that identification of the species present in a community is an absolute necessity for thorough ecological research. The biota of any water body, for example, is more than a quantity of “biomass” or a “pathway for energy”. Many ecologists, especially those beginning their research careers, have the greatest difficulty in identifying the species present, and the quality of their work is limited by this difficulty. The

ecologist may indeed investigate systems using methods very different from those engaged in descriptive biology, but he is nevertheless dependent on a sound basis of taxonomic information for the proper reporting of his results. Briefly stated, ten may be equal to ten, but ten oranges are not equal to ten cows, and ten of one dragonfly species are not equal to ten of another. The "emergency measure" of identifying a species only as far as the genus or family is not satisfactory because two congeneric species may have completely different habitat preferences, feeding habits, and seasonal activity cycles. In short, for one ecologist to properly compare his work with that of another, he must know the name of the species he has encountered and of those that have influenced the biotic communities he has been studying.

In the past, ecologists usually relied on taxonomic specialists to identify their specimens. Since the specimens invariably belonged to a wide variety of taxa, they were distributed among a number of taxonomists, each of whom was an expert only for his own small phylogenetic group. This practice has ceased to function in recent years because of the failure of those in charge of distributing research funds to support scientists who wish to engage themselves in taxonomic work professionally. As the taxonomists reached retirement age, they left active research without being able to pass their knowledge on to a successor. As time went on, more and more personal knowledge and skill that is difficult or impossible to get from books was permanently lost.

The disappearance of the best taxonomists was accompanied by a decline in the quality of ecological work. This may not be considered totally undesirable by persons in government and business who are constantly confronted by the demands of environmentalists. As ecology moves increasingly out of the laboratory and into the courtroom, the ground rules change, and where principles remain unclear, the lawyers have more room to maneuver, using their skills of persuasion rather than being forced to confront research results already proven beyond the shadow of a reasonable doubt. Furthermore, laws passed to protect endangered species can be better circumvented if no people can be found who are capable of identifying such species.

Although there may well be incentives to suppress taxonomic research, the virtual demise of taxonomy as a field of biology has been instigated mainly by the scientific community itself. Ambition and the desire for quick success have motivated the staffs of many institutions to seek persons promising to achieve great breakthroughs, and no place was left for routine systematic work, which is by nature slow and methodical. Often, it was the number publications rather than their quality or length that determined whether or not a person could succeed in finding gainful employment in science. Recently, science citation indices have become the criterion for judging success, prompting young researchers to investigate whatever everyone else is investigating in order to assure themselves of a maximum number of other scientists who would have reason to cite their work. Pressure was placed on the young scientist to come up with something clever very quickly, leaving no time to learn in depth about the organisms he was

encountering. It is especially unfortunate that the worldwide elimination of taxonomist positions came just prior to the development of computer equipment that makes it very easy to establish data banks. Thus, science was robbed of the personnel competent to systematize and disseminate the great body of information that had accumulated during two centuries of intensive work by systematic biologists in all parts of the world.

A long time went by without any crisis becoming evident because the taxonomists and systematic biologists already working in the museums and universities continued donating their time to help identify specimens collected or used in the laboratory by ecologists, physiologists, geneticists, and biochemists. Even after their retirements, many continued contributing time to help younger colleagues in other fields of biology. Moreover, a number of excellent specialists were employed in other fields of work rather than in the biological sciences and made their contributions to the knowledge of the world's flora and fauna as a hobby.

With the gradual elimination of the competent taxonomists and systematic biologists through death or disability, however, the problems of defining community structure, determining species diversity, and identifying the organisms causing some problem in the field have been intensifying. For many taxa, there are no longer experts who can be consulted, or those experts that are still active are hopelessly overworked.

The result is the loss of a vast body of information about the flora and fauna in all parts of the world. Without knowledge of the species that have been encountered, the ecologist is faced with a dilemma. He must learn to identify a vast array of species belonging to the widest variety of phylogenetic groups, or he must limit his research to superficial phenomena. Hence there has been an increasing tendency to use numbers instead of names and to try to equate quantities of unlike and undefined substances or objects, although this cannot yield any reliable results, as mentioned above.

The second aspect of the problem must be dealt with by the taxonomists themselves, who have in the past often been guilty of laxity in quality control of their work. The ambition to gain status by naming new species has certainly been a motivating factor for many of these scientists, and for this purpose, it is easier to write short papers with sketchy descriptions of aberrant specimens than to produce comprehensive reviews compiling the available information on genera or families together with thorough, well illustrated descriptions of new taxa. As mentioned above, it is evident that the examination of type specimens for positive identification of South American insects is often impossible because none were designated, or if they were, they have been lost or greatly damaged. For better or worse, the published literature frequently provides the only criteria for identifying species.

While compiling this series, the enormously broad spectrum of quality in the taxonomic publications became evident. Some papers are of very high quality, such as the works of Belle on the Odonata. These publications provide descriptions of all essential morphological characters, the exact locations of type

specimens, and precise collecting data. Any morphological details lacking in the text can be seen in the detailed illustrations. It is clear from these papers that the species described are actually distinct from all species previously described.

In general, more recent publications tend to include better descriptions than older ones, but this is not the case with all taxa. Many works more than a century old are still useful for identifying species, and some of the information they provide cannot be found in any more recent publications. On the other hand, many recent publications are extremely poor, providing either very sketchy descriptions or showing a very poor comprehension of the concept of species as a closed phylogenetic grouping of individuals, which may possess a considerable degree of individual variability (Mayr, 1963).

Many of the better taxonomic publications are rather long, but length is no guarantee of quality. There are some excellent concise works, which can be used with great reliability for the identification of species. Some very long works, including incredible amounts of detail, on the other hand, are very poorly organized and omit much essential information while including vast amounts of trivia. Authors who are more collectors than biologists have used very keen, practiced observation abilities to find the most minor differences among single populations to produce massive numbers of nominal species that are indistinguishable to less skilled observers. Among the European fauna, long lists of synonyms attest to the vast amount of printer's ink that has been squandered on the description and suppression of spurious taxa. Unfortunately, revisions of many South American taxa are still lacking, and many of the nominal species included in the keys will certainly prove to be junior synonyms when more is known about the variability of natural populations.

In the following sections, minimum criteria will be suggested for describing new taxa. All of the features an author should describe to define a new species or subspecies within a particular taxonomic group will be mentioned. It is further suggested, as a general rule, to base descriptions on a holotype and several paratypes. New species described from only one or two specimens should be regarded as questionable, particularly when the morphological differences between them and specimens of other nominal species are very slight. The practice of choosing type specimens that are missing various structures, such as legs, abdomina, or antennae, should be discouraged. With modern means of mass transportation available, there should be no serious obstacle to collecting more material from the locations at which the specimens of the alleged new species were encountered, and funds should be provided for such collecting for the reasons outlined above.

It would probably be justified to declare many names of species poorly described and without known type specimens as *nomina dubia* and omit them from the key. However, whenever distinctive features were found in the original description that can be used to distinguish a species from all other known species in the genus, the name is included in the keys. Names from the keys must therefore be used with caution because one or more undescribed species may also have the characteristics in question. Where such situations are

apparent, it is hoped that specialists for the groups in question, if any are presently active, will designate lectotypes for the species most likely to have been referred to by the earlier authors. Holotypes, paratypes, and original descriptions should be provided for any similar, congeneric species that were hitherto undescribed.

Scope of the work

The families recognized are mainly those found in the key of Brues *et al*. (1954), and some of the new families that have been described by various authors after the appearance of that key are omitted because they have not been generally accepted, are too poorly defined, are too similar to other families to recognize any general definitive characteristics for use in the key, or seem for another reason to be of doubtful validity.

Fig. 1: The geographical scope of this work is limited to continental South America and the offshore islands shown on this map.

Fig. 2: The Brazilian states where the species were found are generally reported as shown on this map. Older reports, however, may not reflect the modern political boundaries, so it often requires knowledge of the travels of entomologists to determine the precise locations of known occurrence. D.F. designates the Federal District of Brasilia.

Geographically, the work is limited to continental South America and islands very close to the coast, such as Tierra del Fuego (**Fig. 1**). Islands far enough offshore to be zoogeographically distinctive, such as the Galapagos Islands, are not included, even though politically, they are parts of South American countries. Except in the case of Brazil, the distribution reported in the keys usually refers only to the country in which the species have been found. When they have been reported in the literature, the Brazilian states are shown, as depicted in **Figure 2**. However, some inaccuracies may have been inadvertently

introduced in the cases of states which have changed their boundaries since the insects were described. For example, Mato Grosso formerly encompassed the present states of Mato Grosso, Mato Grosso do Sul, and Rondônia, so species reported in older literature from Mato Grosso may actually be confined to any one of these three present states.

Acknowledgements

The preparation of these keys required the search of a large amount of literature. A great deal of help was provided in obtaining many obscure or archaic papers by Frau G. Lechner of the Max-Planck-Institut für Limnologie Library in Plön and the Timberland Public Library System in Washington, U.S.A. Other works were provided courtesy of Senhora Marilia Junqueira of the Fundação Centro Tecnológico de Minas Gerais in Belo Horizonte. Special thanks are due to Dr. Dennis R. Paulson of the University of Puget Sound, who permitted me with review several rare publications that were unobtainable through the library system, and to Dr. Rosser Garrison of the California Department of Food and Agriculture for providing me with valuable reprints, as well as giving me access to many recent papers, including two of his own that were still in press. Drs. Paulson and Garrison also provided me with their own unpublished information on the taxonomic status of several rare species. To all of those who provided their advice and assistance in the completion of this work, I offer my sincere thanks.

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Section 3

Odonata

Members of the Odonata are attractive and interesting members of the freshwater community. They are among the largest insects with aquatic larvae that inhabit terrestrial or littoral habitats as adults. Most species have eye-catching markings, and several are among the most beautiful of insects. Some species are strong flyers, and their adults can be found far from water. Others are typically found only near the edge of the water bodies in which the larvae develop. Because of their predatory habits, they are unappreciated allies of mankind, which have certainly saved millions of lives through their control of mosquitoes and other disease vectors and reduced the losses of many wetland crops through their habits of eating a wide variety of flying herbivorous insects.

The approved common name for all members of the order is "dragonfly." However, many local common names have been adopted. In addition, the common name, "damselfly," is often used to designate members of the suborder Zygoptera. In this book, dragonfly is used for all members of the Odonata, following the recommendation of Gloyd and Wright (1959), although damselfly is often encountered in earlier literature.

The Odonata is considered to be a relatively primitive group of insects, which is well-represented in the fossil record since the Palaeozoic. Some of the extinct species resembling dragonflies and classified in a separate order, Protodonata, were much larger than any of the modern species. Their fossils date from the Upper Carboniferous and Permian. Species in the modern groups of Odonata were common throughout the Mesozoic (Riek and Kukalova-Peck, 1984). Bechly (1996) reviewed the various classification systems developed according to the arrangement of the wing veins of both modern and ancient species. From the information presented, it is apparent that the Odonata had arisen as a distinct group of insects not long after winged species first appeared on earth. Their basic morphological structure and the organs modified for mating are unique among the insects. Furthermore, few insects can match the flying abilities of anisopterans, especially with regard to the duration of their flights. Only soaring birds regularly match the time spent in the air by the large aeshnids. At the same time, however, the dragonflies are capable of speed and maneuverability usually matched only by animals that usually fly only short distances at any one time, such as dipterans and insectivorous birds.

All known species of Odonata are predators as adults and larvae, and as such, they are very valuable for providing biological control over many harmful insects, especially those with aquatic larvae. Unfortunately, in spite of their contribution to the biological control of many pests, some dragonfly species have been decimated by pesticides and other toxic substances used in and near water bodies, and some have been permanently reduced in number due to the drainage of wetlands and destruction of small ponds (Heckman, 1981; Caspers

and Heckman, 1982). These losses undoubtedly reduce the capacity of ecosystems to limit pest populations by natural processes very severely.

Recently, dragonflies have been subjected to various control measures because they are thought to cause losses among hatchling fishes in aquaculture facilities (Santos *et al.*, 1988). Generally, only the largest dragonflies could consume many hatchling fishes. Placing screens over the small tanks and ponds in which the tiny fishes are kept to interfere with dragonfly spawning would seem to be a much more economical way of keeping dragonflies out of the water than using insecticides. It would also protect the hatchlings from piscivorous birds. As the hatchlings increase in size, they rapidly become too large for dragonfly larvae to prey upon, limiting the period of time that protection against dragonflies would be necessary. In any case, it could be argued that the small economic gains the fish culturists could expect by eliminating dragonflies would be more than offset by the cost to local public health, especially in tropical regions where malaria, yellow fever, dengue fever, and other insect-borne diseases are endemic.

South American dragonfly species have traditionally been described based on adult specimens. However, the larvae of many species have been described, as well. Being relatively large, colorful insects, dragonflies attracted the attention of collectors early, and much of the taxonomic work on the South American species was completed during the 19th century. During the 20th century, authors were very conscientious in providing illustrations and detailed descriptions. In addition, many specialists compiled systematic reviews of various families and genera during the first half of the 20th century. As a result, the taxonomy of the South American Odonata is relatively well established.

Nevertheless, there have been recent revisions of the rarer families of South American dragonflies, and new species are still being discovered. However, relatively few undescribed species of Odonata will be encountered among South American specimens because their size and conspicuous color patterns make them easy to tentatively identify from a distance, and many taxonomists have been attracted to the group. The discovery of some new species can nevertheless be expected after more remote regions in Amazonia and the Andes have been visited by entomologists. Considerable effort in all parts of the continent will still be required to provide descriptions of both sexes of the rarer species and to find and describe all larvae.

The larvae of dragonflies and other insects with incomplete metamorphosis were formerly called nymphs or naiads. In recent years, however, the term larva has been applied to the immature stages of all insects belonging to the Pterygota, that is, insects with wings or secondarily wingless.

Metamorphosis occurs after the larvae have climbed out of the water on emergent plant stems or other objects, usually at night, when they are less vulnerable to predation during the relatively long period of wing development and exoskeleton hardening. Occasionally, emerging dragonflies are observed shortly after sunrise. An emergence while the sun is warming the habitat gives them the advantage of avoiding dew, which can be fatal to the dragonfly if it moistens a wing while it is still expanding.

There are too many dragonfly species in South America to cover in a single volume. This insect order must therefore be treated in two separate volumes, one for the Zygoptera and the other for the Anisoptera. The key and illustrations provided here permit specimens in each group to be easily distinguished at a glance. Refer to the **Morphology** section of this volume (p. 16) for definitions of morphological terms in the key, as well as for a more detailed description of the typical structures observed on members of the Zygoptera.

Key to the suborders

Adults

1. The fore and hind wings are similar in size and shape, and a quadrangle instead of a triangle is present in the basal half of the wing. At rest, the wings are normally held nearly parallel to the body axis. The apex of the male abdomen is characterized by two superior and two inferior appendages (**Fig. 3.1**). The adults are generally found near the water bodies in which the larvae develop.
.....Suborder **Zygoptera**..This volume
- The proximal part of the hind wing is wider than that of fore-wing. At rest, the wings are held nearly perpendicular to the body axis. A supratriangle and triangle are present in the proximal part the wings. The apex of the male abdomen has two superior and one inferior appendage (**Fig. 3.2**). Adults of many species are strong flyers, and some may be encountered far from water.
.....Suborder **Anisoptera**..Volume on **Odonata - Anisoptera**

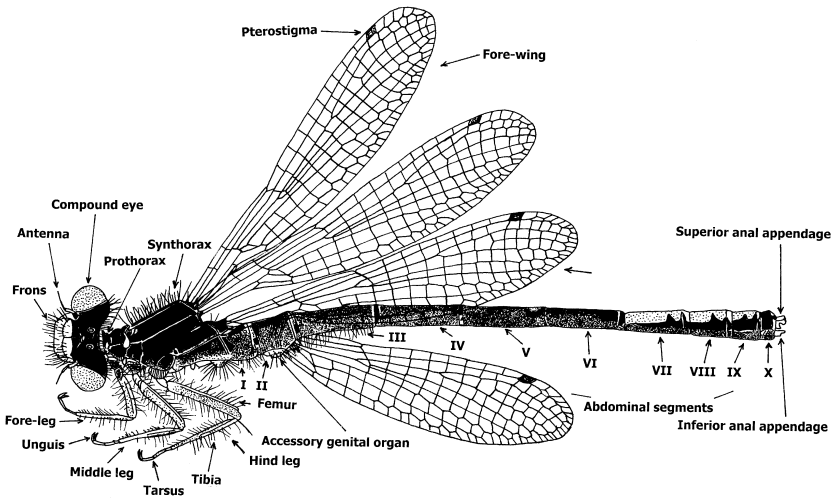


Fig. 3.1 The external morphological structures of *Protallagma titicacae*, a member of the Zygoptera, in lateral view. Based on Kennedy (1939a).

Larvae

1. The gills are externally visible as three flattened caudal lamellae, the longest of which is at least 1/3 the length of the abdomen, which is cylindrical and not wider near the apex than at the base (**Fig. 3.3**).
.....Suborder **Zygoptera**..This volume
- No external gills are visible. The longest caudal appendage is less than 1/3 the length of the abdomen, which is usually flattened dorsoventrally and becomes gradually wider from its base to its middle or beyond (**Fig. 3.4**).
.....Suborder **Anisoptera**..Volume on **Odonata - Anisoptera**

It is noteworthy that there is little chance of misidentifying the suborder of any extant species of Anisoptera or Zygoptera. Generally, members of the Anisoptera tend to be larger, more robust, and stronger flyers than members of the Zygoptera. A few species of Anisoptera, however, are relatively small. Like almost all zygopterans, some anisopterans are almost always found at or near the water's edge, while others fly long distances from water. However, even the anisopterans that remain near water usually fly along the shore periodically in search of food, while zygopterans tend to spend more time resting on littoral plants.

The motion of the wings when flying is also distinctive. In flight, the wings of zygopterans appear to be fluttering, while those of anisopterans are held more rigidly, giving the insect the appearance of a small glider. Most anisopterans fly considerably faster than zygopterans and appear to expend much less effort when hovering in the air. During the day, anisopterans are usually considerably harder to catch than zygopterans.

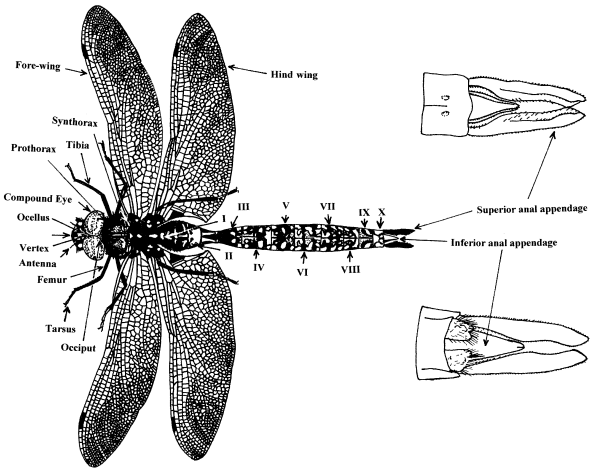


Fig. 3.2 The external morphological structures of an adult *Rhionaeschna diffinis*, a member of the Anisoptera, shown in dorsal view. Based on Mabille (1888).

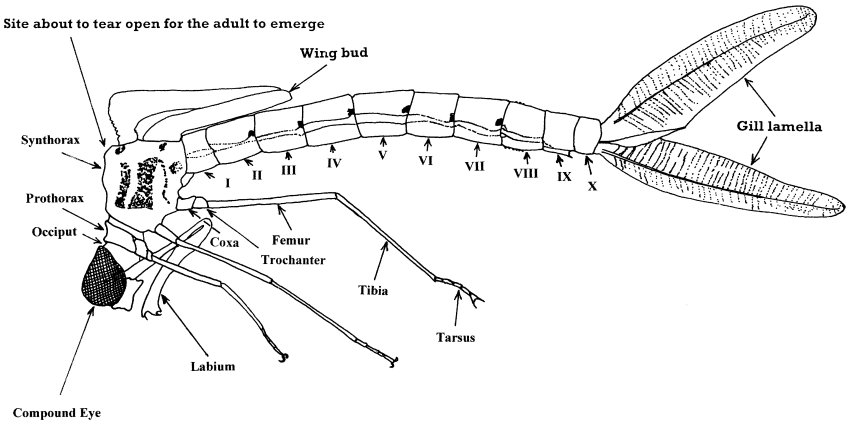


Fig. 3.3 Names of important anatomical structures of the larva of *Lestes pictus*, a member of the Zygoptera; shown is the last instar just at the beginning of the final molt. The exoskeleton is about to rupture along the dorsal midline of the synthorax, which is shown bulging. Based on Santos (1972a).

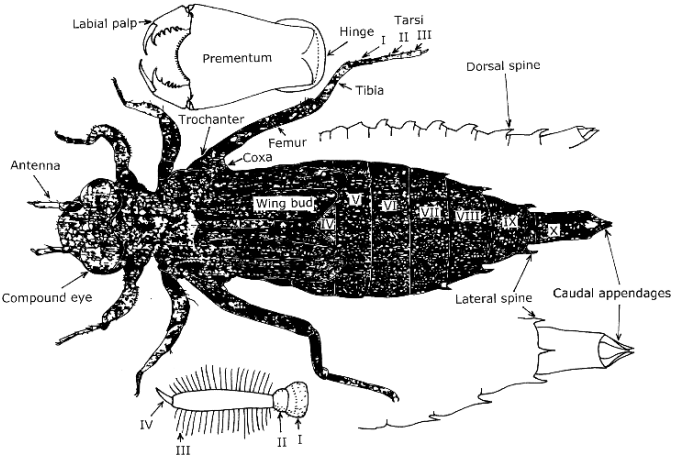


Fig. 3.4 Names of the main anatomical structures of a larva identified as *Peruviogomphus* sp., a member of the Anisoptera. The drawing based on an exuvia of the final instar shows some distortion, although the robustness of the chitin maintains the general form of the larva very nearly as it appeared in life. Other names of some structures frequently appear in the literature, such as "palpal lobes" for labial palps. Near the apex on the outer margin of the labial palp, there is a moveable hook. Some species have a median cleft along the anterior margin of the prementum. Dorsal or lateral spines, or both, are sometimes present on the abdominal segments and have been used as characteristic features to distinguish the species. Based on Belle (1992).

Section 3, Part 1

Zygoptera

3.1.1. Morphology

Adult dragonflies can usually be recognized at a glance by their robust bodies and elongate shapes. The general characteristics of the order are distinctive, and there is little chance of confusing them with other insects. Species of Zygoptera are generally smaller, more slender, and less agile in the air than anisopterans. Both share a special feature in the location and arrangement of the copulatory organs, which are found on the ventral surface of the second and third abdominal segments of the male and on the ventral side of the eighth and ninth abdominal segments of the female, structurally associated with the ovipositor. The male genitalia on the second segment are often referred to as the secondary sex apparatus because the sperm has to be transferred there from a genital opening on the ventral side of the ninth abdominal segment prior to mating. Copulation involves a very complex set of movements, usually beginning with the anal appendages at the apex of the male abdomen grasping modified structures on the prothorax of the female. A mating pair will often remain joined in this way for a considerable period of time, during which the female may deposit some of her eggs. To obtain the sperm, the female must bend the abdomen ventrad and anteriad to bring the ventral side of the ninth abdominal segment into contact with the structures on the second abdominal segment of the male. This is sometimes done while the two are in flight. The pair may also rest on plants with the female grasping a branch and the male remaining rigidly attached to the female prothorax by the abdominal appendages.

Dragonflies are apparently among the insects that have developed complex genital structures to prevent interspecific mating. Thus, both the anal appendages of the male and the structure of the prothorax of the female should be included in all descriptions of new species.

Characteristics of all dragonflies include a head with the mouth directed ventrad and designed for grasping and chewing in adults. The mouths of larvae are highly modified into an organ that can be unfolded and shot rapidly forward to seize prey.

The structure of the thorax is also a characteristic of the Odonata. The prothorax is well developed, while the mesothorax is fused with the metathorax to form a single structure called the synthorax or pterothorax. In the literature, these names are used more or less interchangeably. The synthorax of zygopterans is usually elongated along the body axis, while that of anisopterans is more compact.

The heads of the adults typically bear large compound eyes with facets facing in almost every direction. Three simple ocelli are also present. The structure of the zygopteran head is distinctive, characteristically being much wider than

long, with widely-separated, globular compound eyes on the sides. In contrast, the head of anisopterans is closer to spherical in shape, with the compound eyes of some species in contact with each other. The head of the larva also bears large compound eyes, indicative of the role visual orientation plays in the predatory behavior of all life stages.

The extant species of Odonata fall into two well defined groups: the suborder Zygoptera, encompassing the more fragile-looking dragonflies, often called damselflies, which hold their wings almost parallel to the abdomen when at rest, and the suborder Anisoptera, encompassing the large, robust "true" dragonflies, which maintain their wings approximately perpendicular to the long axis of the body, even at rest.

Most larvae creep on the bottom or climb on water plants in search of prey. A few are adept at burrowing into the sediment and may have modified limbs for that purpose. Larvae of Zygoptera species are recognized at a glance by the three plate-like gills attached at the apex of the abdomen. A few species, notably members of the family Polythoridae, bear small, supplementary gills on the second through seventh abdominal segments.

The mouthparts of adult dragonflies are modified for seizing and chewing prey, which they often capture in flight. The fore-legs of all or almost all dragonflies are used to push the prey against the mouth so that the powerful mouthparts can quickly crush the victim or rip it apart. These legs are usually armed with various kinds of robust spines to assist in firmly holding the prey. The mouth is also used in defense to bite larger animals that try to seize the dragonfly. The labia of the larvae are modified into an organ sometimes called the mask, which can be thrust rapidly forward for seizing prey with labial palps modified for grasping and holding.

Zygopteran larvae show fewer obvious morphological adaptations from the basic body plan than anisopteran larvae. For example, the general shape of the known zygopteran larvae tends to be slender and elongate, while anisopteran larvae show great variations in the general body form. Their exposed gill laminae make larval zygopterans more subject to alterations in water quality, especially in the concentration of oxygen and amount of fine suspended matter in the water. Anisopteran larvae, with their enclosed respiratory chambers, are better able to shut out harmful substances that may block gas exchange at respiratory surfaces. For this reason, zygopteran larvae have not developed the kind of burrowing habits that some anisopterans have. The most obvious modifications in the general morphology of the zygopteran body are those that make it more hydodynamically suitable for clinging to objects in fast-flowing water. Streamlining in a way that forces the body ventrad and modification of the legs for firm grasping of the substrate are typical of rhithral species. The external respiration surfaces of zygopteran larvae are ideal in cold, well-oxygenated, lotic water. However, many other species are adapted for life in lentic water.

Zygoptera larvae, which usually appear to have more delicate and less robust bodies than anisopterans, are most frequently found climbing on water plants in

standing water or clinging to rocks or pieces of wood in streams. A few species have adapted to life in the water that collects in hollow trees and bromelias. In standing water containing much organic matter, periodic oxygen shortages may occur. The larvae of species in habitats characterized by less than optimal conditions for respiration usually have the capability of moving the gill lamellae in a way to create a current across them. Studies of the physiological modifications permitting certain zygopteran species to store oxygen in the body for brief periods would provide useful information.

3.1.1.1. Adult morphology

The features of the adult usually used for identifying the species include the color pattern, wing venation, genital organs, and shape of other structures on the thorax and abdomen. The terminology for the external morphology used throughout the keys for members of the Zygoptera and Anisoptera are depicted in **Figures 3.1** and **3.2**, respectively. Nomenclature used for the wing veins of zygopterans is shown in **Figures 3.1.1** through **3.1.4**. In **Figure 3.1.1**, the system developed by Needham (1903a) is shown. In **Figure 3.1.2**, the alternative system of nomenclature developed Tillyard (1926) and adopted by Chao (1953) is depicted. **Figure 3.1.3** shows a newer system developed by Riek and Kukalová (1984). The wings illustrated in these figures are those of species with relatively few veins. **Figure 3.1.4** shows the wing of a calopterygid species, characterized by a relatively large number of wing veins; the abbreviations in this figure will be used throughout this volume, except where otherwise noted. It most approximates that of Chao (1953), which is the system most frequently encountered in 20th century literature. For a more detailed explanation of the morphological nomenclature, these and some of the more specialized publications cited below should be consulted. In the keys, some structures are referred to by better-understood popular names, such as fore-leg instead of prothoracic leg. It should be stressed that some of the structures used in the figures had been given other names in earlier literature. Although the system of Riek and Kukalová (1984) has been used in several recent publications on the wing veins, it is neither the most frequently encountered nor the newest system Bechly (1996). Wherever necessary, alternative names are defined in the keys when earlier authors have used them in comprehensive works. The proliferation in the number of competing nomenclature systems has made descriptions of the wing venation without detailed illustrations confusing, to say the least. The value of changes based on the latest hypothesis concerning the evolution of insect wings is far outweighed by the confusion caused by frequent changes in the names and abbreviations. Some of original species descriptions are ambiguous because the author failed to define the nomenclature system he used. In case of doubt, the figures in the keys should be referred to.

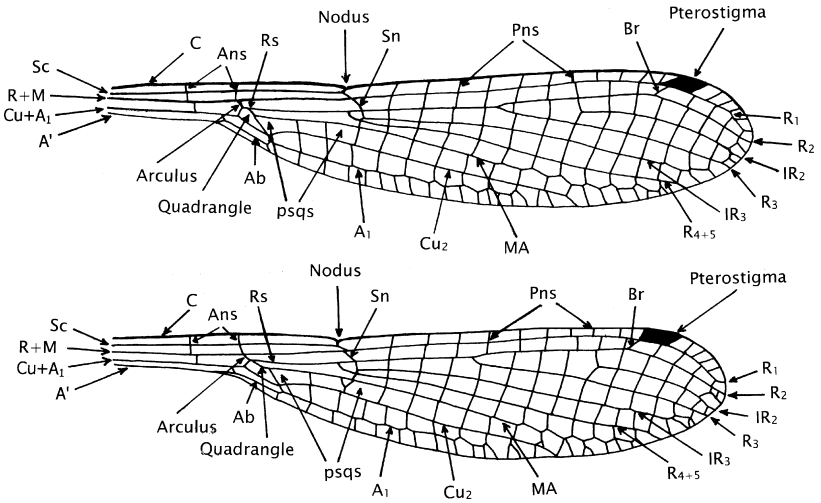


Fig. 3.1.1 Fore and hind wing of *Antiagrion antigone* with the wing veins labeled according to the nomenclature developed by Needham (1903a) as adapted by Hammond and Merritt (1983): C = costa, Sc = subcosta, R = radius, Rs = radial sector, M = media, Cu = cubitus, A = anal. This nomenclature corresponds to one of those in general use for insect wings. Dragonflies have more long veins than most other insects, so several that appear to arise between branches of the radius are called intercalary veins and abbreviated as IR with a subscript number. Branches of veins and intercalaries are numbered from the anterior end of the wing root around the circumference to the posterior root. The edge of the wing is delimited by the costa, which completely surrounds the periphery of the dragonfly wing. Abbreviations, such as R+M and $R_{4+5,}$ indicate that two veins are perceived to be fused and run concurrently. The nodus is a reinforced break in the costa along the anterior edge of the wing. The pterostigma is rarely absent and usually prominent; an oblique cross vein posterior to it is called the brace (Br). The discal area of the zygopteran wing is characterized by the quadrangle, possibly analogous to the triangle of the anisopteran wing. The narrow basal part of the zygopteran wing is called the petiole. Wings based on Ris (1928a).

The earliest specialist who undertook to describe large numbers of South American dragonflies, Baron M. Edmund de Selys Longchamps, used no abbreviations to designate the wing veins. For almost a century, the set of abbreviations employed in the comprehensive work of Needham (1903a) was followed as a standard by many authors, supported by an exhaustive work on Zygoptera wings by Munz (1919). A different nomenclature was introduced by Tillyard (1926), Fraser (1938, 1948a), and Forbes (1943), whose proposals for the abbreviations were based on their own understanding of the evolution of the

wing veins. All of the additions and modifications made during the first half of the 20th century were reviewed by Chao (1953). **Table 3.1.1** compares the nomenclature for the main long veins by the authors reviewed by Chao (1953) and those of Riek and Kukalová (1984). Other recent proposals for revising the abbreviations have also appeared in recent literature (Bechly, 1996). Because the older nomenclature is encountered in a vast body of literature, while the newer names are encountered only in a few recent publications, the older system preferred by Chao (1953) will be given preference. Hopefully, the illustrations of wings in this volume will prove adequate to dispel any confusion, which is unavoidable when so many different systems of nomenclature are in use.

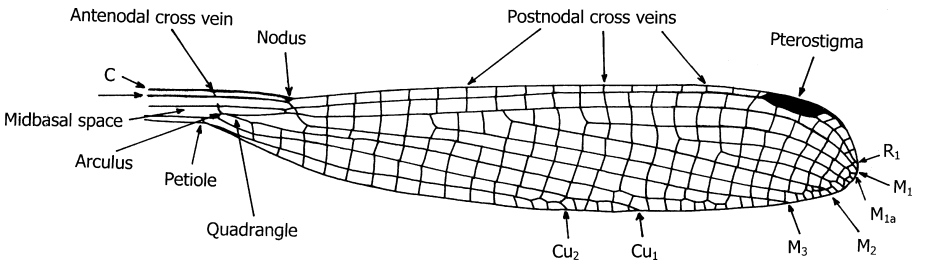


Fig. 3.1.2 Another system of nomenclature shown for the veins in a wing of *Heteragrion erythrogastrum*, a member of the Megapodagrionidae. Obviously, this system is incompatible with that shown in **Figure 1** regarding the locations of many veins, although the basic abbreviations are the same for the vein names. Based on Kennedy (1939b).

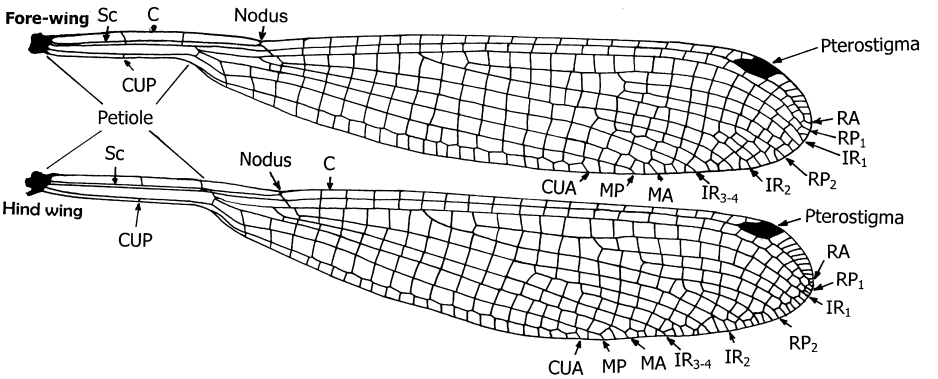


Fig. 3.1.3 Fore and hind wing of *Heteropodagrion sanguinipes* showing the abbreviations for the veins as introduced by Riek and Kukalova-Peck (1984). Based on De Marmels (2001).

Table 3.1.1 Comparison of the nomenclature and abbreviations used for zygopteran wing veins by various authors (Chao, 1953; Riek and Kukulova, 1984). Selys provided the original names but used no abbreviations. Names of minor veins are not shown. Confusion over names and abbreviations has been increasing due to additional modifications in recent years. Whenever possible, rely more on the illustrations than on verbal descriptions by authors.

Names		Abbreviations					
Selys's name	Chao's name	Needham (1903a)	Tillyard (1926)	Tillyard &Fraser (1938)	Forbes (1943)	Chao (1953)	Riek and Kukulova (1984)
Costa	Costa+ subcosta	CC	C	C	C	C	C
Subcosta	Subcosta	Sc	Sc	Sc	Sc	Sc	Sc
Median	Radius+ Media	R+M	R+M	R+M	R_1 Rs+M+Cu	R+M	RA
	First radius	R_1	R_1	R_1	R_1	R_1	RA
Arculus, upper sector	Radial sector	M_{1+3}	-	Rs	-	R_3	RP
Principal sector	Second radius	M_1	R_2	R_2	R_2	R_2	RP_1
Postnodal sector	Second radius intercalary	M_{1a}	IR_2	IR_2	-	IR_2	IR_1
Nodal sector	Third radius	M_2	R_3	R_3	R_3	R_3	RP_2
Subnodal sector	Third radius intercalary	Rs	IR_3	IR_3	R_4	IR_3	IR_2
Median sector	Fourth+fifth radius	M_3	R_{4+5}	R_{4+5}	M	R_{4+5}	IR_{3-4}
Arculus, lower sector	Anterior media	M_4	MA	MA	Cu_1	MA	MA
Triangle, superior sector	Posterior cubitus	Cu_1	Cu_2	Cu_2	P_1	CuP	MP
Postcosta	Anal	A	-	A_1	-	A	-
Triangle, inferior sector	First anal	Cu_2	-	1A	1Ax	A_1	CuA
Proximal sub-basal sector	Second anal	A_2	-	-	3Ax	A_2	CuP

The venation of many Zygoptera species is far less complex than that of the Anisoptera. However, members of such families as Pseudostigmatidae, Calopterygidae, Polythoridae, and Heliocharitidae have a total number of cells in each wing equal to or greater than those of most Anisoptera species. The most prominent structures on the wings of zygopterans include the **nodus**, **quadrangle**, and **pterostigma** (**Figs. 3.1.1, 3.1.2, 3.1.3, and 3.1.4**).

Many zygopterans have a narrow **petiole** at the base of the wing, which is a proximal section that is distinctly narrower than the apical part, making the wing appear somewhat like an elongated paddle at the end of a short stem.

Other features frequently used to characterize the wings of certain species are the numbers of **antenodal** and **postnodal** cross veins in the costal and subcostal spaces. **Antenodal** describes the cross veins proximal to the **nodus**, and **postnodal** refers to those distal to it. Generally, the cross veins in the costal and subcostal spaces are paired so that they appear to run from vein C along the anterior margin of the wing through vein Sc to vein R_1. When a vein runs only through the costal space and has no apparent continuation in the subcostal space, it is said to be incomplete. In the total count of antenodal cross veins, an incomplete vein is counted as ½. Antenodal cross veins obviously more robust than the others are sometimes present. These are called **primary antenodal cross veins**. The others are called **secondary antenodal cross veins**.

Size and color can often provide a means for quickly identifying a particular species of dragonfly. It is possible for a person familiar with the local fauna to immediately identify many living insects in the field from the color pattern alone. However, some dragonfly species show considerable sexual dichromatism, so the different color patterns of males and females must be recognized separately. Furthermore, the colors of some species change with age. Teneral species are typically pale, and the pigments become brighter as reproduction begins. Senescent specimens of one or both sexes may take on another hue, sometimes strikingly different from that of younger adults.

While it may be possible for a trained observer to perform field studies of South American dragonflies by recognizing the distinctive color patterns of the local species, using color to identify specimens of these insects in museum collections is frequently difficult or impossible. The patterns of some species fade out completely, while those of others remain, but the colors change considerably shortly after the insect dies. This is true whether the specimens are dried and stored pinned in insect cases or preserved in a liquid. It would therefore be useful to produce permanent records of the colors by photographing living insects, as some odonatologists are now doing. Various books for identifying the dragonfly fauna of many European countries now rely mainly or exclusively on color photos of all species. These books can be used in a way similar to many works that are available on the bird or reptile fauna. It is premature to try to produce such a book for the South American dragonflies because there are still probably a considerable number of undescribed species on the continent, and before the photos could be used, the specimens would have to be identified by reference to various anatomical structures. It is not premature,

however, to begin compiling a file of photos of living specimens that have been identified correctly to species, and such photos are already being posted on the Internet by Dr. Dennis R. Paulson of the University of Puget Sound and others. Books on the local fauna in specific regions of South America will probably appear before too long. In any case, a compendium of color photos of all South American species will be considerably more voluminous than one for the European or North American fauna because of the far greater estimated number of species.

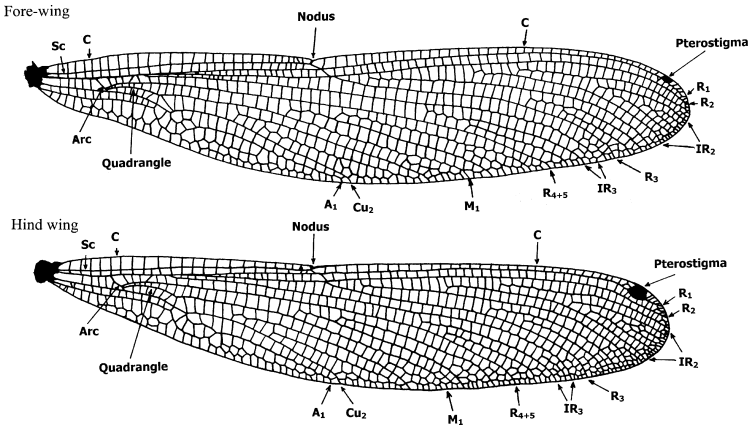


Fig. 3.1.4 Abbreviations of the main wing veins of *Ormenophlebia saltuum*, a member of the Calopterygidae, a family characterized by a dense network of veins, using the system appearing in this book, except where otherwise noted. The wing illustration is based on Garrison (2006) and the nomenclature mainly on Chao (1953).

As in most other aquatic insects, a fundamental characteristic of each dragonfly species is the structure of the genitalia and other organs used during mating (**Fig. 3.1.5**, **3.1.6, and 3.1.7**). The reproductive behavior of dragonflies is complex, involving intricate movements of the abdomen and its special genital appendages. Some species typically mate in flight, and some females spawn with the male still holding her between the head and prothorax with the **anal appendages**, sometimes also called the **caudal appendages**, at the posterior end of the abdomen. Those in the dorsal pair are called the **superior anal appendages** or the **cerci**, due to their apparent homology with this appendage in other insect groups. Ventral to this pair in the Zygoptera are two **inferior anal appendages**, often called the **paraprocts**. Only one such appendage is present in members of the Anisoptera. The name **anal appendage** has been commonly used in the older literature, and it is retained in this volume only for adults, thereby distinguishing their structures from the corresponding parts of larvae, for which the newer terminology of **epiproct**, **cerci**, and **paraprocts** is employed.

The nomenclature of the male genitalia on the ventral side of the second abdominal segment is shown in **Figure 3.1.5**. The nomenclature of the penis lobes is shown in **Figure 3.1.6**.

The actual pore from which the sperm are initially emitted is located on the ventral side of the ninth abdominal segment, and the male must actively transfer the sperm from this pore to the genitalia, often called the **secondary** or **accessory genitalia,** on the second segment, which is actually used in copulation. The copulatory structures of the female are found on the ventral side of the eighth abdominal segment and are protected by the **vulvar lamina**, which in most zygopterans, forms a part of the **ovipositor** (**Fig. 3.1.7**).

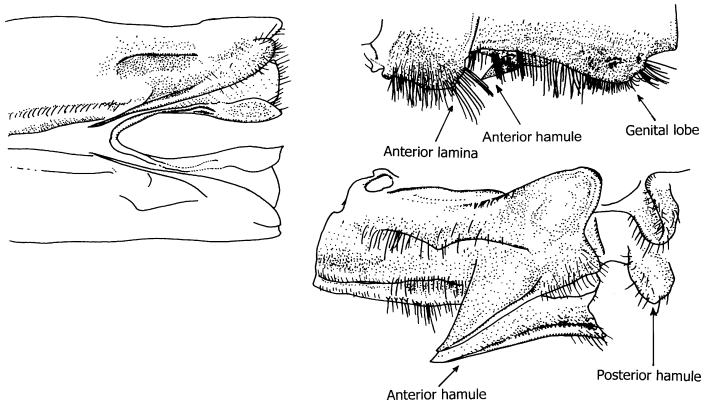


Fig. 3.1.5 Genitalia on the second abdominal segment of a male *Ormenophlebia imperatrix* in ventral (left) and lateral view (upper right), and the hamules in ventrolateral view (lower right) showing the nomenclature of the structures visible when the penis is withdrawn. Based on Garrison (2006).

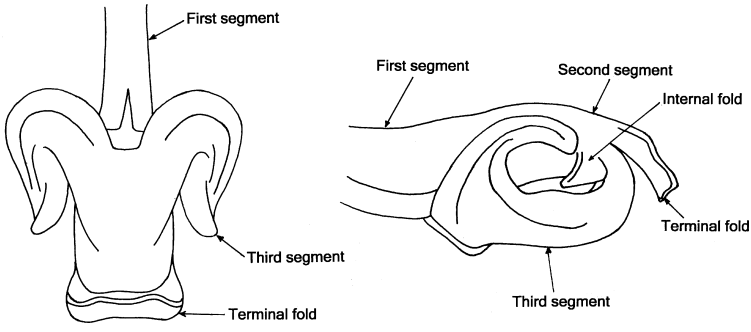


Fig. 3.1.6 Penis of *Hetaerina sanguinea* in ventral (left) and lateral view (right) with the names used for the lobes by Kennedy (1916, 1920a). Alternatively, Pfau (1971) insisted that the penis consists of only two segments, the second combining the second and third of Kennedy (1916).

When the male is prepared for mating, the appendages at the apex of his abdomen grasp the female by processes on the prothorax, presumably structured to permit mating only with a conspecific male. During mating, the pairs may be seen flying with the male above or in front of the female, seemingly carrying her at the end of his abdomen (**Fig. 3.1.8**). Mating occurs when the female extends her abdomen beneath the male so that the opening on the eighth abdominal segment contacts the **penis**, also called the **genital ligula** by Pfau (1971), which is extended from the genitalia beneath the second abdominal appendage. These maneuvers appear considerably acrobatic, especially when performed in flight. The mating is usually rapid, but individuals of some species will remain attached before and after mating for considerable periods of time. Mating pairs of zygopterans are frequently seen resting on plants. Some spawn on emergent vegetation or other objects, but others spawn directly into the water, often while still attached.

The male prothorax and female anal appendages have different characteristic shapes, but they are not specially modified for mating and therefore may be considerably smaller and less complex in morphology than those of the opposite sex. In most females, the ovipositor is the most obvious structure at the apex of the abdomen (**Fig. 3.1.7**).

Because of the complex maneuvers associated with mating, species-specific modifications of certain structures and markings can be found on various parts of the body. Examples of remarkable features subject to sexual dimorphism and dichromatism are greatly elongated abdomens, horn-like processes on the thorax, and brightly colored spots or patterns of bright metallic colors.

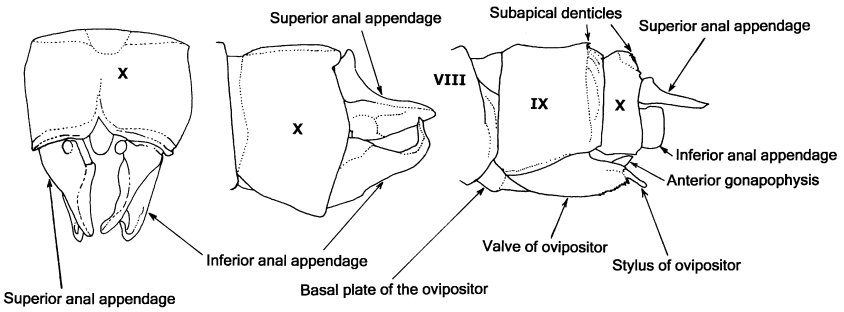


Fig. 3.1.7 *Dimeragrion unturanense* (left to right): apex of the abdomen of a male in dorsal and lateral view and the apex of the abdomen of a female in lateral view. Based on De Marmels (1992a).

Often used by taxonomists as identifying features are the lobes on the dorsal side of the prothorax, the appendages at the apex of the abdomen of both males and females, and the structures on the ventral side of the second abdominal segment of the male, the presence of which permits the immediate recognition of the sex. Males and females usually differ in numerous other ways, as well.

Sexual dimorphism is sometimes considerable among Odonata species, and certain spots or other markings are apparently used by the insects for recognizing suitable mates. After completing a pale teneral stage, young specimens usually become brightly colored, apparently with species-specific markings that act as cues for mating. As mentioned earlier, dragonflies of some species take on a different coloration after mating is complete, identifying themselves as mated or senescent individuals to members of the opposite sex. This is especially important for spawning females, which would otherwise be disturbed by the continual attention of male suitors no longer needed. Such females may take on the coloration of males or at least lose those markings identifying them to males as ready to mate.

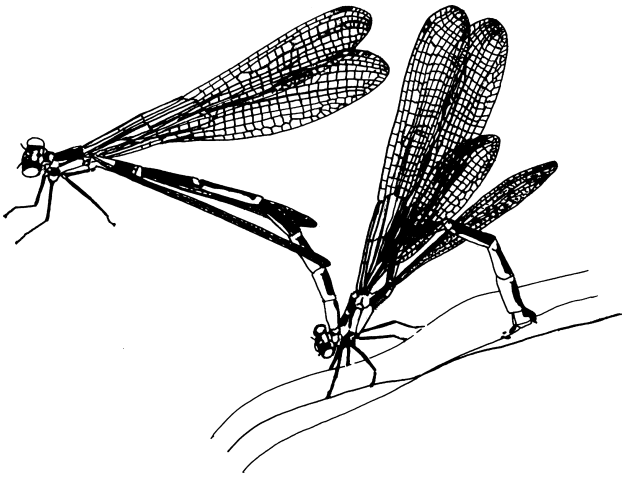


Fig. 3.1.8 A spawning pair of *Antiagrion grinbergsi*, members of the Zygoptera. They are joined for mating and depositing eggs, with the anal appendages of the male grasping modified structures on the female pronotum, and the male rising straight above the female. Mating occurs when the female moves the posterior tip of the abdomen beneath the male and contacts the genital structures on the ventral side of the second abdominal segment. Based on Jurzitza (1974).

Assuming that specific bright markings on one or both of the sexes are used for recognition of a conspecific, unmated partner, certain features of the color pattern could be regarded as definitive species-specific features for identification. It is not yet recommended to identify all South American specimens on coloration alone, because the intraspecific variability and color changes during the lives of males and females have been investigated for only a few species. However, color has been used by many authors to distinguish individual species from closely related ones, and color is frequently used as an identifying feature in the keys. Of course, caution must be used because of the loss of color that occurs after years of preservation in museum collections.

In addition to the features of the wings, genital structures, and color pattern, several other characters are frequently used to distinguish the different species of adults. These include the relative lengths of spines on the legs, the presence of morphological modifications on the head or thorax, the general shape of the abdomen and its individual segments, the presence of spines on different parts of the body, rows of denticles along some of the margins of the segments, and the size and shape of the ovipositor of the females. The names of structures visible on the head are shown in **Figure 3.1.9**. The color patterns on some of these structures are frequently used in the keys to help distinguish the species.

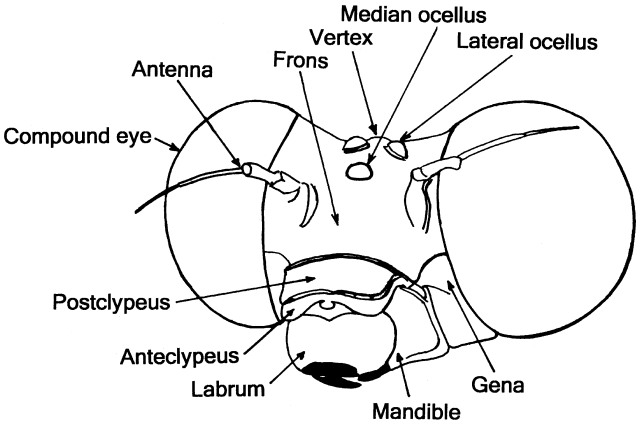


Fig. 3.1.9 The head of *Archaeopodagrion bilobata* in oblique frontal view. Based on Kennedy (1946).

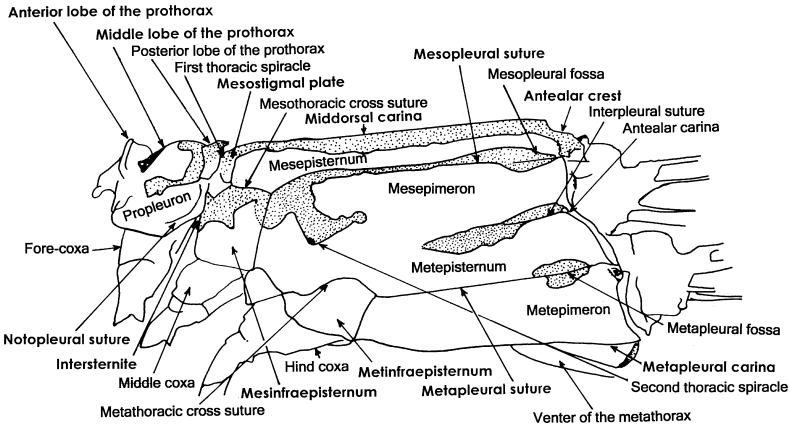


Fig. 3.1.10 The thorax of *Telagrion nathaliae* in lateral view showing the names of the structures most frequently used in the keys. Based on Lencioni (2006).

Special attention should be given to the features of each sex since even the wing veins may show considerable sexual dimorphism. Unfortunately, only one sex of many species has been described, making positive identification of the other problematic. While collecting specimens, remember that mating pairs are particularly valuable for the confirmation that both sexes really belong to the same species. In observing such pairs, the considerable extent of the sexual dichromatism of many species becomes evident.

Most illustrations of the thoracic color pattern show the synthorax in dorsal or lateral view (**Fig. 3.1.10**). Diagrams showing the synthorax unfolded on a flat surface, which are common in the literature on Anisoptera, are seldom encountered in descriptions of Zygoptera species. However, some authors have used them.

3.1.1.2. Larval morphology

The larva possesses a well defined head, thorax, and abdomen, typical of species with incomplete metamorphosis. Zygoptera larvae are generally more elongate than those of the Anisoptera and are characterized by the three plate-like gills at the posterior end of the abdomen (**Fig. 3.1.11**), the shape and armament of which are often important features for identifying the genera and species.

The mouthparts of larval dragonflies are modified into an organ for the capture of prey, commonly called the mask, which is the greatly elongated and jointed labium. At rest, this structure is normally held along the ventral sides of the head and thorax. Most dragonfly larvae hunt by remaining motionless as their prey approaches or moving very slowly toward the prey. As soon as the prey comes within range, the mask shoots forward, and its modified labial palps grasp the prey, which is immediately pulled into contact with the other mouthparts and chewed. The palps are thus considerably different in structure from the delicate sensory organs characteristic of most other insect groups. They are rather broad grasping organs armed with various spines and setae. The labrum and mandibles are compact and robust in order to quickly masticate the prey. As in adults, prey usually seems to be tracked by sight rather than by tactile or olfactory senses. Many Zygoptera larvae move very little while hunting. The body form and color of some camouflage them while they wait motionless in submerged plant masses until suitable prey approaches. Many change color to match their background. Body markings may become pronounced at times or fade out, according to their location and whether or not larger predators are present. Movement toward prey by many Zygoptgera species first occurs when an organism of suitable size is almost within range of the extended labium.

A few zygopteran species are adapted to strong currents in mountain streams. These species usually cling to rocks and other objects in the water, where they await the approach of mayfly, stonefly, or diptera larvae. Frequently, these larvae seek out partially sheltered waters behind rocks, where the current is

slower than in the main channel and their prey is relatively abundant. Modifications of the body shape and claws to suit the life style are characteristic of these species. Less modification is shown by the many species adopted to lotic habitats of moderate flow.

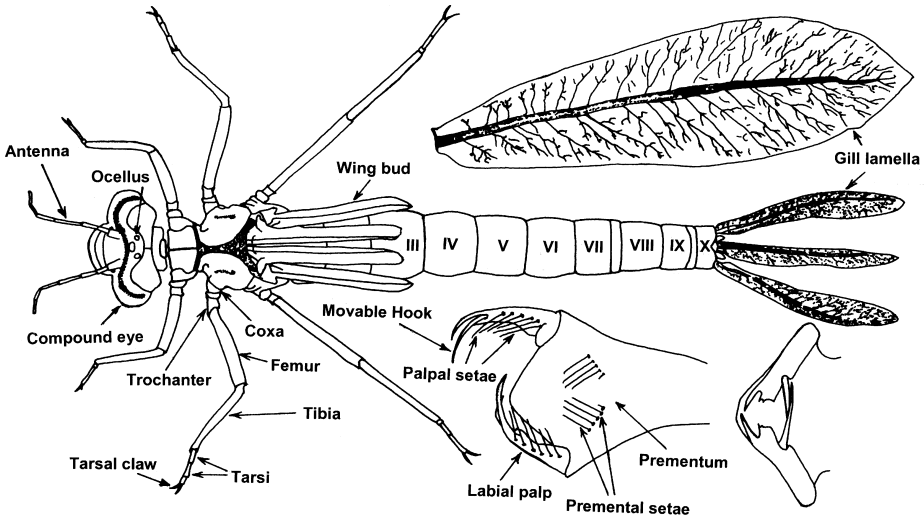


Fig. 3.1.11 *Oxyagrion simile* larva: habitus (left), labium in ventral (lower center) and frontal view (lower right), and a lateral gill lamina (upper right). Based on Santos (1966a), who misidentified the larva as *Oxyagrion brevistigma,* according to Costa (1978).

The number and location of the setae on the labium and the shape of the tooth-like prominences on the mandibles are often employed as features for distinguishing the species of larvae. Other characters of the head sometimes employed for identification include the relative sizes of the individual antennal segments, relative length of the labium, positions of the ocelli, and distance between the compound eyes (**Fig. 3.1.11**).

Characteristic features of the individual species may also include the relative lengths and shapes of the various segments of the legs, including the tarsal segments, and the armament on the legs, especially the lengths of the setae relative to the diameter of the segment, the distance between the setae, and the presence and length of rows of setae on each segment of each of the legs.

The plate-like gill lamellae have frequently been used as distinguishing features for Zygoptera larvae. Species-specific characteristics of these structures include the relative lengths of the median and lateral lamellae, the presence of branches, the relationship of the maximum width to the length of each lamella, the location of the widest part, the shape or special modifications of the apex, and the kind of armament along the lateral margins of the individual lamellae.

Also important is the orientation of the wing buds, which are parallel in some species and divergent in others. Wings may be developed enough in the final larval instar to dissect out and observe the venation.

The tergites on the abdomen, which are the dorsal plates covering the individual segments, cover most of the dorsal and lateral surfaces of each segment. The ventral plates, or sternites, are usually small and cover only the median part of the ventral surface. The lateral regions between the tergites and sternites are known as pleurae.

The thoracic plates of most Zygoptera larvae are not greatly modified, and they are less frequently employed for distinguishing the species than the corresponding parts of adults. Like the thorax of the adult, that of the larva has a prothorax clearly separated from the **synthorax**, also called the **pterothorax**, formed by the fusion of the **mesothorax** and **metathorax**, from which the two pairs of wing buds and the mesothoracic and metathorcic legs arise.

There are considerably fewer descriptions of zygopteran larvae native to South America than there are of anisopteran larvae. For this reason, the keys to the larvae lack several genera and most known species. Most keys to the genera of larvae are tentative because the morphological characters used to distinguish them may not hold true after the larvae of all species have been described. Features of the larvae that have hitherto been ignored by taxonomists, such as the proportions of the individual leg segments and features of their spines, may become more important after the larvae of more species have been described. Therefore, it is important that descriptions of larvae be as thorough as possible.

While the color pattern is a very useful feature for distinguishing adult dragonflies and has a certain limited utility for distinguishing anisopteran larvae, it is not at all reliable for most zygopteran larvae, which have a much greater propensity for changing their color to match their background and may become almost colorless and translucent when disturbed.

Unless otherwise noted, the morphological features used in the keys are valid only for the final instar larva. In most cases, earlier instars closely resemble the later stages, but far too little is known about the early stages of zygopteran species to make any general rules.

3.1.2. Ecology

Dragon and damselflies form a group of species with rather similar ecological roles. All species are predatory, both as larvae and as adults. All known South American larvae are aquatic, albeit with varying degrees of tolerance for desiccation and water quality. Adults have relatively long seasonal flight periods, requiring them to actively nourish themselves by hunting for prey. The positions of the individual species and even the individual larval instars in the food web, however, may be distinct because of the different sizes of the prey consumed and the microhabitats which the larvae inhabit.

Aside from the size preferences, South American dragonflies are not known to discriminate against prey in any way, although more detailed study may reveal that stingers or chemical repellants render some insects unsuitable for food. Their lack of specialization makes dragonflies very useful in controlling undesirable aquatic insects, including mosquitoes and biting gnats, which often form important items in the diet, especially when the undesirable species are abundant enough to become serious pests. The efficiency with which dragonflies hunt and their healthy appetites give them the capability to make noticeable inroads into the abundance of harmful insects. The positive economic impact of dragonflies in the tropics has often been the subject of speculation but not established by quantitative studies. If appropriate ecological and economic studies are ever undertaken, it is likely that the impact of dragonflies would prove to be far greater than previously thought.

Almost all species of Zygoptera are less capable of capturing agile dipterans in flight than are strong-flying species of Anisoptera. However, their habits of remaining close to water bodies permit them to prey on the emerging adults of Diptera species with aquatic larvae, including mosquitos. Zygopterans are also observed capturing prey resting on littoral plants, something most species of Anisoptera do not usually do. Hence most species of Zygoptera compete for feeding niches with anisopterans little, if at all. While few zygopterans could be classified as weak flyers, they cannot compete with anisopterans as wide-ranging aerial hunters. Most of them specialize instead in slowing patrolling the littoral zone for small insects flying or resting on plants.

Larval zygopterans are relatively small and delicate, making them less likely to feed on fish fry, especially those of commercially raised food fishes. Although the larvae could theoretically cause losses among hatchling aquarium fishes, there are no reliable reports that any zygopteran larva has had a negative economic impact on any kind of aquaculture.

Although adult zygopterans are occasionally observed far from water, they are typically observed in large numbers only along the margins of ponds, lakes, streams, and rivers. Dragonfly larvae are found in most kinds of water body, from fast-flowing streams to ponds and even temporary stagnant pools. A few species develop in water trapped in bromelias (Santos, 1966b, 1978; De Marmels, 1985a). Because of their external gill lamellae, zygopteran larvae are less adaptable to unusual ways of life than anisopterans. For example, no South American zygopteran larvae are conspicuously modified for burrowing in coarse sediments, although a few are adapted for clinging to the underside of stones in fast-flowing streams.

Adult dragonflies of both suborders generally have very good vision and use this sense extensively in hunting. As a result, the insects are typically diurnal, flying only during daylight hours. Some zygopterans are crepuscular, apparently giving them an advantage for finding adults of prey species that have just metamorphosed from aquatic larvae or pupae and are therefore particularly vulnerable. At night, flying and hunting by all knows species ceases.

The larvae of many dragonfly species, including possibly all zygopterans, seem to hunt primarily by observing movement. This and their need for gas exchange through the gill lamellae make turbid water unsuitable for most species. Zygopteran larvae are generally more sensitive than anisopterans to temporary periods of poor water quality because their respiratory surfaces are always exposed to the ambient water rather than being enclosed in chambers that can be closed.

Ecological differences between species include the kind of water body in which their larvae develop, the diurnal activity pattern, and the prey that they most frequently choose. Prey choice seems to depend mainly upon the relative size and availability of prey. Usually, the larger the dragonfly, the larger the prey. Therefore, zygopterans tend to prey on smaller insects than anisopterans. For trapping relatively small prey, the fore-legs of some dragonflies are armed with rows of strong, close-set, spine-like setae. Tiny insects swept from the air are immediately pushed to the mouth for crushing and chewing. In contrast, shorter and thicker spines with more space between them are characteristric of dragonflies that hunt relatively large prey. Much has still to be learned about specific feeding habits, and some surprises may yet be encountered.

The habitat preferences of dragonflies have been studied more thoroughly than those of most other aquatic insects in South America. Studies of various kinds of habitat have yielded lists of dragonfly species commonly found in them. Because they are much less suited to undertaking long-distance flights, it might be thought that zygopterans should be more restricted to particular geographical regions than anisopterans. However, the range information shows that this not the case. Many damselfly species are known to have extensive ranges, although much more remains to be learned about zygopteran than about anisopteran distribution because the larvae of many more anisopteran species can be distinguished. As in the case of anisopterans, local zygopteran distribution tends to depend on the availability of suitable habitats for the larvae.

Some species require constant movement of oxygen-rich water across the respiratory surfaces and die quickly when removed from the fast-flowing streams they inhabit. Those species inhabiting masses of submerged plants in standing or slowly-flowing water take advantage of the large quantities of oxygen given off by the plants during the daylight hours. At night, they remain inactive, minimizing their need for oxygen. Little is known about the respiratory physiology of the larvae inhabiting water trapped in bromelias.

Those species that develop in fast-flowing streams are modified to resist being carried away by the flowing water. The body shape is streamlined in a way that forces the body ventrad, and the tarsal claws are modified for firmly grasping the substrate. Species in the families Calopterygidae, Perilestidae, and Protoneuridae typically have stream-dwelling larvae. Larvae of *Mnesarete guttifera* were found in stream water with an extremely low electrical conductivity of less than 3 $\mu S \cdot cm$ (Heckman, 1998a).

Most zygopteran species prefer fairly warm water, and some survive in standing water that reaches a fairly high temperature. In the Pantanal of Mato

Grosso, the larvae of several coenagrionid species were common among water plants at times when the water temperature sometimes exceeded 35°C during the day. At these times, however, photosynthesis raised the oxygen saturation of the water well above 100% (Heckman, 1998a). During the dry season, when the water quality deteriorated considerably and much of the floodplain dried up, zygopterans were able to survive as adults or as eggs that would hatch after the freshet.

Few South American zygopteran species inhabit the cold waters of southern South America and the high Andes. Notable among the Chilean fauna are the species of *Antiagrion*, which seem to be endemic to that country. The few other zygopterans found in Chile are typically widespread lowland and foothill species with extensive ranges throughout South America.

Like the adults, zygopteran larvae choose their prey mainly according to size. The main food items of many and probably most of them seem to be arthropods in the size range of cladocerans. Some of these organisms have thick shells, however, and may not be palatable to all zygopterans. Few seem capable of overpowering the larger insects and small vertebrates that anisopteran larvae frequently consume. The species-specific feeding habits of zygopteran larvae will provide a rich field for future research, which will first require descriptions of the many larvae that are still unknown to science.

Some of the specific kinds of habitat frequented by dragonflies include cool water bodies of the Andes region (De Marmels, 1997a) and in Patagonia (Muzón, 1995a, 1997a), subtropical wetlands (Jurzitza, 1982a), ponds and rivers in the Atlantic forest (Ferreira-Peruquetti and Marco, 2002), temporary water bodies in the tropical wet-and-dry climatic zone (Heckman, 1998a, b), dry forest areas (Longfield, 1929), the Amazon rainforests (Kirby, 1897; Sjöstedt, 1918; Schmidt, 1942; Hamada and Oliveira, 2003), and forests of northern South America (Geijskes, 1971; De Marmels, 1989a). Many small, local water bodies and wetlands have special conditions suitable for dragonflies with highly specialized habitat requirements. Much is still to be learned about rare species limited by their specialized habitat requirements.

The individual species not only show habitat preferences, they also display various degrees of tolerance to extreme environmental conditions (von Ellenrieder, 2000). Many zygopterans are limited to well-defined habitats, either lentic or lotic. Naturally, the more tolerant species can be found over much greater ranges than the more specialized ones. A few are found throughout vast areas of the South American continent and in parts of Central America and the Caribbean, as well.

Unlike many anisopterans, most female zygopterans seldom stray far from the water bodies in which they developed. They therefore do not have to choose from among many different bodies of water within a large area that they patrol. They produce fewer eggs, so the chances for survival are improved by a more careful choice of spawning sites. Fewer zygopteran than anisopteran species deposit their eggs directly into the water, although some apparently do. Female zygopterans generally have well-developed ovipositors for depositing their eggs

on plants and objects extending above the surface of the water. Most zygopterans deposit one or two eggs at a time on objects extending above the surface of the water or just below it. Many are able to insert the eggs into tiny holes or irregularities in the substrate, affording them some protection prior to hatching. Not enough is known about the habits of most South American species to report the differences in oviposition habits. However, zygopterans on other continents seem to have developed strategies peculiar to the species for keeping the eggs safe until hatching. Some deposit their eggs on objects at the water surface, while others deposit eggs on plants overhanging the water so that the hatching larvae fall into the water. Females of a few species extend the abdomen well below the surface of the water and deposit more than a few eggs on a sheltered surface below the water, such as a depression in a log or inside a dense mass of water plants. The ovipositors of zygopterans vary in size and shape according to the spawning habits of the species.

The males of some zygopteran species continue to grasp the female by the prothorax with the anal appendages after the female begins spawning. Pairs are often seen resting on littoral plants with the male extending vertically above the female (**Fig. 3.1.8**).

Elucidating the spawning habits of the individual South American dragonfly species and determining the habits of the individual larval instars will provide a fertile field for future investigation.

3.1.3. Preservation and examination

Most adult zygopterans are very easy to collect along the margins of streams, ponds, and lakes. Unlike anisopterans, most zygopterans remain at rest on littoral plants and other objects at the water's edge during much of their diurnal periods of activity. They usually fly only short distances to capture prey, mate, and deposit their eggs. Most can be captured easily in flight using a large insect net, and some can be captured by hand while they are resting on littoral plants. They are also easy to find and observe along streams and beside ponds and lakes, and they can also be photographed without difficulty in the field. The bright colors of most make them easy to spot against against a background of vegetation. Zygopterans can be captured most easily after sunup or shortly before sunset. Is is also possible to find them resting on plants at night using a strong light. Some odonatologists prefer to collect them after rain.

Zygopteran larvae that inhabit submerged vegetation are often well camouflaged. Others conceal themselves under large rocks in streams. By placing collections of submerged plants and stream sediment in a shallow pan, the zygopteran larvae can be more easily observed. They are more delicate than anisopteran larvae, and care must be taken in transferring them to aquaria to prevent the loss of gill lamellae. Living larvae can be prodded until they swim or creep into shallow containers, such as Petri dish covers, and transferred into

bottles of water for transport. Specimens grasped with metal tongs are often injured and die after a short time in aquaria.

Once in aquaria, larval zygopterans from lentic habitats can usually be raised to adults, but most are more sensitive to poor water quality and temperature changes than anisopteran larvae. Those larvae that inhabit fast-flowing streams are much more difficult to capture alive and raise to adulthood. Most of these larvae die quickly in standing water, and special recirculation systems must be constructed to raise them to adults. Transporting them alive to the laboratory is also difficult, but some success may be achieved using cold water supersaturated with oxygen. Best results for most stream species will be obtained by placing them in plastic bags half filled with water and half with 100% oxygen. This requires the kind of plastic bags used for transporting aquatium fishes and a small oxygen bottle in the field.

Larvae of many species from the temperate zones undergo metamorphosis at about the same time during the same season each year, regardless of the conditions under which the larvae developed. The same seems to be true of many South American species. Rearing the larvae will answer many questions about the development of the individual species and will permit many previously unknown larvae to be identified to species and described. Series of exuviae should be collected and preserved along with the adults. The exuviae are only moderately durable, and most cannot be preserved well by drying.

Some experimentation will be required to learn how best to feed the larvae of each species. Commercially raised *Daphnia* and similar live fish foods are consumed by some larvae that live in standing water. Mosquito larvae are also consumed by many zygopterans. The larvae that inhabit fast-flowing water seem to subsist mainly on smaller benthic insect larvae, mainly those of mayflies, stoneflies, and dipterans. Supplying this kind of food may prove to be a difficult problem if no streams are located near the laboratory.

In the past, adults of both Anisoptera and Zygoptera were usually preserved dry and pinned in insect display cases. This method of preservation is suitable for the great majority of species because their bodies are robust, but over a period of many years, colors fade and sometimes change considerably. In the case of zygopterans, care must be taken while drying the specimens to prevent the abdomen from drooping and curling under the pin. Usually, it is best to pin the specimen and place the whole preparation on a flat, dry, absorbent surface. This gives the specimen a chance to stiffen with the abdomen extended straight posteriad and the wings separated in a way the permits easy examination. After the insect has become sufficiently stiff, it can be placed in the display case in a fairly life-like position.

More recently, it has become customary to store preserved dragonflies in small envelopes. Glassine envelopes are often used by collectors in the field, while cellophane envelopes seem preferable for storage in permanent collections. Before placing the specimen in the envelope, the wings should be moved slightly apart for easy examination after the specimen has stiffened. At this time,

it is also recommended to keep the abdomen straight so that it will harden in this position.

Generally, specialists suggest keeping captured insects alive for a period of time to allow them to discharge the contents of the digestive tract. It is also especially important for adult dragonflies that have been collected shortly after metamorphosis to be kept alive until the chitinous exoskeleton has hardened and taken on its adult coloration. The animal is then killed by placing it in a closed jar with a toxic substance. At the present time, ethyl acetate or acetone are usually preferred because they seem to affect the color pattern less than other substances. However, acetone tends to remove natural pruinosity. Heat from summer sunlight is also used by some collectors to kill the dragonflies.

If specimens are to be pinned, it should be done immediately after the specimen is killed so that its body will adhere to the pin as it dries. Specimens should not be moved on the pin during the drying process. The pin is customarily inserted through the synthorax slightly to the right of the centerline so that it emerges again along the midline on the ventral side.

Another suitable way to store dragonfly specimens is in a preservative. A recommended liquid is ethanol, which may be mixed with a small amount of a reducing agent to slow discoloration and up to 5% glycerine to keep the specimens soft and prevent serious damage in case the ethanol evaporates from the container.

An important advantage of keeping specimens in a preservative is the exclusion of small destructive insects, which can unexpectedly appear in collections of dry arthropods and rapidly destroy them before their presence is even noted. Dermestid beetles are famous consumers of museum collections, requiring the construction of special storage cases to keep them out. In tropical countries, tiny ants are able to gain access to specimens in seemingly air-tight boxes and eliminate entire collections in a matter of hours. Poisons are often placed in the cases to kill the insects, creating a hazard for entomologists who work many hours with the collection.

These problems have prompted increasing numbers of entomologists to opt for liquid preservatives, even in the case of relatively large insects. The size and shape of zygopterans and the natural position of their wings in life permit many of them to be stored in the space that would be required for only a few anisopterans. It is therefore likely that the method of pinning and drying zygopterans will be completely abandoned in favor of preservation in liquids. Many collectors now leave the specimens in the collecting envelopes when they place them in ethanol for long-term preservation. This gives them increased protection and helps to prevent the legs from entangling or tearing the wings.

For small adults and larvae, 96% ethanol may be used with good results, although 80% alcohol is sometimes recommended (Smith and Pritchard, 1956). Specimens with especially bright colors can also be preserved dry after treatment with acetone. If this method is used, a device for keeping the humidity extremely low is necessary to prevent mold from destroying the specimens. Under no circumstances should formalin be used as a long-term preservative. It

causes distortion of both adults and larvae and eliminates the color pattern of the adults. In addition, adults placed in formalin must first be fully moistened with ethanol to keep them from floating on the surface of the liquid and failing to be effectively preserved. I have often examined specimens with wings and legs that were distorted during the process of fixation in formalin. Such specimens are difficult to examine and sometimes so distorted that they cannot be identified with certainty. Formalin is also harmful to the health. Nevertheless, specimens may be fixed in ether, a mixture of formalin and alcohol, or acetic acid mixtures and then transferred to ethanol as soon as possible after fixation without running the risk of serious distortion.

Different collectors have their own preferred methods of fixing their specimens. Some recommend placing the specimens in acetone for 8 to 12 hours immediately after killing and then drying them in the air. Although the acetone discolors the eyes, it seems to protect most of the other colors. Unfortunately, it makes the specimens unsuitable for DNA studies and analyses of the fatty tissues. It also makes the specimens hard and brittle. Some collectors air dry the specimens without using any chemicals as fixatives. More details can be found in Corbet *et al.* (1960).

Some researchers have been able to conduct field studies on adult dragonflies using binoculars (Dunkle, 2000). For such studies to be successful, it is necessary to recognize each species from easily observed features, such as the color pattern. To facilitate this, photograph catalogs of positively identified specimens will have to be produced for South America. Photographing the dragonflies in the field and then positively identifying them will eventually make it possible to produce field guides. Photography or production of digital images should be given priority in field studies so that field guides can be prepared. Photographs of South American dragonflies are now being posted on the Internet. One particularly extensive photo collection has been posted by Dennis Paulson.

For larvae, fixatives are sometimes used for killing and better preservation. However, whenever possible, larvae should be raised in aquaria until the adults emerge because of the valuable information that can be obtained about the growth and the morphology of the individual instars. The exuvia of each instar should be preserved for later study in ethanol with up to 5% glycerine added. The ethanol not only keeps the exuviae pliable, it protects them from the mold and bacteria that may attack dried speciemens if the humidity becomes too high.

Although the ideal way of eliminating all chance of error in matching the larvae with the adults is to raise the larvae to adulthood in the laboratory, this is not always feasible. If it is not possible to keep the larvae alive, ethanol is the preferred preservative. While some taxonomists suggest using a 70% or 80% solution, others recommend using 95% ethanol for other aquatic insect larvae (Edmunds, 1959). My personal recommendation is to use the commonly marketed 96% solution because after specimens with small amounts of water are introduced into the alcohol, the final concentration will usually be diluted to no more than 80%. However, specimens transferred to 96% ethanol also show no

notable distortions or unusual discoloration. Adding 5% glycerine to the preservative keeps the specimens somewhat less brittle and protects them from inadvertent short-term desiccation. A reducing agent can also be added to protect the color pattern.

Preservatives other than ethanol are not recommended because of the damage they do to the chitin of the exoskeleton. Aqueous solutions, such as formalin, also have a tendency to cause swelling of whole specimens and damage to the chitin, although some authors have reported using 2% formalin, disregarding its newly discovered dangers to human health.

For over a century, the great value of maintaining collections of exuviae together with the newly emerged adults for taxonomic study has been recognized (Needham, 1897). Not only for basic taxonomic studies but also for general ecological surveys of aquatic species, exuviae should be collected in the field and preserved in alcohol, whenever possible, together with adults collected while emerging. It should be remembered that teneral specimens are less than desirable for taxonomic studies, as already discussed. Descriptions of both larval and adult specimens positively matched greatly facilitate the correct identification of the species and also provide specimens of great value for future taxonomic study. Complete series of exuviae from all instars of individuals cultured in the laboratory are of even greater value for morphological studies, permitting the external anatomy of the larval stages and adults of each species to be fully described without problems of mismatching the larvae of one species with the adult of another, as sometimes has occurred when large collections of unmatched adults and larvae have been studied.

As already mentioned, the less satisfactory way of obtaining conspecific specimens of larvae and adults is to collect them in the field and assume that common congeneric specimens probably belong to the same species. Obviously, this results in a degree of uncertainty when using the resulting descriptions to identify specimens. Added to this is the fact that specimens in museum collections are sometimes incorrectly labeled or placed in the wrong containers after examination. Furthermore, in mixed collections of dragonflies taken during general surveys, preserved specimens appearing unusually etiolated and fragile, which had probably just molted before fixation, might appear to be different species from older specimens with normally hardened exoskeletons. It must also be remembered that the color of senescent specimens may be considerably different from that of younger ones.

3.1.4. Zoogeography

Because of their tendency to remain close to the water body in which they developed, most species of Zygoptera would not seem likely to readily colonize new habitats. Nevertheless, many species are widespread throughout large regions of South America and sometimes Central America and nearby

Caribbean islands, as well. Zoogeographical barriers on the South American continent therefore seem to be less of a factor in the distribution of the dragonflies than are the ecological tolerances of the individual species. This applies in almost equal measure to zygopterans and anisopterans, in spite of the superior flying ability of the anisopterans.

Based on published records, many South American dragonflies seem to be confined to the continent and a few offshore islands. Some Central American and Caribbean species are also found in northern South America, but the region of the West Indies seems to be inhabited mainly by a distinct dragonfly fauna thought to include surprisingly few species that are also distributed in South America. A few species are nearly cosmopolitan in distribution, and several more have ranges encompassing both North and South America. However, the high percentage of South American dragonfly species thought to be endemic to that continent suggests that there is a Central America and Caribbean zoogeographic barrier that relatively few dragonfly species have succeeded in crossing. It is suspected, however, that more thorough surveys will substantially increase the list of species found in both Central and South America. If this is not the case, the ecological differences between the Central American water bodies and those in northern South America will certainly merit closer study.

Circumantarctic distribution patterns are not well illustrated by any group of dragonflies. No family of Zygoptera is confined to the southern part of South America, and those that have representatives in other parts of the southern hemisphere are widespread in other parts of the world, as well. Although zygopterans would seem more likely to display geographical limitations to their ranges than anisopterans, this is apparently not the case. The zygopteran families with the most limited patterns of distribution are confined primarily to equatorial of subtropical regions.

On the South American continent, the main geographical regions that are ecologically distinct are generally characterized by their own dragonfly fauna. The Andes provide dragonflies with a series of habitat zones running from the foothills up to the high alpine meadows and mountain lakes. The lowlands include the forests of northern South America, the Amazonian rain forests, dry forests, seasonally flooded wetlands, the Atlantic forest, warm subtropical farmland, temperate forests, temperate grasslands, and the cool regions of Patagonia. Each of these regions offers typical habitats for certain species, and each also includes microhabitats that support more specialized elements of the dragonfly fauna. In **Section 3.1.2**, special studies on the dragonfly fauna in some of these regions were listed. It should be noted that a few species are encountered in a great many different regions of South America, while others seem to be endemic to only one limited geographical location. The picture may change, however, after more information on the ranges of the individual species becomes available. Vast areas of South America have never been subjected to exhaustive entomological surveys.

The cursory range information reported in the keys could be greatly improved by more zoogeographical studies of the South American dragonfly fauna. It is

hoped that the keys provided herein will stimulate such studies by facilitating the identification of specimens collected. Even the little supplemental information provided in the keys on the ecology of many species should help odonatologists estimate their ranges until more accurate information is available based on actual visits to poorly studied regions.

3.1.5. Taxonomic problems

Descriptions of South American dragonflies have generally been good, and a well-structured and apparently reliable systematic classification already exists. Some zygopteran species, however, are difficult to identify, and several genera require revision. In addition, the larvae of many species have still not been described. Generally, more problems are encountered in identifying zygopteran specimens than in identifying anisopterans, mainly because of a few problematic groups.

One troublesome aspect of working with the literature on the South American Odonata is the large number of short publications that must be reviewed. Most comprehensive reviews and long monographs are out of date, and only a few recent publications have provided adequate reviews of large genera. As a result, anyone wishing to use original descriptions must review large numbers of short papers published in different journals from many parts of the world. While this book may alleviate this problem, taxonomists will still have to consult original publications in the future when modifying the systematics, making a good library service essential.

Most taxonomists who have been engaged in work with the dragonflies must be complimented on their conformity with conventions established among themselves. These include not describing new species based only on larvae, providing illustrations of the genitalia, describing more or less the same structures of related species, and basing descriptions of features given special attention by earlier authors. Because of this, problems are encountered less frequently when reviewing publications on dragonflies than when working with the literature on many other insect groups.

In spite of the relatively good and reliable work done by taxonomists specializing in South American Odonata, synonyms are frequently encountered (Garrison, 1991a). It is likely that more names will be reduced to synonyms after the natural variability of the South American species has been elucidated. Species appear in the keys that were described many years ago from a small set of specimens, sometimes only one, and have not been positively identified again. Some may be truly rare, but others may have been described again under other names because of minor differences, which may not be taxonomically significant. Much work is still needed to adequately define all of the species.

Recent revisions have made it relatively easy to identify the species of several families, but other families have been ignored for many years, and several of the names in the keys will probably become synonyms after the next thorough

revision. In fact, the largest family, Coenagrionidae, is one of those in need of revision.

General reviews of Neotropical Zygoptera species have been limited by difficulties in recognizing various species in such genera as *Argia*. Although attempts have been made to satisfactorily describe each of the species so that they can be distinguished unequivocally, nobody has succeeded in preparing a fully reliable key to this large genus. It is not clear how many species are really valid because enough is not yet known about the natural intraspecific variability. Much could be learned through rearing experiments, both about the correct determination of species-specific characteristics and about larval morphology.

Although efforts to define the ecological requirements of the individual species have intensified in recent years, ecologists are still confronted with problems identifying the species they observe, especially when only specimens of larvae are available. It is therefore important that the remaining taxonomic studies be completed as soon as possible.

The keys provided here are limited in accuracy by the gaps in the knowledge of the species that still exist. After tentative identifications have been made using the key, it is best to check the original descriptions and revisions of the species in the literature. If circumstances permit, the specimen should be compared with the type specimen to confirm the identification.

3.1.6. Suggestions for improvement

Field investigations should be encouraged throughout South America to provide descriptions of the larval instars and both male and female adults. To reliably characterize specific kinds of habitat according to the species present, it is usually necessary to be able to correctly identify all life stages of each species. For example, to facilitate faunal surveys, larval specimens as well as adults must be identified to species. Therefore, preliminary taxonomic work will require the correct matching of identified adults with the corresponding larvae in the water. This may be done in several ways. Artificial habitats can be created in the laboratory for rearing larvae to adulthood. In this way, all stages can be described as they develop. Dragonflies inhabiting standing water are usually fairly easy to maintain in aquaria, but those that develop in streams may be difficult to rear unless rather complex circulation systems are built. For those species that breed mainly or exclusively in the water trapped in bromelias, it may be necessary to raise the plants before larvae can be reared to adulthood.

To obtain descriptions of the final instar larvae, it is often easiest to collect the exuviae left on emergent plants, pieces of wood that extend above the surface of the water, or objects along the shore. These exuviae are usually found dry and firmly clinging to the emergent objects. They must then be correctly matched with the adults found near the water body. If an adult is observed emerging and kept alive for a considerable amount of time to allow the exoskeleton to harden and take on their final coloration, the larvae can be positively identified even if

only the adult is known. Some teneral specimens look so different from the fully formed adult that identifications may be difficult. In such cases, one of the many new methods of photography or video can be selected to document the emergences and color changes that the dragonfly goes through as it takes on the coloration of a mature adult. Reliable records will then be available to recognize not only the larvae but also teneral specimens in each stage of maturation without the need to collect large series of specimens.

If emerging adults cannot be found together with the exuviae, parallel collections of larvae and adults from individual water bodies can often be used by taxonomists to correctly match individual larval forms with the corresponding adults. In a few cases, however, congeneric species might be confused, so this method must be used with great caution, and a considerable number of specimens will be required to make sure that all common species in the habitat have been identified.

Descriptions of new dragonfly species or previously undescribed life stages of known species should be prepared in a way that can be readily understood by other scientists, especially those who have not specialized in the taxonomy of the group. The importance of good illustrations cannot be overemphasized, and several authors cited in the keys below have provided exemplary illustrated descriptions that make identification by non-specialists relatively easy.

It would be extremely useful to have descriptions of the final instar larvae and adults of both sexes of each South American species. However, the rules of scientific nomenclature do not demand this, and authors cannot be expected to provide such complete sets of descriptions each time a new species is described in the future. Nevertheless, a minimum standard for species descriptions should be imposed by the editors of journals, and a set of features that should be described for each life stage is proposed in the outline below.

One practice that should be strongly discouraged is the description of a new species based on a life stage that has not been described for all other species in the genus. For example, if five congeneric species have been described only from adult male specimens, the description of a sixth based only on larval specimens should not be permitted. In such a case, it is obviously not possible to rule out the possibility that the sixth "species" is already among those previously described. Whenever more than one specialist is working on the taxonomy of any particular group, they should establish conventions by mutual agreement to designate a definitive life stage and sex to be described any time a new species of a given genus or family is named. Fortunately, the problem of incomplete descriptions making it impossible to distinguish species without examination of the type specimens does not occur very often when working with the Zygoptera of South America.

The following elements should be included in any description of an adult:

1. The genitalia of both sexes should be illustrated in dorsal or ventral and lateral view, and the ovipositor of the female should be shown in ventral and lateral view. Structures modified for mating should also be included, especially the anal appendages of the male and prothorax of the female. An illustration of the

anal appendages of the female would also be very helpful. If specimens of both sexes are not available, the description should await the collection of additional specimens. If it is deemed impossible to collect more specimens, then an adult of the sex most frequently designated as the holotype for congeneric species should be selected. In most cases, this will be the male. It is important to avoid descriptions of conspecific males and females as two distinct species.

2. The vein pattern of both the fore and hind wing should be clearly illustrated, and if sexual dimorphism is strong, the wings of both males and females should be illustrated. Markings on the wings should be described, and any tint or clouding of the wing membrane should be recorded.

3. The lengths of the head and abdomen, fore and hind wings, pterostigma, antenna, anal appendages, and other prominent structures should be provided along with the total length. Total length should be measured from the midpoint of the anterior margin of the head to the apex of the longest anal appendage. For comparison with published descriptions giving total length without the appendages, the appendage length can be subtracted from the total length, unless the apex of the abdomen has an unusual form. If such is the case, this should also be reported. The pterostigma should be measured along the costal vein, which runs along the leading edge of the wing. If any part of the body is measured differently, the anterior and posterior limits should be stated.

4. The color patterns of both sexes and the larvae should be described in detail. If the specimens examined are teneral, senescent, or faded due to the preservation method, this should be stated.

5. Detailed descriptions of the heads of both males and females should include the color pattern, location and disposition of the ocelli, peculiarities of the mouthparts, presence of any processes or modified setae, and the antennae.

6. The legs, size and arrangement of their spines, and the tarsal claws of adults of both sexes and larvae should be described and illustrated. The description should include mention of the color pattern, prominent setae, distances between spines relative to the length of one spine, relative lengths of the segments, and any remarkable modifications, such as horns or tubercles on any part of the head or body.

7. Every anatomical character introduced by earlier authors as identifying features for recognizing species in the respective genus or family should be described, and the couplet in an existing key that would be reached if a specimen were “keyed out” should be mentioned. In every case, the reader of the descriptions should know unambiguously how the new species differs from all of those that were previously described in its genus.

In addition, descriptions of the eggs would be useful, and observations of the preferred habitats and special behavior patterns should be recorded. Dimensions should be provided as maxima and minima for the series of specimens. The range of each dimension is important to someone trying to identify a specimen, while the average is of little value to someone who does not know the range.

A note on the figures

Most illustrations were drawn based on figures appearing with the original descriptions of the species or later review papers. In a few cases, they are based on figures prepared to justify taxonomic revisions or with descriptions of taxa later found to be synonyms of species already described. When using illustrations of specimens other than a holotype, there is a risk of perpetuating earlier published errors in identification. Original figures on which those in this book are based should be consulted as primary sources whenever they exist. Minor discrepancies between illustrations and specimens being examined will exist because individual variability of these insects can be considerable, and few taxonomists have worked with sufficient numbers of specimens from South America to appreciate the degree of this variability.

It is a general characteristic of dragonflies that many wing veins, virtually always including the costal veins, are lined with tiny denticulations, spines, or setae. These are omitted from most of the figures, which are meant to display the arrangements of the veins and the color patterns in a semi-diagrammatic way. These and other structures that are omitted from the illustrations should be ignored in making identifications unless they are specifically mentioned as diagnostic features in the keys. Similarly, minor differences between the numbers of cross veins and the positions of other veins in the specimen being examined and the illustrations of these features should be disregarded because such characters are often quite variable. Some judgement must be used to distinguish important from minor features. For example, if a range of 8 to 11 cross veins is given in one of the keys, and a specimen being examined possesses 7, this would not indicate that the dragonfly must belong to another species. If, however, the specimen had 4 such cross veins, the likelihood that it belongs to another species would be great. Similarly, minor deviations from the reported size ranges can be disregarded, but large differences of more than 20% of the reported dimensions are significant enough to support a conclusion that the specimen probably belongs to a different species. This percentage, however, is also arbitrary. For example, if the dimensions of only one specimen were reported in the original description, a 20% deviation would be less significant than if 20 specimens had been measured to obtain the reported size range.

As in the case of most insect orders, the genitalia are the most definitive structures. After a specimen is tentatively identified based on wing veins, color, size, or other features in a key, the genitalia or secondary sexual structures, such as the anal appendages or structures on the prothorax, should be compared with the illustration provided. If no illustration is provided, the original species description should be consulted. Unfortunately, in some cases, there are neither good illustrations nor adequate descriptions of the genitalia, and it will be necessary to compare a specimen with type specimens designated in the original description to make a positive identification. In such cases, taxonomists are encouraged to undertake revisions of the group to which the species belongs.

3.1.7 Key to the families of Zygoptera in South America

Adults

Information for the key was taken from Munz (1919) and Brues *et al.* (1954).

1. There are five or more antenodal cross veins in each wing, and the wings are not distinctly petiolate. The arculus is nearer to the base of the wing than to the nodus (**Fig. 3.1.12**). 2
- There are two to four antenodal cross veins in each wing, and the wings are distinctly petiolate. Vein R_{2+3} is nearly always fused with R_1 for a short distance beyond its origin (**Fig. 3.1.13**). 5

2. An arculus is absent. Usually, only the distal primary antenodal cross vein is present (**Fig. 3.1.14**).
.....Polythoridae..p. 60
- An arculus is present (**Fig. 3.1.12**). 3

3. Both primary antenodal veins are absent (**Fig. 3.1.15**).
.....Calopterygidae..p. 103
- Both primary antenodal veins are present. The discoidal cells are well separated from R_1 (**Fig. 3.1.12**). 4

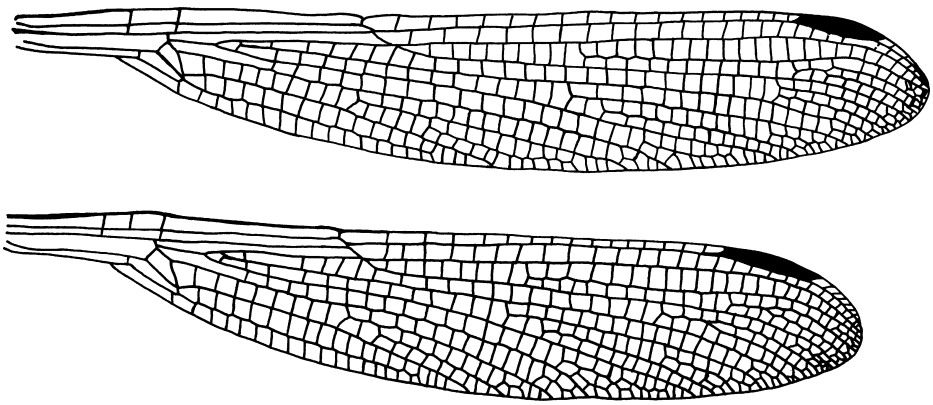


Fig. 3.1.12 The fore and hind wing of a female *Rimanella arcana.* Based on Needham (1933).

4. Vein R_{2+3} is not arched toward R_1. Few secondary antenodal cross veins are present, and usually the total number of antenodal cross veins is three or fewer (**Fig. 3.1.12**).
.....Amphipterygidae
There are only two Neotropical species in this family: *Amphipteryx agrioides* Selys, 1853, which is found in Central America and has not yet been identified

in South America, and *Rimanella arcana* (Needham, 1933), known from Venezuela, Guyana, Surinam, and Amazonas. Its synonym is *Rima arcana* Needham, 1933.

- Vein R_{2+3} is sometimes arched toward R_1 shortly beyond its origin. Secondary antenodal cross veins are numerous (**Fig. 3.1.16**). The femur of the middle leg, directed posteriad, extends beyond the second amdominal segment, and the legs lack spurs.

.....Heliocharitidae..p. 164

This family is also called Dicteriastidae or Dicteriadidae.

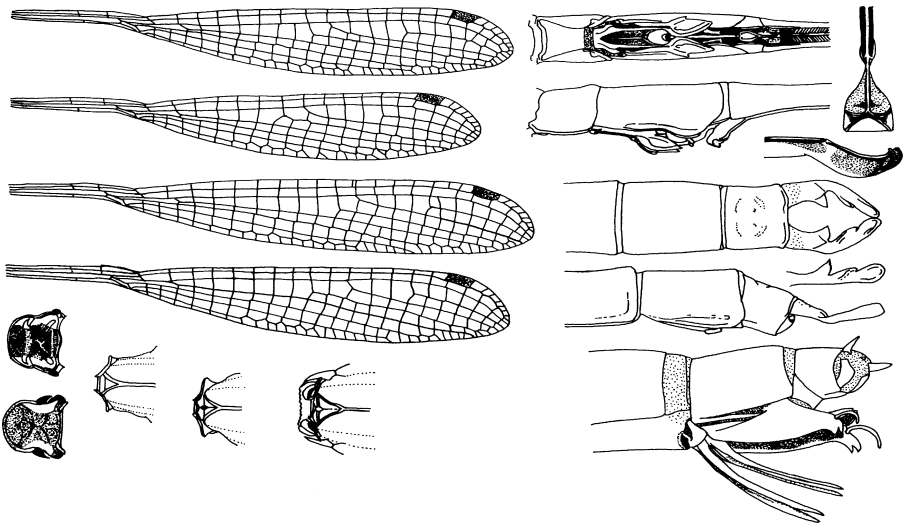


Fig. 3.1.13 *Perissolestes castor:* fore and hind wing of a male (upper left) and a female (middle left); dorsal view of the prothorax of a male and a female (lower left, above and below, respectively); mesostigmal laminae of a male in posterior view, a female in posterior view, and a female in dorsal view (lower left center, left to right); the genitalia on the second abdominal segment in ventral and lateral view (upper right center, above and below, respectively); apex of the penis in ventral and lateral view (upper right, above and below, respectively); and (middle to lower right): the apical segments of the male abdomen in dorsal and lateral view with the superior anal appendage in oblique view between them and the apex of the female abdomen with the ovipositor expanded after treatment in potassium hydroxide. Based on Kennedy (1937).

5. The distal corner of the quadrangle contacts the posterior margin of the wing. Vein Cu_2 arches sharply anteriad where it arises near the quadrangle (**Fig. 3.1.13**).

…….....Perilestidae..p. 165

- The distal corner of the quadrangle does not reach the margin of the wing, and vein Cu_2 does not arch sharply anteriad at its origin (**Fig. 3.1.17**). 6
6. R_{4+5} and R_3 both arise far proximal to the level of the subnodus. IR_3 is usually at least half way between the arculus and the subnodus and usually nearer the arculus. CuP and A_1 complete. Supplemental sectors connect IR_3, R_{4+5}, and MA (**Fig. 3.1.17**). .....Lestidae..p. 176
- R_{4+5} and IR_3 arise nearer to the subnodus than the arculus. At most, R_{4+5} arises halfway between the arculus and the subnodus (**Fig. 3.1.18**). 7

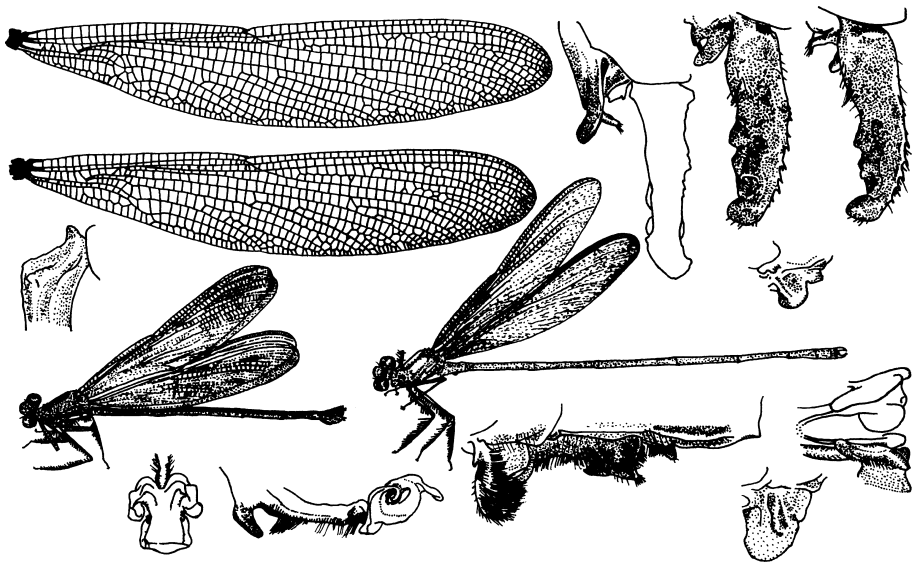


Fig. 3.1.14 *Bryoplathanon globifer:* fore and hind wing of a male (upper left), habitus of a female (lower middle left) and male (lower middle right), left female intersternite (upper middle left), setose tubercle on the first and visible genitalia on the second abdominal segment of a male in lateral view (lower right center), male anterior hamules in ventral view (lower right), and the setose tubercle of a male with the setae removed (below and left of the hamules) and a female (upper middle right), penis in ventral and lateral view (lower left center, left and right, respectively), and male anal appendages in lateral, mediodorsal, and dorsal view (upper right, left to right). Based on Garrison (2006).

7. The nodus is located very close to the base of the wing at 1/6 to 1/4 of the wing length. The pterostigma is absent or is strangely formed, not chitinized, or formed from several cells and never braced (**Fig. 3.1.18**).
.....Pseudostigmatidae..p. 201

- The nodus is usually located more than 1/4 of the wing length from the base, or, if not, then the pterostigma is not strangely formed. The pterostigma is strongly chitinized or, rarely, hypertrophied (**Fig. 3.1.19**). 8

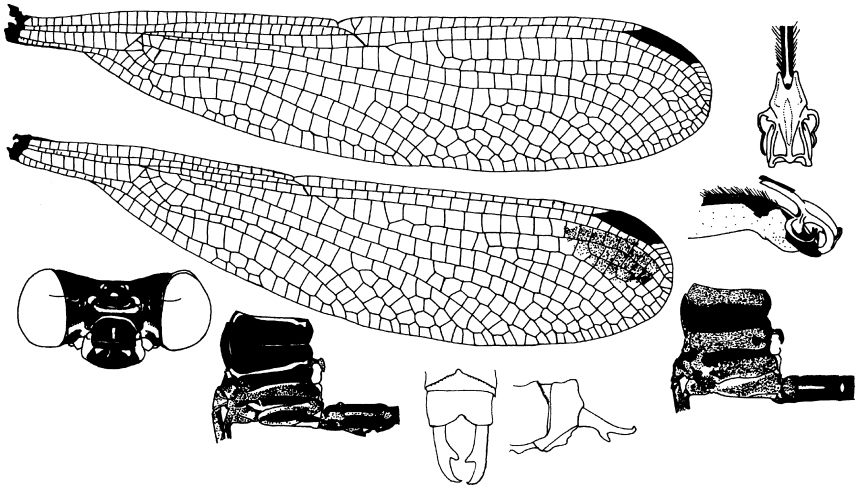


Fig. 3.1.15 *Miocora peraltica*: fore and hind wing of a male (upper left); head of a male in anterior view (lower left); diagram of the thoracic color pattern diagrammatically displayed in one plane with the lateral surface below and dorsal surface above, showing the female (lower left center) and male (lower right); penis in ventral (upper right) and lateral view (middle right), and apex of the male abdomen in dorsal (lower center) and lateral view (lower right center). Based on Calvert (1917) and Kennedy (1940).

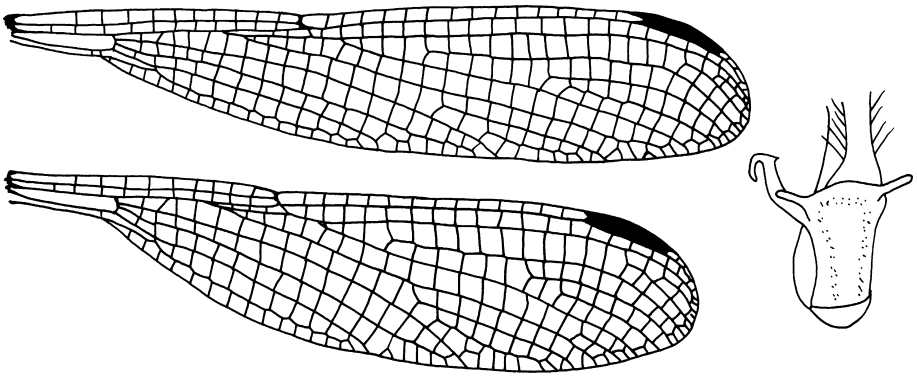


Fig. 3.1.16 The fore and hind wing of *Dicterias atrosanguinea* (left) and its penis (right). Based on Needham (1933), who labeled his drawing of the wing *D. procera,* and Dunkle (1991a).

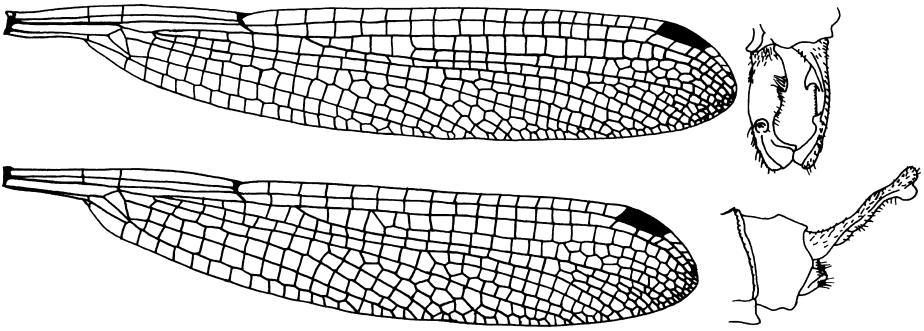


Fig. 3.1.17 *Archilestes tuberalatus:* fore and hind wing of a female (left), apex of the abdomen of a male in dorsolateral (upper right) and lateral view (right). Based on Williamson (1921).

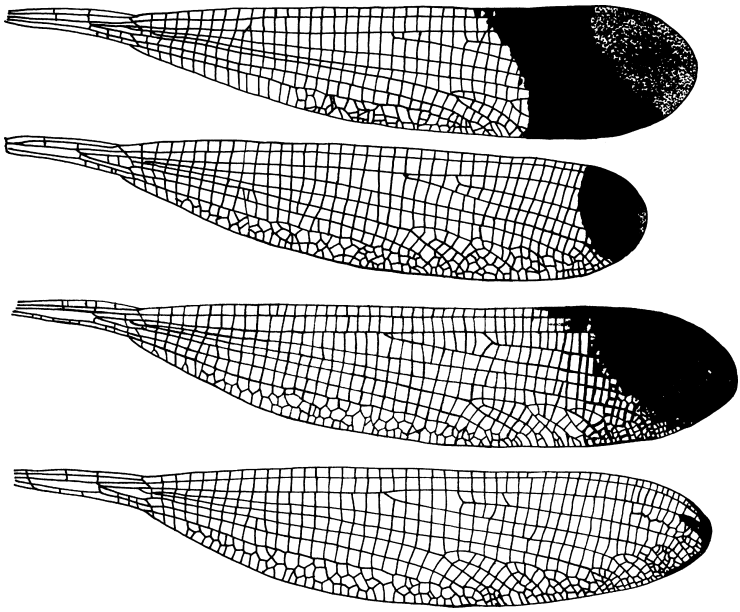


Fig. 3.1.18 The fore and hind wing of a male (below) and female (above) *Anomisma abnorme.* Based on figures labeled *Anomisma terminatum* by Schmidt (1942).

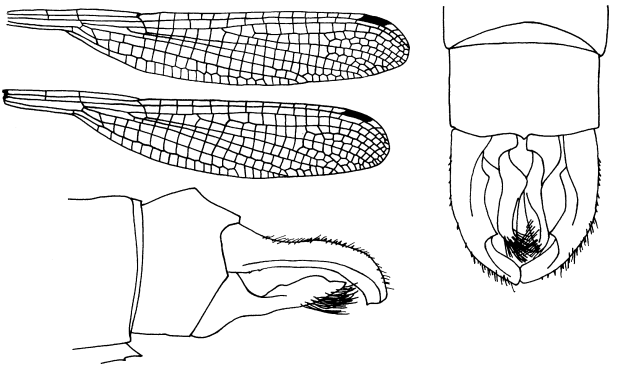


Fig. 3.1.19 *Allopodagrion erinys* male: fore and hind wing (upper left) and apex of the male abdomen in dorsal (right) and lateral view (lower left). Based on Ris (1913).

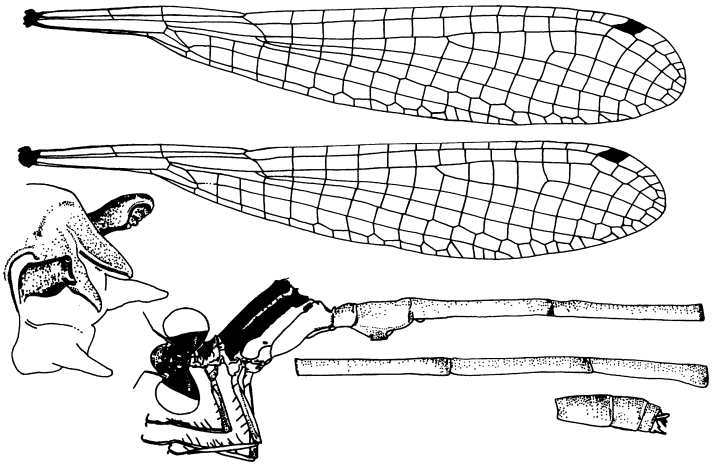


Fig. 3.1.20 *Inpabasis rosea* male: fore and hind wing (above); head, thorax, and first four abdominal segments (lower left to middle right); the fifth through seventh abdominal segments (lower center to lower middle right); eighth through tenth abdominal segments (lower right) and anal appendages (lower left). Based on Garrison and Costa (2002).

8. Supplementary sectors are present distally and are found proximally at least as far as the pterostigma (**Fig. 3.1.19**).
…….....Megapodagrionidae..p. 213
- Supplementary sectors are absent, or they form a few cellules that are aligned distally and do not occur as far proximally as the pterostigma (**Fig. 3.1.20**). 9

9. Veins Cu_2 (CuP) and A_1 are present and well developed (**Fig. 3.1.20**).
…….....Coenagrionidae..p. 299
- Vein A_1 is absent or greatly reduced. Vein Cu_2 (CuP) is sometimes reduced, as well (**Fig. 3.1.21**). 10

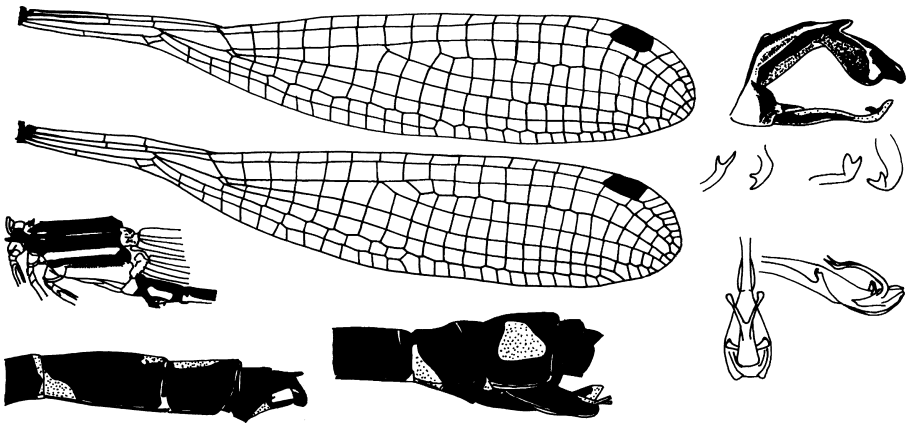


Fig. 3.1.21 *Palaemnema picicaudata:* fore and hind wing (upper left), color pattern on the lateral surface of the male thorax (middle left), apex of the abdomen of a male (lower left), and a female (lower center), the superior and inferior appendages of the male (upper right) with four enlargement of the apices of the inferior appendages (middle right), and the penis in ventral (lower right center) and lateral view (lower right). Based on Kennedy (1938).

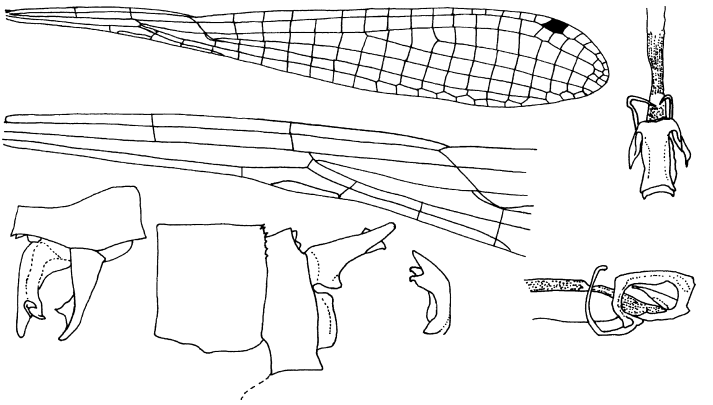


Fig. 3.1.22 *Lamproneura lucerna* male: fore-wing (above left), enlargement of the basal portion of the same wing (middle left), penis in ventral (upper right) and lateral view (lower right), apex of the abdomen in dorsolateral (lower left) and lateral view (lower left center), and superior anal appendage in ventroposterior view (lower right center). Based on De Marmels (2003).

10. An extra cross vein is present in the post-costal space very close to the base of the wing. Another cross vein is present in the anal crossing, Ac. Many postnodal veins are present (**Fig. 3.1.21**).
……..…….....Platystictidae..p. 558
Only the genus *Palaemnema* is present in South America.
- No additional cross vein is present in the post-costal space. Comparatively few postnodal veins are usually present (**Fig. 3.1.22**).
…….....Protoneuridae..p. 572

Larvae

Information for the key was taken from Brues *et al*. (1954), Santos and Costa (1988), De Marmels (1990a), Novelo-Gutiérrez (2003), Costa *et al*. (2004), and Lencioni (2005, 2006). The larvae of many species have not been described, so the key is reliable only for the known species.

1. The length from the anterior margin of the head to the apex of the tenth abdominal segment is shorter than the length of the lateral gill lamella and shorter than a hind leg. The hind tibia is longer than the abdomen without the gill lamellae. The gill lamellae are triangular in cross section and bear spines near their apices. The median gill lamella is much shorter than the lateral ones. The legs appear long and narrow. The second of the seven segments of the antenna is the longest. On the head, there are prominent tubercles on the ocellar area. The labial palp bears three long teeth distally and two setae at its base (**Fig. 3.1.23**). Total length of last instar larva: at least 30 mm.
.....Heliocharitidae..p. 164
This family is also called Dicteriastidae or Dicteriadidae.
- The hind tibia is not longer than the abdomen without the gill lamellae, or the gill lamellae are not triangular in cross section, or the second of seven antennal segments is not the longest, or there are no prominent tubercles on the ocellar area (**Fig. 3.1.24**). 2
2. The lateral gill lamellae appear to consist of two segments; the basal one is short had has two median, spine-like projections, and the apical one resembles a caudal filament. The median lamella is short and ends in four spines. The antennae are short and consist of eight segments. The anterior part of the prementum of the only know South American species has parallel sides (**Fig. 3.1.25**).
.....Amphipterygidae
There are only two Neotropical species in this family: *Amphipteryx agrioides* Selys, 1853, which is found mainly in Central America and has not yet been identified in South America, and *Rimanella arcana* (Needham, 1933), known from Venezuela and Surinam. Its synonym is *Rima arcana* Needham, 1933.
- The shape of the median and lateral gill lamellae are similar, although their lengths may be different (Fig. 3.1.26). 3

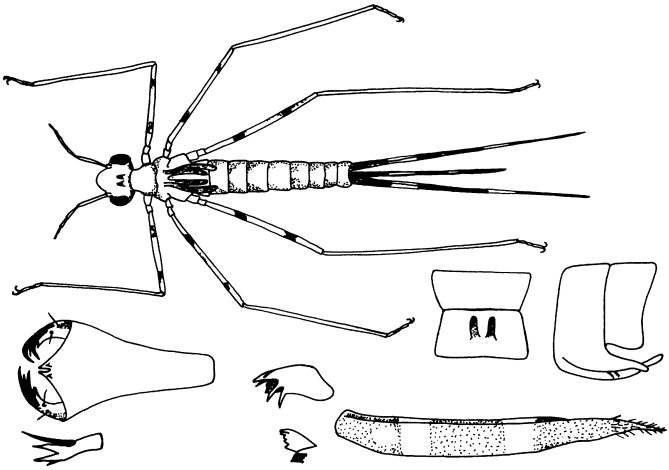


Fig. 3.1.23 *Heliocharis amazona* larva: habitus (above), labium with the lateral lobes in dorsal view (middle left), left lateral lobe in external view (lower left), right maxilla viewed from inside and the left mandible in ventral view (lower left center, above and below, respectively), eighth and ninth abdominal segments of a male larva in dorsal view and ninth and tenth segments of a female abdomen in lateral view (middle right, left and right, respectively), and the middle gill lamella in lateral view (lower right). Based on Santos and Costa (1988).

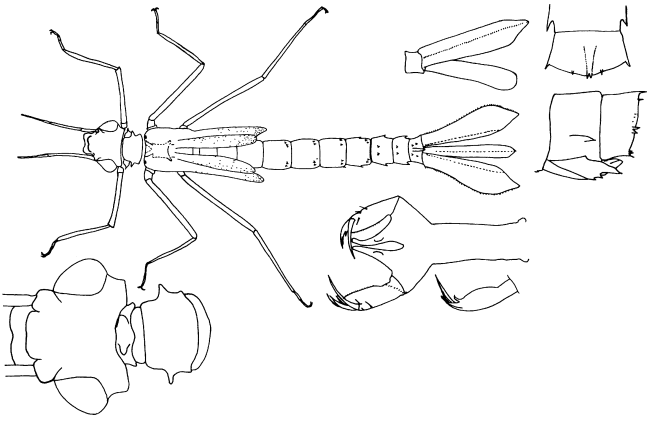


Fig. 3.1.24 *Hetaerina auripennis* male larva: habitus (upper left), head and prothorax in dorsal view (lower left), labium with palps in dorsal view (lower middle right) with a palp in ventral view (lower right), gill lamellae in lateral view (upper right center), and the apex of the abdomen in dorsal (upper right) and lateral view (middle right). Based on Santos (1970a).

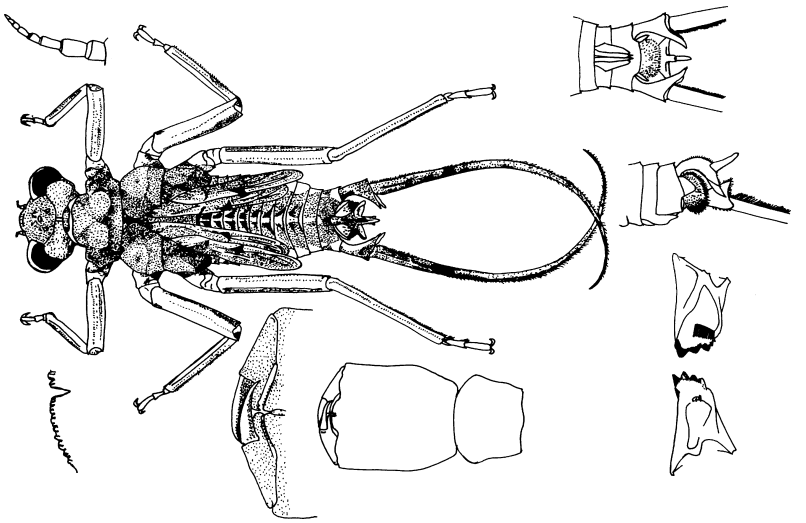


Fig. 3.1.25 *Rimanella arcana* larva: habitus (middle left); antenna (upper left); middle and one side of the anterior margin of the prementum, anterior part of the prementum with the labial palps, and entire labium (lower left to center); mandibles in posterior view (lower right), apex of a male abdomen in ventral view (upper right); and apex of a female abdomen in lateral view (upper middle right). Based on Lencioni (2005).

3. The first segment of the antenna is as long or longer than the combined length of all other segments (**Fig. 3.1.24**). The distal portion of the prementum has two well-developed projections that are widely separated, except at their apices. The median caudal gill is flat and much shorter than the lateral ones, which are triangular in cross section.
.....Calopterygidae..p. 103
- The first segment of the antenna is shorter than all of the other segments combined, and the distal portion of the prementum is not divided to form widely-separated projections (**Fig. 3.1.26**). 4
4. There are ventrolateral gills on the second through seventh abdominal segments, and the gill lamellae appear bloated and bear digitiform or conical projections (**Fig. 3.1.26**).
.....Polythoridae..p. 60
- The abdomen lacks supplementary ventral gills on any of the segments (**Fig. 3.1.27**). 5
5. The median lobe of the prementum lacks a cleft at the apex (Fig. 3.1.27). 6
The median lobe of the prementum has a prominent cleft at the apex (**Fig. 3.1.28**). 8

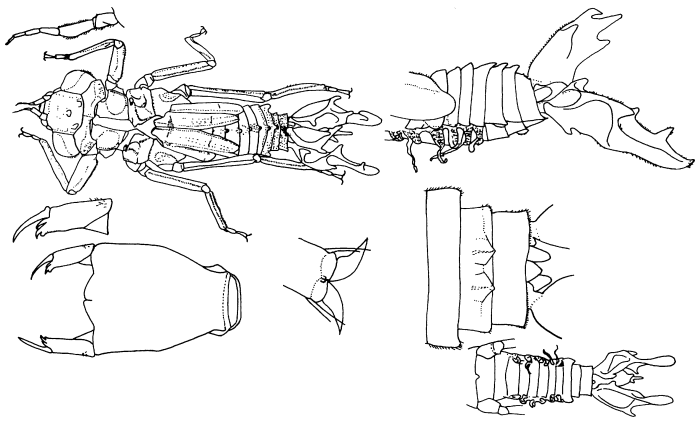


Fig. 3.1.26 *Cora cyane* male larva: habitus drawn from the exuvia with the antenna enlarged above it (upper left); labial palp enlarged above the entire labium (lower left); tarsal claw on the hind leg (lower center); abdomen in lateral (upper right) and ventral view, showing both the abdominal gill filaments and the caudal gills (lower right); the eighth to tenth segments of the abdomen showing the gonapophyses and cerci (middle right). Based on De Marmels (1982a).

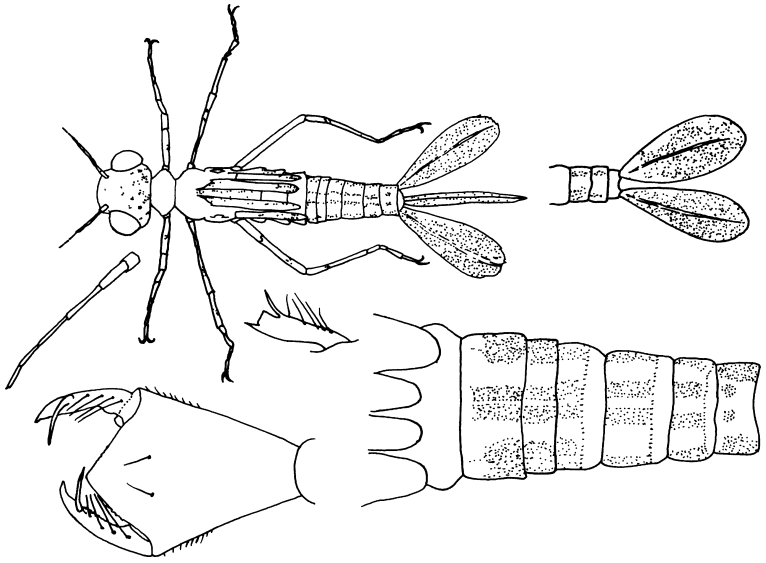


Fig. 3.1.27 *Peristicta aeneoviridis* larva: habitus (upper left), antenna enlarged (middle left), inner surface of the mentum (lower left), labial palp (middle), fourth through tenth abdominal tergites (lower right), and lateral view of the apex of the abdomen (upper right). Based on Santos (1972b).

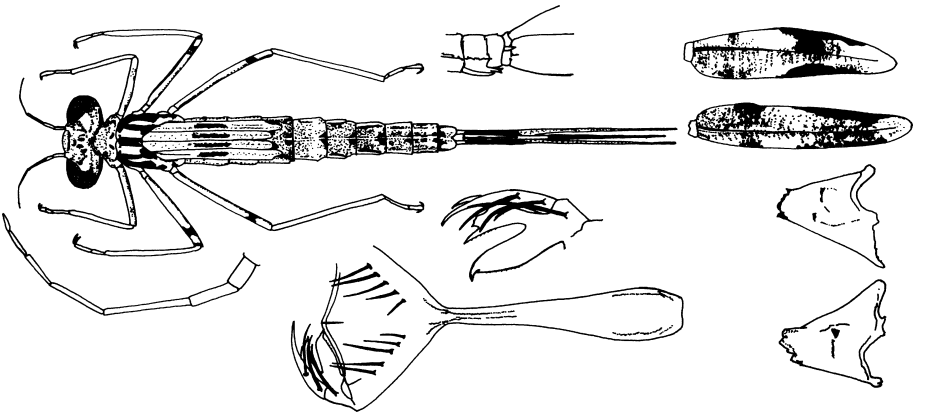


Fig. 3.1.28 *Lestes tenuatus* larva: habitus of a male larva (upper left), antenna (lower left), labium with one palp removed (lower center) and a labial palp (above labium), mandibles (lower right), apex of the abdomen and bases of gill lamellae of a female larva (upper center), and gill lamellae in lateral view (upper right). Based on Geijskes (1941).

6. There is only one seta on each side of the prementum. Each labial palp ends in a truncate terminal hook and truncate moveable hook without well-formed serrations. There is frequently a triangular projection at the posterolateral corner of the pronotum. The caudal gill lamellae are constricted in the middle and have an opaque basal half and a pale apical half, which is not broader than the basal half (**Fig. 3.1.27**).
.....Protoneuridae..p. 572
- The prementum lacks setae, or it usually does not have only one seta on each side, but if it does, then the labial palp is not truncate at the apex, or it is truncate with well-formed serrations. There is never a triangular projection at the posterolateral corner of the pronotum. The basal and apical halves of the caudal gill lamellae do not obviously differ from each other (**Fig. 3.1.29**). 7
7. The caudal gills are stalked and have a broadened, pointed, leaf-like apical portion (**Fig. 3.1.29**). There are no premental setae. The final instar larvae are longer than 17 mm without the caudal gill lamellae.
.....Pseudostigmatidae..p. 201
- The caudal gills are usually slender and lamellate, do not widen suddenly in the distal part, and are held in a vertical plane. However, if they do widen in the distal half, then, on each side of the prementum, there is a single long seta. If no

premental setae are present, then a long seta is present near the base of the moveable hook on the palp (**Fig. 3.1.30**).

.....Coenagrionidae..p. 299

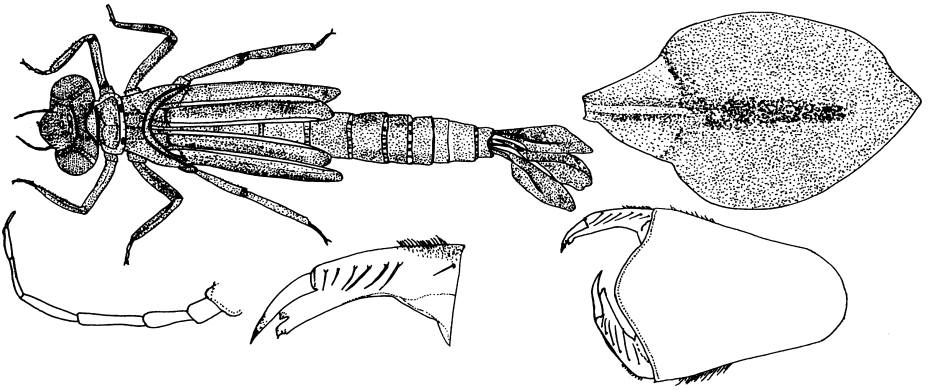


Fig. 3.1.29 *Mecistogaster ornata:* habitus (upper left), antenna (lower left), labial palp (lower center), labium (lower right), and a lateral gill (upper right). Based on Ramírez (1995).

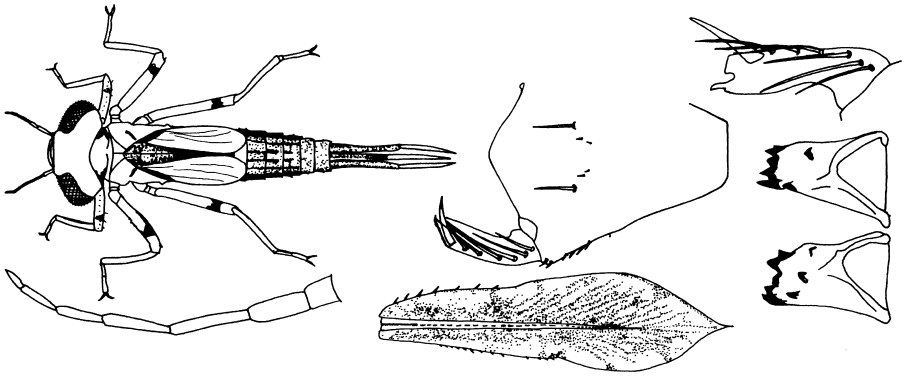


Fig. 3.1.30 *Telebasis demararum* larva: habitus (upper left), antenna (lower left), labium with one of the palps removed (upper center), a labial palp (upper right), mandibles (lower right), and a lateral gill lamella (lower center). Based on Geijskes (1941).

8. The prementum is widest at a point well basal to the insertions of the labial palps. There are two longitudinal areas of minute striations running parallel to each other on the dorsal surface of the prementum. There are one or two blunt denticles at the apex of each labial palp (**Fig. 3.1.31**).
.....Platystictidae..p. 558
- The prementum is widest near the insertions of the labial palps. There are no longitudinal areas of minute striations on the dorsal surface of the prementum (**Fig. 3.1.28**). 9

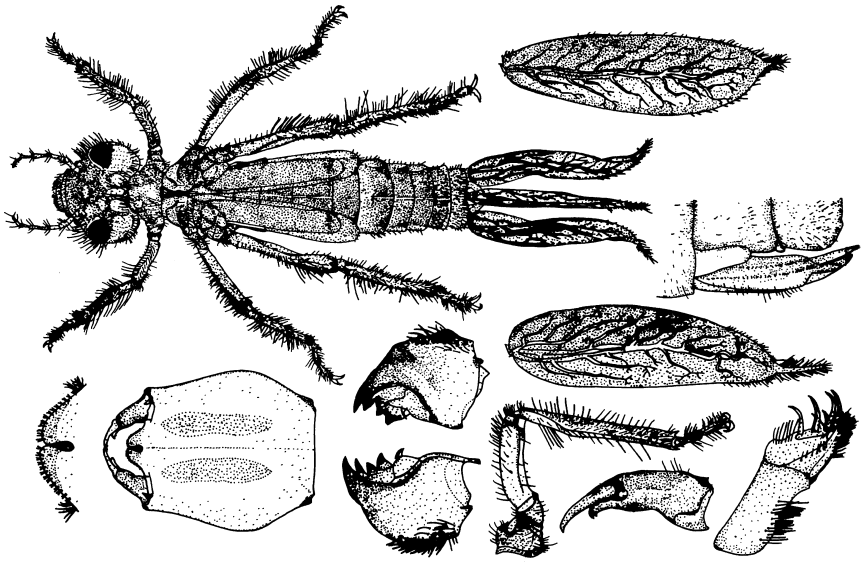


Fig. 3.1.31 *Palaemnema desiderata* Selys, 1886, larva: habitus (upper left), anterior margin of the prementum (lower left), labium (lower left center), mandibles (lower center), fore-leg (lower right center), labial palp in ventral view (below leg), lacinia (lower right), middle gill lamina (upper right), lateral gill lamina (lower middle right), anlage of the ovipositor of a female larva (upper middle right). The species is North American and not among the South American fauna. Based on Novelo-Gutiérrez and González-Soriano (1986a).

9. The end hook on the labial palp is separated from the other hooks by an emargination much deeper than those separating any of the other hooks. The moveable hook has one or more long setae. The median lobe of the prementum is incised, and the lateral lobes are deeply cleft. The caudal gills are leaf-like, and their secondary tracheae are arranged at right angles to the gill axis. The legs are usually long (**Fig. 3.1.28**).
.....Lestidae..p. 176

- The end hook on the labial palp is separated from the other hooks by an emargination about as deep as those separating the other hooks. The moveable hook lacks setae. The median lobe of the labium is produced but not incised. The legs are short to medium in length (**Fig. 3.1.32**). 10

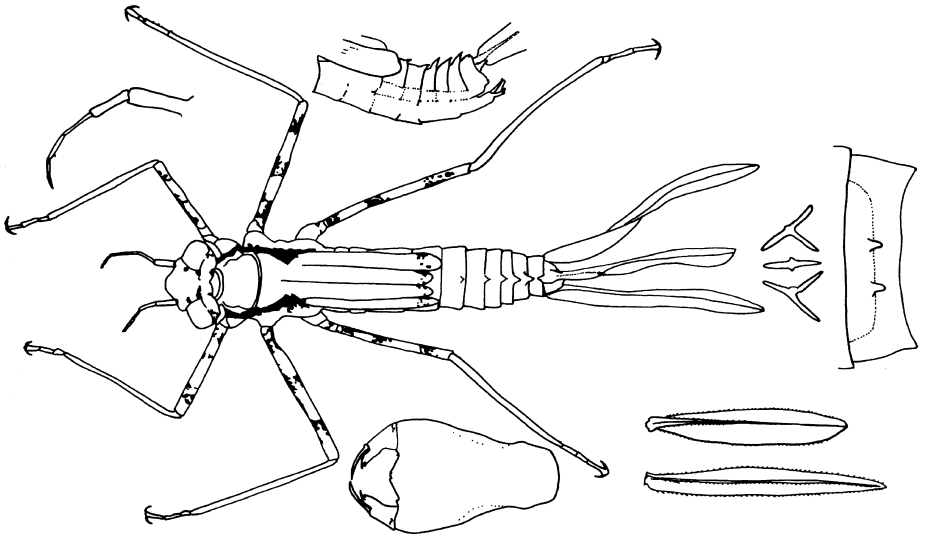


Fig. 3.1.32 *Teinopodagrion venale* larva: habitus (center), antenna (upper left), labium (lower center), lateral view of a female abdomen (upper center), middle and lateral gill lamella (lower right, above and below, respectively), cross sections of the three caudal gill lamellae (right center), and ninth abdominal segment of a male larva in ventral view (right). Based on De Marmels (1982b).

10. On the labial palp, the end hook is narrow and acute, and the intermediate hooks are broadly separated. All three caudal gills are nearly the same size, have a leaf-like shape, and are broadly rounded at the apex (**Fig. 3.1.33**).
.....Perilestidae..p. 165

- On the labial palp, the end hook is broad, truncate and quadrilateral in shape at the apex; the intermediate hooks are close to each other. The caudal gills are triangular or sac-like, inflated, and frequently taper to an apical filament (**Fig. 3.1.32**).
.....Megapodagrionidae..p. 213

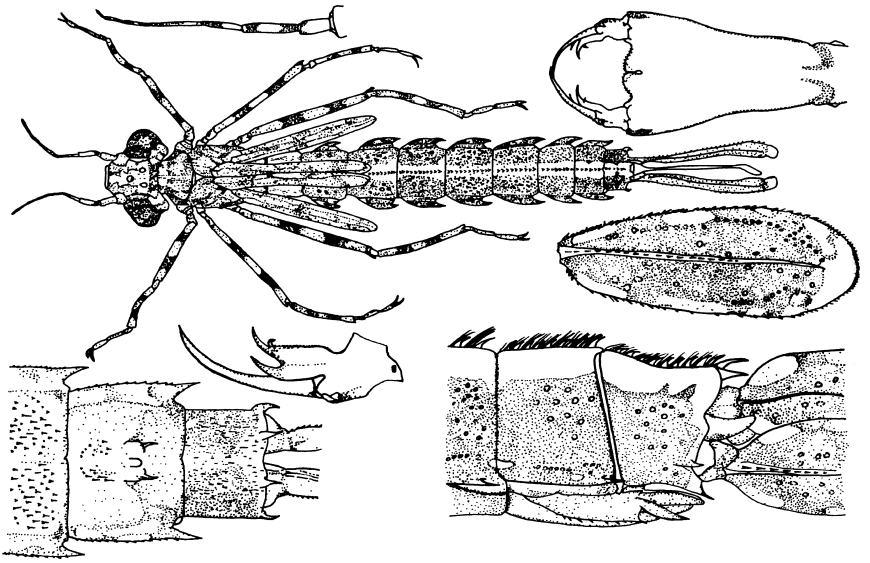


Fig. 3.1.33 *Perissolestes magdalenae* larva: habitus of a final instar male (upper middle), antenna (upper left), dorsal view of labium (upper right), ventral view of a labial palp (left of center), apex of the male abdomen without gill lamellae in ventral view (lower left), apex of a female abdomen in lateral view (lower right), and a lateral gill in lateral view (middle right). Based on Novelo Gutiérrez and González Soriano (1986b).

Polythoridae

Key to the genera of the adults in South America

Information for the key was taken from Kennedy (1940), Montgomery (1967), De Marmels (1988a), Lencioni (2005), and Garrison (2007).

1. Vein Cu_2 is unforked (**Fig. 3.1.34**). The wing is 4 to 5 times as long as wide and hyaline or faintly spotted. 2
 - Vein Cu_2 is forked at least once, or, if not, the wing has a large, heavily pigmented marking (**Fig. 3.1.35**). 3
2. The antenna is long; its third segment is at least twice as long as the second. The stigma is at least five times as long as high. There are two cross veins in the quadrangles of each wing. The wings have a narrow petiole and simple venation, with only six extra sectors in addition to M_{1a} (**Fig. 3.1.34**).
.....*Stenocora* Kennedy, 1940

Only a single species in this genus has been described: *Stenocora percornuta* Kennedy, 1940, from Ecuador and Peru.

- The antenna is shorter, and its third segment is less than twice as long as the second. The length of the inner side of the stigma is three to four times its length. There are two to four cross veins in the quadrangles of the fore-wing and four in the hind wing. There are more than six extra sectors in addition to M_{1a}; three or four of them are located between M_{1a} and M_2, and four to six, between M_3 and M_4. The petiole and stigma are less narrow (**Fig. 3.1.36**).
.....*Miocora* Calvert, 1917..p. 69

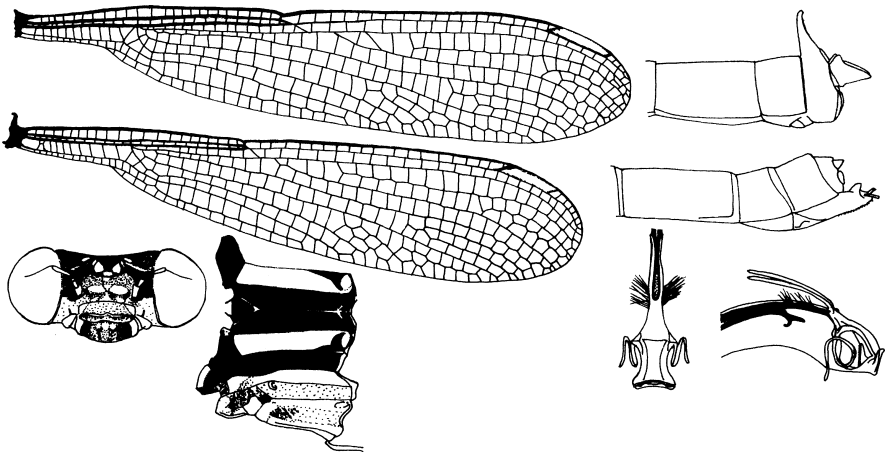


Fig. 3.1.34 *Stenocora percornuta:* fore and hind wing of a male (upper left), head of a female in frontal view (lower left), diagrammatic view of the color pattern on the thorax of a teneral female (lower left center), apex of the abdomen of a male (upper right) and female in lateral view (middle right), penis in ventral (lower right center) and lateral view (lower right). Based on Kennedy (1940).

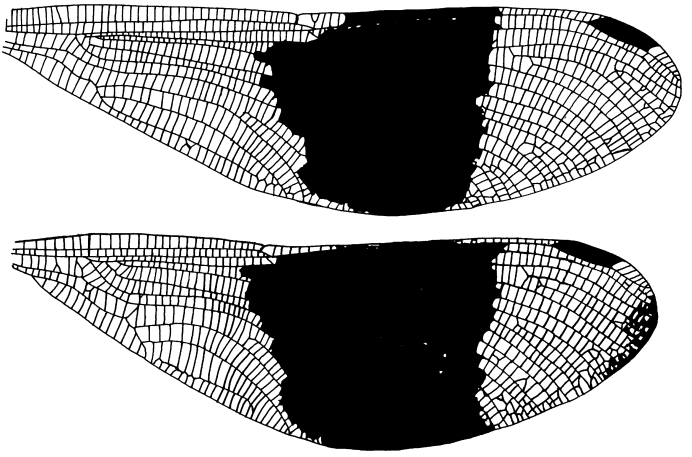


Fig. 3.1.35 Fore and hind wing of a male *Euthore fassli.* Based on Ris (1914).

3. The quadrangle of the hind wing is scarcely longer than that of the fore-wing. Vein Cu_2 is sometimes forked only once, and there is no third sector between the two branches of the fork. The nodus is closer to the pterostigma than to the wing base. The wing petiole runs about 2/3 of the distance from the wing base to the arculus. The fore-wing is about 4 1/2 times as long as wide. The arculus is almost half the distance from the wing base to the subnodus. There is only one thickened antenodal. The wings are hyaline (**Fig. 3.1.37**).
.....*Cora* Selys, 1853..p. 70
- Vein Cu_2 is always forked twice, forming a third sector between the two main branches of the fork, and the quadrangle of the hind wing is 1.5 to 2 times as long as that of the fore-wing (**Fig. 3.1.38**). 4

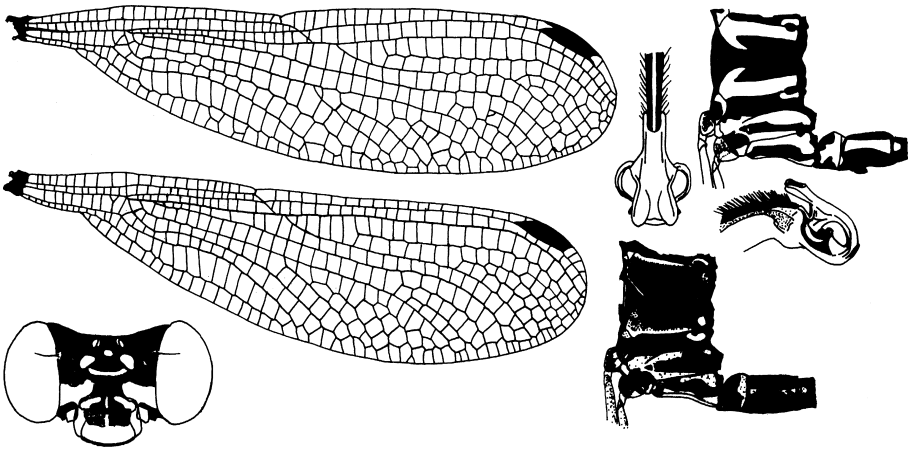


Fig. 3.1.36 *Miocora pellucida:* fore and hind wing of a male (upper left), the head of a female in anterior view (lower left), diagram of the thoracic color pattern diagrammatically displayed in one plane with the lateral surface below and dorsal surface above, showing the female (lower right) and male (upper right); penis in ventral (upper right center) and lateral view (middle right). Based on Kennedy (1940).

4. The wing petiole runs 1/3 to 2/5 of the distance from the wing base to the arculus. The fore-wing is less than 3 times as long as wide. The superior anal appendage of the male has a ridge along its inner margin but lacks a tooth (Fig. 3.1.39). The inferior anal appendage of the male is short and finger-like. Total length: 27 to 29 mm.
.....*Chalcothore* De Marmels, 1985
This genus was established for a single species, *Chalcothore montgomeryi* (Rácenis, 1968) from Venezuela. Syn: *Euthore montgomeryi* Rácenis, 1968.

- The wing petiole runs about half of the distance from the wing base to the arculus. The fore-wing is about 3½ times as long as wide. The arculus is slightly more than 1/3 the distance from the wing base to the subnodus. Sometimes there are two thickened antenodal cross veins continuous across the C and Sc areas (**Fig. 3.1.38**). 5

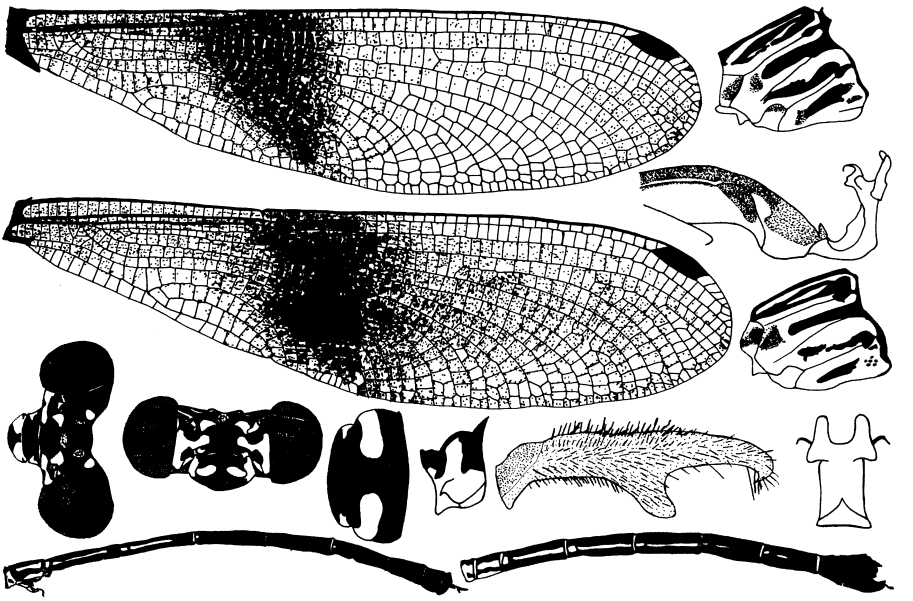


Fig. 3.1.37 *Cora chiribiquete:* the hind wing of a male (upper left) and a female (upper middle left); lateral view of the pterothorax of a male (upper right) and a female (middle right); and (lower middle row, left to right): head of a male in dorsal and anterior view, prothorax of a male in dorsal and lateral view, superior appendage of a male in lateral view, and the apex of the penis in dorsal view; the penis in lateral view (upper middle right); lateral views of the abdomen of a male (lower left) and a female (lower right). Based on Zloty and Pritchard (2001).

5. The fore-wing is obviously longer and narrower than the hind one. Sectors arise from the main veins in a way that makes them appear forked. Vein M_2 arises two to four cells beyond the subnodus, at least in the fore-wing (**Fig. 3.1.38**). The fore-wing is hyaline and longer and narrower than the hind wing, which is usually iridescent.

.....*Chalcopteryx* Selys, 1853..p. 79

- The fore and hind wings are the same general size and shape. Sectors arise from the main veins in a way that does not make the veins appear forked. Vein M_2 arises only one or two cells beyond the subnodus (**Fig. 3.1.35**). 6

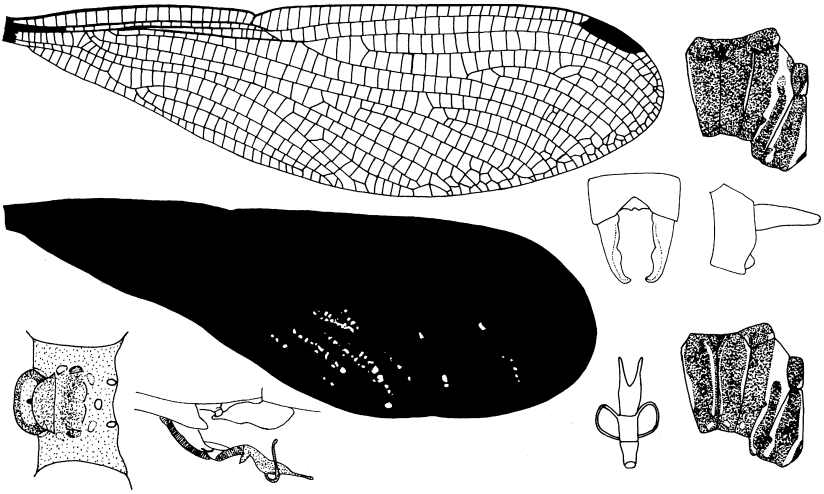


Fig. 3.1.38 *Chalcopteryx scintillans:* fore and hind wings of a male (upper left), the head of a male in dorsal view not showing the compound eyes (lower left), diagrammatic view of the color pattern of a male (upper right) and a female synthorax (lower right), penis in ventral (lower right center) and lateral view (lower left center), and apex of the male abdomen in dorsal and lateral view (middle right). Based on Schmidt (1943) and Santos and Machado (1961).

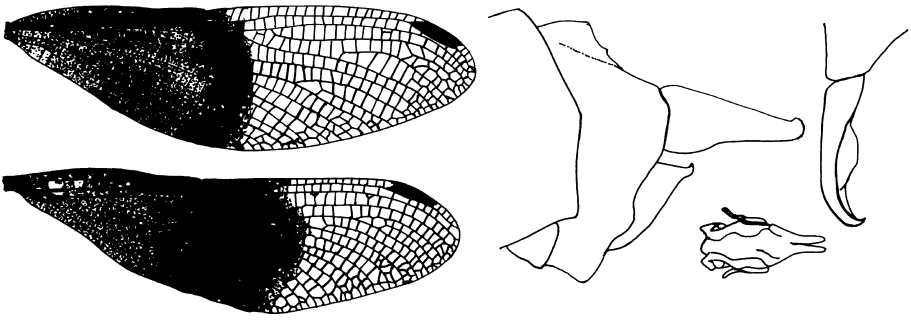


Fig. 3.1.39 *Chalcothore montgomeryi* male: fore and hind wing (left), apical segment of the penis in ventral view (lower right center), superior anal appendage in dorsal view (right), and apex of the abdomen in lateral view (center). Based on De Marmels (1988a).

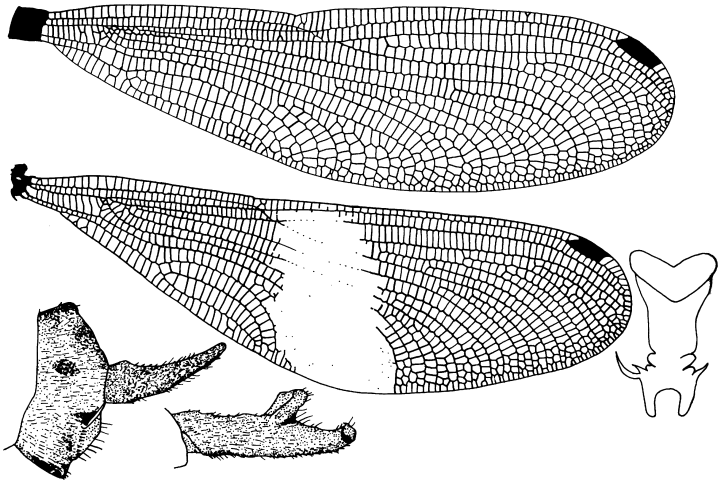


Fig. 3.1.40 *Polythore beata* male: fore and hind wing (above), apex of the abdomen in lateral view (lower left), superior anal appendage in dorsal view (lower left center), and the penis in ventral view (lower right). Based on Bick and Bick (1986) and Lencioni (2005).

6. There are 20 to 35 antenodal cross veins, 6 to 10 cross veins beneath the stigma, and usually no sectors more than three or four cells long between M_4 and Cu_1. No sectors between M_2 and Rs arise proximal to the stigma (**Fig. 3.1.35**).
.....*Euthore* Selys, 1869..p. 82
- There are 40 to 50 antenodal cross veins, often 12 or more cross veins beneath the stigma, and prominent sectors between M_4 and Cu_1, at least in the hind wing. The nodus is closer to the wing base than to the pterostigma. Several sectors between M_2 and Rs arise as far proximal as the proximal end of the stigma in the hind wing (**Fig. 3.1.40**). At least one of the wings has colored markings.
.....*Polythore* Calvert, 1917..p. 86

Key to the genera of the larvae in South America

Information for the key was taken from Santos and Costa (1987), De Marmels (1988a, 1995), and Lencioni (2005). Information on polythorid larvae in South American is fragmentary. The key is accurate only for known larvae.

1. The caudal gill lamellae may be divided into about three or fewer large lobes ending in large, conical apices, but finger-like projections are absent. The tibiae are subequal to or longer than the femora on the same legs, and the hind legs extend farther posteriad than the posterior margin of the tenth abdominal

segment. The posterolateral lobes of the head are angular at the corners. The buds for the fore-wing reach only the third abdominal segment, and those for the hind wing reach the fourth (**Fig. 3.1.41**). An empodium, that is, a small process between the claws, is absent.

.....*Chalcopteryx* Selys, 1853..p. 79

- The both the middle and lateral caudal gill lamellae bear at least four finger-like processes and are usually folded in multiple planes (**Fig. 3.1.42**). The side lobes of the head are angular at the corners. The buds for the fore-wing reach at least to the fourth abdominal segment, and those for the hind wing reach at least to the fifth. An empodium is present. 2

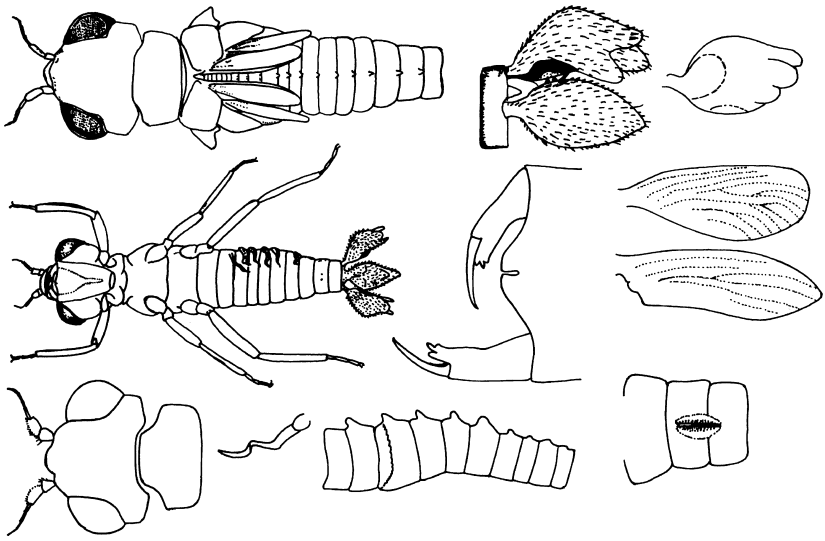


Fig. 3.1.41 *Chalcopteryx radians* larva: Habitus of a female without legs or gills, drawn from an exuvia (upper left); habitus of a female in ventral view showing the abdominal gill filaments on one side (middle left); outline of head and pronotum in dorsal view (lower left); anterior margin of the prementum and the labial palps (center); an abdominal gill filament from the fourth segment (lower left center), outline of the abdominal segment in lateral view (lower right center); anterior and posterior wing buds (middle right, above and below, respectively); eighth through tenth abdominal segments of a female in ventral view (lower right); tenth segment with one median and one lateral gill in dorsal view (upper right center); outline of a median gill in lateral view (upper right). Based on Santos and Costa (1987) and Lencioni (2005).

2. The hind legs, extended posteriad, do not reach the apex of the tenth abdominal segment. These segments become progressively smaller, so the ninth is not notably smaller than the eighth. No fingers on the caudal gills are three or

more times as long as their basal width. The prementum is slightly longer than wide. Each tibia is shorter than the femur on the same leg. The posterolateral lobes of the head are rounded at the corners (**Fig. 3.1.43**).
.....*Euthore* Selys, 1869..p. 82
- The hind legs, extended posteriad, reach beyond the apex of the tenth segment of the abdomen. In dorsal view, ninth and tenth abdominal segments appear set off from the others because they are notably smaller than the eighth. If none of the fingers on the caudal gills are three or more times as long as their greatest width, then the lamellae also bear large lobes on the basal half (**Fig. 3.1.42**). 3

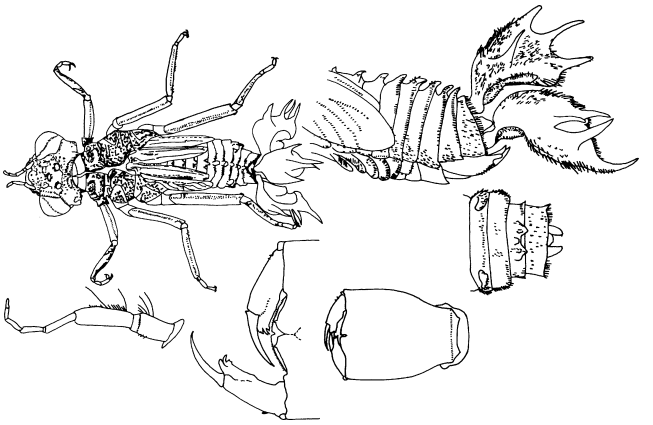


Fig. 3.1.42 *Chalcothore montgomeryi* larva: habitus drawn from the exuvia of a female (upper left), antenna of a male (lower left), anterior margin of the labium with labial palps of a female (lower center), labium of a female (lower right center), female abdomen in lateral view (upper right), and ventral view of the seventh to tenth segments of the male abdomen showing the gonapophyses and cerci. Based on De Marmels (1988a).

3. Most finger-like processes on the caudal gill lamellae are about half as long as the lamella. The first through ninth abdominal segments bear curved mid-dorsal processes. The abdominal gills on the second through seventh abdominal segments are short, thick, and covered with small scales (**Fig. 3.1.42**). Scales also cover the dorsal hooks and the posterior margins of the fifth through tenth segments. The posterolateral lobes on the head are sharply angled at the corners. Total length of the final instar larvae of the only knows species, excluding the gills: 9 to 11.5 mm. Length of a lateral gill lamella: c. 2.5 mm.
.....*Chalcothore* De Marmels, 1985
This genus includes one species, *Chalcothore montgomeryi* (Rácenis, 1968) from Venezuela. Syn: *Euthore montgomeryi* Rácenis, 1968.

- Most of the finger-like processes on the caudal gill lamellae are much shorter than half the length of the lamella. There are lobe-like lateral processes on the eighth segment that make it appear much wider than the ninth and tenth. The abdominal gills on the second through seventh abdominal segments are long and string-like. The fore-tibiae are longer than the fore-femora (**Fig. 3.1.44**). 4

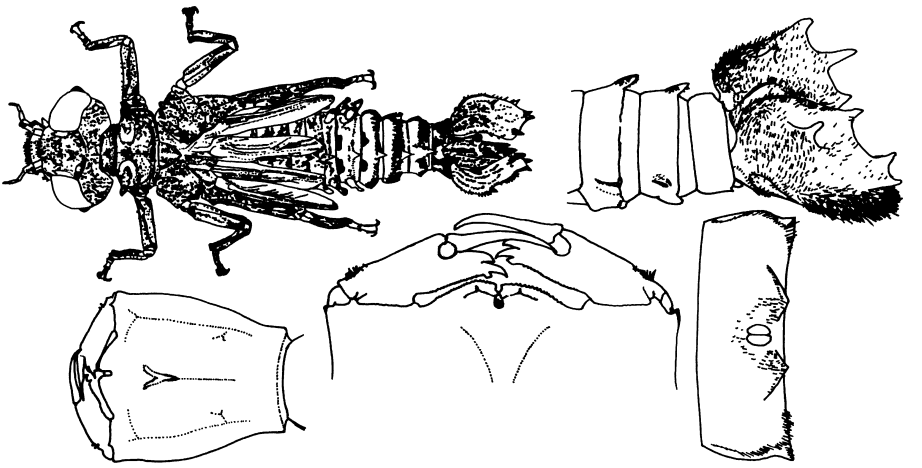


Fig. 3.1.43 *Euthore meridana* larva: habitus (upper left), labium in dorsal view (lower left), apical margin of the prementum and labial palps in dorsal view (lower center), ventral view of the ninth abdominal segment (lower right), and apical segments of the abdomen and caudal gills in lateral view (upper right). Based on De Marmels (1995).

4. The seventh, eighth, and ninth abdominal segments each bear a mid-dorsal process that curves posteriad, while those anterior to them have, at most, a slight posteromedial prominence that does not curve. The lateral caudal gill lamellae are convoluted with many lobes and processes in different planes and have a tongue-like extension at the base. The posterolateral lobes of the head are angled at the corners. The empodium is minute (**Fig. 3.1.26**).
.....*Cora* Selys, 1853..p. 70

- The first through ninth abdominal segments each bear a curved mid-dorsal process. The lateral caudal gill lamellae are inflated and bladder-like with a dense covering of fine setae and short, finger-like processes on the dorsal surface. The posterolateral lobes of the head are rounded at the corners (**Fig. 3.1.44**). The tubular gills on the second through seventh abdominal segments taper and are contorted in life; extended, they are nearly half as long as the abdomen. The one final instar larva that has been described reaches a length of about 15 mm.
.....*Polythore* Calvert, 1917..p. 86

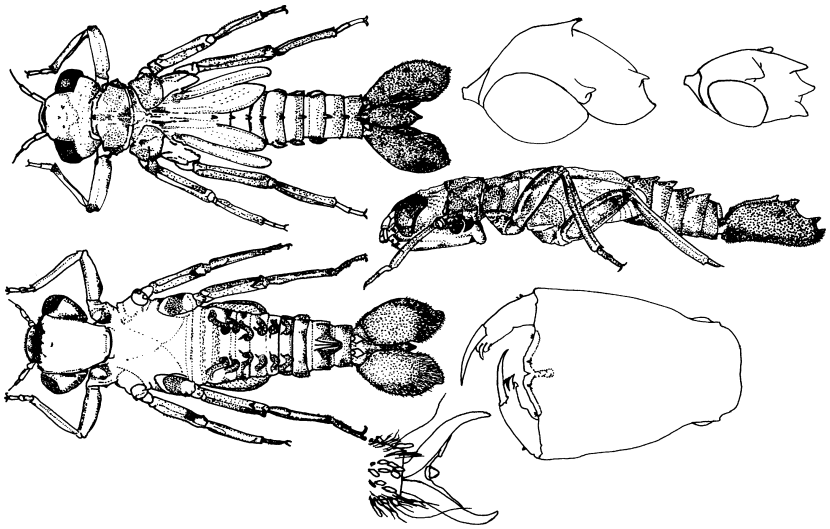


Fig. 3.1.44 *Polythore spaeteri* larva: habitus in dorsal (upper left), ventral (lower left), and lateral view (middle right); labium in dorsal view (lower right); tarsal claw showing the empodium and scales (lower center), paraproct (upper right center) and epiproct (right center). Based on Etscher *et al.* (2006), who did not, however, match the larva to the adult with certainty.

Key to the species of adult *Miocora* in South America

Information for the key was provided by Kennedy (1940) and Garrison (2002).

1. The wings lack spots (**Fig. 3.1.36**). Length of the male abdomen including appendages: 29 mm. Length of the female abdomen including ovipositor: 37 mm. Length of fore-wing: 23 to 25 mm. Length of hind wing: 22 to 24 mm.
.....*Miocora pellucida* Kennedy, 1940 (Peru).
- The hind wing has a spot posterior to the stigma, which may or may not reach the costa near the wing tip (**Fig. 3.1.15**). Length of the male abdomen including appendages: 32 mm. Length of female abdomen including ovipositor: 25 mm. Length of fore-wing: 25 to 26 mm. Length of hind wing: 24 to 24.5 mm. The color is mainly black or blackish brown with pale markings, probably blue, on the thorax and pale green spots on each side of the first and third abdominal segments and pale green lateral stripes on the second.
.....*Miocora peraltica* Calvert, 1917 (Central America, Colombia, Ecuador). Syn: *Miocora subapicalis* Kennedy, 1940.

Key to the species of adult *Cora* in South America

Information for the key was provided by Kennedy (1940), Montgomery (1967), Bick and Bick (1990a, 1991), Zloty and Pritchard (2001), and Garrison (2007). The key is reliable only for males. *Josocora* Kennedy, 1940, and *Kalocora* Kennedy, 1940, which were distinguished by the number of forks in vein Cu_2 (CuA), were shown by Bick and Bick (1990a) and Garrison (2007), respectively, to be synonyms of *Cora* because the number of forks can vary among conspecific specimens.

1. Each wing is only about 3.35 times as long as wide and is heavily pigmented across the midlength on broad, metallic bands (**Fig. 3.1.45**). Length of male abdomen: c. 27 mm. Fore-wing length of male: 19 to 20 mm. Length of pterostigma: c. 1.5 mm. The habitat of the larvae is fast-flowing mountain streams, but neither they nor the females have been described.
..... *Cora aurea* Ris, 1918 (Colombia). Syn: *Kalocora aurea* (Ris, 1918).
- Each wing 4 to 5 times as long as wide (**Fig. 3.1.37**). 2

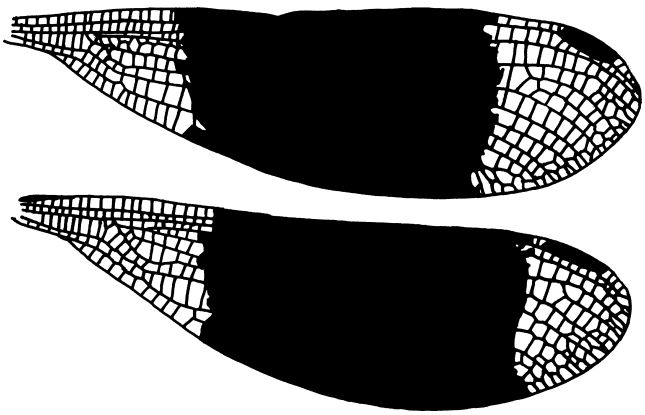


Fig. 3.1.45 Fore and hind wing of *Cora aurea.* Based on Kennedy (1940).

2. The coloration of second abdominal segment is at least half dark. The penis is concave at the apex or it bears horns (**Fig. 3.1.46**). 3
- The dorsal coloration of the second abdominal segment is entirely or almost entirely pale. The colors on the pterothorax are blue and black. The penis is convex or truncate at the apex (**Fig. 3.1.47**). 14
3. The dorsal surface of the second abdominal segment is blue on the basal half. The apex of the penis is concave, but no distinct horns are present. A dark stripe extends the entire length of the humeral suture (**Fig. 3.1.46**). Length of

abdomen: 38 to 39 mm. Fore-wing length: 35 to 37 mm. Length of pterostigma: c. 3.5 mm.
.....*Cora inca* Selys, 1854 pars (Ecuador, Colombia, Venezuela, Brazil). Syn: *Cora brasiliensis* Montgomery, 1967. The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).
- The dorsal surface of the second abdominal segment is entirely dark. There are two distinct horns at the apex of the penis (**Fig. 3.1.48**). 4

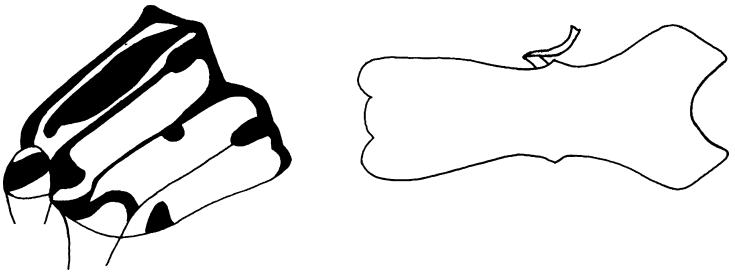


Fig. 3.1.46 *Cora inca* male: pattern on the lateral surface of the synthorax (left) and the apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

4. The hind wings and sometimes the fore-wings are golden in color or have golden markings distal to the nodus (**Fig. 3.1.38**). 5
- The wings are hyaline or hyaline with dark markings. 6

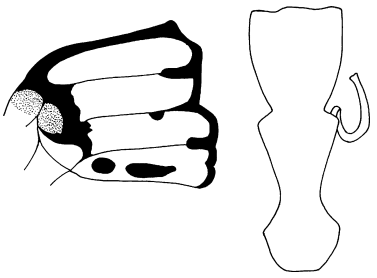


Fig. 3.1.47 *Cora xanthostoma* male: pattern on the synthorax (left) and apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

5. All wings are golden in color with a reddish gold pterostigma. The horns of the penis are about 0.27 to 0.30 mm long. Wing length: 34 to 36 mm.
.....*Cora dorada* Bick and Bick, 1991 (Ecuador).

- The hind wings are hyaline with a reddish brown pterostigma and a triangular gold band crossing the entire wing. The horns of the penis are about 0.16 mm long (**Fig. 3.1.38**). Fore-wing length of the male and female: 29 to 30 mm. .....*Cora chiribiquete* Zloty and Pritchard, 2001 (Colombia).

6. There are two long, parallel, black stripes on each mesepisternum between the humeral suture and dorsal carina (**Fig. 3.1.48**). The wings are hyaline, and the pterostigma is dark. 7

- The mesepisternum lacks two long, parallel, black stripes between the humeral suture and dorsal carina (**Fig. 3.1.49**). 8

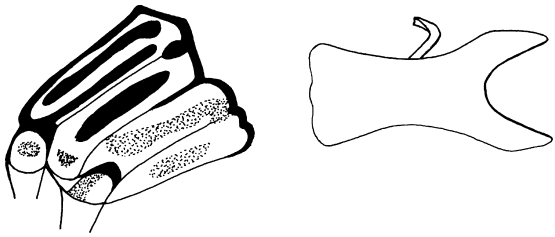


Fig. 3.1.48 *Cora munda* male: pattern on the lateral surface of the synthorax (left) and the apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

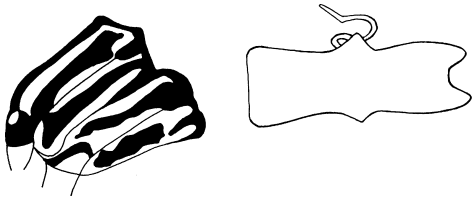


Fig. 3.1.49 *Cora dualis* male: pattern on the lateral surface of the synthorax (left) and the apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

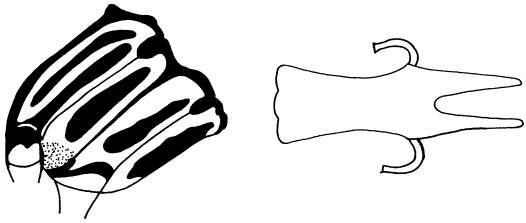


Fig. 3.1.50 *Cora terminalis* male: pattern on the lateral surface of the synthorax (left) and the apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

7. The horns of the penis are about 0.20 mm long (**Fig. 3.1.48**). There is usually a small dark spot at the apex of the wings. Wing length: about 27 mm.
.....*Cora munda* MacLachlan, 1878 (Ecuador).
- The penis horns are about 0.30 mm long (**Fig. 3.1.50**). An apical dark area of the wing usually begins at the mid-point of the pterostigma; it is more extensive in the fore-wing than in the hind. Wing length: about 34 mm.
.....*Cora terminalis* MacLachlan, 1878 (Ecuador, Colombia, Peru, Bolivia). Syn: *Euthore terminalis* (MacLachlan, 1878).

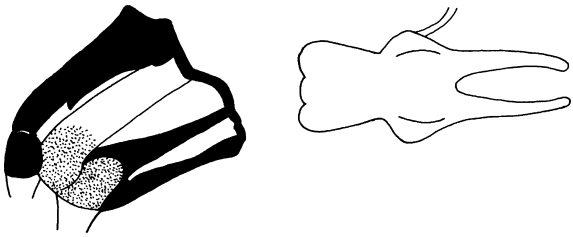


Fig. 3.1.51 *Cora klenei* male: pattern on the lateral surface of the synthorax (left) and the apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

8. A pale stripe on the mesepisternum along the dorsal carina and humeral suture surrounds or almost surrounds a large black area (**Fig. 3.1.49**). 9
- The color pattern on the mesepisternum does not include a pale stripe along the dorsal carina and humeral suture surrounding or almost surrounding a large black area (**Fig. 3.1.51**). 11
9. The fore-wing is about 41 mm long. There is a small white spot just distal to the nodus along the costal vein. The stripes on the mesepisternum and metepimeron extend to the ventral margin of the sclerites (**Fig. 3.1.49**).
.....*Cora dualis* MacLachlan, 1878 (Ecuador).
- The fore-wing is 25 to 28 mm long. There is no white spot just distal to the nodus along the costal vein. 10
10. There is a dark apical spot on each wing. The mesepisternal and epimeral stripes do not reach the ventral margins of the sclerites. The apical horns of the penis are much longer than wide and only slightly divergent (**Fig. 3.1.52**). Length of abdomen: 38 to 44 mm. Hind wing length: c. 30 mm. Length of pterostigma: 2 mm or shorter.
.....*Cora modesta* Selys, 1869 pars (Colombia, Peru). Syn: *Cora bogotensis* Foerster, 1914.

- The wings lack dark apical markings. The top of the head has four light spots near the bases of the antennae. The apical horns of the penis are wider than long and strongly divergent (**Fig. 3.1.53**). Fore-wing length: c. 25 mm.
.....*Cora lugubris* Navás, 1934 (Colombia).

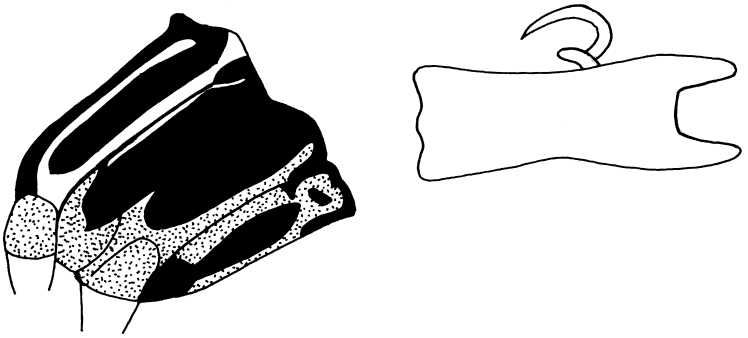


Fig. 3.1.52 *Cora modesta* male: pattern on the lateral surface of the synthorax (left) and the apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

11. A dark band on each wing extends from just distal to the nodus to or nearly to the apex (**Fig. 3.1.54**). 12
- Apical markings on the hyaline wings, if present, are confined to small spots near the apex (**Fig. 3.1.51**). 13

12. Each wing has a broad, colored, transverse band beginning about 1/4 of the way from the nodus to the pterostigma, and its proximal margin is convex. The light stripe on the margin of the mesepisternum very narrow, occupying much less than 1/3 of the area between the humeral suture and the mid-dorsal carina. There are not more than two light spots at the bases of the antennae. The light humeral stripe includes areas on both sides of the suture. Length of abdomen: c. 34 mm. Hind wing length: c. 28 mm.
.....*Cora subfumata* Förster, 1914 (Peru). Syn: *Cora semiopaca subfumata* Förster, 1914. The status of this taxon is in doubt, and Bick and Bick (1990a) regarded it as a *nomen dubium*.
- The colored transverse band on the fore-wing begins about at the nodus and ends about 4.5 mm proximal to the pterostigma. The mesepisternum is mainly pale in color (**Fig. 3.1.54**).
.....*Cora parda* Bick and Bick, 1991 (Peru). A Central American species, *Cora semiopaca* Selys, 1853, also has a colored band on the wing, which extends from about 4 to 5 mm distal to the nodus to somewhere between the proximal and distal end of the pterostigma. Its mesepisternum is mainly dark.

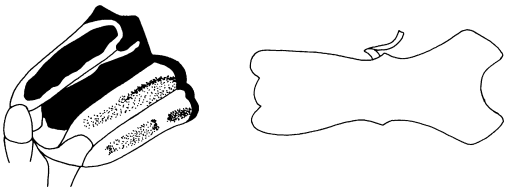


Fig. 3.1.53 *Cora lugubris* male: pattern on the lateral surface of the synthorax (left) and the apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

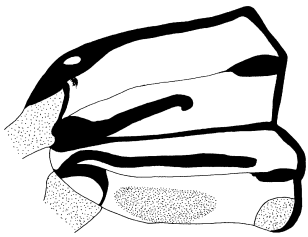


Fig. 3.1.54 Synthorax of *Cora parda* in lateral view. Based on Bick and Bick (1991).

13. The mesepimeron is mainly blue gray, but there is a black stripe running its entire length. The predominant coloration is blackish with a few green stripes. The wings are uniformly yellowish. The nodus of the fore-wing is located midway between the wing base and the inner border of the stigma. The horns at the apex of the penis are more than 1/3 of the length of the apical segment and converge slightly at their apices (**Fig. 3.1.51**). Length of the male abdomen: 31 to 32 mm. Hind wing length of male: about 24 to 26 mm.
.....*Cora klenei* Karsch, 1891 (Ecuador, Colombia). Syn: *Josocora klenei* (Karsch, 1891).

- The mesepimeron is mainly black or brown. The light antehumeral stripe covers only slightly less than half of the width of the mesepisternum. The penis horns are less than 1/3 as long as the apical segment of the penis and are nearly parallel (**Fig. 3.1.55**). Length of abdomen: about 30 mm or less; length of Hind wing: 25 mm or less.
.....*Cora confusa* Kennedy, 1940 (Ecuador). There are four somewhat similar Central American species: *Cora skinneri* Calvert, 1907, and *Cora chirripa* Calvert, 1907, which have fore-wings at least 26 mm long; *Cora obscura* Ris, 1918; which differs from *C. confusa* in having a nearly all black mesepisternum and penis horns only 0.7 mm long, and *Cora notoxantha* Ris, 1918, on which the black stripe on the dorsal carina is narrow and the pale areas on the mesepimeron and mesepisternum are yellowish orange or bluish gray.

14. The dorsal surfaces of the fourth through sixth abdominal segments of the male are dark. 15
- The dorsal surfaces of the fourth through sixth abdominal segments of the male are pale. 16
15. The dorsal surfaces of the eighth and ninth and usually the seventh abdominal segments are blue. There is at least one sector between vein Cu_2 and A_1 in the hind wing (**Fig. 3.1.47**). The apical segment of the penis has two constrictions along its length, one in the form of a sharp excision forming an internal angle only slightly more than 90°. Length of abdomen: c. 33 mm. Forewing length: c. 28 to 29 mm. Length of pterostigma: c. 3 mm.
.....*Cora xanthostoma* Ris, 1918 (Colombia, Venezuela). The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).
- The seventh through ninth abdominal tergites are black dorsally. The mesepisterna are blue with black markings. The thorax is blue without black markings crossing the metathorax. There are no sectors between vein Cu_2 and A_1 in the hind wing. The apical segment of the penis has only one long constriction, giving its lateral borders a simple sigmoid curve (**Fig. 3.1.56**).
.....*Cora irene* Ris, 1918 (Bolivia, Peru). Two somewhat similar species have been reported only from Central America: *Cora notoxantha* Ris, 1918, can be distinguished by its orange mesepisternum with a narrow black stripe on the mid-dorsal line; *Cora chirripa* Calvert, 1907, by its yellowish thorax with black spots on its metepisterna and metepimeron.

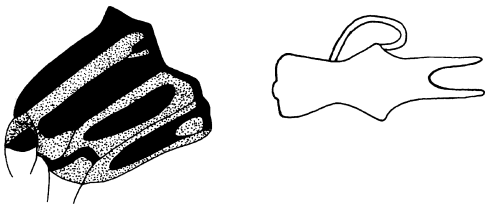


Fig. 3.1.55 *Cora confusa* male: pattern on the lateral surface of the synthorax (left) and the apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

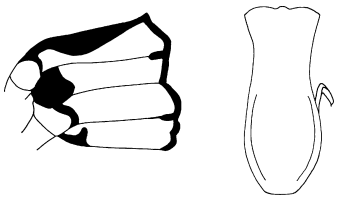


Fig. 3.1.56 *Cora irene* male: pattern on the synthorax (left) and apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

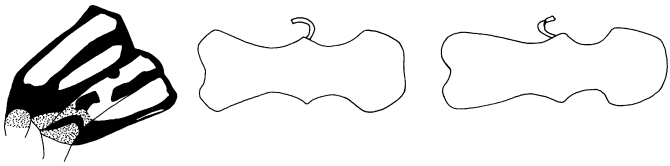


Fig. 3.1.57 *Cora marina* male: pattern on the lateral surface of the synthorax (left) and ventral view of the apical segment of the penes of two different specimens taken at the same location in Mexico (center and right). Based on Bick and Bick (1990a).

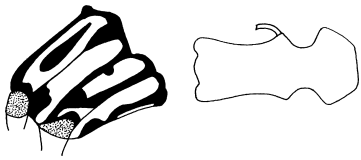


Fig. 3.1.58 *Cora jocosa* male: pattern on the lateral surface of the synthorax (left) and the apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

16. There is a complete black stripe running along the humeral suture. There are four more or less complete stripes on either side of the thorax (**Fig. 3.1.57**). Fore-wing length of male: 26.5 to 29.5 mm.
.....*Cora marina* Selys, 1868 pars
(Mexico, Central America, Colombia, Venezuela). Syn: *Cora alcyone* Selys, 1873.
- If a black stripe runs along the humeral suture, it is not complete (**Fig. 3.1.58**).
.....17
17. There are black stripes running the length of the first and second lateral sutures. The nodus of the fore-wing is located midway between the wing base and the apex. In ventral view, the constriction basal to the apex of the penis is more than half as wide as the maximum width of the apical segment of the penis (**Fig. 3.1.58**). The predominant color is bluish. Length of the male abdomen: about 31 mm. Hind wing length of male: about 24 mm.
.....*Cora jocosa* MacLachlin, 1881
(Ecuador, Peru). Syn: *Josocora jocosa* (MacLachlin, 1881).
- If black stripes are present along the first or second lateral sutures, they are incomplete. The third through eighth abdominal tergites are light colored. In ventral view, the constriction basal to the apex of the penis is more than half as wide as the maximum width of the apical segment of the penis (**Fig. 3.1.59**).
.....*Cora cyane* Selys, 1853
(Venezuela, Ecuador). Syn: *Cora incana* Hagen in Selys, 1869.

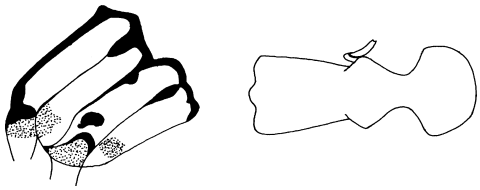


Fig. 3.1.59 *Cora cyane* male: pattern on the lateral surface of the synthorax (left) and the apical segment of the penis in ventral view (right). Based on Bick and Bick (1990a).

Comparison of the known *Cora* larvae in South America

Information was provided by De Marmels (1985b), Novelo-Gutiérrez and González-Soriano (1985), and Etscher et al. (2006). Information on the larvae of this genus is fragmentary, so a more comprehensive key cannot yet be prepared.

1. The dorsal spines on the abdominal segments are slender and acute at their apices. The processes on the caudal gills are relatively long and acutely pointed (**Fig. 3.1.60**).
.....*Cora marina* Selys, 1868 pars (Mexico, Central America, Colombia, Venezuela). Syn: *Cora alcyone* Selys, 1873.
- The dorsal spines on the abdominal segments are thick and blunt at their apices. The processes on the caudal gills are short and rounded (**Fig. 3.1.26**). Total length of final instar exuvia: c. 13.5 mm.
.....*Cora cyane* Selys, 1853 (Venezuela, Ecuador). Syn: *Cora incana* Hagen in Selys, 1869.

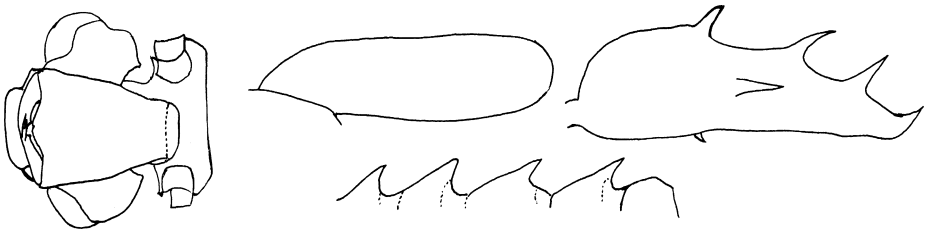


Fig. 3.1.60 *Cora marina* larva: head and prothorax in ventral view (left), profile of a wing bud (upper center), lateral caudal gill lamella (upper right), and profile of the dorsal margin of the sixth through tenth abdominal segments (lower right). Based on De Marmels (2007a).

Key to the species of adult *Chalcopteryx* in South America

Information for the key was provided by Schmidt (1943), Santos and Machado (1961), Montgomery (1967), Lencioni (2005), and Costa (2005).

1. The abdomen of the male is about 28 mm long. The length of the male fore-wing is about 20.1 mm, and the hind wing is about 18 mm. The anterior margin of the pterostigma is about 2 mm in the fore-wing and 1.5 mm in the hind wing. The male has no inferior anal appendage (**Fig. 3.1.61**). The general coloration is black with a few yellow markings. The antehumeral stripe is narrow. The wings are hyaline with black veins becoming milky white toward the apex. The female has not been described.
.....*Chalcopteryx seabrai* Santos and Machado, 1961 (French Guiana, Territory of Amapa).
- The abdomen is usually 19 to 24 mm long. The hind wing length varies from 15 to 17 mm (**Fig. 3.1.62**). 2
2. The fore-wing is dark, sometimes with hyaline "window spots" and a hyaline area near the base. The hind wing is completely darkened with a metallic green shine (**Fig. 3.1.62**). There is no antehumeral stripe, and the humeral stripe is narrow.
.....*Chalcopteryx radians* Ris, 1914 (Pará, Mato Grosso).
- The fore-wings are clear except sometimes for brownish streaks or clouds at the base (**Fig. 3.1.63**). 3

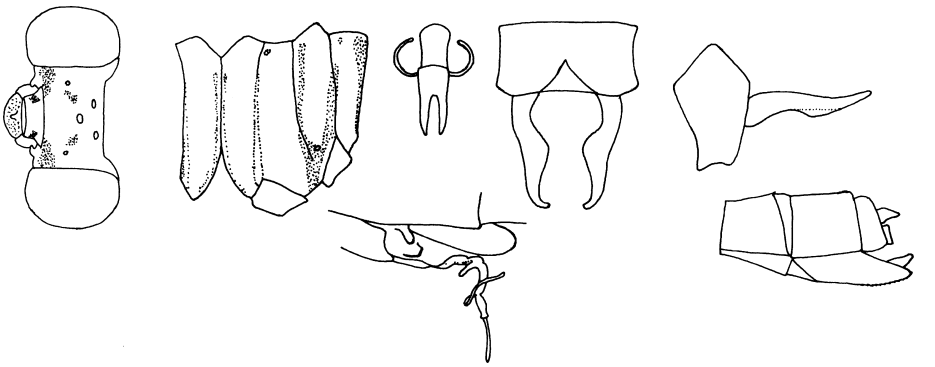


Fig. 3.1.61 *Chalcopteryx seabrai* (above, left to right): head in dorsal view, diagram of the color pattern on the thorax, penis in ventral view, apex of the male abdomen in dorsal and lateral view, and (below, left and right): male genitalia on the second abdominal segment in lateral view, and the apical segment of the female abdomen in lateral view. Unshaded surfaces in the figure are black, and stippled surfaces are yellow. Based on Santos and Machado (1961).

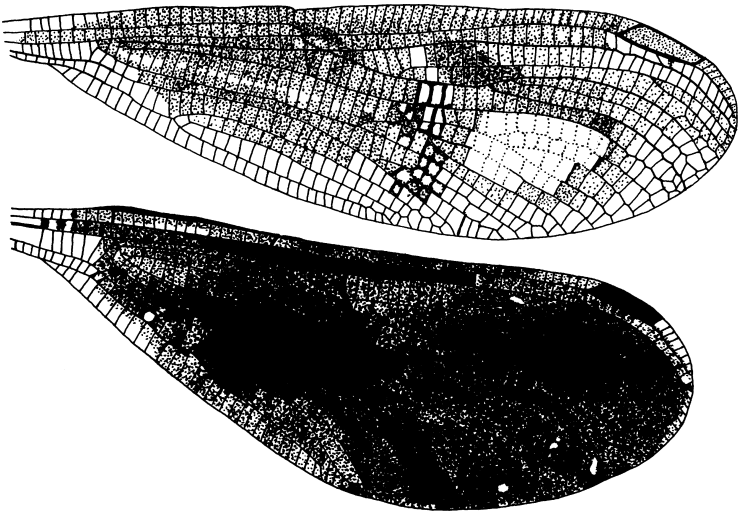


Fig. 3.1.62 Fore and hind wing of *Chalcopteryx radians*. Based on Ris (1914).

3. The fore-wings of the male are no more than 1.5 mm longer than the hind wings, and the corresponding difference in the female is c. 0.6 mm. The fore-wing is hyaline, while almost the entire hind wing, except for the apex, is shiny metallic. The mesepisternum is black, except for narrow lines near the mid-dorsal carina and humeral suture (**Fig. 3.1.39**).
.....*Chalcopteryx scintillans* MacLachlan, 1870 (Peru, Venezuela, Amazonas, Rondônia).
- The fore-wing of the male is at least 2 mm longer than the hind wing (**Fig. 3.1.63**). 4
4. The abdomen of the male is at least 21 mm long, and the hind wing is at least 19 mm. The antehumeral stripe is broad; the middle 2/3 of the mesepisternum of the male are light colored. In lateral view, the anal appendages are straight, and in dorsal view, they converge strongly (**Fig. 3.1.63**). Most of the hind wing membrane is clouded: colored toward the apex but not metallic and metallic greenish near the quadrangle. The abdomen is black, except sometimes for small brownish orange spots on the lateral margins of the anterior segments.
.....*Chalcopteryx rutilans* (Rambur, 1842) (Peru, Bolivia, Pará, Amazonas, Rondônia, Goiás, Mato Grosso). Two subspecies were recognized by Schmidt (1952): *Chalcopteryx rutilans rutilans* has a broad light band on the mesepisternum that is separated from the humeral line, while in *Chalcopteryx rutilans confluens* Schmidt, 1952, these stripes are confluent for the ventral half of their length. *C. r. confluens* has been found only in Bolivia and Brazil. The validity of the two nominal subspecies was discussed by Santos and Machado (1961).

- The abdomen of the male is about 19 mm long, and the hind wing is about 15 mm. The total length of the male is about 22 mm, and its fore-wing is about 18 mm long. Both the fore and hind wing are hyaline. There is no ante-humeral stripe, and the humeral stripe is narrow. Inferior anal appendages are absent (**Fig. 3.1.64**).
.....*Chalcopteryx machadoi* Costa, 2005 (Pará).

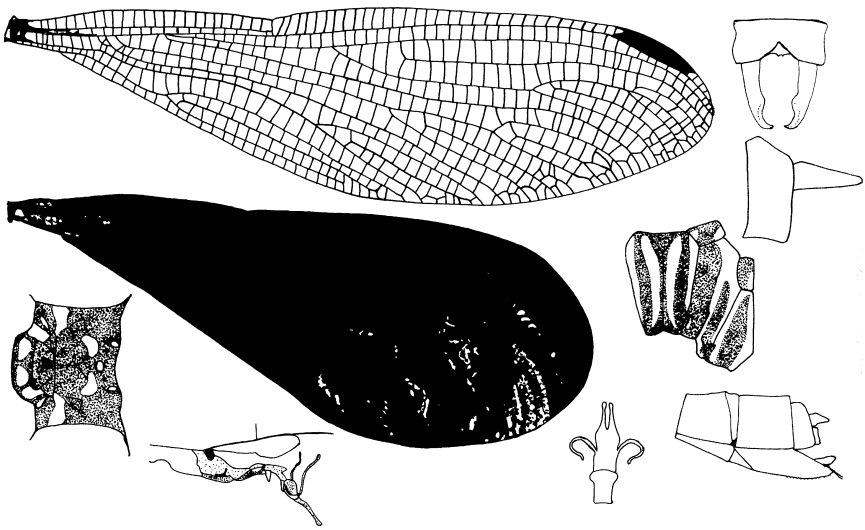


Fig. 3.1.63 *Chalcopteryx rutilans:* fore and hind wing of a male (upper left), head beween the eyes in dorsal view (lower left), diagram of the thoracic color pattern of a male (lower middle right), penis in ventral (lower right center) and lateral view (lower left center), apex of the male abdomen in dorsal (upper right) and lateral view (upper middle right), and apex of a female abdomen in lateral view. Based on Schmidt (1942) and Santos and Machado (1961).

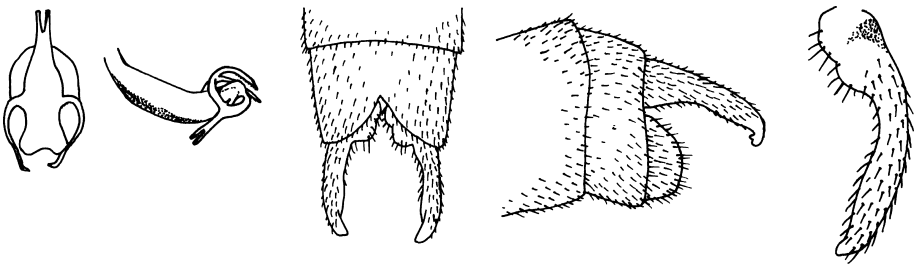


Fig. 3.1.64 *Chalcopteryx machadoi* male (left to right): penis in dorsal and lateral view, apex of the male abdomen in dorsal and lateral view, superior anal appendage in dorsolateral view. Based on Costa (2005).

Information on known *Chalcopteryx* larvae in South America

Information for the key was provided by Lencioni (2005). Descriptions and illustrations lack adequate distinguishing features for the two known larvae.

1. The distal half of the prementum has concave lateral margins (**3.1.65**).
.....*Chalcopteryx scintillans* MacLachlan, 1870 (Peru, Venezuela, Amazonas, Rondônia).
- The distal half of the prementum is nearly parallel sided, with only a slight widening at the apical corners, if at all (**Fig. 3.1.42**).
.....*Chalcopteryx radians* Ris, 1914 (Pará, Mato Grosso).

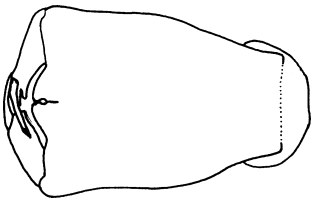


Fig. 3.1.65 Labium of a *Chalcopteryx scintillans* larva. Based on De Marmels (1992b).

Key to the species of adult *Euthore* in South America

Information for the key was provided by Ris (1918), Kennedy (1920a), Montgomery (1967), and De Marmels (1982c). De Marmels (2007a) treated several of these nominal species as subspecies of *Euthore fasciata,* but this system of classification is not followed here. This genus requires a revision.

1. The wings lack dark bands beyond the nodus. The base of the wing as far as the quadrangle or beyond is dark golden yellow or brown. 2
- The wings are not colored at the base but have dark cross bands distal to the nodus or dark apices (**Fig. 3.1.66**). 3
2. The golden or brown areas at the wing bases extend beyond the quadrangle along the costal margin. Length of male abdomen: 39 to 43 mm; female abdomen: 35 to 38 mm. Fore-wing length of male: 31 to 35 mm; female: 34 to 37 mm. Length of pterostigma of male: 2.5 to 3 mm; female: 3 to 3.5 mm.
.....*Euthore hyalina* (Selys, 1853) (Colombia, Peru, Bahia). Syn: *Thore hyalina* Selys, 1853.
- The golden or brown area at the wing base extends over the entire width of the wing to the nodus or even to the pterostigma in the male.
.....*Euthore mirabilis* MacLachlan, 1878 (Ecuador).

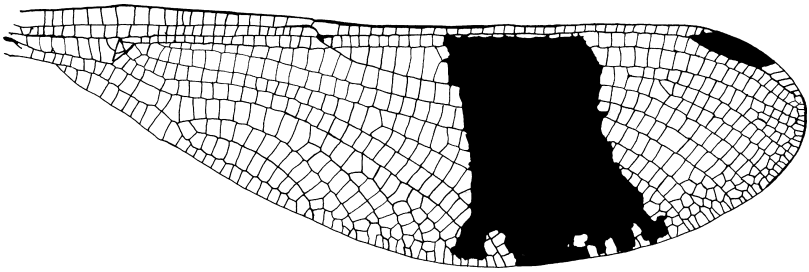


Fig. 3.1.66 The hind wing of a female *Euthore fasciata*. Based on Munz (1919) and Kennedy (1940).

3. There is a wide band at or distal to the nodus, but the wing tip is hyaline (**Fig. 3.1.35**). 4
- The apex of the wing is dark. 6
4. The dark band is closer to the nodus than to the pterostigma. The opaque zone is wider at the costal than at the posterior margin of the wing (**Fig. 3.1.35**). Length of male abdomen: 34 to 40 mm. Hind wing length of male: 29 to 32 mm. Length of pterostigma: 2.5 to 3.0 mm.
.....*Euthore fassli* Ris, 1914 (Colombia).
- The dark band is closer to the pterostigma than to the nodus. The opaque zone, if present, is proximal to the dark band and approximately of equal width at the costal and anal margins (**Fig. 3.1.66**). 5
5. The milky white opaque or semi-opaque band on the wing is just proximal to the dark cross band (**Fig. 3.1.66**). Length of male abdomen: 32 to 35 mm; female abdomen: 27 to 28 mm. Fore-wing length of male: 25 to 28 mm; female: 27 to 29 mm. Length of pterostigma of male: 2.5 to 3 mm; female: c. 2.5 mm.
.....*Euthore fasciata* (Hagen in Selys, 1853) (Venezuela, Colombia, Ecuador, Amazonas). Syn: *Euthore plagiata* Selys, 1873. Arbitrary "forms" or subspecies are treated as species here.
- The wing lacks a milky white band. The penis has lateral protrusions but no distinct horns (**Fig. 3.1.67**). Length of male abdomen: c. 35 mm. Hind wing length of male: c. 26.5 mm. The female was not described by Calvert (1909).
.....*Euthore inlactea* Calvert, 1909 (Peru). Syn: *Euthore fasciata inlactea* Calvert, 1909. Whether this should be regarded as a species or a subspecies is not clear.
6. The maximum width of the wing is at least 10 mm. Length of male abdomen: c. 39 mm; female abdomen: c. 37 mm. Fore-wing length of male: c. 32 mm; female: c. 28 mm. Length of pterostigma of male: c. 3 mm; female: c. 3.5 mm.
.....*Euthore leroii* Ris, 1918 (Colombia).

- The maximum width of the wing is no more than 9 mm. 7

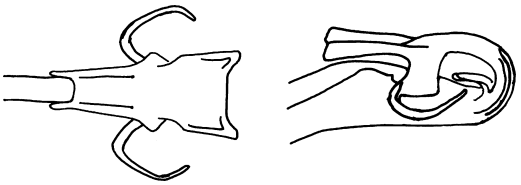


Fig. 3.1.67 *Euthore inlactea:* penis in ventral (left) and lateral view (right). Based on Kennedy (1920a).

7. The apical dark area of the wing begins at the proximal end of the pterostigma. Length of male abdomen: 40 to 42 mm; female abdomen: 33 to 34 mm. Fore-wing length of male: 32 to 34 mm; female: 31 to 34 mm. Length of pterostigma: 2.5 to 3 mm.
.....*Euthore fastigiata* (Selys, 1859) (Colombia, Venezuela). Syn: *Thore fastigiata* Selys, 1859; *Euthore fasciata fastigiata* (Selys, 1859). Whether this is a species or subspecies is still not clear.
- The apical dark area begins at a distance proximal to the proximal end of the pterostigma that is equal to the length of the pterostigma.
.....*Euthore meridana* Selys, 1879 (Venezuela). Syn: *Euthore fasciata meridana* Selys, 1859. Whether this should be regarded as a species, a subspecies, or a synonym of *E. fasciata* is not clear. The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).

Information on the known species of *Euthore* larvae in South America

Information for the key was provided by Ris (1914) and De Marmels (2007a). No definite associations between presumptive larvae and adults of *Euthore fasciata* and *E. fastigiata* have been established, making descriptions doubtful (De Marmels, 2007a). The similarity and variability of *Euthore fasciata, E. fastigiata,*and *E. meridana* suggest that they may be conspecific.

1. The total length of the final instar larva, excluding the gill lamellae, is less than 15 mm. The hind tibia is shorter than 4 mm. The apices of all finger-like processes on the gill lamellae are evenly rounded (**Fig. 3.1.68**).
.....*Euthore fasciata* (Hagen, 1853) (Venezuela, Colombia, Ecuador, Brazil). Syn: *Euthore plagiata* Selys, 1873. The subspecies often assigned to this species are arbitrarily treated as species here.

- The total length of the final instar larva, excluding the gill lamellae, is more than 15 mm. The hind tibia is longer than 4 mm. The apices of some of the finger-like processes on the gill lamellae are relatively acute (**Fig. 3.1.69**). 2

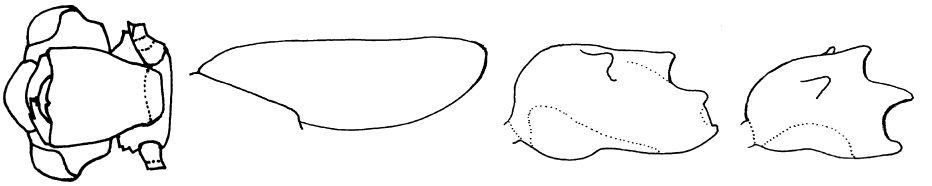


Fig. 3.1.68 *Euthore fasciata* larva (left to right): head and prothorax in ventral view, outline of wing bud, and a lateral and the middle gill lamella. Based on De Marmels (2007a).

2. The prementum is about twice as long as its narrowest width (**Fig. 3.1.69**). .....*Euthore fastigiata* (Selys, 1859) (Colombia, Venezuela). Syn: *Euthore fasciata fastigiata* (Selys, 1859). Whether this should be regarded as a species or a subspecies is not clear.

- The prementum is considerably shorter than twice its narrowest width (**Fig. 3.1.44**). .....*Euthore meridana* Selys, 1879 (Venezuela). Syn: *Euthore fasciata meridana* Selys, 1859. Whether this should be regarded as a species or a subspecies is not clear.

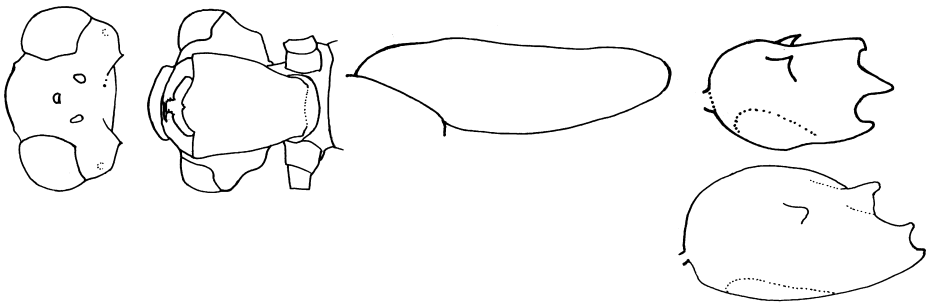


Fig. 3.1.69 *Euthore fastigiata* larva (left to right): head in dorsal view, head and prothorax in ventral view, outline of wing bud, and a middle (above) and lateral gill lamella (below). Based on De Marmels (2007a).

Key to the species of adult male *Polythore* in South America

Information for the key was provided by Ris (1918), Schmidt (1942), Fraser (1946a), Montgomery (1967), Bick and Bick (1985, 1986, 1990b, c), Burmeister and Börzsöny (2003), and Lencioni (2005). Information is lacking on the larvae of all but one South American species, identified by presumption.

1. The wings are smoky gold with a cream overlay (**Fig. 3.1.70**). Length of fore-wing: 42 to 47 mm; hind wing: 39 to 44 mm; abdomen: c. 48.5 mm. .....*Polythore williamsoni* (Förster, 1903) (Peru). Syn: *Thore williamsoni* Förster, 1903.
- The wings are not entirely smoky gold (**Fig. 3.1.71**). 2

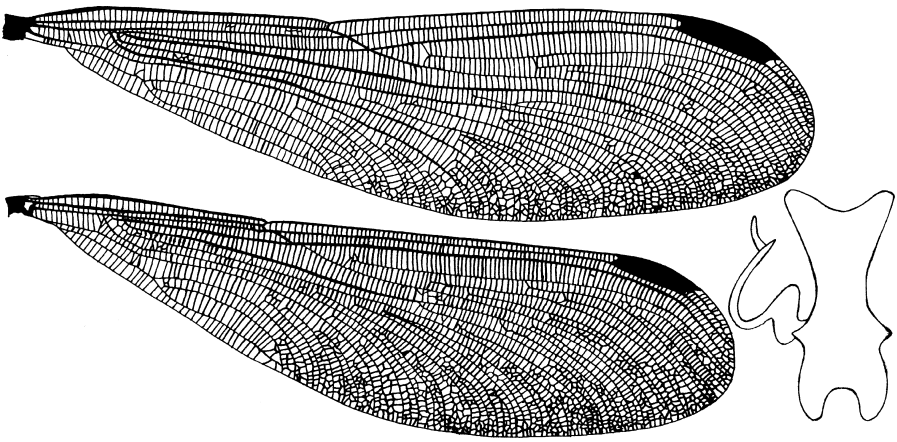


Fig. 3.1.70 The veins in the fore and hind wing of *Polythore williamsoni* (left) and its penis (right). The opaque area and shading of the wing membrane are not shown. Based on Schmidt (1943) and Bick and Bick (1986).

2. Both the fore and hind wings are entirely amber. The penis horns are divergent (**Fig. 3.1.71**). 3
- Either the fore or the hind wing or both have distinct dark or opaque patterns, and the penis horns are not divergent (**Fig. 3.1.72**). 4
3. The penis horns are strongly divergent, and the flagellae do not appear to consist of two segments (**Fig. 3.1.71**). The wings are uniformly amber or golden brown. Length of male abdomen: 33 to 40 mm. Hind wing: 27 to 34 mm. .....*Polythore concinna* (MacLachlan, 1881) (Colombia, Ecuador). Syn. *Sapho pulchella* Kirby, 1889.
- The penis horns are only slightly divergent, and the flagellae appear to consist of two segments (**Fig. 3.1.73**). The fore-wing is tinted an almost uniform amber,

only slightly lighter near the base and darker brownish near the apex. Fore-wing length: c. 42 mm. Hind wing length: c. 38 mm. The species inhabits primary rainforest.

.....*Polythore spaeteri* Burmeister and Börzsöny, 2003 (Peru).

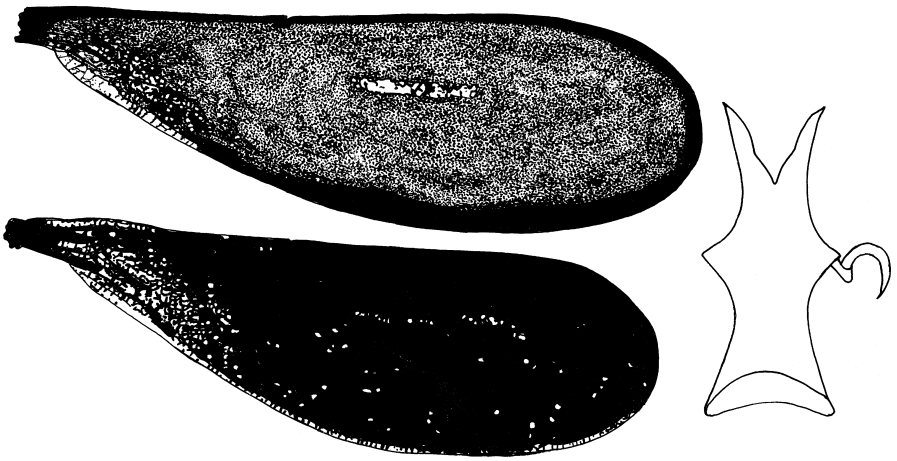


Fig. 3.1.71 *Polythore concinna* male: fore and hind wing (left) and penis (right). Based on Bick and Bick (1986).

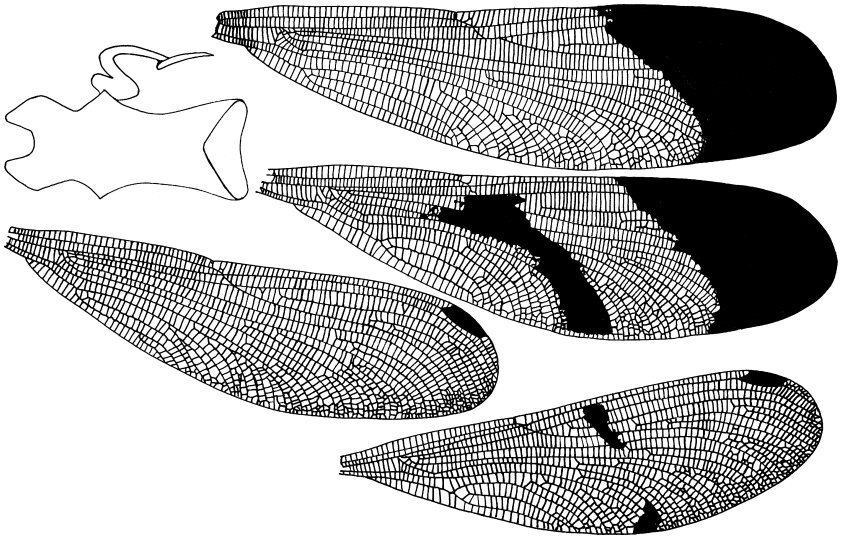


Fig. 3.1.72 Fore and hind wing of a male (upper right) and female (below) *Polythore victoria* and the penis (upper left). Based on Ris (1918) and Bick and Bick (1986).

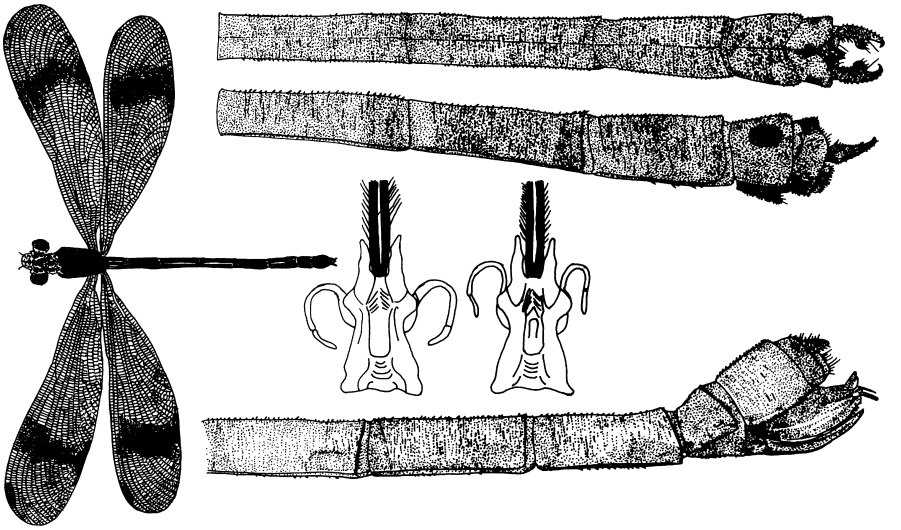


Fig. 3.1.73 *Polythore spaeteri:* habitus of a female in dorsal view, showing the dark markings that are present on the wings of the female (left); sixth through tenth abdominal segments of a male in dorsal and lateral view (above right, above and below, respectively); penis of two specimens in ventral view (center), and apical segments of the female abdomen in lateral view (lower right). Based on Burmeister and Börzsöny (2003).

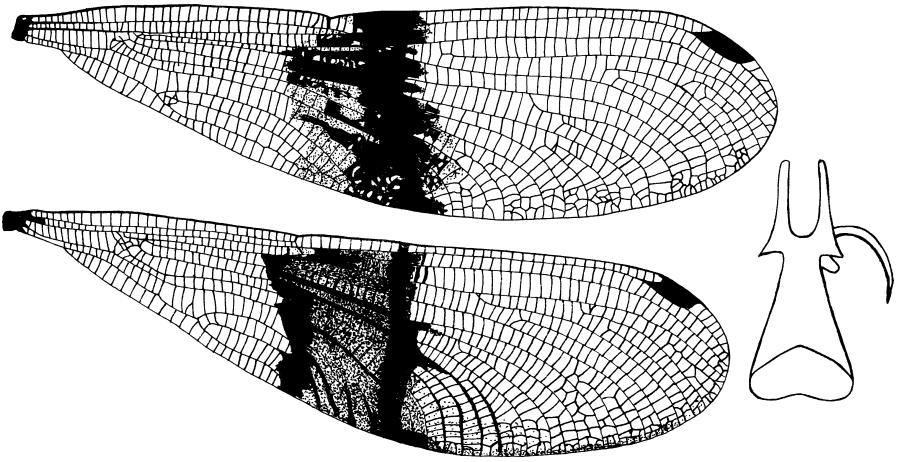


Fig. 3.1.74 Fore and hind wing of a female *Polythore aurora* (left) and the penis (right). The band shown as dark is actually semi-opaque orange, and on some specimens, it occupies a much larger area from the mid-length to the wing tip. Based on Schmidt (1943) and Bick and Bick (1986).

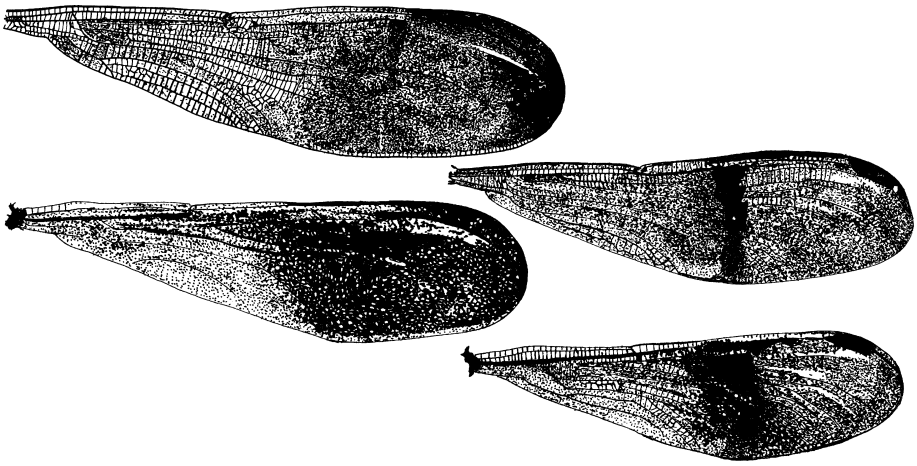


Fig. 3.1.75 *Polythore manua* fore and hind wings of a male (left) and a female (right); the dark cross bands are orange in the male and brown in the female. Based on Bick and Bick (1990b).

4. The fore and hind wing have clearly different color patterns (**Fig. 3.1.72**). 5
- The fore and hind wings have similar color patterns (**Fig. 3.1.74**). 9

5. The fore-wing is uniformly hyaline, while the hind wing has an opaque band in the middle (**Fig. 3.1.41**). Hind wing length: 27 to 31 mm.
.....*Polythore beata* (MacLachlan, 1869) (Colombia, Peru, Amazonas). Syn: *Thore beata* MacLachlan, 1869; *Thore inaequalis* Selys, 1869.
- The fore-wing has a color pattern of contrasting markings (**Fig. 3.1.72**). 6

6. The cross bands on the fore-wings of the males are orange, and those in the hind wings are brown (**Fig. 3.1.75**). It is difficult to distinguish all females from those of other species. Total length: 46 to 52 mm. Length of abdomen: 36 to 42 mm. Fore-wing length: c. 37 mm. Hind wing length: 35 to 37 mm. Length of pterostigma in the fore-wing: 3.9 to 4.1 mm.
.....*Polythore manua* Bick and Bick, 1990 (Peru).
- There is a black or dark brown terminal band on both wings, but sometimes a hyaline area is left at the extreme apex of the wing (**Fig. 3.1.72**). 7

7. A brown terminal band on the male wings has an oblique proximal margin that runs at an angle of about 60^{o} to the transverse axis, narrowing the band considerably from the anterior to the posterior margin of the wing. On the hind wing, there is a second band beginning posterior to the nodus and curving parallel to the margin of the apical black mark (**Fig. 3.1.72**). Length of male

abdomen: 43 to 56 mm. Fore-wing length of male: 38 to 41 mm. Length of pterostigma of male: 3 to 5 mm.
.....*Polythore victoria* (MacLachlan, 1869) (Peru, Bolivia). Syn: *Thore victoria* MacLachlan, 1869.
- The black terminal band remains nearly of equal width and is only slightly narrowed toward the posterior margin. There is no distinct dark band proximal to the dark apical marking on the hind wing, although the wing may be generally darkened (**Fig. 3.1.76**). 8

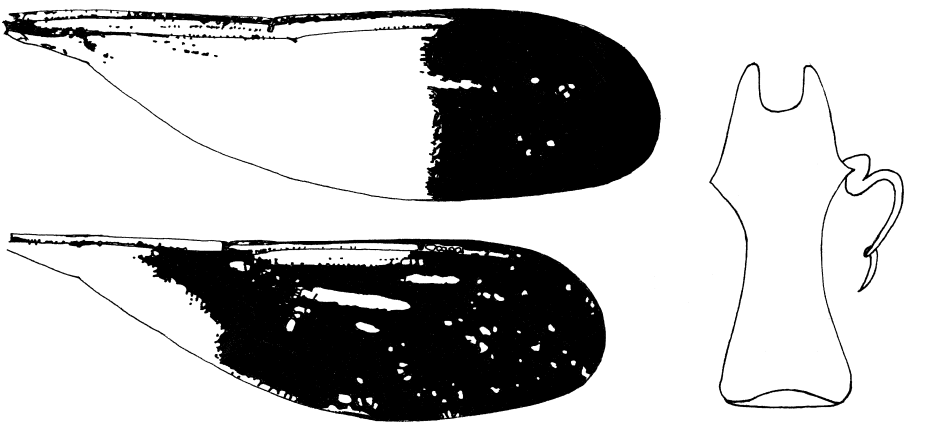


Fig. 3.1.76 *Polythore ornata* male: fore and hind wing (left) and penis (right). Based on Bick and Bick (1986).

8. Proximal to the black apical third of the hind wing is a dark brown area that scarcely contrasts with the apical black. Sometimes these two areas are separated by a lighter lunule. The apical area is very light or hyaline from the distal end of the pterostigma on the costal margin and about the level of the proximal end at the anal margin. A second color variety, common among younger specimens, has the same general pattern but for hyaline wing tips. The fore-wing has a black apical third bordered proximally by a white area (**Fig. 3.1.76**). Total length: c. 44 mm. Length of abdomen: c. 35 mm. Hind wing length: 35 to 39 mm.
.....*Polythore ornata* (Selys, 1879) pars (Bolivia, Peru). Syn: *Thore ornata* Selys, 1879; *Thore montana* Förster, 1914; *Thore pozuzina* Förster, 1914. Specimens keying out here were originally described under the synonym, *Thore pozuzina* Förster, 1914.

- In the hind wing, the area between the terminal band and the quadrangle is brown with an orange or orange yellow pruinescence, contrasting strongly with the brown apical marking, which darkens to shiny black with age. The fore-wing is orange from about the quadrangle to the border of the terminal black area, or it is separated from the black by a very diffuse zone of greenish white, which becomes less evident with age (**Fig. 3.1.77**). Length of male abdomen: 43 to 53 mm. Fore-wing length of male: 39 to 50 mm. Length of pterostigma of male: 4 to 5 mm.
.....*Polythore boliviana* (MacLachlan, 1878) (Bolivia, Peru). Syn: *Thore boliviana* MacLachlan, 1878.

9. There are orange bands running from the nodal area on both wings (**Fig. 3.1.74**). 10
- Bands or markings on both wings are opaque white (**Fig. 3.1.78**). 11

10. The pale band on each wing includes the area immediately posterior to the nodus. The horns of the penis enclose an elliptical area (**Fig. 3.1.74**). The band on the male hind wing is wider than that on the fore-wing and reaches the level of the nodus. The dark brown borders on each wing of the female are narrow and end far short of the apex of the wing. Hind wing length of male: c. 29 mm.
.....*Polythore aurora* (Selys, 1879) pars (Ecuador, Peru, Amazonas). Syn: *Thore aurora* Selys, 1879.
- The pale band on each wing is located entirely distal to the nodus (**Fig. 3.1.79**). The band on the hind wing of the male is slightly narrower than that on the fore-wing. The wings of teneral individuals are almost clear, except for a chalky white band of variable size, which is sometimes almost absent. Length of fore-wing: 31 to 33 mm; hind wing: 29 to 30 mm; abdomen: 36 to 38 mm.
.....*Polythore batesi* (Selys, 1879) pars (Peru, Pará, Amazonas). Syn: *Thore batesi* Selys, 1879.

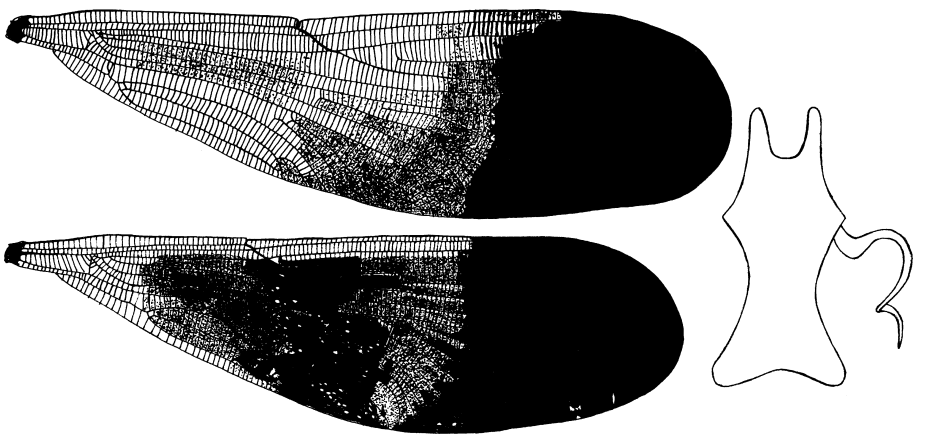


Fig. 3.1.77 *Polythore boliviana* male: fore and hind wing (left) and penis (right). Based on Schmidt (1943) and Bick and Bick (1986).

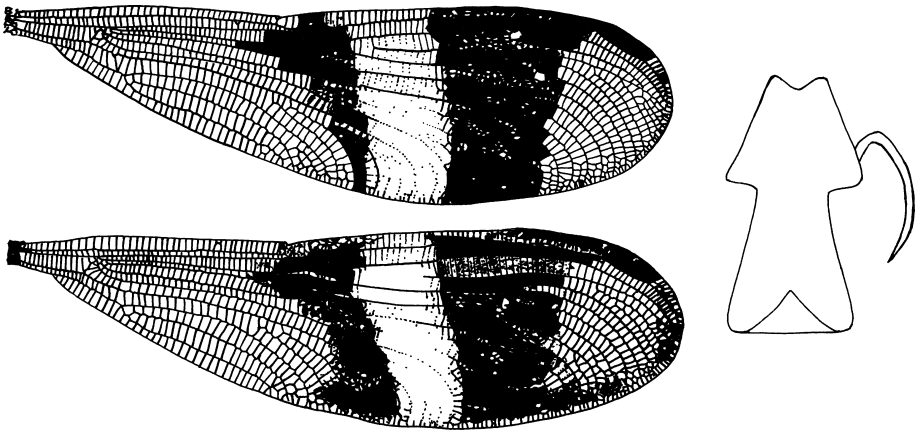


Fig. 3.1.78 *Polythore vittata:* fore-wing of a male (upper left) and a female (lower left) and the penis in ventral view (right). The basal parts of the wing are hyaline; the blackened parts are translucent brown surrounding a translucent white band. The apical parts of the wings have amber or smoky membranes. Based on Bick and Bick (1986) and Lencioni (2005).

11. There are no prominent black markings on the wings (**Fig. 3.1.80**). 12
- The wings have prominent black markings (**Fig. 3.1.78**). 14

12. The entire white band is distal to the nodus (**Fig. 3.1.79**). Length of fore-wing: 31 to 33 mm; hind wing: 29 to 30 mm; abdomen: 36 to 38 mm.
.....immature *Polythore batesi* (Selys, 1879) pars (Peru, Pará, Amazonas). Syn: *Thore batesi* Selys, 1879.
- The white band extends over the wing both proximal and distal to the nodus (**Fig. 3.1.80** 13

13. The horns of the penis are 0.20 to 0.25 mm long; they enclose an elliptical area (**Fig. 3.1.74**). The band on the hind wing of the male is wider than that on the fore-wing, and it reaches the level of the nodus. The color of the band is opaque white in immature specimens. The dark brown borders on each wing of the female are narrow and end far short of the apex of the wing.
.....immature *Polythore aurora* (Selys, 1879) pars (Ecuador, Peru, Amazonas). Syn: *Thore aurora* Selys, 1879.
- The horns of the penis are 0.10 to 0.15 mm long. The cross bands on the wings begin proximal to the nodus, and the width of the part proximal to the nodus about equals the width of the part distal to it. The light bands on the thorax remain milky white in mature males (**Fig. 3.1.80**). Hind wing length of male: 26 to 30 mm.
.....*Polythore mutata* (MacLachlan, 1881) (Ecuador, Colombia). Syn: *Thore mutata* MacLachlan, 1881.

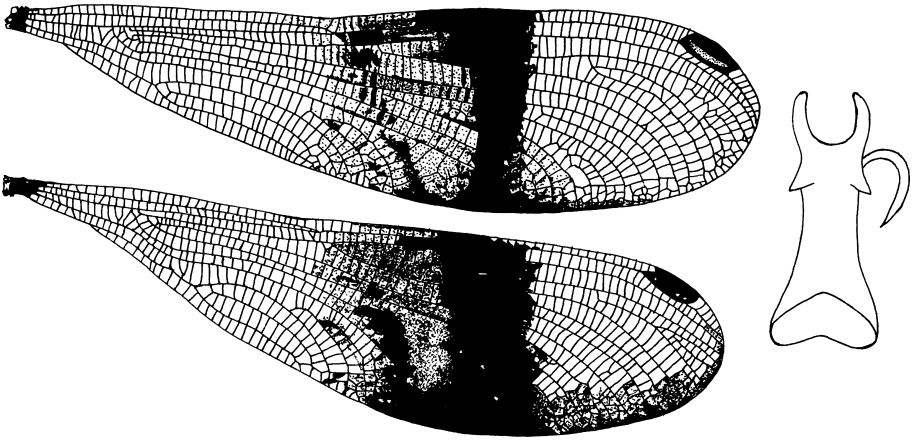


Fig. 3.1.79 Fore and hind wing of a female *Polythore batesi* (left) and the penis (right). The band shown as dark is actually opaque white, and on some specimens, it reaches to the wing tip. Based on Schmidt (1943) and Bick and Bick (1986).

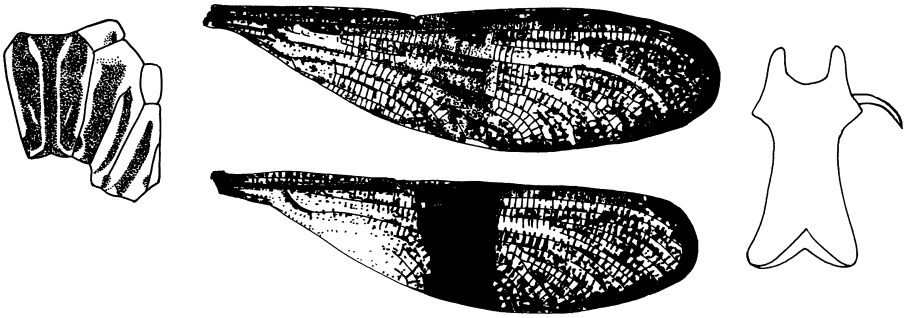


Fig. 3.1.80 *Polythore mutata* (left to right): diagram of the color pattern on the synthorax of a male, fore and hind wing of a female, penis in ventral view. Based on Schmidt (1942) and Bick and Bick (1986).

14. The black marking on the wing does not reach the apex, and it is divided by a white band (**Fig. 3.1.78**). The mesepisternum has a light stripe about 2/5 as long as the height of the thorax about midway between the marginal stripes. Length of male abdomen: 43 to 54 mm. Fore-wing length of male: 39 to 50 mm. Length of pterostigma of male: 4 to 6 mm.
.....*Polythore vittata* (Selys, 1869)
(Ecuador, Peru, Amazonas). Syn: *Polythore vittata* race *aequatorialis* (Selys, 1873), *Polythore albovittata* (Selys, 1973); *Thore accostai* Navás, 1924; *Thore tincta* Navás, 1924; *Thore picta* Selys (nec Rambur, 1842).

- The black marking on the wing reaches the apex, and it is not divided by a white band (**Fig. 3.1.81**). 15

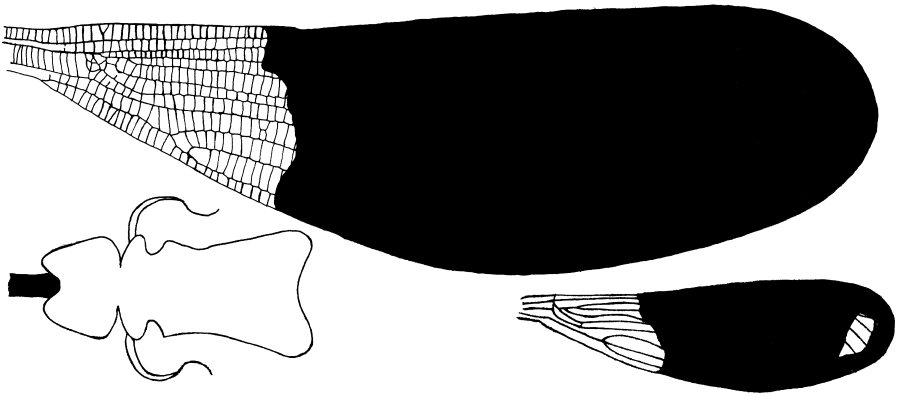


Fig. 3.1.81 *Polythore gigantea:* hind wing of a male (above), penis (below left), and diagrammatic illustration of the pattern on the wing of a female (lower right). Based on Munz (1919) and Bick and Bick (1985).

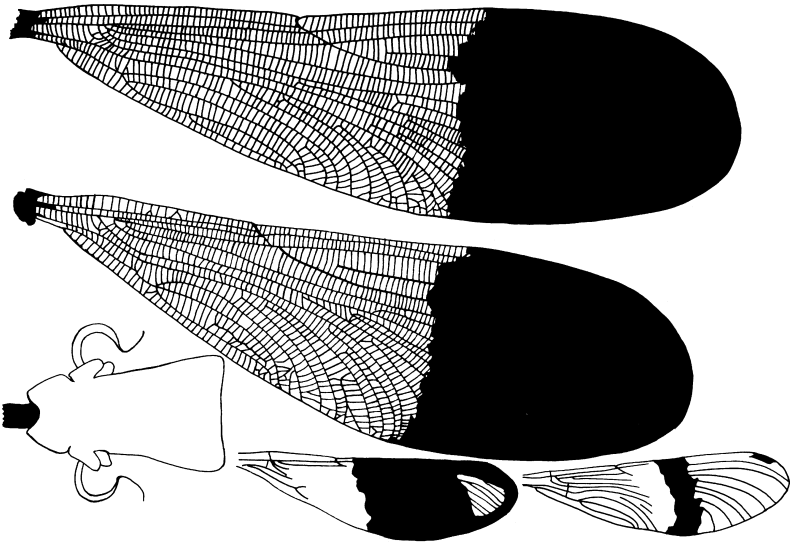


Fig. 3.1.82 The fore and hind wing of a male *Polythore procera* (above), the penis (lower left), and two color patterns encountered on the hind wings of females (lower center and right). The area of the male wing not covered by the black marking, except for the extreme basal and anterior parts, are opaque white. The areas of the female wings on which the long veins are not shown are opaque white, and those showing the veins are transparent. Based on Schmidt (1943) and Bick and Bick (1985).

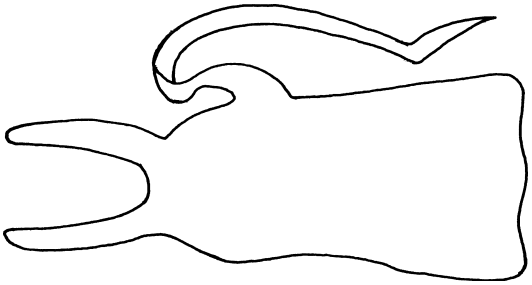


Fig. 3.1.83 *Polythore picta:* the apical segment of the penis of in ventral view. Based on Bick and Bick (1990c).

15. The black area on the wing of the male begins proximal to the nodus and extends to the apex (**Fig. 3.1.81**). There is no opaque white border proximal to the black apical area. Length of abdomen: c. 38 mm. Fore-wing length: c. 40 mm. Length of pterostigma: c. 4 mm.
.....*Polythore gigantea* (Selys, 1853)
(Colombia, Venezuela, Ecuador, Peru). Syn: *Thore gigantea* Selys, 1853.
- The darkened area on the wing of the male begins distal to the nodus and extends to the apex (**Fig. 3.1.82**). 16

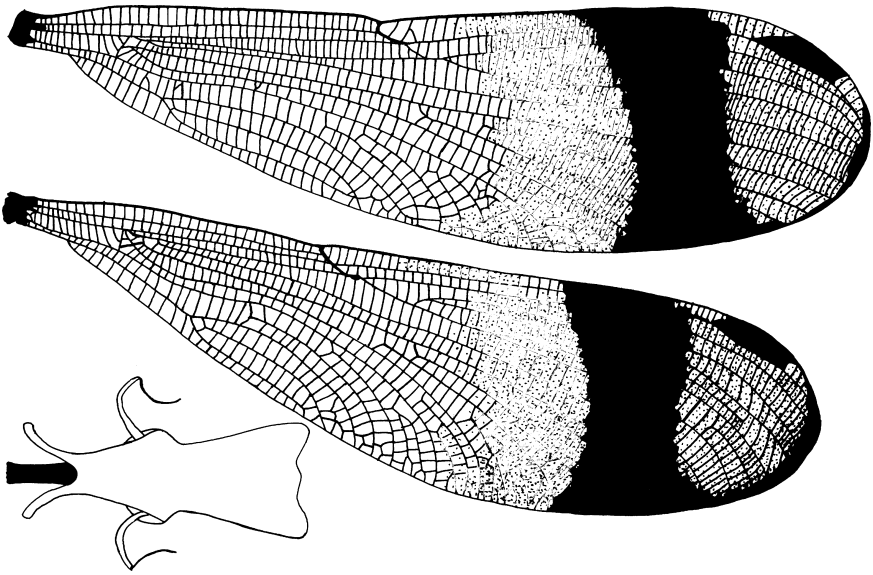


Fig. 3.1.84 The fore and hind wing of *Polythore derivata* (above) and apical segment of the penis in ventral view (lower left). The stippled areas bordering the dark bands are opaque. Based on Schmidt (1943) and Bick and Bick (1985).

16. On the wing of the male, there is a large white area proximal to the black marking. It sometimes extends proximad as far as the quadrilateral. The terminal black band usually begins at 1/3 the distance from the node to the pterostigma or less, but always distal to the nodus. Penis horns are not developed but represented by triangular lateral protuberances (**Fig. 3.1.82**). Length of male abdomen: 37 to 54 mm. Fore-wing length of male: 39 to 48 mm. Length of pterostigma of male: 4 to 6 mm.
.....*Polythore procera* (Selys, 1869)
(Colombia, Ecuador, Amazonas).
- White markings bordering on the terminal black marking are absent, or if present, they are confined to a narrow white band bordering on the blackish area. Penis horns are always well developed (**Fig. 3.1.83**). 17

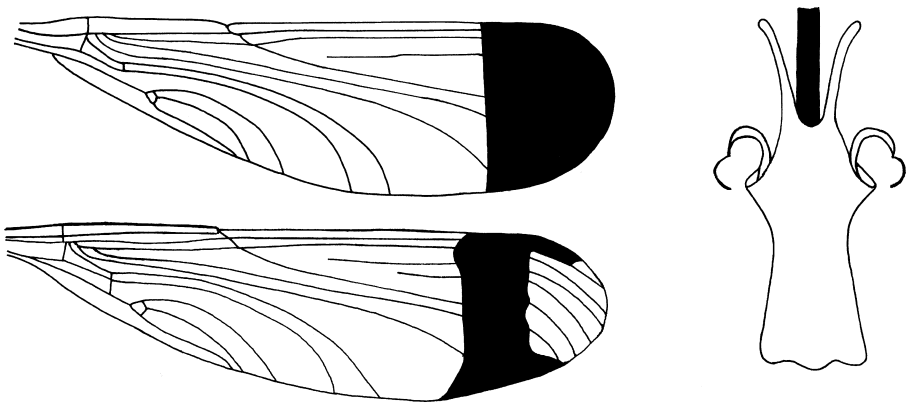


Fig. 3.1.85 *Polythore terminata*: diagrammatic depiction of the dark pattern on the hind wing of a male (upper left) and a female (lower left) and the apical penis segment in ventral view (right). Based on Bick and Bick (1985).

17. The wings have a white band proximal to the blackish apical marking (**Fig. 3.1.84**). 18
- The wings lack a white band proximal to the blackish apical marking (**Fig. 3.1.85**). 19
18. The terminal black band begins at more than 2/3 of the distance from the nodus to the pterostigma and covers only 11% to 28% of the wing length of the male. The white marking proximal to the terminal black marking is a relatively narrow stripe. Penis horns are well developed and strongly divergent (**Fig.**

3.1.84). Length of male abdomen: 45 to 50 mm. Fore-wing length of male: 41 to 47 mm. Length of pterostigma of male: 3.5 to 5.5 mm.
.....*Polythore derivata* (MacLachlan, 1881)
(Colombia, Ecuador, Bolivia, Peru). Fraser (1946a) recognized five subspecies: *P. derivata derivata* from all of the countries within the range; *P. derivata adjuncta* Fraser, 1946, from Colombia, and *P. derivata antigua* Fraser, 1946, *P. derivata prisinata* Fraser, 1946, and *P. derivata terminata* Fraser, 1946, from Peru. The last of these is now regarded as a distinct species.
- The terminal black band covers only 30% to 36% of the wing length of the male. The apical segment of the penis does not have lateral processes as wide or slightly wider than the apex (**Fig. 3.1.83)**.
.....*Polythore picta* (Rambur, 1842)
(Colombia, Peru, Guyana, French Guiana, Surinam, Amazonas). Syn. *Polythore saundersii* (Selys, 1853). *Polythore picturata* (Selys, 1873), and *Thore picta* race *picturata* (Selys, 1873).
19. The horns of the penis are from 0.2 to 0.3 mm long and strongly divergent (**Fig. 3.1.85**). Hind wing length: 37 to 38 mm.
.....*Polythore terminata* Fraser, 1946
(Peru). The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).
- The penis horns are shorter than 0.2 mm long and approximately parallel (**Fig. 3.1.86**). 20

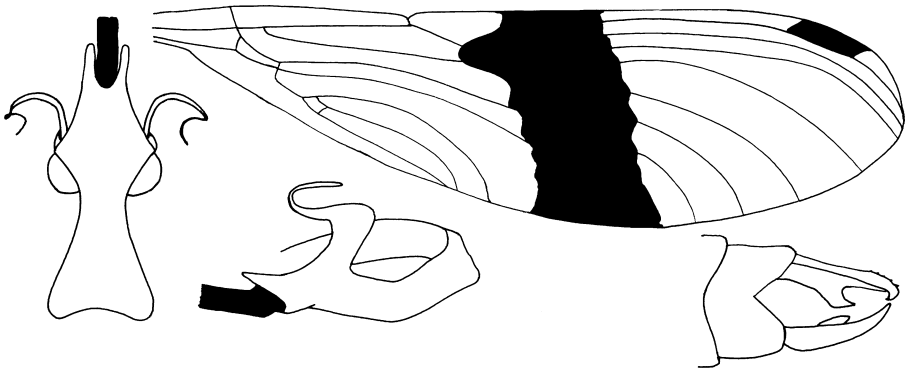


Fig. 3.1.86 The apical segment of the penis of *Polythore lamerceda* in ventral (left) and lateral view (lower left center), diagrammatic illustration of the hind wing of a female on which the proximal border of the blackish area is located approximately the same distance from the base as on the male wing, and the anal appendages of a male in dorsomedial view. The blackish area on the wing of the male usually extends to the apex. Based on Bick and Bick (1985).

20. The black area on the male wing covers 48% to 55% of the length from just distal to the nodus to the apex (**Fig. 3.1.86**). Length of abdomen: c. 43 mm. Hind wing length: c. 33 mm.
.....*Polythore lamerceda* Bick and Bick, 1985 (Peru).
- The black area on the wing of the male covers 16% to 36% of the wing length. It is never bordered by a whitish area. The apical segment of the penis has lateral processes as wide or slightly wider than the apex. The lateral margin from the lateral process to the horns of the penis is slightly concave. (**Fig. 3.1.87**). Hind wing length: 34 to 46 mm.
.....*Polythore neopicta* Bick and Bick, 1990 (Ecuador, Peru).

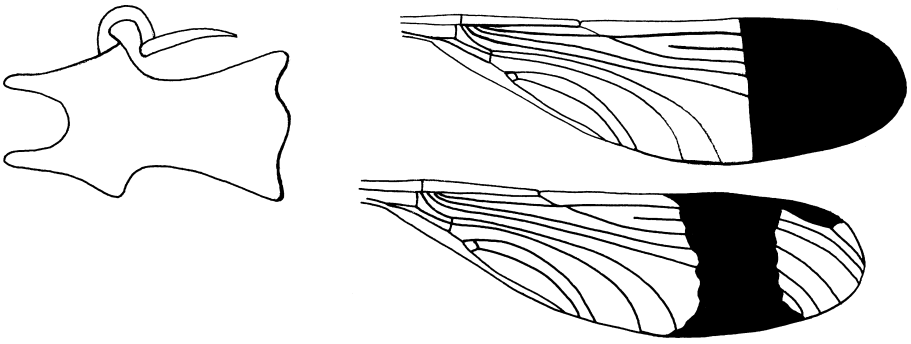


Fig. 3.1.87 The apical segment of the penis of *Polythore neopicta* in ventral view (left) and a diagrammatic depiction of the pattern on the hind wing of a male (upper right) and a female (lower right). Based on Bick and Bick (1985, 1990c), who mistakenly identified the wings as those of *Polythore picta*.

Key to the species of adult female *Polythore* in South America

Information for the key was provided by Ris (1918), Schmidt (1942), Fraser (1946a), Montgomery (1967), Bick and Bick (1985, 1986, 1990b, c), Burmeister and Börzsöny (2003), and Lencioni (2005). All females cannot be identified with certainty because their considerable intraspecific variability produces many overlaps in the morphological characters.

1. Both wings are completely hyaline, except for a slight cloudiness along the costal margin. Hind wing length: 34 to 36 mm.
.....*Polythore ornata* (Selys, 1879) pars (Bolivia, Peru). Syn: *Thore ornata* Selys, 1879; *Thore montana* Förster, 1914; *Thore pozuzina* Förster, 1914. Specimens keying out here were originally described under the synonym, *Thore montana* Förster, 1914.

- There are colored markings on at least one of the wings (**Fig. 3.1.73**). 2
2. The fore-wing is completely hyaline (**Fig. 3.1.72**). 3
- The fore-wing is not completely hyaline (**Fig. 3.1.73**). 5
3. There is a rectangular white band, about 4 mm wide, across the hind wing near the nodus, as in the male (**Fig. 3.1.41**). Hind wing length: 27 to 31 mm.
.....*Polythore beata* (MacLachlan, 1869) (Colombia, Peru, Amazonas). Syn: *Thore beata* MacLachlan, 1869; *Thore inaequalis* Selys, 1869.
- Any band crossing the wing from the area of the nodus is less than 2.6 mm wide. 4
4. The narrow pale band across the hind wing meets the costal margin at an angle of about 90°. Hind wing length: 34 to 36 mm.
.....*Polythore ornata* (Selys, 1879) pars (Bolivia, Peru). Syn: *Thore ornata* Selys, 1879; *Thore montana* Förster, 1914; *Thore pozuzina* Förster, 1914.
- The narrow pale band across the hind wing or its vestiges meet the costal margin obliquely, not forming an angle of 90° (**Fig. 3.1.72**). Length of female abdomen: 33 to 38 mm. Fore-wing length of female: 35 to 41 mm. Length of pterostigma of female: 3 to 4 mm.
.....*Polythore victoria* (MacLachlan, 1869) (Peru, Bolivia). Syn: *Thore victoria* MacLachlan, 1869.
5. The wings all have one large black or dark brown marking divided by a white band of uniform width (**Fig. 3.1.78**). Length of female abdomen: c. 37 mm. Fore-wing length of female: c. 40 mm. Length of pterostigma of female: c. 4.5 mm.
.....*Polythore vittata* (Selys, 1869) (Ecuador, Peru, Amazonas). Syn: *Polythore vittata* race *aequatorialis* (Selys, 1873), *Polythore albovittata* (Selys, 1973); *Thore accostai* Navás, 1924; *Thore tincta* Navás, 1924; *Thore picta* Selys (nec Rambur, 1842).
- Each wing does not have one large black or dark brown marking divided by a white band of uniform width (**Fig. 3.1.75**). 6
6. The color pattern on mature female wings usually includes yellow, orange, or pale brown. In immature specimens, these markings are usually opaque white. The patterns on fore and hind wings are often notably different. If black or dark brown markings are present, they may be interrupted by bands of white, orange, or pale brown (**Fig. 3.1.79**). 7
- The color pattern on mature female wings never includes yellow, orange, or pale brown. The patterns on the fore and hind wings are substantially the same. Black or dark brown markings may border on opaque white markings proximal to them, but they are never interrupted or bordered by white on the distal side. The black or dark brown markings of some conspecific females extend to the apex of the wing, while others have hyaline areas apical to or enclosed by the dark markings (**Fig. 3.1.82**). This variability in the wing coloration is observed in most species in this group. 14

7. A narrow white band, approximately 1.9 mm wide, crosses the wing from the area of the nodus, and a narrow brown band, about 1.2 mm wide, borders it on the distal side. Hind wing length: 34 to 36 mm.
.....*Polythore ornata* (Selys, 1879) pars (Bolivia, Peru). Syn: *Thore ornata* Selys, 1879; *Thore montana* Förster, 1914; *Thore pozuzina* Förster, 1914.
- The bands on at least one of the wings are thicker, or the light band is orange, ochraceous, or pale brown. 8
8. Both the fore and hind wings are entirely amber except for white, orange, or brown bands distal to the area of the nodus (**Fig. 3.1.71**). Bands are present on both wings, but those on the fore-wing are only about 2.2 mm wide; those on the hind wing have concave margins on the proximal side. The pattern on the wings is attractive and considerably variable, but none of the markings are bordered by well-defined dark brown bands. Hind wing of female: 29 to 32 mm.
.....*Polythore concinna* (MacLachlan, 1881) (Colombia, Ecuador). Syn. *Sapho pulchella* Kirby, 1889.
- The wings are not entirely amber with white, orange, or brown bands. 9
9. The color pattern on the fore-wing is distinctly lighter than that on the hind wing, which contains some dark brown markings. 10
- The fore-wing has markings as dark or nearly as dark as those on the hind wing, although the sizes of the markings may vary considerably. 11
10. The fore-wing has a white or yellow ochraceous band, and brownish ochreceous ones are present on the hind wing. Hind wing length: 29 to 31 mm.
.....*Polythore mutata* (MacLachlan, 1881) (Ecuador, Colombia). Syn: *Thore mutata* MacLachlan, 1881.
- The fore-wing has a light orange band just distal to the nodus and no darker band, while the hind wing has a rather narrow brown band bordered by darker brown. Hind wing length: c. 34 to 35 mm.
.....*Polythore williamsoni* (Förster, 1903) (Peru). Syn: *Thore williamsoni* Förster, 1903.
11. The pale band across the fore-wing begins well distal to the nodus (**Fig. 3.1.75**). 12
- The pale band on the fore-wing begins proximal to, at, or slightly distal to the nodus (**Fig. 3.1.79**). 13
12. Hind wing length of female: c. 29 to 32 mm. The pterostigma on the fore-wing is 2.2 to 2.6 mm long; that on the hind wing is 2.0 to 2.2 mm (**Fig. 3.1.79**). The border of the dark brown marking may extend to 8 mm from the apex of the wing, although it has also been reported to reach the apex. Length of fore-wing: 31 to 33 mm; abdomen: 36 to 38 mm. The pale stripe changes from opaque white to orange with age, and brown markings also darken with age.
.....*Polythore batesi* (Selys, 1879) (Peru, Pará, Amazonas). Syn: *Thore batesi* Selys, 1879.
- Hind wing length of female: 30 to 37 mm. The pterostigma on the fore-wing is 3.2 to 4.1 mm long; that on the hind wing is 2.7 to 3.4 mm. The wings are clouded light brown, and a lunule is present about 10 cells distal to the nodus in

the fore-wing and 14 cells distal to it in the hind wing; this lunule is bright orange in the fore-wing and grayish brown in the hind wing. The lunule is bordered on the distal side by a black band of variable width (**Fig. 3.1.75**). Total length: 46 to 52 mm. Length of abdomen: 36 to 42 mm. Length of fore-wing: 31 to 37 mm. It is difficult to distinguish all females from the other species in this and the next couplet because of the great intraspecific variability.
.....*Polythore manua* Bick and Bick, 1990 (Peru).
13. Hind wing length of female: 32 to 37 mm. The fore-wing has a white, ochraceous, or orange band, while similar bands on the hind wing are light brown bordered on the distal side by a wide, dark brown band and sometimes by a narrow brown band on the proximal side of the hind wing, as well (**Fig. 3.1.77**). Length of female abdomen: 32 to 35 mm. Fore-wing length of female: 35 to 40 mm. Length of pterostigma female: 3 to 4 mm.
.....*Polythore boliviana* (MacLachlan, 1878) (Bolivia, Peru). Syn: *Thore boliviana* MacLachlan, 1878. Wing length was shown to be the main feature for distinguishing females of the species in this couplet (Bick and Bick, 1986). However, some overlap in the wing length can be expected, so there is still no known way to positively distinguish all females.
- Hind wing length of female: c. 28 to 31 mm. The pale band on the fore-wing begins at or proximal to the nodus (**Fig. 3.1.74**).
.....*Polythore aurora* (Selys, 1879) pars (Ecuador, Peru, Amazonas). Syn: *Thore aurora* Selys, 1879.
14. The black or dark brown area on the wing begins well proximal to the nodus and often completely surrounds a subapical hyaline area. There is no opaque white border proximal to the black area (**Fig. 3.1.81**). Length of abdomen: c. 38 mm. Fore-wing length: c. 40 mm. Length of pterostigma: c. 4 mm.
.....*Polythore gigantea* (Selys, 1853) (Colombia, Venezuela, Ecuador, Peru). Syn: *Thore gigantea* Selys, 1853.
- The black or dark area on the wing begins near or distal to the nodus (**Fig. 3.1.85**). 15
15. The percentage of the wing length between the proximal border of the shiny black or dark brown area and the apex of the wing is not more than 36% (**Fig. 3.1.85**). 16
- The percentage of the wing length between the proximal border of the shiny black or dark brown area and the apex of the wing is not less than 38% (**Fig. 3.1.82**). 20
16. The percentage of the wing length between the proximal border of the shiny blackish area and the apex of the wing is 13% to 21%. Each wing has a well-defined opaque white band distal to the nodus (**Fig. 3.1.84**). Length of female abdomen: c. 36 mm. Fore-wing length of female: c. 48 mm. Hind wing length of the female: 34 to 39 mm. Length of female pterostigma: c. 4.5 mm.
.....*Polythore derivata* (MacLachlan, 1881) (Colombia, Ecuador, Bolivia, Peru). Fraser (1946a) recognized five subspecies: *P. derivata derivata* from all of the countries within the range; *P. derivata*

adjuncta Fraser, 1946, from Colombia, and *P. derivata antigua* Fraser, 1946, *P. derivata prisinata* Fraser, 1946, and *P. derivata terminata* Fraser, 1946, from Peru. The last of these is now regarded as a distinct species.

- The percentage of the wing length between the proximal border of the shiny black or dark brown area and the apex of the wing is at least 21%, or, if it is 21% or more, there is no white marking on any wing of a mature specimen, although immature insects may have a white band (**Fig. 3.1.85**). Positive identifications of females is not possible using the rest of the key. The descriptions permit merely a tentative identification with a fair to good likelihood of success, which improves with the number of specimens from individual populations that are examined. Male specimens are required to achieve a high probability of success. 17

17. The wings are transparent and clouded light brown with a greenish bronze tinge and a dark brown band across the wing with a greenish bronze tinge and a deeply concave proximal margin; no darkened or pale lunule or white marking is evident on any wing (**Fig. 3.1.73**). Length of female abdomen: c. 33 mm. Hind wing length of female: c. 34 mm.
..... *Polythore spaeteri* Burmeister and Börzsöny, 2003 (Peru).

- The dark brown bands do not have a greenish bronze tinge, or they do not have deeply concave proximal margins (**Fig. 3.1.85**). 18

18. There is never a white marking on any wing. The percentage of the wing length between the proximal border of the shiny black or dark brown area and the apex of the wing is 21 to 31% (**Fig. 3.1.85**). Hind wing length: 36 to 37 mm. No character reliable for distinguishing the females of this and the two species in the next couplet has ever been found, and overlaps exist due to the intraspecific variability of both nominal species.
.....*Polythore terminata* Fraser, 1946 (Peru).

- Immature specimens and some mature ones have whitish markings on the wings. The percentage of the wing length between the proximal border of the shiny black or dark brown area and the apex of the wing is 16% to 36% (**Fig. 3.1.87**). 19

19. The percentage of the wing length between the proximal border of the shiny black or dark brown area and the apex of the wing is 30% to 36%. There are white markings on the wings of a minority of specimens. Hind wing length: 36 to 37 mm. Male specimens are necessary to distinguish the two species in this couplet.
.....*Polythore picta* (Rambur, 1842) (Colombia, Peru, Guyana, French Guiana, Surinam, Amazonas). Syn. *Polythore saundersii* (Selys, 1853). *Polythore picturata* (Selys, 1873), and *Thore picta* race *picturata* (Selys, 1873).

- The percentage of the wing length between the proximal border of the shiny black or dark brown area and the apex of the wing is 16% to 35% (**Fig. 3.1.87**).

There is a whitish area or narrow white band on the wings of immature specimens. Hind wing length: 31 to 39 mm.
.....*Polythore neopicta* Bick and Bick, 1990 (Ecuador, Peru). The descriptions of *P. picta* from Peru, provided by Bick and Bick (1985), actually refer to this species. Specimens with white markings may be confused with *P. picta,* and those without such markings may be confused several other species, as already discussed.
20. A white band is absent proximal to the blackish area, or, if it is present, it is narrow and distal to the nodus (**Fig. 3.1.86**). Hind wing length: c. 36 mm.
.....*Polythore lamerceda* Bick and Bick, 1985 (Peru).
- There is a white area proximal to the blackish marking, and it either covers a large area, sometimes even reaching the quadrangle, or is a narrow band located at the nodus (**Fig. 3.1.82**). Length of female abdomen: 36 to 41 mm. Fore-wing length of female: 35 to 45 mm. Hind wing length of female: 34 to 37 mm. Length of pterostigma of female: 4 to 5 mm.
.....*Polythore procera* (Selys, 1869) (Colombia, Ecuador, Amazonas).

Calopterygidae

Key to the genera of adults in South America

Information for the key was provided by Selys (1853, 1869), Munz (1919), Cowley (1984), Needham and Fisher (1940), Bridges (1994), and Garrison (2006).

1. The mid-basal space, which is the area in the wing delimited by the wing root, arculus, and veins R+M and Cu+A_1, is not subdivided by cross veins (**Fig. 3.1.88**). 2
- The mid-basal space is subdivided by cross veins (**Fig. 3.1.89**). 3
2. Vein IR_2 runs parallel to R_1 for a short distance and then curves posteriad, ending at the upper sector of the arculus. There is a tuft of strong setae at the apex of the superior anal appendage of the male (**Fig. 3.1.88**).
.....*Iridictyon* Needham and Fisher, 1940..p. 110
- Vein IR_2 converges with R_1 for a short distaince near the apical end of the quadrangle before curving posteriad to meet the upper sector of the arculus obliquely two to six cells from the arculus. Vein Cu_{2a}, is present. Vein IR_3 in the hind wing is usually strongly curved. There is no tuft of setae at the apex of the superior anal appendage of the male.
.....*Calopteryx* Leach, 1815
This is a Holarctic genus, apparently with no Neotropical species found south of Honduras.

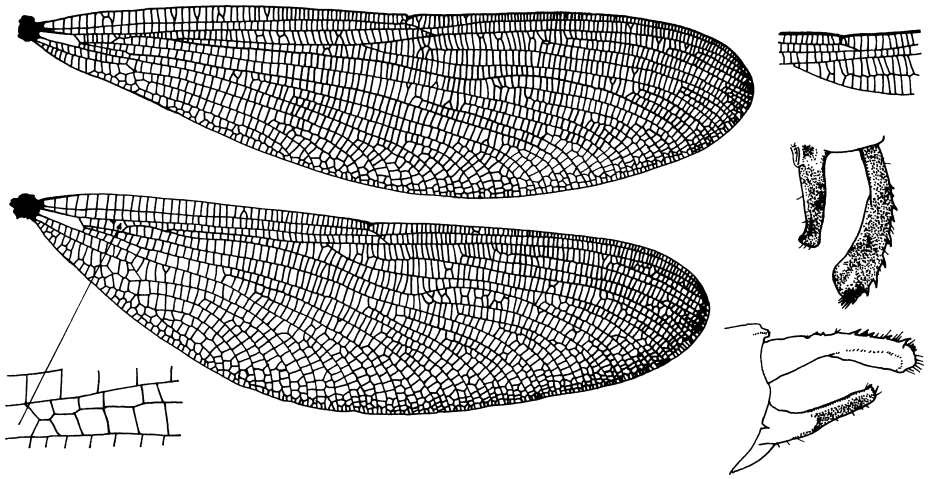


Fig. 3.1.88 *Iridictyon myersi* male: fore and hind wing (upper left), veins in the region of the nodus (upper right) and in the region of the intercalery vein anterior to Rs (lower left), anal appendages in mediodorsal (middle right) and lateral view (lower right). Based on Garrison (2006).

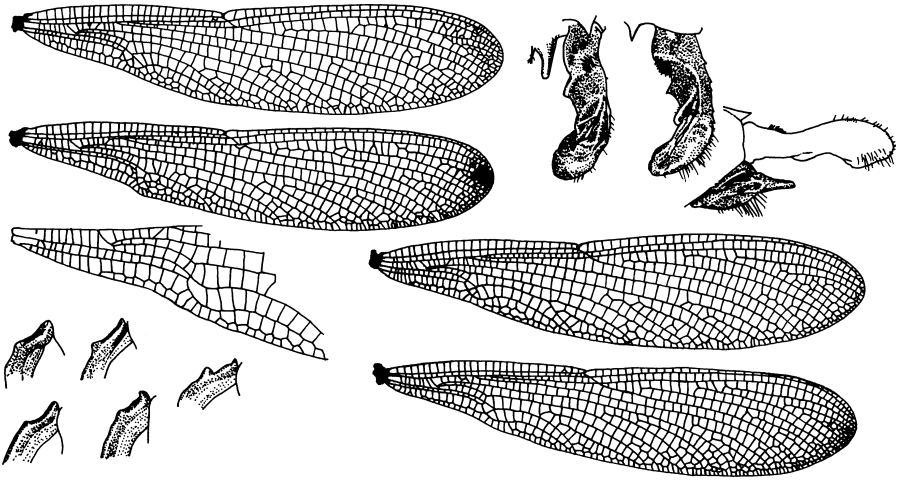


Fig. 3.1.89 *Mnesarete loutoni:* fore and hind wing of a male (upper left) and a female (lower right); anal appendages on one side of a male abdomen in mediodorsal, dorsal, and lateral view (upper right, left to right); and the left intersternite of five female specimens (lower left). Based on Garrison (2006).

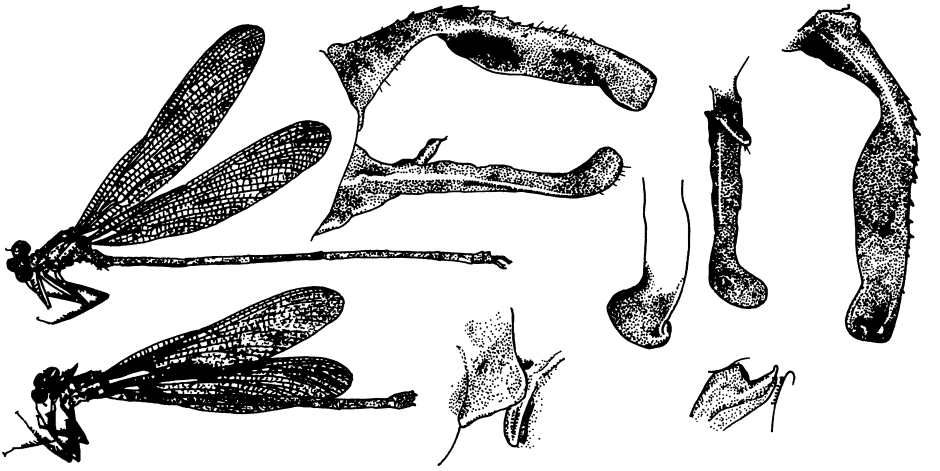


Fig. 3.1.90 *Ormenophlebia imperatrix:* habitus of a male (upper left) and a female (lower left), anal appendages of a male in lateral view (upper center), inferior anal appendage in dorsomedial view (upper right center) and its apex in ventral view (right center), superior anal appendage in dorsomedial view (right), posterior margin of the female prothorax in lateral view (lower center), and female intersternite (lower right center). Based on Garrison (2006).

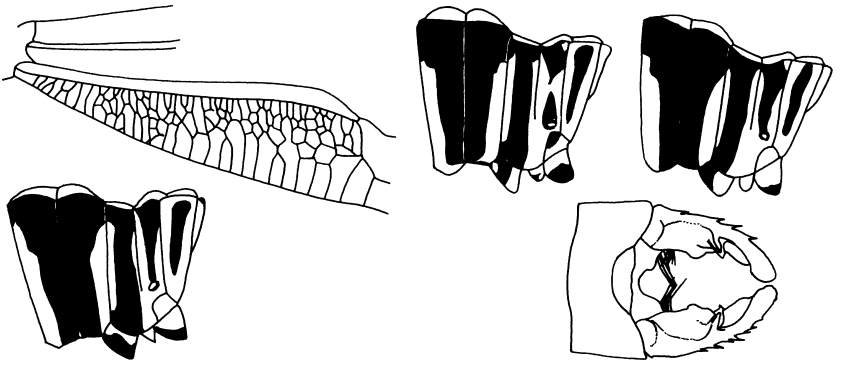


Fig. 3.1.91 *Hetaerina capitalis* (above, left to right), the veins in the proximal, posterior part of the hind wing of a male; diagrams of the color patterns on the synthoraces of two male specimens; (below, left to right): diagram of the color patterns on the synthorax of a female; the apex of the male abdomen in dorsal view. Based on De Marmels (1985c).

3. Both males and females bear a setose tubercle formed by the anterior lamina on the first abdominal segment, best visible in lateral view (**Fig. 3.1.14**).
.....*Bryoplathanon* Garrison, 2006

The only known species in this genus is *Bryoplathanon globifer* (Hagen in Selys, 1853), from Rio de Janeiro, São Paulo, and Minas Gerais. Syn: *Lais globifer* Hagen in Selys, 1853; *Mnesarete globifer* (Hagen in Selys, 1853).

- The anterior lamina on the first abdominal segment is poorly developed; it sometimes forms a low transverse ridge but never bears a tubercle. Vein Cu_{2a} is usually absent (**Fig. 3.1.89**). 4

4. The abdomen of the male exceeds 60 mm in length, and that of the female exceeds 45 mm. The dominant color is metallic green. The genital lobe of the male is distinct from the anterior part of the second abdominal segment. In lateral view, the superior anal appendage of the male has an angulation in the apical half. The fore-wing either lacks a pterostigma, or only a small one is present in the male. The pterostigma of the hind wing is large and polygonal in the male and a smaller quadrilateral in the female (**Fig. 3.1.90**).
.....*Ormenophlebia* Garrison, 2006..p. 111

- The abdomen of the male reaches only 42 mm in length, and that of the female does not exceed 39 mm. The genital lobe of the male is not clearly distinct from the anterior part of the second abdominal segment. In lateral view, the superior anal appendage of the male is nearly straight. If a pterostigma is present, it is similar in the fore and hind wing, quadrangular in shape in the female (**Fig. 3.1.89**). 5

5. The wing bases of the male are dark brown, whitish, or hyaline, or they are reddish over the entire base and beyond the nodus. There are usually only two rows of cells posterior to the anal bridge in the fore-wing. The wing veins near the base are reddish only on teneral specimens, while those veins of mature adults are black. Posterior to the cubito-anal area of the wing, the veins of all but two species are not more than slightly reticulate. Most species of both sexes have a color pattern of thin pale tan lines along the sutures of the metallic red, green, or gray synthorax (**Fig. 3.1.89**).
.....*Mnesarete* Cowley, 1934..p. 113

- The wing bases of the male display variable red spots, sometimes confined to a reddish tinge on the membrane surrounded by red veins, except in some specimens of *Hetaerina titia* Calvert, 1902, a species not known from South America. If the red spots near the wing base are not evident, there are more than two rows of cells posterior to the anal bridge in the fore-wing. The veins near the bases of the wings are usually red. Posterior to the cubito-anal area of the wing, the veins are reticulate in most specimens. In both sexes, the color pattern on the synthorax consists of broad pale tan lines on the metallic red or green ground color of the synthorax (**Fig. 3.1.91**). Unfortunately, there may be specimens of some *Hetaerina* species that will key out to *Mnesarete*, particularly those of *Hetaerina vulnerata*, *H. cruentata*, and *H. caja*. In case of doubt, a specimen should be run through both keys.
.....*Hetaerina* Selys, 1853..p. 133

Tentative key to the genera of known larvae in South America

Information was provided by Costa (1986), Costa *et al*. (2004), and Garrison (2006). Because the larvae of few species have been described, it is not considered likely that the characteristics reported here will hold true for all species. Reportedly, the larva of *Bryoplathanon* has been found but not yet described (Carvalho and Nessimian, 1998).

1. There are no spines at the posterolateral corners of the eighth abdominal segment, although there may be such spines on the ninth and tenth. The first segment of the antenna does not bear spines or setae. The wing buds end above the fourth abdominal segment (**Fig. 3.1.92**). 2
 - There are distinct spines at the posterolateral corners of the eighth, ninth, and tenth abdominal segments (**Fig. 3.1.93**). 3

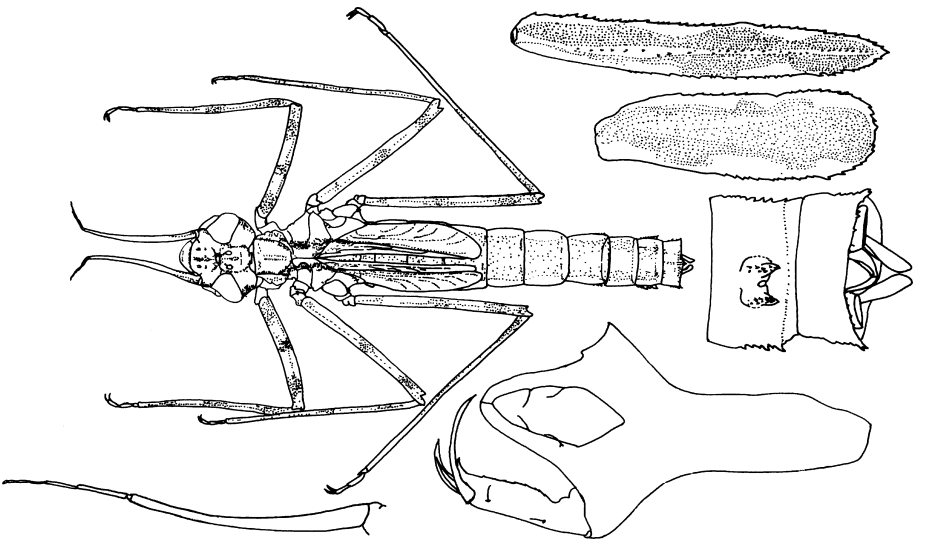


Fig. 3.1.92 *Iridictyon trebbaui* larva: habitus of male final instar without the gill lamellae (upper left), antenna enlarged (lower right), labium with one of the palps in dorsal view (lower right), apex of the abdomen in ventral view (middle right), and a lateral (upper right) and median gill lamella (upper middle right). Based on De Marmels (1992b).

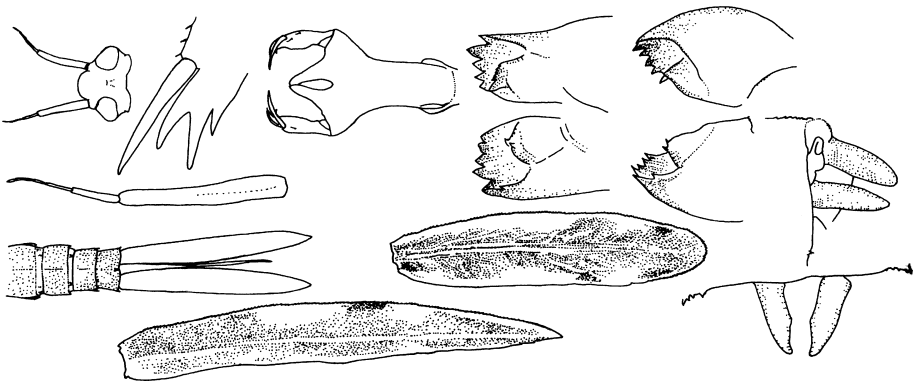


Fig. 3.1.93 *Mnesarete grisea* larva (above, left to right): head in dorsal view, enlarged apex of the labial palp, prementum in dorsal view, medial views of the left (above) and right mandibles (below), posterior views of left (above) and right mandible (below), apex of the abdomen without the gill lamellae in dorsolateral view, and (lower part of illustration): antenna (middle left), apex of the abdomen showing gill lamellae (lower left), middle gill lamella (lower right center) and lateral lamella (lower left center), and apex of the abdomen without the gill lamellae in dorsal view (lower right). Based on Garrison (2006).

2. Extended posteriad, both the hind and the middle legs reach beyond the apex of the tenth abdominal segment. The first segment of the antenna is about as long as the head and prothorax combined, and it is longer than 1.8 times the combined length of the rest of the antennal segments (**Fig. 3.1.92**).
.....*Iridictyon* Needham and Fisher, 1940..p. 110
- Extended posteriad, the middle and hind legs do not reach the apex of the tenth abdominal segment. The first segment of the antenna is longer than the head but much shorter than the head and prothorax combined, and it is shorter than 1.75 times the combined length of the rest of the antennal segments (**Fig. 3.1.94**).
.....*Ormenophlebia* Garrison, 2006..p. 111
3. The first segment of the antenna is not armed with spines or setae (**Fig. 3.1.93**).
.....*Mnesarete* Cowley, 1934..p. 113
- The first segment of the antenna is armed with setae (**Fig.3.1.95**).
.....*Hetaerina* Selys, 1853..p. 133

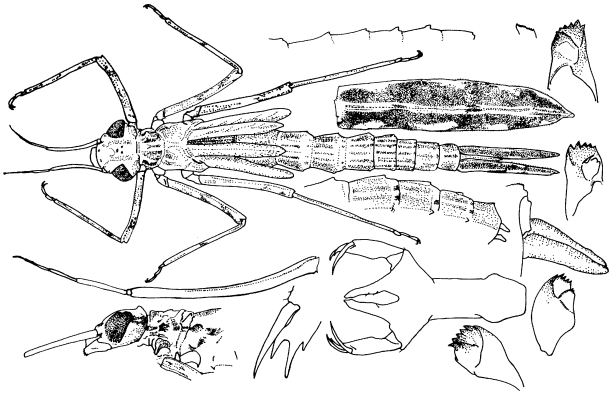


Fig. 3.1.94 *Ormenophlebia imperatrix* male larva: habitus (upper left), antenna (lower middle left), head and prothorax in lateral view (lower left), prementum in dorsal view with an enlargement of the apex of the right labial palp to its left (lower center), right mandible in posterior (lower right) and medial view with an enlargement of the tiny teeth on its inner ridge to its left (upper right), left mandible in median (upper middle right) and posterior view (below right side of prementum), lateral view of dorsal profile of the sixth through tenth abdominal segments (upper center) and a dorsal view of one side of the same segments (below abdomen of habitus illustration), superior anal appendages in lateral view (middle right), and a lateral gill lamella (above abdomen of habitus illustration). Based on Garrison (2006).

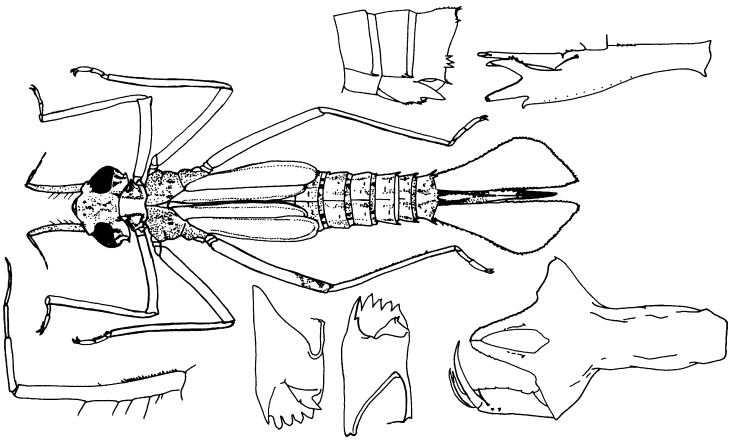


Fig. 3.1.95 *Hetaerina caja dominula* larva: habitus (upper left), antenna (lower left), mandibles (lower center), inner surface of the prementum (lower right), labial palp (upper right), apex of the abdomen of a female larva in lateral view (upper center). Based on Geijskes (1943).

Key to adults in the genus *Iridictyon* reported from South America

Information for the key was provided by Garrison (2006). Enough information is not yet available about the larvae to provide a key.

1. Vein RP_2 arises between the wing root and the nodus. In mediodorsal view, the apical half of the superior anal appendage of the male appears no more than slightly wider than the basal half (**Fig. 3.1.88**). Both wings of the female are hyaline.
.....*Iridictyon myersi* Needham and Fisher, 1940 (Venezuela, Guyana).
- Vein RP_2 arises distal to the nodus. In mediodorsal view, the apical half of the superior anal appendage of the male appears twice as wide as the basal half. The wings of the female are either hyaline, or there is a whitish band across the hind wing curving from posteriad to proximad from the nodus (**Fig. 3.1.96**).
.....*Iridictyon trebbaui* Rácenis, 1968 (Venezuela, Guyana).

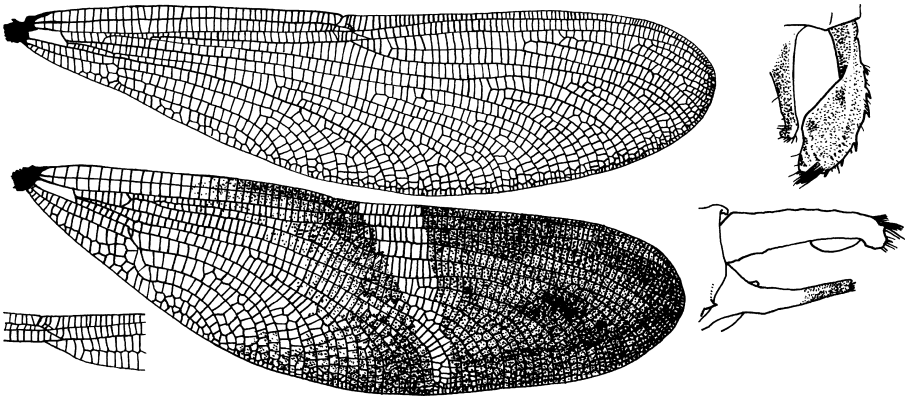


Fig. 3.1.96 *Iridictyon trebbaui* male: fore and hind wing (upper left), veins in the region of the nodus (lower left), anal appendages in dorsal (upper right) and lateral view (lower right). Based on Garrison (2006).

Key to the species of adult male *Ormenophlebia* in South America

Information for the key was provided by Garrison (2006). Enough information is not yet available about the larvae to provide a key.

1. The inferior anal appendage is only 2/5 to 3/4 as long as the superior anal appendage, and it ends in two processes, one directed toward the midline and blunt at the apex, and the other directed posteriad (**Fig. 3.1.97**). 2
- The superior and inferior anal appendages are nearly equal in length, and the apex of the inferior appendage is either clubbed or digitiform (**Fig. 3.1.90**). 3

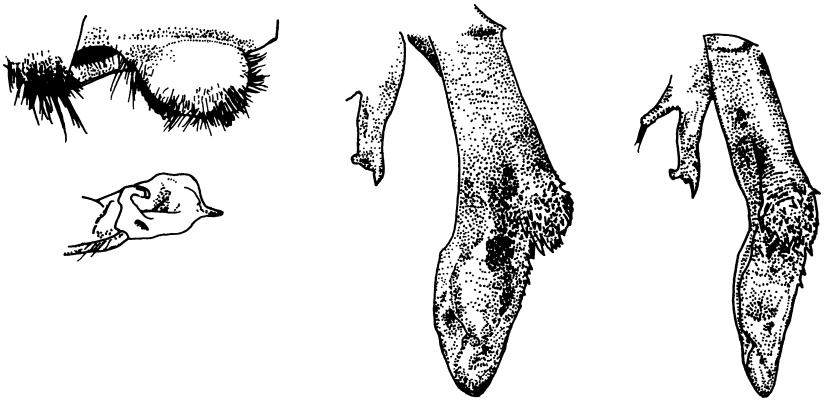


Fig. 3.1.97 *Ormenophlebia rollinati* male: tubercle and genitalia on the first and second abdominal segments (upper left), penis in lateral view (lower left), and the anal appendages on one side in mediodorsal (center) and dorsal view (right). Based on Garrison (2006),

2. The genital lobe on the second abdominal segment of the male is globular and in profile, forms more than a semicircle. The inferior anal appendage is about 2/5 as long as the superior anal appendage. There is a warty and spiny process at the dorsal angle formed by the superior anal appendage. The apical process of the inferior anal appendage directed mesad is capitate at the apex, while the apex of the one directed posteriad is acute (**Fig. 3.1.97**). The labrum of the male is entirely black. The thorax is metallic green. Estimated length of male abdomen: 72 mm. Hind wing length of male: c. 42.5 mm. The specimen described was damaged, and no female has been described.
.....*Ormenophlebia rollinati* (Martin, 1897) (Bolivia). Syn: *Lais rollinati* Martin, 1897; *Mnesarete rollinati* (Martin, 1897).
- In lateral view, the genital lobe on the second abdominal segment extends about as far ventrad as the anterior lamina. The inferior anal appendage is about 3/4 as long as the superior anal appendage. There is no warty process at the dorsal angle formed by the superior anal appendage. Both processes at the apex

of the inferior anal appendage are capitate. All sutures on the thorax are covered by continuouos yellow stripes. The inferior anal appendages of the male have very short dorsal extensions and a dorsoventrally flattened distal process with two or three denticles at the apex. The wing veins of the male are black. The lateral margin of the posterior lobe of the teneral female prothorax curves evenly and is convex or nearly straight for its entire length (**Fig. 3.1.98**). This is a tentative feature, and females can still not be identified with certainty. Except for a black costal vein, the veins in the wings of juvenile females are red. Length of male abdomen: 65 mm; female: 46 mm. Hind wing length of male: c. 40 mm; female: c. 39 mm.

.....*Ormenophlebia regina* (Ris, 1918)

(Bolivia). Syn: *Lais regina* Ris, 1918, *Mnesarete regina* (Ris, 1918).

Fig. 3.1.98 *Ormenophlebia regina* (left to right): view of the tubercle on the first and the genitalia on the second abdominal segments of two male specimens in lateral view, penis in ventral view, left female intersternite, lateral area along the posterior margin of the prothorax, male anal appendages on one side of the abdomen in mediodorsal and dorsal view, and the apex of the inferior anal appendage in medioventral (above) and ventral view (below). Based on Garrison (2006).

3. The genital lobe on the second abdominal segment of the male is rounded but occupies less than the posterior half of the margin of the genital opening; it extends about as far ventrad as the anterior lamina. The superior anal appendage of the male has a deep indentation in the ventral margin. The finger-like apex of the inferior anal appendage bends sharply toward the midline. The lateral part of the posterior margin of the female prothorax curves sharply near the middle, is concave subapically, and forms an angle where it meets the propleuron (**Fig. 3.1.4**). There is a yellow spot on each lateral margin of the black labrum of the male. The wing veins of both the male and the female are black; the wings have a bluish sheen, and those of the female, a greenish sheen. The black pterostigma

in the fore-wing of the male is large, and that in the hind wing is small. The pterostigma of the female in the fore-wing in inconspicuous, and that in the hind wing is small and gray. Length of male abdomen: 74 mm; female: 50 mm. Hind wing length of male: c. 43.5 mm; female: c. 38.5 mm. Length of the pterostigma in the hind wing is less than 1 mm.
.....*Ormenophlebia saltuum* (Ris, 1918) (Peru). Syn: *Lais saltuum* Ris, 1918, *Mnesarete saltuum* (Ris, 1918).

- In lateral view, the genital lobe on the second abdominal segment of the male has the shape of a low, rounded triangle (**Fig. 3.1.5**). The superior anal appendage of the male does not have a deep indentation in the ventral margin. The apex of the inferior anal appendage is bulbous. The lateral margin of the posterior margin of the female prothorax forms a broad angulation, and the anterior lobe of the intersternite is almost as large as the posterior lobe (**Fig. 3.1.90**). There is a fine, continuous yellow line only on the posterolateral sutures on the thorax; any other yellow lines are incomplete. The wing veins and pterostigma of the male are black, and the wings have a bluish sheen. The costal veins of the female wings are black, and the rest of the veins are yellowish red. The pterostigma in the fore-wing of the female is little different from the ordinary wing cells, and that in the hind wing is very small. Length of male abdomen: 69 mm; female: 47 mm. Hind wing length of male: c. 41 mm; female: c. 38 mm. Length of the pterostigma in the hind wing of the male: longer than 1.5 mm; female: c. 0.5 mm.
.....*Ormenophlebia imperatrix* (McLachlan, 1878) (Colombia, Ecuador). Syn: *Lais imperatrix* McLachlan, 1878; *Mnesarete imperatrix* (McLachlan, 1878).

Key to the species of adult male *Mnesarete* in South America

Information for the key was provided by Calvert (1909), Ris (1918), Fraser (1946a), De Marmels (1989a), and Garrison (2006). The larva of only one South American species has been described, so a key cannot be provided.

1. The inferior anal appendages are vestigial (**Fig. 3.1.99**). The dominant color is always that of metallic copper or coppery black. 2
- The inferior anal appendages are well-developed and at least ¼ the length of the superior appendage (**Fig. 3.1.100**). 4
2. The apex of the median lobe of the superior anal appendage is acutely pointed (**Fig. 3.1.101**). There is a well-defined brown spot at the apex of each wing. Estimated length of male abdomen: 35 mm. Hind wing length: c. 25 mm.
.....*Mnesarete hauxwelli* (Selys, 1869) (Ecuador, Peru). Syn: *Lais hauxwelli* Selys, 1869. Some recent illustrations and descriptions of this species actually refer to *Mnesarete fulgida.*
- The apex of the median lobe of the superior anal appendage is rounded and somewhat semicircular in outline (**Fig. 3.1.99**). 3

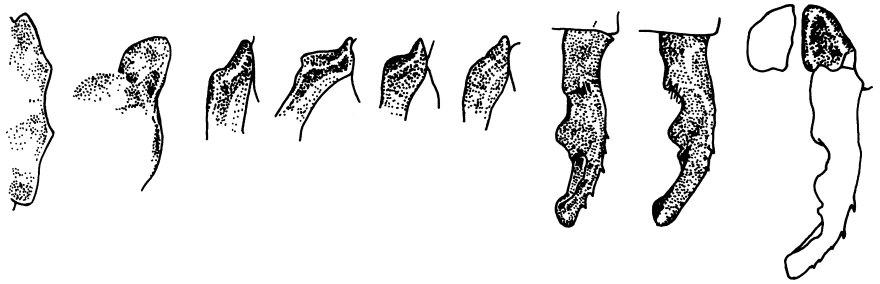


Fig. 3.1.99 *Mnesarete drepane* (left to right): posterior lobe of the female prothorax in dorsal and lateral view, left intersternites of four female specimens, and anal appendages of the male in mediodorsal, dorsal, and ventral view with the rudimentary distal process on both sides shown. Based on Garrison (2006).

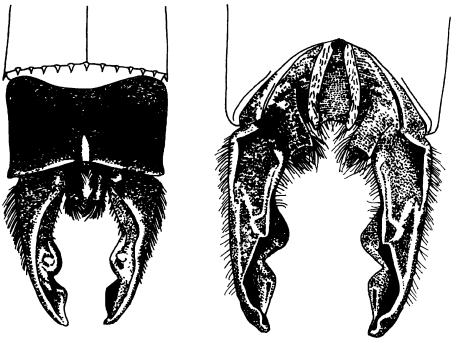


Fig. 3.1.100 *Mnesarete metallica* male: apex of the abdomen in dorsal (left) and ventral view (right). Based on Fraser (1946a), who used the synonym, *Mnesarete hincksi*.

Fig. 3.1.101 *Mnesarete hauxwelli* (left to right): apex of the penis in ventral (above) and lateral view; outline of the superior and the inferior anal appendages of a male in ventral view; male superior anal appendage in dorsomedial and dorsal view; posterior lobe of the female prothorax in dorsal and lateral view; lateral surface of the female prothorax showing the small prothoracic horn; intersternites of five female specimens. Based on Garrison (2006).

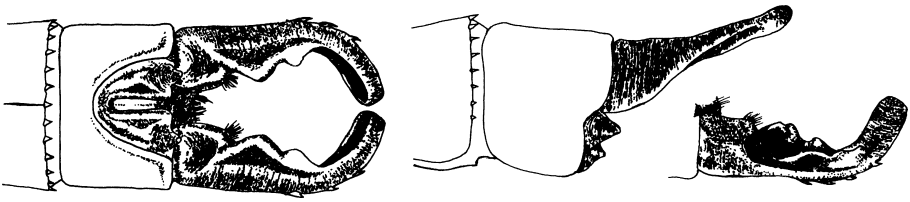


Fig. 3.1.102 *Mnesarete fulgida* male (left to right): apex of the abdomen in ventral and lateral view and superior anal appendage in dorsal view. Based on Fraser (1946a), illustrated as *Mnesarete hauxwelli*.

3. The superior anal appendage curves less than 30º inward (**Fig. 3.1.99**). Length of male abdomen: 34 to 37.5 mm; female abdomen: 29 to 30 mm. Hind wing length: 25 to 28.5 mm. The head and thorax are black with crimson and coppery metallic reflections and a few yellow markings on the thorax. The abdomen is coppery, somewhat lighter on the dorsum. The wings are hyaline except for a dark spot at the apex of the male hind wing.
.....*Mnesarete drepane* Garrison, 2006 (Colombia, Ecuador, Peru).

- The superior anal appendage curves nearly 90º inward. (**Fig. 3.1.102**). Length of male abdomen: c. 35 mm. Hind wing length: c. 25 mm. The thorax is black with crimson and coppery metallic reflections and narrow yellow markings. The abdomen is black with metallic crimson reflections dorsally and dull ventrally. The wings are hyaline with a pale brownish-black triangular mark near the tip of the hind wing, which may be faint in teneral specimens. The female remains undescribed.
.....*Mnesarete fulgida* (Selys, 1879) (Colombia, Ecuador, Peru). Syn: *Lais hauxwelli* non Selys, 1869, sensu Fraser (1946a).

4. In mediodorsal view, an apical lobe on the superior anal appendage completely conceals the distal fossa. There is a small tuft of short black silky hair-like setae at the basal end of the ventral side of the seventh abdominal segment. The entire ventral surface of the eighth segment is clothed with such setae, and there is a sparce coat of such setae on the ventral surfaces of the ninth and tenth segments. The other segments are free of such setae (**Fig. 3.1.100**). Length of male abdomen: 42 mm. Hind wing length: c. 25 mm. The thorax is steely blue black with creamy white stripes. The abdomen is black at the base transitioning to a violet metallic and cupreous metallic sheen posteriad. The

wings are hyaline without any pterostigma but with a small pale brownish-black mark near the apex of the hind wing.
.....*Mnesarete metallica* (Selys, 1869)
(Colombia, Ecuador, Venezuela). Syn: *Lais metallica* Selys, 1869; *Mnesarete hincksi* Fraser, 1946.
- There is no apical lobe on the superior anal appendage, and its distal fossa is visible in mediodorsal view. There are no hair-like setae on the ventral surfaces of the seventh through tenth abdominal segments (**Fig. 3.1.103**). 5
5. A dense group of stiff, bristle-like setae is located between the basal 1/5 and the midlength of the dorsal surface of each superior anal appendage (**Fig. 3.1.103**). The ground color is bright metallic copper, red, or dark blue. 6
- There is no dense group of bristle-like setae on the dorsal surface of the superior anal appendage (**Fig. 3.1.104**). 11

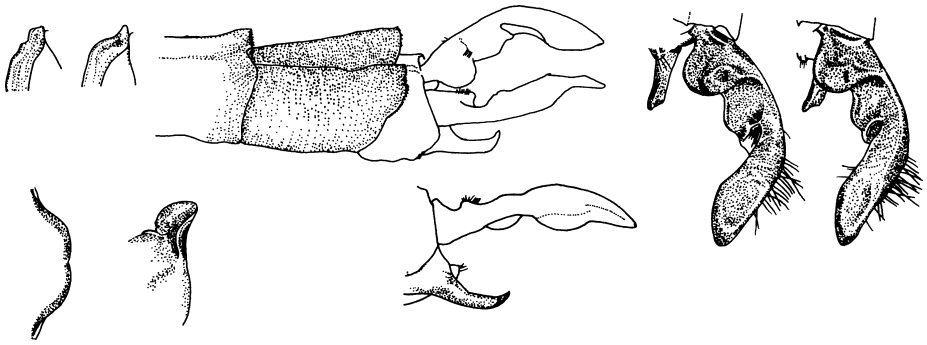


Fig. 3.1.103 *Mnesarete ephippium:* left intersternites of two female specimens (upper left), posterior lobe of the female prothorax in dorsal (lower left) and lateral view (lower left center), apical segments of the male abdomen in mediodorsal view (upper center), male anal appendages in lateral view (lower center), and male anal appendages on one side in mediodorsal (upper right center) and dorsal view (upper right). Based on Garrison (2006).

6. The base of the superior anal appendage forms a semicircular lobe that is much wider than the apical part of the appendage (**Fig. 3.1.103**). Length of male abdomen: 34 to 38 mm; female: 27 to 32 mm. Hind wing length: 24 to 28 mm. The head and thorax are black with a coppery sheen, and the abdomen is copper colored.
.....*Mnesarete ephippium* Garrison, 2006
(Colombia, Ecuador, Peru).
- If the superior anal appendage has a basal lobe, it is not wider than the apical part of the appendage (**Fig. 3.1.105**). 7

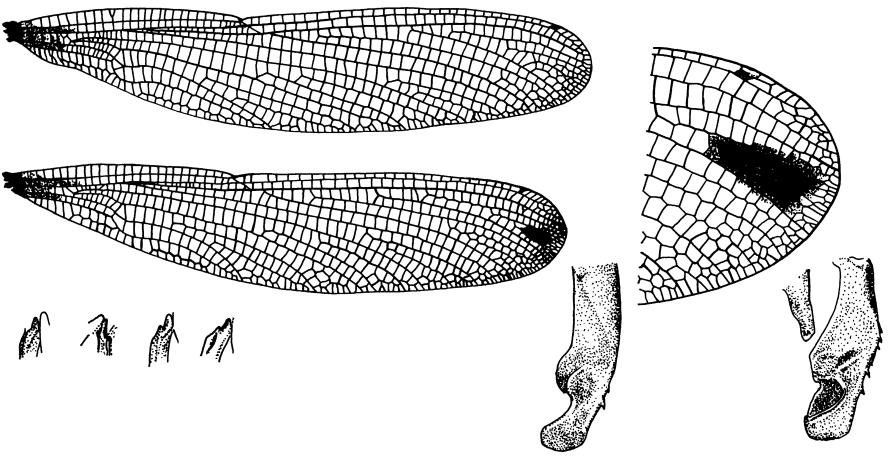


Fig. 3.1.104 *Mnesarete borchgravii:* fore and hind wing of a male (upper left), enlarged apex of the hind wing showing reduced pterostigma and dark subapical spot (upper right), anal appendages in mediodorsal (lower right) and superior anal appendage in dorsal view (lower right center), and left intersternites of four females (lower left). Based on Garrison (2006).

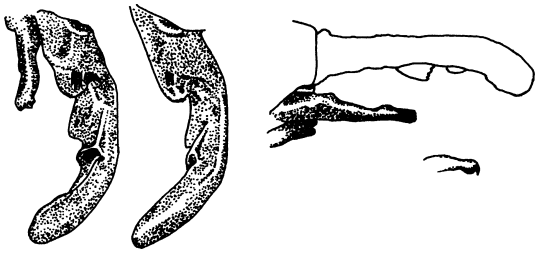


Fig. 3.1.105 *Mnesarete marginata* (left to right): anal appendages of a male in mediodorsal, dorsal, and lateral view (above), and the apex of the inferior anal appendage in posterior view (below). Based on Garrison (2006).

7. A vestigial basal lobe is present on the superior anal appendage; it protrudes posteriad and overlies the base of the median lobe (**Fig. 3.1.105**). The female has not been described.
.....*Mnesarete marginata* (Selys, 1879) (Peru). Syn: *Lais marginata* Selys, 1879.
- The only trace of a posterior lobe, if any, is a slight bulge at the base of the superior anal appendage (**Fig. 3.1.106**). 8

8. The inferior anal appendage is at least half as long as the superior appendage (**Fig. 3.1.106**). The body is bright metallic red. 9
- The inferior anal appendage is no more than 0.45 as long as the superior appendage (**Fig. 3.1.107**), and its apex is blunt and bears two to four small, recurved teeth. The body is metallic dark blue. 10

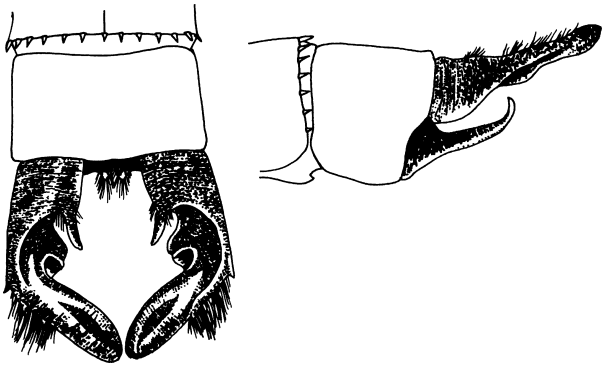


Fig. 3.1.106 *Mnesarete cupraea* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Fraser (1946a).

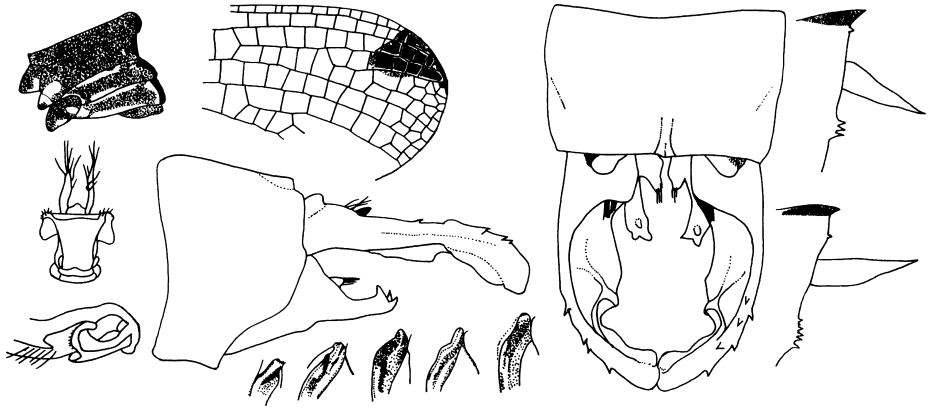


Fig. 3.1.107 *Mnesarete astrape:* synthorax of a female in lateral view (upper left), apex of the hind wing of a male (upper center), penis in ventral (middle left) and lateral view (lower left), left intersternites of five female specimens (lower center), apex of the male abdomen in dorsal (right center) and lateral view (below wing apex), and the posterior margins of the tenth sternites of two female specimens with appendages (right). Based on De Marmels (1989a) and Garrison (2006).

9. The median lobe of the superior anal appendage forms a prominent, irregular semicircle. The inferior appendage of the male is conical for most of its length with a strong curvature dorsad at the apex (**Fig. 3.1.106**). Hind wing length: 25.5 to 28 mm.
.....*Mnesarete cupraea* (Selys, 1853)
(Peru, Bolivia, Venezuela, Guyana, French Guiana, Surinam, Pará, Ceará, Maranhão, Amazonas, Mato Grosso, Rondônia). Syn: *Lais cupraea* Selys, 1853; *Mnesarete scintilla* Rácenis, 1968.
- The median lobe of the superior anal appendage forms a regular semicircle. The inferior anal appendage of the male is thick at the base, then tapers and curves strongly and is nearly cylindrical for most of its length, with a slight dorsad curve at the apex (**Fig. 3.1.108**). Length of male abdomen: 39 to 42 mm. Hind wing length: 29 to 30 mm. The thorax of the male is crimson metallic with narrow yellow markings. The abdomen is crimson metallic on the anterior segments and violet blue on the posterior ones. Wings of the male are hyaline with a triangular pale brownish mark near the tip of the hind wing. The female is dark steely blue with fine yellow lines on the thorax. The wings of the females are clouded with a greenish gray tint.
.....*Mnesarete devillei* (Selys, 1880)
(Ecuador, Peru, Bolivia). Syn: *Lais devillei* (Selys, 1880).

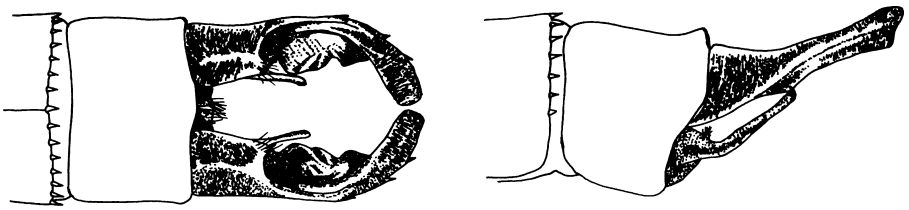


Fig. 3.1.108 *Mnesarete devillei* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Fraser (1946a).

10. The basal portion of the posterior margin of the hind wing is sinuous. The superior anal appendage has a triangular median lobe, and its apical half is as thick as its basal half. There is a spine at the posterior end of the mid-dorsal carina on the tenth abdominal segment that extends beyond the posterior margin of the segment (**Fig. 3.1.89**). Length of male abdomen: 32 to 37 mm; female: 30 to 32 mm. Hind wing length: 23 to 29 mm.
.....*Mnesarete loutoni* Garrison, 2006
(Peru, Amazonas).
- The basal portion of the posterior margin of the hind wing is not sinuous. The superior anal appendage has a median lobe that is only slightly developed, and

its apical half is thinner than its basal half. The mid-dorsal carina on the tenth abdominal segment lacks a spine at the end but is sometimes raised to form a keel (**Fig. 3.1.107**). Length of male abdomen: 32 to 37 mm; female: 30 to 32 mm. Hind wing length: 23 to 29 mm.
.....*Mnesarete astrape* De Marmels, 1989 (Venezuela, Amazonas, Pará).
11. The dominant color is metallic copper. The superior anal appendage is narrow with a small median lobe (**Fig. 3.1.109**).
.....*Mnesarete aenea* (Selys, 1853) (Peru, Bolivia, Rondônia, Amazonas, Pará). Syn: *Lais aenea* Selys, 1853.
- The dominant color is dark brown or metallic green. The superior anal appendage is robust near the midlength and sometimes has a prominent median lobe (**Fig. 3.1.104**). 12

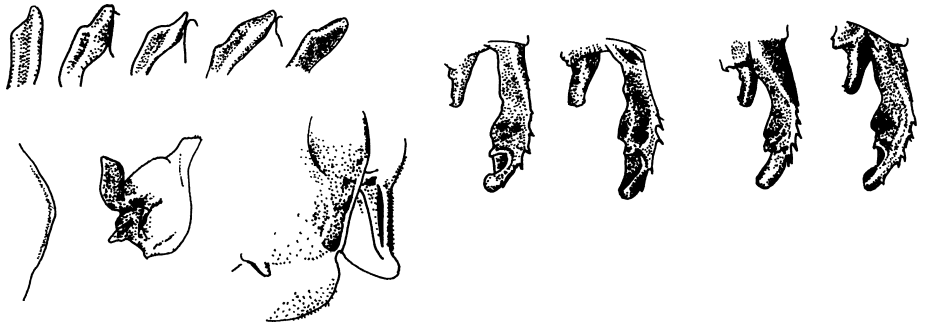


Fig. 3.1.109 *Mnesarete aenea:* left intersternites of five female specimens (upper left), hind lobe of female prothorax in dorsal view (lower left) and lateral view of the entire prothorax with an enlarged view of the lateral part of its posterior margin (right of dorsal view, left and right, respectively), and anal appendages on one side of two male specimens in mediodorsal (upper right center) and dorsal view (upper right). Based on Garrison (2006).

12. The wings have pterostigmata, which may be missing on one or more of the wings in exceptional cases (**Fig. 3.1.104**). 13
- No wing has a pterostigma (**Fig. 3.1.110**). 14
13. The apex of the fore-wing is hyaline, but the hind wing has an isolated apical spot that does not reach the wing margin. There is a ridge along the dorsal surface of the superior anal appendage that is not interrupted along its entire length (**Fig. 3.1.104**). Hind wing length: 33 to 40 mm.
.....*Mnesarete borchgravii* (Selys, 1869) (Rio de Janeiro, São Paulo, Santa Catarina). Syn: *Hetaerina borchgravii* Selys, 1869.

- Both wings are hyaline at the apex. The ridge along the superior anal appendage is interrupted, leaving an isolated section proximal to the transverse ridge (**Fig. 3.1.111**). Hind wing length: 26 to 29 mm.
.....*Mnesarete lencionii* Garrison, 2006 (Paraguay, Argentina, São Paulo).

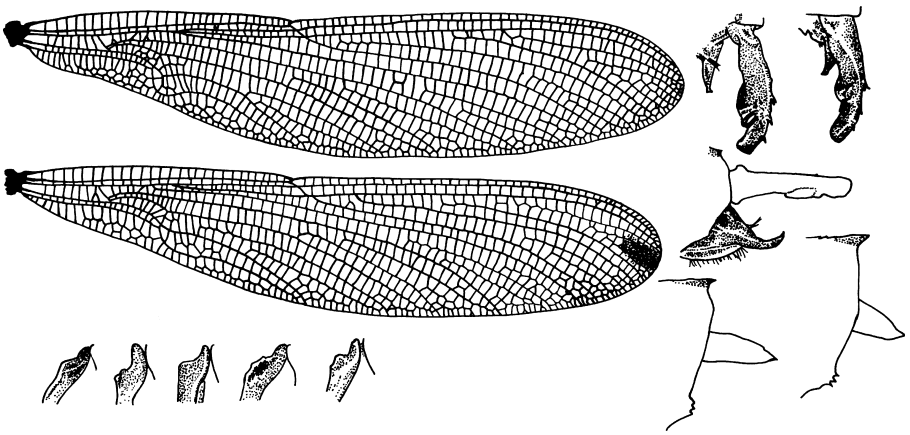


Fig. 3.1.110 *Mnesarete williamsoni:* fore and hind wing (upper left), left intersternites of five female specimens (lower left), male anal appendages on one side of the abdomen in dorsomedial (upper right center), dorsal (upper right), and lateral view (middle right), and apices of the abdomens of two female specimens in lateral view. Based on Garrison (2006).

Fig. 3.1.111 *Mnesarete lencionii* (left to right): penis in ventral and lateral view, a superior and inferior anal appendage in dorsal view and those of two specimens in dorsomedial view, apex of the inferior anal appendage in posterior view to show the recurved hooklets, and the intersternite of four female specimens. Based on Garrison (2006).

14. In lateral view, the inferior anal appendage appears sharply bent just distal to its midlength, and it is club-shaped and bears small leaf-like lobes at the apex (**Fig. 3.1.112**). Length of male abdomen: c. 33 mm. Hind wing length of male: c. 25 mm. The female has not been described.
.....*Mnesarete rhopalon* Garrison, 2006 (Minas Gerais).
- Either the inferior anal appendage does not appear sharply bent in lateral view, or its apex is narrow and spatulate (**Fig. 3.1.110**). 15

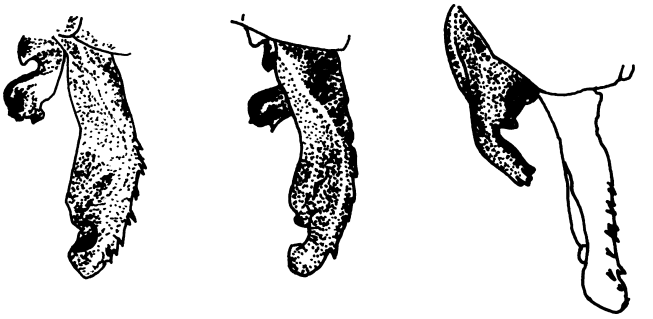


Fig. 3.1.112 *Mnesarete rhopalon* male (left to right): anal appendages in mediodorsal, dorsal, and lateral view. Based on Garrison (2006).

15. In lateral view, the inferior anal appendage appears sharply bent, and its apex is narrow and spatulate (**Fig. 3.1.110**). Length of male abdomen: 32 to 34 mm; female: 26 to 29 mm. Hind wing length: 22 to 26 mm.
.....*Mnesarete williamsoni* Garrison, 2006 (Pará).
- The inferior anal appendage appears straight in lateral view, and its apex is not narrow and spatulate (**Fig. 3.1.113**). 16
16. The apex of the inferior anal appendage is elongate, acutely pointed, and directed medioposteriad, and it has two small subapical teeth on its dorsal surface. There is no median lobe on the superior anal appendage, but there is a small lobe located on the medial edge about 15% of the way from the base to the apex (**Fig. 3.1.113**). 17
- The apex of the inferior anal appendage is hooked or blunt and armed with two small, strongly curved teeth (**Fig. 3.1.114**). 18
17. In ventral view, the inferior anal appendage curves to enclose a rhombic excavation (**Fig. 3.1.115**). While formally maintained as a valid species until more specimens can be examined, this will almost certainly become a synonym of *Mnesarete guttifera,* the minor morphological differences observed thus far seeming to be within the variability of a single species.
.....*Mnesarete mariana* Machado, 1996 (Bahia).

- In ventral view, the inferior anal appendage is nearly straight and does not appear to enclose a deep excavation (**Fig. 3.1.113**). Length of male abdomen: c. 38 mm. Hind wing length of male: 29 to 30 mm.
.....*Mnesarete guttifera* (Selys, 1873)
(Paraguay, Argentina, Mato Grosso, Brasilia, Goiás, Bahia, Minas Gerais, São Paulo, Paraná). Syn: *Lais guttifera* Selys, 1873.

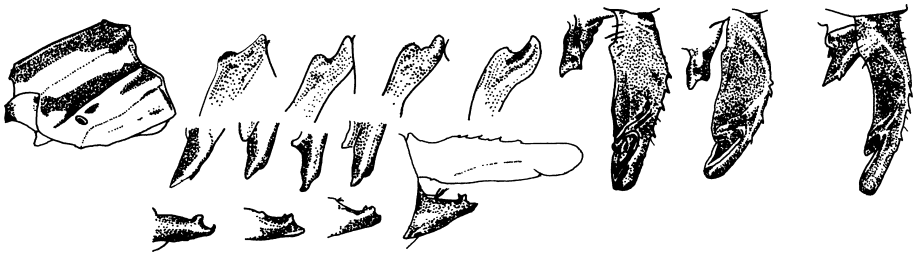


Fig. 3.1.113 *Mnesarete guttifera:* synthorax of a female in lateral view (left), left intersternites of four females (upper left center), male anal appendages on one side of two specimens (right center) and the same appendages in dorsal (right) and lateral view (lower center), and the apices of the inferior anal appendages of three specimens in lateral (lower left center) and four in ventral view (middle, between intersternites and lateral views). Based on Garrison (2006).

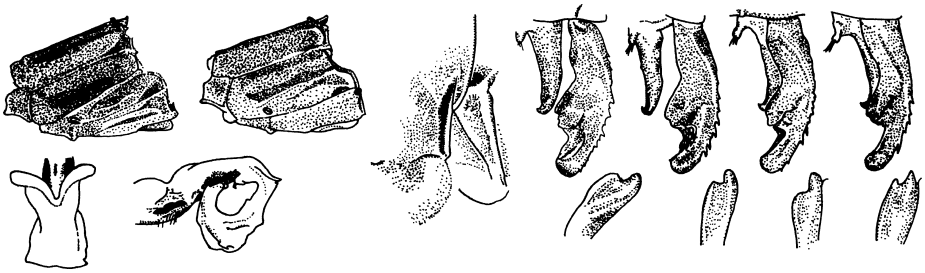


Fig. 3.1.114 *Mnesarete grisea* (upper row, left to right): lateral view of the synthorax of a male and a female where the lighter color is mainly gray and the darker color, green; lateral area of the posterior margin of the female prothorax; male anal appendages of two specimens in mediodorsal view and the same two in dorsal view; and (lower row, left to right) penis in ventral and lateral view; and left intersternites of four female specimens. Based on Garrison (2006).

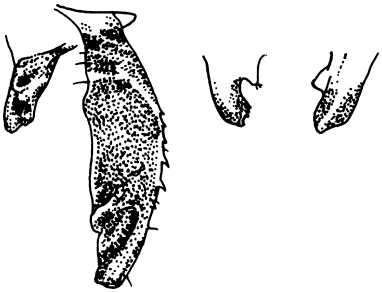


Fig. 3.1.115 *Mnesarete mariana* male (left to right): inferior and superior anal appendage in dorsomedial view and the apex of the inferior appendage in lateral and ventral view. Based on Machado (1996).

18. The synthorax is dull blackish with a weak greenish sheen on the anterior half of the mesepimeron and posterior half of the metepisternum and dark reddish brown on the posterior half of the mesepisternum and posterior half of the mesepimeron (**Fig. 3.2.114**). Older individuals are darker on the brown areas, but there is no metallic sheen. The superior anal appendage is not more than twice as long as the inferior appendage, which ends in a single hook curved toward the midline. There is a black spot at the apex of the otherwise hyaline hind wing of the male. The wings of the female have reddish brown or black veins and slightly yellowed membranes. The abdomen of the male is dull black, except for reddish brown lateral markings on the first two segments and a whitish ventral pruinosity; that of the female is similar except for a pair of dull reddish brown stripes running through all ten segments. Length of male abdomen: c. 35 mm; female: c. 29 mm. Hind wing length of male: 27 to 40 mm; female: 28 to 31 mm. The 40 mm maximum hind wing length of the male may be a typographical error by Ris (1918), because elsewhere he reports the maximum length to be 30 mm.

.....*Mnesarete grisea* (Ris, 1918) (Argentina). Syn: *Lais grisea* Ris, 1918.

- Extensive dark and metallic areas on the synthorax include most of the mesepimeron and metepisternum; paler areas are limited to thin lines along the sutures. The superior anal appendage is at least twice as long as the inferior appendage, which has two or more small teeth at its apex (**Fig. 3.1.116**). 19

19. The anterior section of the superior ridge along the superior anal appendage is directed diagonally toward and sometimes intersects with the middle portion of the transverse ridge. The distal margin of the penis is transverse, and its apical lobes are vestigial (**Fig. 3.1.116**). 20

- The anterior section of the dorsal ridge along the superior anal appendage is isolated from or meets only the distal portion of the transverse ridge. The distal margin of the penis is emarginate near the middle, and its vestigial apical lobes are absent (**Fig. 3.1.117**). 21

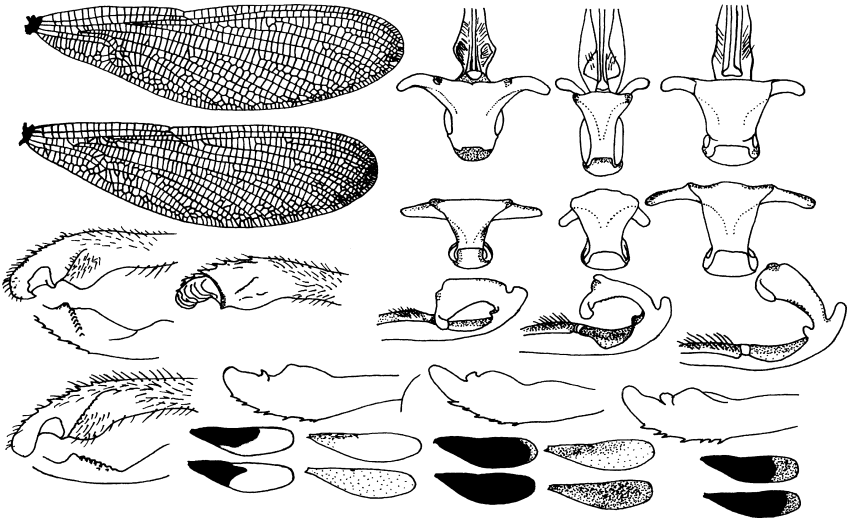


Fig. 3.1.116 *Mnesarete pudica:* wing venation of the fore and hind wing of *Mnesarete pudica phryne* (upper left), the extent of the dark and lighter shading on the fore and hind wings of a male *M. p. phryne,* female *M. p. phryne,* male *M. p. pudica,* female *M. p. pudica,* and a male hybrid *M. p. pudica* x *phryne* (lower left center to right, respectively); penes of *M. p. phryne, M. p. pudica,* and *M. p. pudica* x *phryne* (9 figures at upper right, taxa arranged left to right, respectively) in ventral (upper row), posteroventral (middle row) and lateral view (lower row); superior anal appendage of a male in dorsal oblique view of *M. p. phryne* (middle left, left figures), *M. p. pudica* (middle left, right figure), and *M. p. pudica* x *phryne* (lower left), and the inferior anal appendage of a male in oblique ventral view of *M. p. phryne*, *M. p. pudica*, and *M. p. pudica* x *phryne* (row above color diagrams of wings, left to right, respectively). Based on Costa (1986).

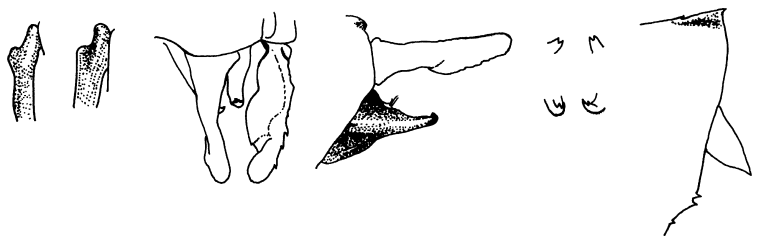


Fig. 3.1.117 *Mnesarete smaragdina* (left to right): left intersternites of two female specimens, anal appendages of a male in mediodorsal and lateral view, apices of the inferior anal appendages of two specimens (above and below) in posterior view, and apex of the tenth abdominal segment of a female in lateral view. Based on Garrison (2006).

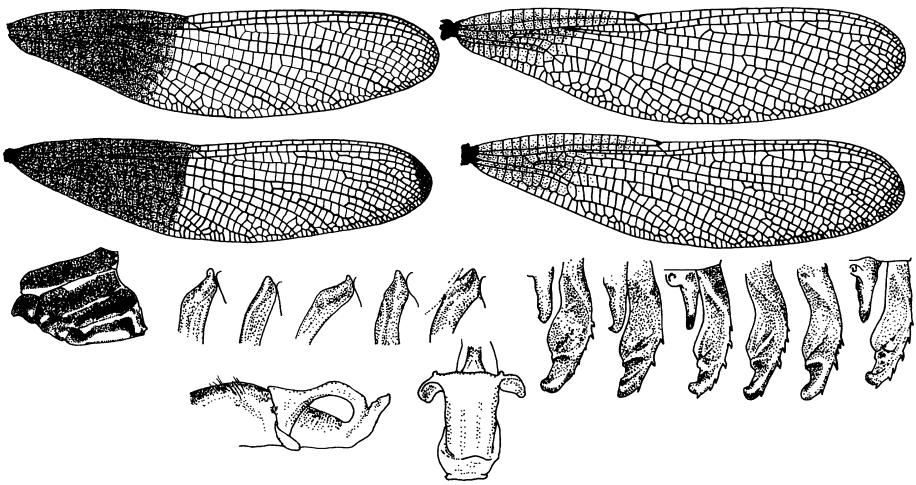


Fig. 3.1.118 *Mnesarete fuscibasis:* fore and hind wing of a male (upper left) and a female (upper right), synthorax of a female in lateral view (lower middle left), penis in ventral (lower center) and lateral view (lower left center), left intersterites of five females in lateral view (above views of penis), and the anal appendages of three different specimens in mediodorsal (three at lower right center) and dorsal view (three at lower right). Based on Garrison (2006).

20. The wing membrane is wine red as far as the nodus or beyond (**Fig. 3.1.116**). .....*Mnesarete pudica* (Hagen in Selys, 1853) (Argentina, Paraguay, Mato Grosso, Goiás, Minas Gerais, São Paulo, Paraná, Rio Grande so Sul). Syn: *Lais pudica* Hagen in Selys, 1853. Two subspecies have been described: *Mnesarete pudica pudica* (Hagen in Selys, 1853), with the reddish color on the wing membrane extending to the apical 1/5 of the fore-wing and the apex of the hind wing, and *Mnesarete pudica phryne* Costa, 1986, on which the red color barely passes the nodus. *M. p. phryne* is known only from Brazil, where it shares a common range with *M. p. pudica*. Hybrids between the two have also been described (Costa, 1986).

- The wing membranes are either hyaline or dark brown proximal to the nodus (**Fig. 3.1.118**). Length of male abdomen: 31 to 32 mm. Hind wing length of male: 22 to 24 mm.
..... *Mnesarete fuscibasis* (Calvert, 1909) (Mato Grosso, Goiás). Syn: *Hetaerina fuscibasis* Calvert, 1909.

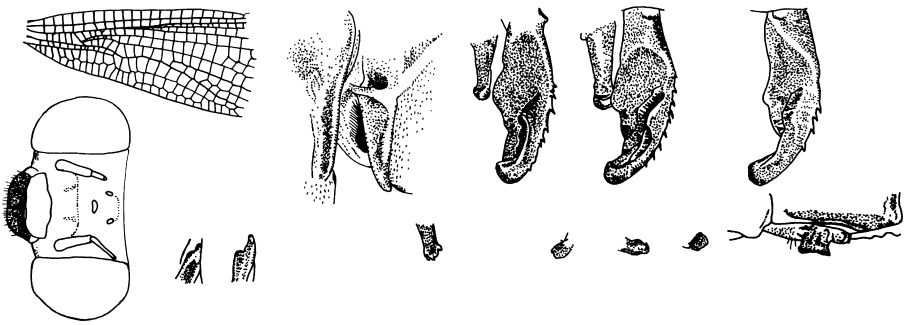


Fig. 3.1.119 *Mnesarete hyalina* (above, left to right): basal part of the male forewing, lateral part of the posterior margin of the male pronotum, anal appendages of two male specimens in mediodorsal view and of one in dorsal view, and (below, left to right): head in dorsofrontal view, left intersternite of a male and a female, apex of the inferior anal appendage of one male in posterolateral and of three in posterior view, and the male genitalia on the second abdominal segment in lateral view. Based on Garrison (2006).

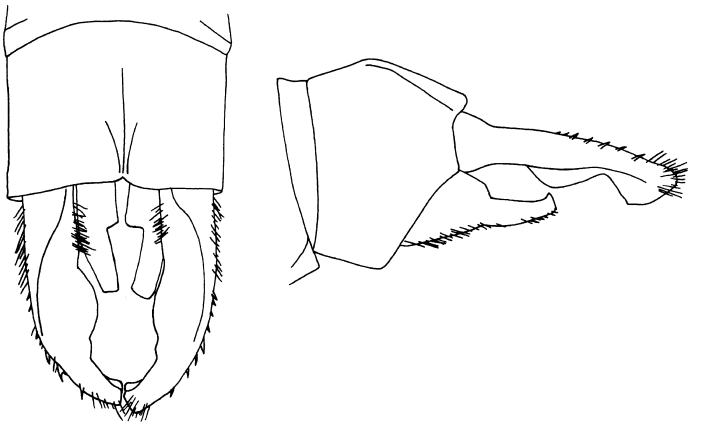


Fig. 3.1.120 Apex of the male abdomen of *Mnesarete pruinosa* in dorsal (left) and lateral view (right). Based on Ris (1913).

21. There is an obvious gap in the dorsal ridge on the superior anal appendage proximal to the transverse ridge, which leaves the anterior section isolated (**Fig. 3.1.117**). 22
- The dorsal ridge on the superior anal appendage is not interrupted along its entire length (**Fig. 3.1.119**). 23
22. The color of the thorax is bright metallic green. The isolated portion of the dorsal ridge on the superior anal appendage forms a small mound bearing one or two small teeth. There is a small brown spot at the apex of the hind wing (**Fig. 3.1.117**). Hind wing length: 22 to 24 mm.
.....*Mnesarete smaragdina* (Selys, 1869) (Pará). Syn: *Lais smaragdina* Selys, 1869.
- The color of the thorax is dull metallic grayish green, sometimes with whitish pruinosity and sometimes with the middle part of the mesepisternum brilliant white. There is no dark spot at the apex of the hind wing, and the wing bases are hyaline or milky white (**Fig. 3.1.120**). Hind wing length: 27 to 33 mm.
.....*Mnesarete pruinosa* (Hagen in Selys, 1853) (Paraguay, Argentina, Rio Grande do Sul, Santa Catarina, Paraná, Minas Gerais). Syn: *Lais pruinosa* Hagen in Selys, 1853.
23. On the superior anal appendage, the distal fossa lacks a transverse ridge, and the median lobe forms a blunt triangle. The inferior anal appendage is capitate and armed with small teeth and lobes (**Fig. 3.1.119**). Length of male abdomen: 37 to 40 mm. Hind wing length: 27 to 31 mm.
.....*Mnesarete hyalina* (Hagen in Selys, 1853) (São Paulo, Rio de Janeiro). Syn: *Lais hyalina* Hagen in Selys, 1853.
- On the superior anal appendage, there is a transverse ridge on the distal fossa, and the median lobe is broadly arcuate. The inferior anal appendage is not capitate and armed with two or three small, recurved teeth (**Fig. 3.1.121**). Length of male abdomen: 31 to 24 mm. Hind wing length of male: 22 to 25 mm. The female has not been described.
.....*Mnesarete machadoi* Garrison, 2006 (Mato Grosso, Goiás). Syn: *Lais smaragdina* non Selys, 1869, misidentified by Longfield (1929).

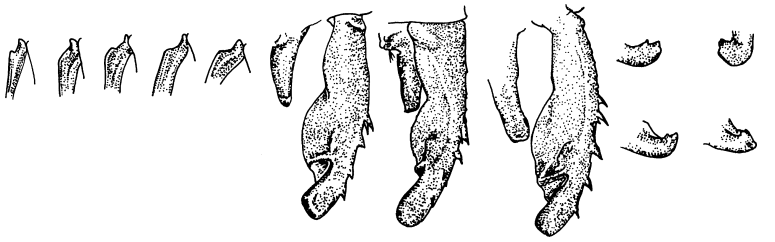


Fig. 3.1.121 *Mnesarete machadoi* male (left to right): intersternites of five specimens, anal appendages of two in dorsomedial view and one in dorsal view, and the apices of four inferior anal appendages in posterior view. Based on Garrison (2006).

Key to the species of known adult female *Mnesarete* in South America

Information for the key was provided by Calvert (1909), Ris (1918), Fraser (1946a), De Marmels (1989a), and Garrison (2006). This key permits only tentative identification of many species because differences are slight, and, in some cases, the identities of the specimens were not fully confirmed. The females of *Mnesarete fulgida, M. machadoi, M. marginata, M. mariana,* and *M. rhopalon* have not been described.

1. The thorax is mainly dull gray with a dull metallic midline stripe covering the middle half of the mesepisternum and no more than the posterior half of the mesepisternum. There is sometimes also an elongate isolated spot at the anterior end of the metepisternum ventral to the wing base. The abdomen is dark on the dorsal surface and pale laterally and on the intersternite, which has an anterior shoulder that forms nearly a right angle with the posterior lobe (**Fig. 3.1.114**). Length of female abdomen: c. 29 mm. Hind wing length of female: 28 to 31 mm.
.....*Mnesarete grisea* (Ris, 1918) (Argentina). Syn: *Lais grisea* Ris, 1918.
- The thorax is mainly metallic coppery, purple, or green, and pale markings are mainly narrow lines along the sutures and stripes that are narrower than the metallic areas that separate them. The intersternite is usually dark and often black in mature specimens (**Fig. 3.1.104**). 2
2. A pterostigma is present on at least one of the wings, although it may be vestigial (**Fig. 3.1.104**). 3
- There is no pterostigma on any wing (**Fig. 3.1.118**). 4
3. There is no horn on the prothorax (**Fig. 3.1.104**). The thorax is mainly metallic dark green. The hind wing is 32 to 24 mm long.
.....*Mnesarete borchgravii* (Selys, 1869) (Rio de Janeiro, São Paulo, Santa Catarina). Syn: *Hetaerina borchgravii* Selys, 1869.
- There is a horn on the prothorax. The intersternite sometimes has a subapical lobe (**Fig. 3.1.111**). The thorax is mainly dark metallic green, and those of older specimens have a whitish pruinosity. The hind wing is 25 to 30 mm long.
.....*Mnesarete lencionii* Garrison, 2006 (Paraguay, Argentina, São Paulo).
4. The greatest width of the hind wing is 24% to 30% of the hind wing length. There is an amber coloration, sometimes weak, covering at least the basal 30% of the wing and often extending in varying intensity over the entire wing (**Fig. 3.1.118**). However, the basal part of the amber shading is usually darkest. There is a narrow, pale antehumeral stripe that covers the medial 30% along the mesepimeral suture at its dorsal end and the 30% along the mesepisternal suture at its ventral end; this stripe may disappear as the insect becomes older. 5
- The greatest width of the hind wing is not more than 23% of the hind wing length. The wings are either entirely hyaline or lightly tinged in amber of a

uniform intensity over the whole area of the wing (**Fig. 3.1.89**). The narrow, pale antehumeral stripe, if present at all, does not abruptly end ventrally, and it is not interrupted, but it is sometimes thin, gradually narrowing from the anterior to the posterior end. 6

5. - The greatest width of the hind wing is 24% to 26% of the hind wing length (**Fig. 3.1.118**). Length of female abdomen: 27 to 28 mm. Hind wing length of female: 23 to 25 mm. The color is mainly black with brown on the second thoracic suture and metallic green or violet reflections on the thorax and sometimes a pair of pale spots on the labrum.
..... *Mnesarete fuscibasis* (Calvert, 1909) (Mato Grosso, Goiás). Syn: *Hetaerina fuscibasis* Calvert, 1909.

- The greatest width of the hind wing is 29% to 30% of the hind wing length (**Fig. 3.1.116**).
.....*Mnesarete pudica* (Hagen in Selys, 1853) (Argentina, Paraguay, Mato Grosso, Goiás, Minas Gerais, São Paulo, Paraná, Rio Grande so Sul). Syn: *Lais pudica* Hagen in Selys, 1853. Two subspecies have been described: *Mnesarete pudica pudica* (Hagen in Selys, 1853), with the reddish color on the wing membrane extending to the apical 1/5 of the fore-wing and the apex of the hind wing, and *Mnesarete pudica phryne* Costa, 1986, on which the red color barely passes the nodus. *M. p. phryne* is known only from Rio de Janeiro, São Paulo, and Minas Gerais, where it shares a common range with *M. p. pudica*, which is known from Paraguay, Argentina, Rio de Janeiro, São Paulo, Minas Gerais, Paraná, Rio Grande do Sul, Goiás, and Mato Grosso. Hybrids between the two have also been described (Costa, 1986).

6. The dark color on the thorax is coppery or coppery purple, in older specimens with a whitish pruinosity on the ventral side and the metepisternum. 7

- The dark color on the thorax is bright metallic green, in older specimens with a whitish pruinosity on the entire surface that makes the thorax appear gray. ...14

7. There is a slight extension along the posterior margin of the hind wing near Cu_1, making it slightly sinuous (**Fig. 3.1.89**). The postclypeus is dark metallic blue, most prominent on the apical half. Length of female abdomen: 30 to 32 mm. Hind wing length: 23 to 29 mm.
.....*Mnesarete loutoni* Garrison, 2006 (Peru, Amazonas).

- The posterior margin of the hind wing near vein Cu_1 is nearly straight. The postclypeus is bright coppery, brightest on the apical half (**Fig. 3.1.109**). 8

8. The prothorax is evenly rounded and bears distinct horns. There is no pale spot on the propleuron (**Fig. 3.1.109**). The hind wing is 23 to 25 mm long.
.....*Mnesarete aenea* (Selys, 1853) (Peru, Bolivia, Rondônia, Amazonas, Pará). Syn: *Lais aenea* Selys, 1853.

- The prothorax is slightly emarginate in the middle, producing two lobes, or there are obtusely angled projections along the lateral margins. Distinct horns are absent, although slight swellings may be present instead (**Fig. 3.1.103**). A pale spot on the propleuron is only rarely present in one or two species. The hind wing is 25 to 29 mm long. 9

9. The intersternite forms an anterior and posterior lobe, subequal in size or with the anterior lobe slightly shorter. In lateral or anterolateral view, the lateral margin of the posterior lobe of the prothorax forms a wide lobe and a 90º angle with the pleural margin. In dorsal view, these lobes are prominent. Length of female abdomen: 30 to 32 mm. Hind wing length: 25 to 29 mm.
.....*Mnesarete hauxwelli* (Selys, 1869) (Ecuador, Peru). Syn: *Lais hauxwelli* Selys, 1869. Some recent illustrations and descriptions of this species actually refer to *Mnesarete fulgida.*

- The anterior lobe on the intersternite is only about ¼ as high as the posterior lobe, which is straight. In lateral or anterolateral view, the lateral margin of the posterior lobe does not form a wide lobe, or the lobe forms an angle much greater than 90º with the pleural margin. In dorsal view, these lobes are not prominent (**Fig. 3.1.103**). 10

10. In lateral view, the lateral margin of the posterior lobe of the prothorax is bent anteriad to expose the posterior surface of the lobe (**Fig. 3.1.103**). Length of female abdomen: 27 to 32 mm. Hind wing length: 24 to 28 mm.
.....*Mnesarete ephippium* Garrison, 2006 (Colombia, Ecuador, Peru).

- In lateral view, the lateral margin of the posterior prothoracic lobe is not bent anteriad, so the posterior surface of the lobe is not visible (**Fig. 3.1.106**). 11

11. In anterolateral view, the lateral margin of the posterior lobe of the prothorax usually forms a small, angulate process. There is a small swelling at the site of the prothoracic horn on other species. The coloration of the female changes with age from metallic violet on the thorax and bright orange at the wing bases to a dark color on the thorax with coppery violet metepisternal and metepimeral stripes, a blue or greenish abdomen, and evenly brownly infuscated wings with blackish veins at the base. Hind wing length: c. 25 mm.
.....*Mnesarete metallica* (Selys, 1869) (Colombia, Ecuador, Venezuela). Syn: *Lais metallica* Selys, 1869; *Mnesarete hincksi* Fraser, 1946.

- In anterolateral view, no lobe is visible on the prothorax or, if a lobe is present, its lateral margin does not form a small, angulate process and is generally broadly rounded (**Fig. 3.1.106**). 12

12. In dorsal view, the posterior lobe of the prothorax has two lobes barely discernible or it is evenly curved along its margin. The anterior lobe of the intersternite is distinct and about ¼ as high as the posterior lobe, and the two lobes are separated by a U or V-shaped indentation. In anterolateral view, the broad lobe along the lateral margin of the hind lobe of the prothorax forms an angle of about 120º with the pleural margin (**Fig. 3.1.106**). Hind wing length: 25.5 to 28 mm.
.....*Mnesarete cupraea* (Selys, 1853) (Peru, Bolivia, Venezuela, Guyana, French Guiana, Surinam, Pará, Ceará, Maranhão, Amazonas, Mato Grosso, Rondônia). Syn: *Lais cupraea* Selys, 1853; *Mnesarete scintilla* Rácenis, 1968.

- In dorsal view, the posterior lobe of the prothorax is distinctly bilobed. The anterior lobe of the intersternite is vestigial, forming a small "shoulder," which joins the posterior lobe at an obtuse angle, or it is completely absent (**Fig. 3.1.99**). 13

13. In anterolateral view, the hind lobe of the prothorax has a moderately developed lobe along its lateral margin. A prothoracic spot is usually present (**Fig. 3.1.108**). Hind wing length: 29 to 30 mm.
.....*Mnesarete devillei* (Selys, 1880) (Ecuador, Peru, Bolivia). Syn: *Lais devillei* (Selys, 1880).

- In anterolateral view, the lateral margin of the hind lobe of the prothorax appears evenly curved without any smaller lobe. The prothoracic spot is usually absent (**Fig. 3.1.99**). Length of female abdomen: 29 to 30 mm. Hind wing length: 25 to 28.5 mm.
.....*Mnesarete drepane* Garrison, 2006 (Colombia, Ecuador, Peru). Garrison (2006) suspects that the still undescribed females of *Mnesarete fulgida* may also key out here.

14. A prothoracic horn is easily evident. The intersternite is mainly pale in color. The ventral surface of the metathorax is completely pale, or there is one medial dark spot (**Fig. 3.1.120**). Hind wing length: 27 to 33 mm.
.....*Mnesarete pruinosa* (Hagen in Selys, 1853) (Paraguay, Argentina, Rio Grande do Sul, Santa Catarina, Paraná, Minas Gerais). Syn: *Lais pruinosa* Hagen in Selys, 1853. The one known specimen of *Mnesarete hyalina,* a poorly known species, also keys out here, and no way to distinguish the females of these two species has yet been found (Garrison, 2006).

- The prothoracic horn is tiny and barely evident, or it is completely absent. The intersternite is dark. The ventral surfaces of the metathorax of fully mature specimens have dark median and lateral markings, some of which border on the metepimeron, or the venter is entirely dark (**Fig. 3.1.113**). Most teneral adults also fit this description, although young adult *Mnesarete guttifera* may be pale ventrally. 15

15. The hind wing is 25 to 30 mm long. The ventral surface of the metathorax of fully mature specimens is uniformly black, but that of young specimens may be pale (**Fig. 3.1.113**). Length of female abdomen: c. 31 mm.
.....*Mnesarete guttifera* (Selys, 1873) (Paraguay, Argentina, Mato Grosso, Brasilia, Goiás, Bahia, Minas Gerais, São Paulo, Paraná). Syn: *Lais guttifera* Selys, 1873.

- The hind wing is 23 to 25 mm long. The ventral surface of the metathorax is black in the middle and along the medial and lateral borders of the metasternum (**Fig. 3.1.107**). 16

16. The color of the postclypeus is dark metallic blue, and the epicranium is dark metallic green. The intersternite is straight with an inconspicuous or obsolete anterior "shoulder." There is a mid-dorsal, a dorsolateral, and about five ventrolateral spines on each side of the posterior margin of the tenth abdominal segment. The superior anal appendage is as long as the tenth abdominal

segment, and its apex is acuminate and directed posteriad (**Fig. 3.1.107**). The wings are hyaline. Length of female abdomen: 30 to 32 mm. Hind wing length: 23 to 25 mm.
.....*Mnesarete astrape* De Marmels, 1989 (Venezuela, Amazonas, Pará).
- Both the postclypeus and the epicranium are metallic green. The intersternite has an obvious anterior "shoulder." There is only a mid-dorsal spine and three ventrolateral spines on each side of the posterior margin of the tenth abdominal segment. The superior anal appendage is shorter than the tenth abdominal segment (**Fig. 3.1.117**). The wings have a yellowish tinge. The two females that key out to the next couplet are still considered indistinguishable, raising the question about the validity of the newest of the nominal species. 17
17. The superior anal appendage is directed ventrad; the space between the ventralmost of the three ventrolateral spine and the other two on the posterior margin of the tenth abdominal segment is greater than the space between the other two. Hind wing length: 22 to 24 mm.
.....*Mnesarete smaragdina* (Selys, 1869) (Pará). Syn: *Lais smaragdina* non Selys, 1869. Misidentified by Longfield (1929).
- The superior anal appendage is directed posteriad, and all three ventrolateral spines on the posterior margin of the tenth abdominal segment are close and equally spaced (**Fig. 3.1.110**). This species is especially large. Length of fore-wing: 42 to 47 mm; hind wing: 39 to 44 mm; abdomen: c. 48.5 mm.
.....*Mnesarete williamsoni* Garrison, 2006 (Pará).

Key to adult males in the genus *Hetaerina* reported from South America

Information for the keys was provided by Ris (1918) and Garrison (1990, 2006).

1. The small inferior anal appendage has a basal plate and median process. The distal process is only a small tubercle or point no more than 1/4 the length of the superior appendage. Some specimens of *Hetaerina sanguinea* have the distal process with a process drawn out to 1/3 the length of the superior process, but the shape of its superior appendage is characteristic (**Fig. 3.1.122**). 2
- The inferior anal appendages each have a fully developed distal process at least 1/4 as long as the superior appendage and one to three small teeth at the apex (**Fig. 3.1.123**). 5
2. The basal half of the superior appendage has a strong, nearly transverse ridge. The middle margin of the appendage is nearly straight and not differentiated (**Fig. 3.1.124**).
.....*Hetaerina miniata* Selys, 1879 (Guatamala to Ecuador, Colombia, Venezuela).

- The basal half of the superior appendage lacks a strongly elevated transverse ridge. The middle margin of the superior appendage has at least a lobe in the middle (**Fig. 3.1.122**). 3

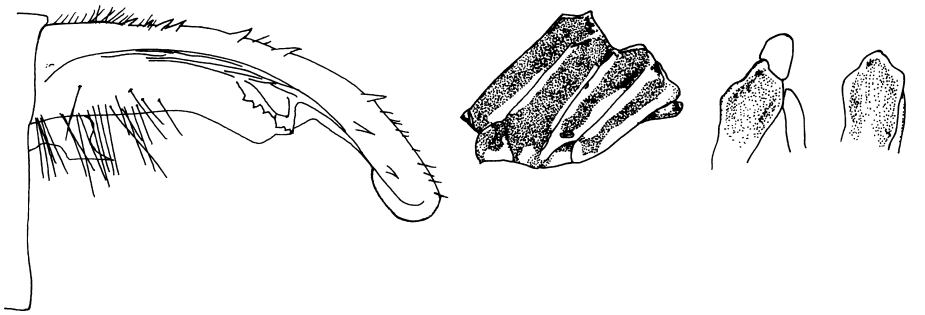


Fig. 3.1.122 *Hetaerina majuscula* (left to right): superior anal appendage of a male in dorsal view, pattern on the synthorax of a female in lateral view, and apices of the intersternites of two female specimens. Based on Ris (1918) and Garrison (1990).

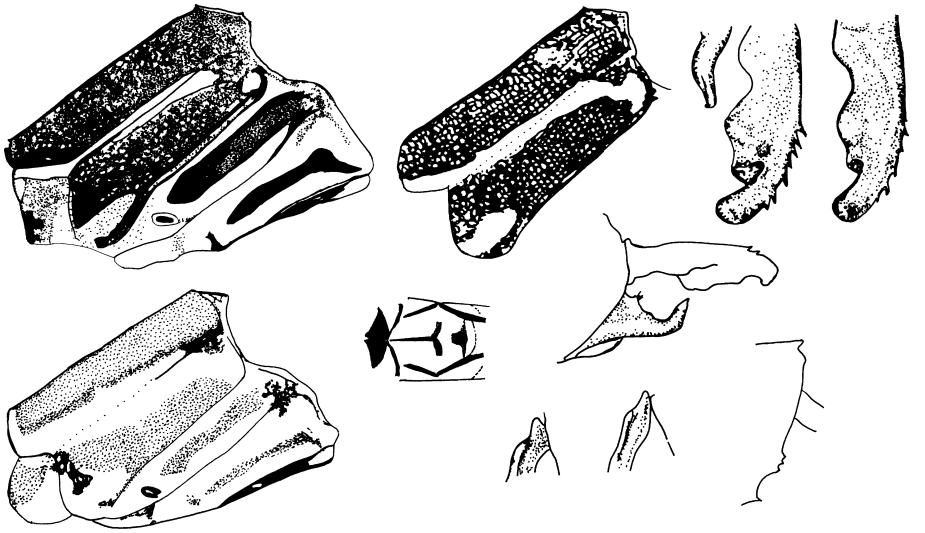


Fig. 3.1.123 *Hetaerina curvicauda:* pattern on the synthorax of a male with a variation to its right (upper left) and that of a female (lower left), ventral pattern on the male metathorax (left center), apex of the male abdomen in lateral view (right center), anal appendages of a male in dorsomedial and dorsal view (upper right, left and right, respectively), intersternites of two females (lower right center), and lateral posterior margin of the tenth abdominal segment of a female showing the three ventrolateral spines (lower right). Based on Garrison (1990).

3. The apex of the hind wing has only a small red spot. The epicranium with the postclypeus is a metallic copper red. The labrum is yellow. The basomesal process of the inferior appendage is thumb-like and as long as the distal process (**Fig. 3.1.125**). The pterostigma is absent. The third segment of the penis is deeply divided to form two curving processes (**Fig. 3.1.6**).
.....*Hetaerina sanguinea* Selys, 1853
(Colombia, Ecuador, Peru, Venezuela, Bolivia, Argentina, Amazonas). Syn: *Hetaerina brevistyla* Selys, 1879.
- The apices of both the front and hind wings have small red spots. The epicranium is matt black. The postclypeus is blue green or brilliant green. The labrum is black. The basomesal process of the inferior appendage is rudimentary (**Fig. 3.1.122**). A pterostigma is usually present. 4
4. The superior anal appendage has a widened median lobe that is not notched or bilobed on its basal half. The basal half of the appendage is wider than the distal half (**Fig. 3.1.91**). Length of male abdomen: 38 to 41 mm; female abdomen: 30 to 36 mm. Fore-wing length: 28.5 to 32 mm.
.....*Hetaerina capitalis* Selys, 1873
(Mexico, Central America, Colombia, Venezuela, Ecuador). Syn: *Hetaerina tolteca* Calvert, 1901; *Hetaerina capitalis* var. *colombiana* Navás, 1923; *Hetaerina crassidens* De Marmels, 1982, *nomen nudum*; probably *Hetaerina maxima* McLachlan, 1879; probably *Hetaerina smaragdalis* De Marmels, 1985.
- The superior anal appendage has a weakly notched lobe on its distal half; viewed mediodorsally, the basal half is narrower than the distal half. The thorax is a metallic coppery black. The second through seventh abdominal tergites often have a purple luster (**Fig. 3.1.122**).
.....*Hetaerina majuscula* Selys, 1853
(Costa Rica to Colombia, Guyana, and Surinam).
5. The labrum is dark metallic green. The pale areas on the thorax are bluish gray. A small pterostigma is always present. The marks at the bases of the fore and hind wing and the apex of the hind wing of the male are vivid red. The bases of the female wings are vaguely clouded with brown (**Fig. 3.1.126**).
.....*Hetaerina sempronia* Hagen in Selys, 1853
(Mexico to Colombia),
- The labrum is not metallic or green. 6
6. The distal process of the inferior appendage is enlarged and dorsoventrally flattened distally. Length of male abdomen: 33 to 41 mm. Fore-wing length of male: 25.5 to 33 mm. The thorax is dark metallic red with reddish brown markings (**Fig. 3.1.127**).
.....*Hetaerina occisa* Hagen in Selys, 1853
(Mexico, Central America, Trinidad, Colombia, Venezuela, Ecuador, Peru, Brazil). Syn: *Hetaerina macropus* Selys, 1853; *Hetaerina heterosticta* Selys, 1854; *Hetaerina occisa* race *albistigma* Hagen in Selys, 1853; *Hetaerina occisa* var. *asticta* Selys, 1873; *Hetaerina occisa* var. *sublimbata* Selys, 1873.
- The distal process of the inferior appendage is not enlarged at the apex (**Fig. 3.1.128**). 7

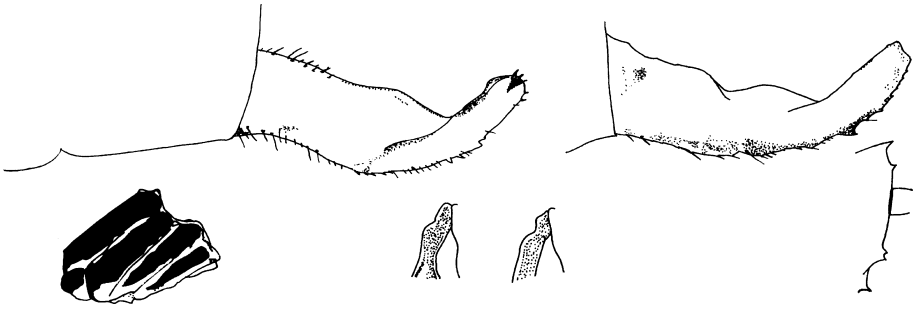


Fig. 3.1.124 *Hetaerina miniata:* slightly varying superior anal appendages of two specimens (above), and (below, left to right): pattern on the synthorax of a female in lateral view, apices of the intersternites of two females, and posterior margin of the tenth abdominal segment of a female in lateral view. Based on Eaton and Calvert (1892-1908) and Garrison (1990).

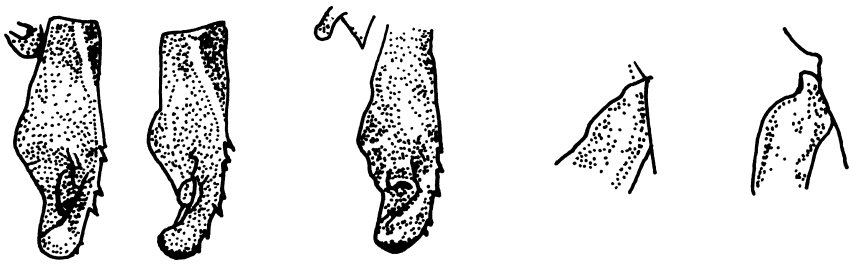


Fig. 3.1.25 *Hetaerina sanguinea* (left to right): superior anal appendages of a male in dorsomedial and dorsal view and those of a different specimen in dorsomedial view, and the apices of the intersternites of two females. Based on Garrison (1990).

7. Viewed laterally, the inferior anal appendage is strongly curved (**Fig. 3.1.123**).
.....*Hetaerina curvicauda* Garrison, 1990 (Peru, Bolivia, Rondônia).
- The inferior anal appendage appears straight when viewed laterally (**Fig. 3.1.128**). 8
8. Part of the metepisternum is metallic green (**Fig. 3.1.129**). 9
- The thorax is mainly metallic red to dull brown interspersed with pale lines along the thoracic sutures. There is no metallic green on the metepisternum (**Fig. 3.1.130**). 13

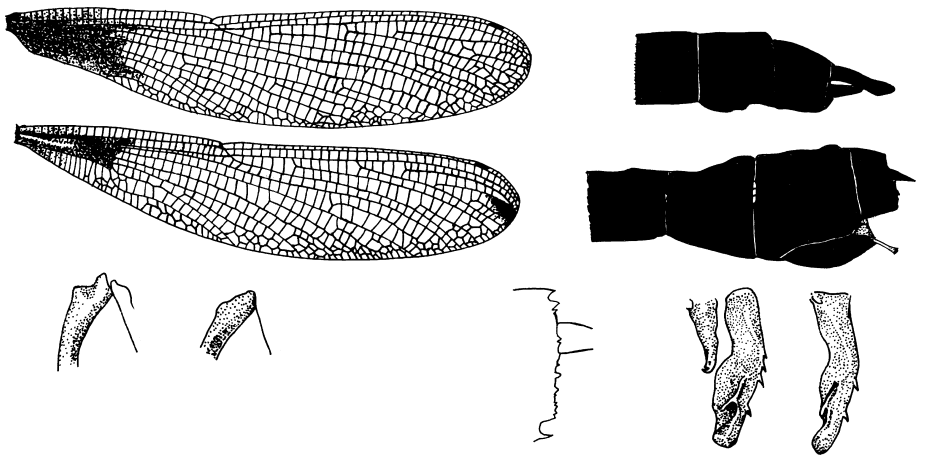


Fig. 3.1.126 *Hetaerina sempronia:* fore and hind wing of a male (upper left) and the apical segments of a male (upper right) and a female abdomen (middle right) in lateral view, apices of the intersternites of two females (lower left), outline of the posterior margin of the tenth abdominal segment in lateral view (lower right center), and the anal appendages of a male in dorsomedial and dorsal view. Based, in part, on Garrison (1990).

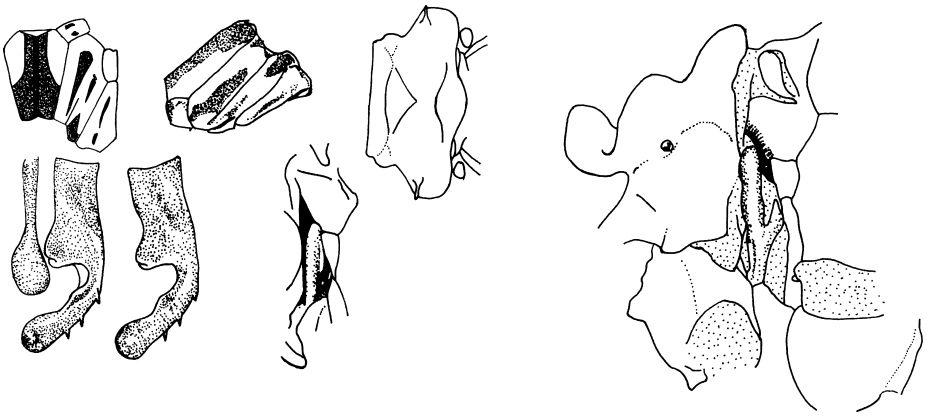


Fig. 3.1.127 *Hetaerina occisa:* diagram of the color pattern on the synthorax of a male (upper left) and lateral view of the synthorax of a female (upper left center), female prothorax and anterior part of the synthorax in dorsal (upper center) and in lateral view enlarged (right), anal appendages of the male in dorsomedial and dorsal view (lower left), and female intersternite in lateral view (lower left center). Based on Ris (1918), who presented his illustration under the synonym, *Hetaerina macropus,* and Garrison (1990).

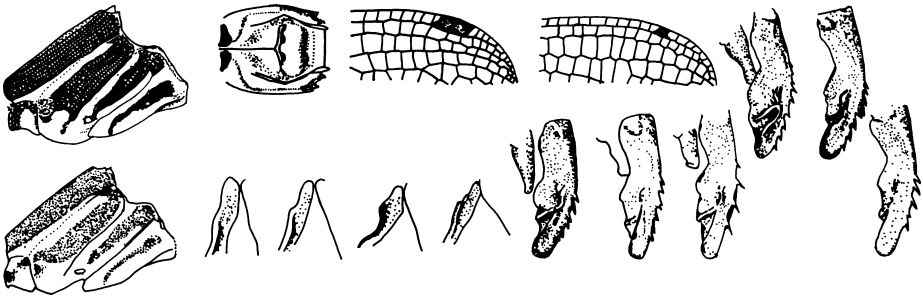


Fig. 3.1.128 *Hetaerina westfalli* (above, left to right): synthorax of a male in lateral and ventral view, apices of two hind wings of males, the anal appendages of a male in dorsomedial and dorsal view, and (below, left to right): synthorax of a female in lateral view, intersternites of four female specimens in lateral view, and the anal appendages of three male specimens in dorsomedial view and one in dorsal view. Based on Garrison (1990).

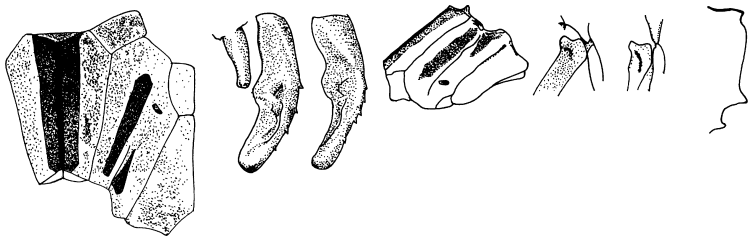


Fig. 3.1.129 *Hetaerina cruentata* (left to right): diagram of the color pattern on the synthorax of a male, anal appendages of a male in dorsomedial and dorsal view, synthorax of a female in lateral view, apices to the intersternites of two females, and the outline of the posterior margin of the tenth abdominal segment in lateral view. Based on Ris (1918) and Garrison (1990).

Fig. 3.1.130 *Hetaerina erythrokalamus* male (left to right): synthorax in lateral view, metasternal part of the synthorax in ventral view, spine at the posterolateral corner of the tenth abdominal segment in dorsal view, and the anal appendages in dorsal and dorsomedial view. Based on Garrison (1990).

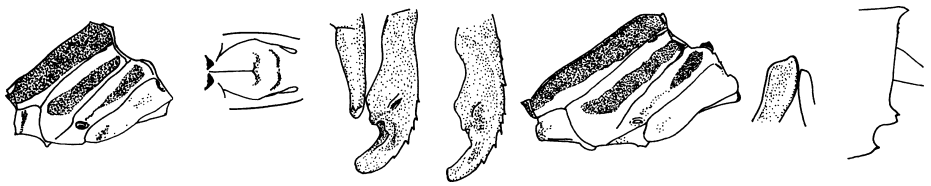


Fig. 3.1.131 *Hetaerina flavipennis* (left to right): synthorax of a male in lateral and ventral view, anal appendages of a male in dorsomedial and dorsal view, synthorax of a female in lateral view, apex of the female intersternite, and outline of the posterior margin of the tenth abdominal segment of a female in lateral view. Based on Garrison (1990).

9. Metallic green coloration is confined to a well-defined inverted wedge-shaped spot on the dorsal end of the metepisternum. The middle margin of the superior appendage is slightly curved with a small median lobe, when viewed mediodorsally. The basal third of the appendage is about as wide as the distal third (**Fig. 3.1.129**). Length of male abdomen: 33 to 40.5 mm. Hind wing length of male: 20 to 29.5 mm.
.....*Hetaerina cruentata* (Rambur, 1842) (Mexico, Central America, Colombia, Peru, Venezuela, Surinam, Brazil?). Syn: *Calopteryx cruentata* Rambur, 1842; *Calopteryx luteola* Rambur, 1842; *Hetaerina brasiliensis* Selys, 1853, *nomen nudum*; *Hetaerina lineata* Hagen in Selys, 1853, *nomen nudum*.
- Metallic green coloration on the metepisternum is at least on part of its edge. The middle margin of the superior appendage is not slightly curved, or if it is, then the basal third is much thicker than the distal third (**Fig. 3.1.131**). 10
10. The apex of the hind wing, and sometimes also the fore wing, has a red spot (**Fig. 3.1.131**). 11
- The apex of the hind wing, and sometimes also the fore wing, has an ill-defined brown spot, or the wing apices are hyaline (**Fig. 3.1.128**). 12
11. The dorsal process of the inferior anal appendage is about 2/3 as long as the superior appendage; at its apex, it forms an incurved tooth (**Fig. 3.1.131**).
.....*Hetaerina flavipennis* Garrison, 1990 (Ecuador).
- There is a red spot at the apex of the hind wing and sometimes at the apex of the fore-wing, as well. The distal process of the inferior appendage is about half as long as the superior; its tip is blunt and armed with two or three small

incurved teeth (**Fig. 3.1.132**). Length of abdomen: c. 40 mm. Length of hind wing: c. 30 mm.

.....*Hetaerina laesa* Hagen in Selys, 1853 (Peru, Venezuela, Guyana, Surinam, French Guiana, Pará, Rondônia, Mato Grosso). Syn: *Hetaerina klugi* Schmidt, 1943; *Hetaerina papavarina* Fraser, 1946.

12. The transverse carina on the superior appendage is indistinct. The fore and hind wing tips are nearly hyaline (**Fig. 3.1.133**). Length of male abdomen: 34 to 42 mm. Hind wing length of male: 24.5 to 31.5 mm.

.....*Hetaerina vulnerata* Hagen in Selys, 1853 pars (Southern United States to Colombia). There is a form of this species without a pterostigma found in northern Mexico).

- There is a well-defined transverse ridge and median lobe on the superior anal appendage, on which the transverse carina is distinct; its upper edge meets the anterior ridge at an acute angle. The apex of the fore-wing is hyaline; that of the hind wing has a diffuse brown spot (**Fig. 3.1.128**). The small pterostigma is usually present, but it is absent from some specimens from Rondônia.

.....*Hetaerina westfalli* Rácenis, 1968 pars (Venezuela, Amazonas, Roraima, Rondônia, Mato Grosso).

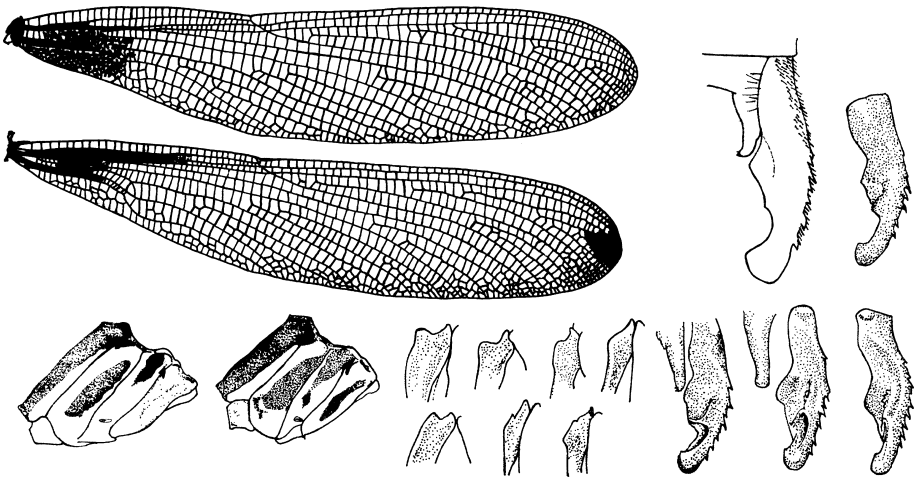


Fig. 3.1.132 *Hetaerina laesa* (above, left to right): fore and hind wing of a male, male anal appendages on the right side in dorsal view, and superior anal appendage of a different male in dorsal view on a smaller scale, and (below, left to right): synthoraces of two female specimens with different color patterns, apices of seven intersternites from different female specimens, anal appendages of two male specimens in dorsomedial view, and one in dorsal view. Based on Garrison (1990) and the illustration labeled *Hetaerina klugi* by Schmidt (1943).

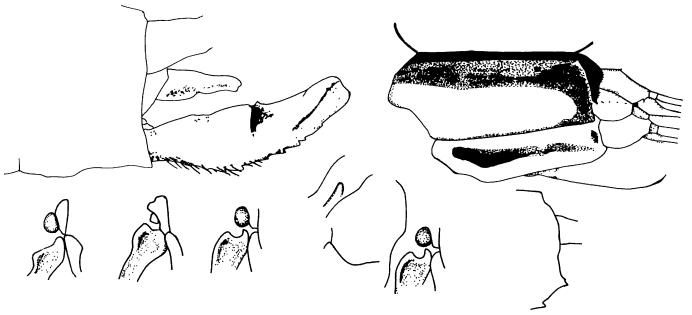


Fig. 3.1.133 *Hetaerina vulnerata:* apex of the male abdomen with the anal appendages on only one side shown in oblique view (upper left), left side of the female mesothorax in dorsal view (upper right), and (below, left to right): apices of the intersternites of three female specimens, prothorax and intersternite showing the prothoracic horn, and profile of the posterior margin of the tenth abdominal segment of the female in lateral view. Based on Eaton and Calvert (1892-1908) and Garrison (1990).

13. Each wing has a pterostigma. 14
 - The wings lack pterostigmata (**Fig. 3.1.134**). 18

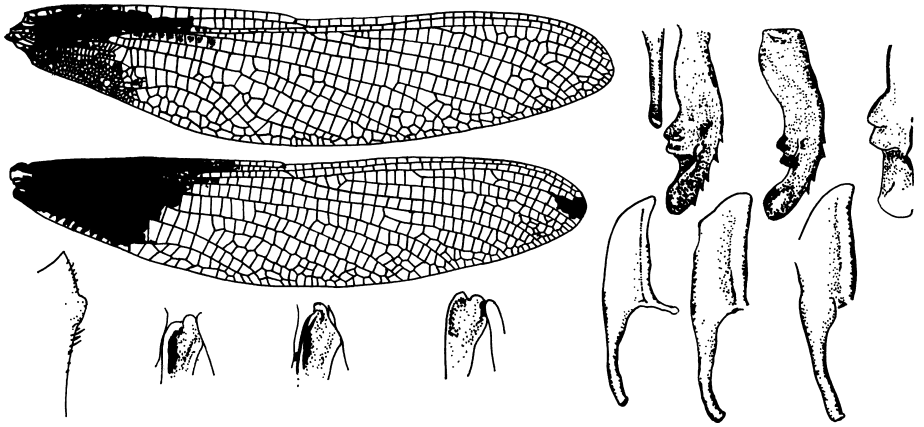


Fig. 3.1.134 *Hetaerina rosea:* fore and hind wing of a male (upper left), posterior margin of the occipital margin on the right side of a female (lower left), intersternites of three female specimens (lower center), anal appendages of a male in dorsomedial and dorsal view (upper right center), portions of the medial lobe on the male superior anal appendage (upper right), distal process of the inferior anal appendage of three male specimens, one showing the basomesal process (lower right). Based on Ris (1913) and Garrison (1990).

14. The hind wing displays a bright red spot (**Fig. 3.1.135**). 15
- The apex of the hind wing is almost hyaline, or it is vaguely clouded with brown (**Fig. 3.1.136**). 17
15. The mid-dorsal carina on the tenth abdominal segment forms a slender, sharp spine extending beyond the posterior margin of the tergite (lacking in a brown male from Surinam). A small pterostigma is present. All four wings have bright red markings both at the base and at the apex (**Fig. 3.1.135**). Total length of male: c. 39.5 mm. Length of male abdomen including appendages: c. 32.5 mm. Hind wing length of male: c. 24 mm. The general color is metallic black with greenish or bluish green reflections. There are few paler markings, which are mostly brownish or beige.
.....*Hetaerina gallardi* Machet, 1989 (French Guiana, Surinam).
- The mid-dorsal carina on the tenth abdominal segment ends as an elevated ridge or disappears altogether (**Fig. 3.1.137**). The apex of the fore-wing is hyaline. 16

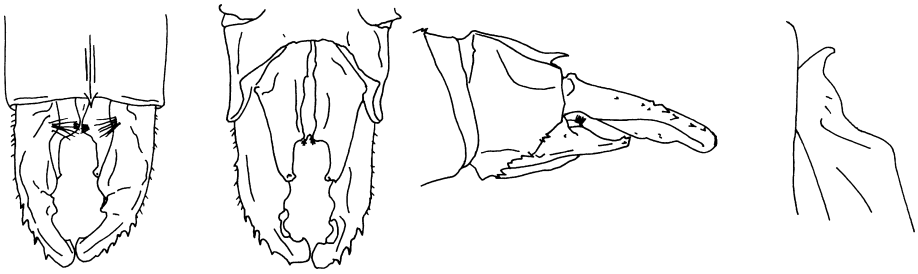


Fig. 3.1.135 *Hetaerina gallardi* (left to right): apex of the male abdomen in dorsal, ventral, and lateral view; the intersternite of a female. Based on Machet (1989).

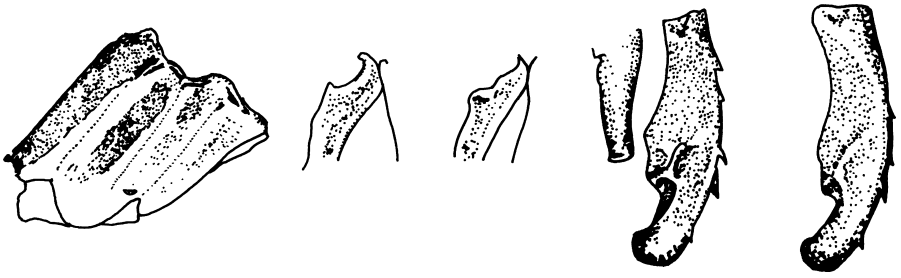


Fig. 3.1.136 *Hetaerina moribunda* (left to right): synthorax of a female in lateral view, apices of two female intersternites in lateral view, and anal appendages of a male in dorsomedial and dorsal view. Based on Garrison (1990).

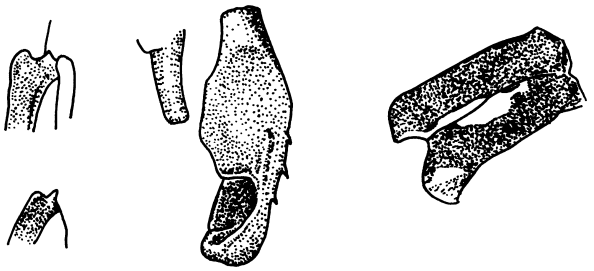


Fig. 3.1.137 *Hetaerina brightwelli* (left to right): intersternites of two female specimens, anal appendages of a male in dorsomedial view, and the pattern on the female synthorax in lateral view. Based on Garrison (1990, 2006).

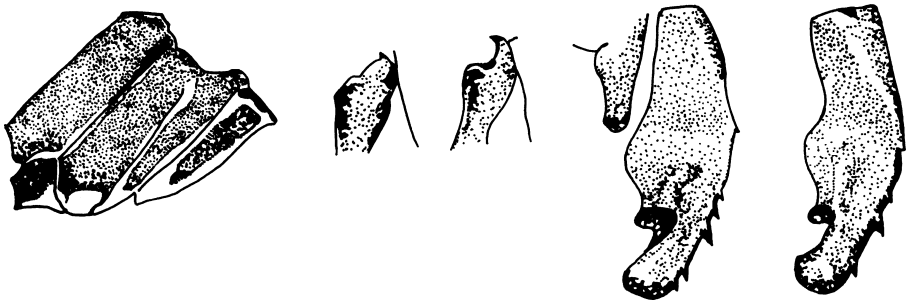


Fig. 3.1.138 *Hetaerina medinai* (left to right): synthorax of a female in lateral view, apices of the intersternites of two female specimens, and anal appendages of a male in dorsomedial and dorsal view. Based on Garrison (1990).

16. Viewed dorsally, the superior appendage has a prominent superior ridge that passes the transverse ridge anteriorly. The distal fossa is large, and its ventral margin extends distally nearly to the tip of the appendage (**Fig. 3.1.137**).
.....*Hetaerina brightwelli* (Kirby, 1823)
(Pará, Rio de Janeiro, São Paulo). Syn: *Agrion brightwelli* Kirby, 1823.
- Viewed dorsally, the ridge of the superior appendage does not pass the transverse ridge anteriorly. The distal fossa is not large, and its dorsal end is not visible (**Fig. 3.1.138**).
.....*Hetaerina medinai* Rácenis, 1968
(Venezuela, Amazonas).
17. Tip of the distal process of the inferior appendage ends in a small, blunt, incurved tooth. Viewed mid-dorsally, the superior appendage has a slightly curved dorsal end on its transverse ridge, which meets the superior ridge to make the distal fossa semi-circular. The basal half of the medial margin of the superior appendage is deeply concave (**Fig. 3.1.136**). There is no metallic green

coloration on the thorax. The mid-dorsal carina of the tenth abdominal segment terminates in a sharp spine that passes the posterior margin of the tergite. .....*Hetaerina moribunda* Hagen in Selys, 1853 (Venezuela, Guyana, French Guiana, Surinam, Ecuador, Amazonas, Rondônia, Mato Grosso).

- Distal process of the inferior appendage is blunt at the tip and ends in two or three small, recurved teeth. Viewed mid-dorsally, the superior appendage has a transverse ridge that meets the superior ridge at an acute angle, making the distal fossa triangular. The medial margin of the superior appendage is strongly convex or concavely angular on the basal half. Usually there is a metallic green triangle on the dorsal end of the mesepimeron. The mid-dorsal carina of the tenth abdominal segment terminates in a keel or a small spine that does not pass the posterior margin of the tergite (**Fig. 3.1.129**). .....*Hetaerina westfalli* Rácenis, 1968 pars (Southern Venezuela, Amazonas, Rondônia, Mato Grosso).

18. The mid-dorsal carina of the tenth abdominal segment forms a spine that passes the posterior margin of the segment (**Fig. 3.1.139**). 19

- The mid-dorsal carina of the tenth abdominal segment ends posteriorly as an elevated ridge or disappears altogether (**Fig. 3.1.140**). 21

19. The wings are red at their apices. The distal process of the inferior anal appendage is about 2/3 the length of the superior appendage; its acute tip is armed with one recurved tooth, often followed basally by another smaller one (**Fig. 3.1.139**). Length of abdomen of male: 41 to 43 mm; female: 32 to 36 mm. Hind wing length of male: 30 to 31.5 mm; female: 29 to 33 mm. .....*Hetaerina charca* Calvert, 1909 (Ecuador, Peru, Bolivia).

- The wings are hyaline or brown at their apices. The distal process of the inferior anal appendage is no longer than 2/3 as long as the superior appendage; its truncate tip armed with two or three small recurved teeth (**Fig. 3.1.141**). 20

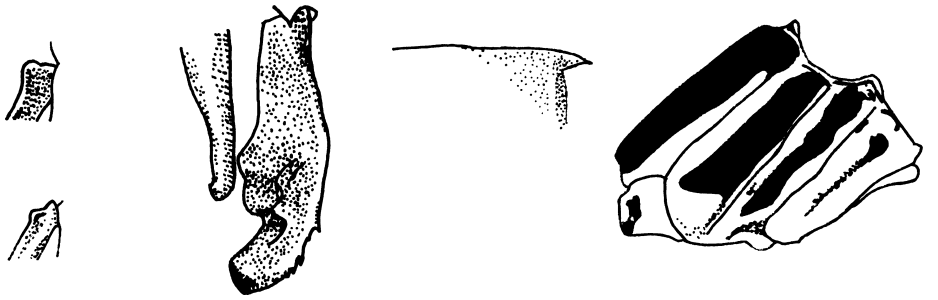


Fig. 3.1.139 *Hetaerina charca* (left to right): apices of the intersternites of two females, anal appendages of a male in dorsomedial view, posterior corner of the tenth abdominal segment of a male in dorsal view, and synthorax of a female in lateral view. Based on Garrison (1990, 2006).

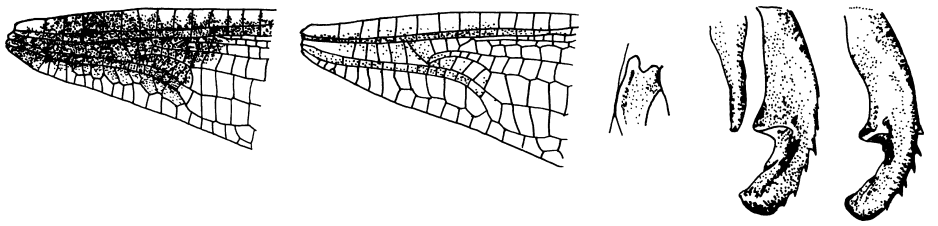


Fig. 3.1.140 *Hetaerina auripennis* (left to right): the basal section of the hind wings of two males, apex of the intersternite of a female, anal appendages of a male in dorsomedial and dorsal view. Based on Garrison (1990).

Fig. 3.1.141 *Hetaerina fuscoguttata* (left to right): male anal appendages in oblique view, superior anal appendage with the outline on one side of the tenth abdominal segment in dorsal view, one posterior corner of the tenth abdominal segment of a male in dorsal view (above), and apices of two female intersternites. Based on Eaton and Calvert (1892-1908) and Garrison (1990).

20. Wing tips hyaline or with only a slight tinge of brown. Viewed dorsally, the superior appendage has two prominent teeth, the first of which is an isolated superior tooth anterior to the transverse ridge. The second is formed by the junction of the transverse ridge and the superior ridge. Viewed mediodorsally, the isolated superior tooth appears like a mound and is not diagonally placed across the median lobe, which forms an evenly convex curve (**Fig. 3.1.130**). The entire labrum is brown.
.....*Hetaerina erythrokalamus* Garrison, 1990 (Guyana, Venezuela, Roraima).
- Wing tips with brown spots, never hyaline. Viewed dorsally, the superior appendage appears to have no prominent teeth. The superior tooth anterior to the transverse ridge is ill-defined, forming a low, diagonally directed mound. The labrum is brown, usually with a white spot on each side (**Fig. 3.1.141**).
.....*Hetaerina fuscoguttata* Selys, 1878 (Costa Rica, Panama, Colombia, Venezuela, Ecuador; a doubtful report from Mato Grosso).

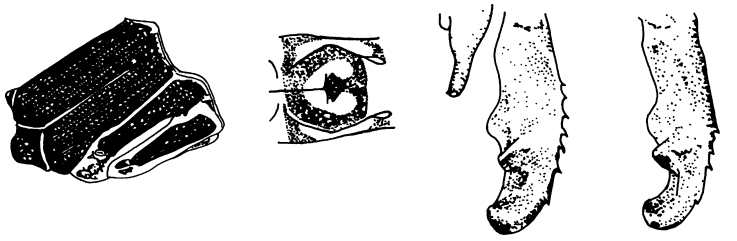


Fig. 3.1.142 *Hetaerina indeprensa* male (left to right): synthorax in lateral view and posterior part in ventral view; anal appendages in dorsomedial and dorsal view. Based on Garrison (1990).

21. The distal process of the inferior appendage terminates in a single recurved tooth or is narrowly blunt without teeth, or blunt with no more than two teeth, one of which is small and difficult to see. Hind wings are hyaline or have an apical red spot (**Fig. 3.1.140**). 22
- The distal process of the inferior appendage has a blunt, truncate tip terminating in two or three small recurved teeth. The distal process is 1/4 to 1/3 as long as the superior appendage (**Fig. 3.1.142**). 27

Fig. 3.1.143 *Hetaerina amazonica* (left to right): synthorax of a female in lateral view, apices of the intersternites of two females in lateral view, anal appendages of a male in mediodorsal and dorsal view. Based on Garrison (1990).

22. The basomesal process of the male inferior anal appendage is a small tubercle. The distal process of the inferior appendage is about half the length of the superior appendage. The median lobe of the superior appendage forms a slight semi-circular curve (**Fig. 3.1.143**).
.....*Hetaerina amazonica* Sjöstedt, 1918 (Venezuela, Pará, Amazonas).

- The basomesal process of the male inferior anal appendage is well developed and forms a thumb-like process. The distal process of the inferior appendage is about 2/3 the length of the superior appendage. The median lobe is bilobed or acute (**Fig. 3.1.140**). 23

23. The superior appendage has an acute median lobe forming one tooth, and its posterior margin is formed by a transverse ridge. The occipital tubercles are small and poorly developed (**Fig. 3.1.140**).
.....*Hetaerina auripennis* (Burmeister, 1839)
(Pará, Amazonas, Rondônia, Mato Grosso, São Paulo, Espirito Santo). Syn: *Calopteryx auripennis* Burmeister, 1839; *Hetaerina divina* Hagen in Selys, 1854; *Hetaerina purpurea* Selys, 1854.

- The superior appendage has a bilobed median lobe, appearing to have either two medially directed teeth or two blunt lobes; sometimes the appendage must be rotated to make the lobes visible (**Fig. 3.1.144**). The occipital tubercles are prominent and well developed. 24

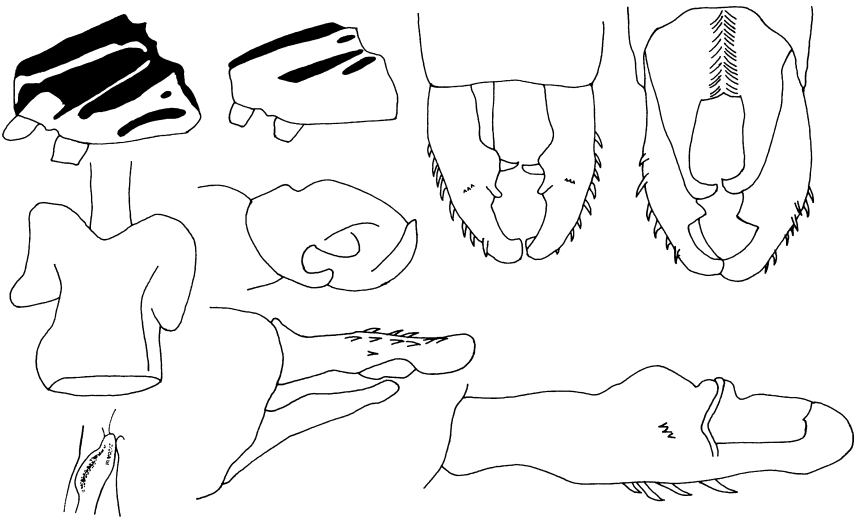


Fig. 3.1.144 *Hetaerina mendezi* (upper row, left to right): color pattern on the lateral surfaces of the synthoraces of a male and a female, apex of the male abdomen in dorsal and ventral view, and (middle left): penis in ventral and lateral view, and (below, left to right): apex of the female intersternite, apex of the male abdomen in lateral view, and inner side of the male superior anal appendage. Based on Jurzitza (1982b) and Garrison (1990).

24. The superior ridge of the superior appendage meets the transverse ridge in a slight curve and does not continue anteriad beyond the transverse ridge. The distal process of the inferior appendage forms a large recurved tooth oriented at 90^{o} where it meets the posterior 1/5 of the appendage (**Fig. 3.1.144**). Length of

male abdomen, including appendages: c. 34 mm; female: c. 27 mm. Hind wing length: c. 25 mm. The male is mainly black and yellowish brown, with a coppery reddish mesepisternum.
.....*Hetaerina mendezi* Jurzitza, 1982
(Argentina, Santa Catarina).
- The superior ridge of the superior appendage continues anteriad beyond the transverse ridge, which is evident when viewed dorsally. The distal process of the inferior appendage proceeds linearly, or if a distal recurved tooth is present, then this structure is small and occupies only the distal 1/10 of the appendage (**Fig. 3.1.145**). 25

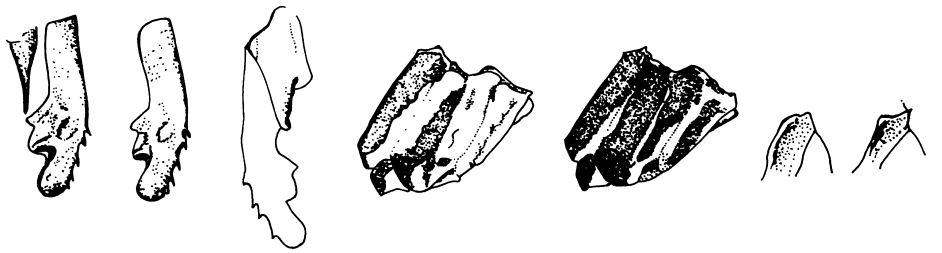


Fig. 3.1.145 *Hetaerina mortua* (left to right): anal appendages of a male in dorsomedial, dorsal, and ventral view; lateral view of the synthoraces of two females, and the intersternites of two females. Based on Garrison (1990).

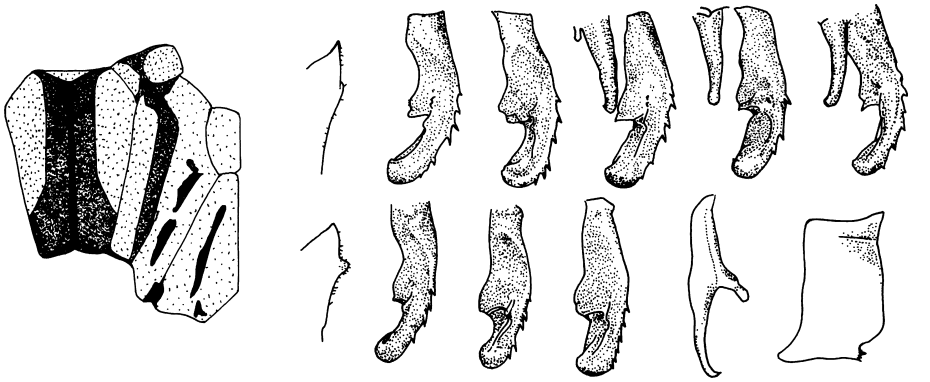


Fig. 3.1.146 *Hetaerina caja* (left): diagram of the color pattern on the synthorax of a male, and (upper row, left to right): posterolateral corner of the head of *Hetaerina caja caja,* superior anal appendages of *H. c. caja* in dorsal view, anal appendages of *H. c. caja* in dorsomedial view, and (lower row, left to right): posterolateral corner of the head of *Hetaerina caja dominula,* superior anal appendages of *H. c. dominula* in dorsal view, male inferior anal appendage of an unspecified subspecies, and lateral view of the tenth abdominal segment of *H. c. caja.* Based on Ris (1918) and Garrison (1990).

25. The distal process of the inferior appendage ends in an acute point (**Fig. 3.1.145**).
.....*Hetaerina mortua* Hagen in Selys, 1853 (Venezuela, Guyana, French Guiana, Surinam, Rondônia, Roraima).
- The dorsal process of the inferior appendage either ends in a recurved tooth or is slightly spatulate (**Fig. 3.1.134**). 26

Fig. 3.1.147 *Hetaerina duplex* (left to right): apex of the abdomen of a male with the superior anal appendage on one side removed, anal appendages of a male in dorsomedial and dorsal view, and apex of the female intersternite. Based on Ris (1918) and Garrison (1990).

26. The lengths of the median lobe and the distal 1/3 of the superior appendage are approximately equal. The posterior end of the median lobe meets the superior ridge at a right or obtuse angle. The dorsal process of the inferior appendage is completely linear or has a slight, medially directed blunt tooth. The hind wing of the male is usually reddish at the base and has a reddish spot at the apex (**Fig. 3.1.134**). Length of male abdomen: 36 to 37 mm; female: 31 to 32 mm. Fore-wing length: c. 25 mm. Hind wing length: 24.5 to 30 mm.
.....*Hetaerina rosea* Selys, 1853 (Peru, Bolivia, Paraguay, Uruguay, Argentina, Bahia, Minas Gerais, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso, Rondônia). Syn: *Hetaerina donna* Selys, 1873.
- Length of the median lobe is about half that of the distal 1/3 of the superior appendage. The posterior end of the median lobe meets the superior ridge at a slightly acute angle. The posterior 1/10 of the distal process of the inferior appendage usually forms a recurved tooth (**Fig. 3.1.146**).
.....*Hetaerina caja* (Drury, 1773) (Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana). Syn: *Libellula caja* Drury, 1773; *Hetaerina hera* Hagen in Selys, 1853, *nomen nudum*. Two subspecies are recognized: *Hetaerina caja caja* (Drury, 1773) from Mexico and Trinidad to Peru, distinguished by small and inconspicuous postoccipital tubercles, which are sometimes absent,

and a median lobe divided into a bluntly rounded anterior and an acute posterior lobe by a cleft; *Hetaerina caja dominula* Hagen in Selys, 1853, from Guyana, French Guiana, Surinam, Venezuela, Brazil, and possibly Argentina, characterized by large and conspicuous postoccipital tubercles and a median lobe divided into two bluntly rounded lobes by a cleft (**Fig. 3.1.146**).

27. The apex of the hind wing has a brown tinge or is hyaline (**Fig. 3.1.142**). ..28
- The apex of the hind wing is red. 32

28. The hind wing tip is smoky brown or with a well defined brown spot and differs in coloration from the fore-wing tip. The labrum is mainly white with a narrow, well-defined brown median line, which is never wider than the width of each pale lateral spot (**Fig. 3.1.142**). 29
- The fore and hind wing tips are both the same color, either hyaline or slightly tinged with brown. The labrum is entirely black or dark brown, sometimes with small white lateral spots, which never exceed the width of the dark median part (**Fig. 3.1.147**). 30

29. Most of the superior ridge of the superior appendage is absent, but a vestige may be present near the distal end (**Fig. 3.1.142**). There is a well defined brown spot on the hind wing tip. The antennal scape is dark, except at the extreme base. .....*Hetaerina indeprensa* Garrison, 1990 (Pará).
- The superior ridge of the superior appendage is well defined. There is only a diffuse brown tinge on the hind wing tip. The antennal scape is pale (**Fig. 3.1.128**).
.....*Hetaerina westfalli* Rácenis, 1968 pars (Southern Venezuela, Amazonas, Rondônia, Mato Grosso; specimens with these characteristics only known from Amazonas).

30. Viewed mid-dorsally, the superior appendage has a small notch directly posterior to the median lobe followed by a small, sharp tooth (**Fig. 3.1.133**).
.....*Hetaerina vulnerata* Hagen in Selys, 1853 pars (Southern United States to Colombia).
- Viewed mid-dorsally, the superior appendage does not have a distinct notch proximal to a sharp tooth (**Fig. 3.1.147**). 31

31. The abdomen is 36 mm or longer. There are 26 to 30 antenodal cross veins. The superior appendage usually has a distinct ridge on the dorsal side anterior to the transverse ridge. Viewed dorsally, the middle margin appears to possess an inferior and a superior tooth (**Fig. 3.1.147**).
.....*Hetaerina duplex* Selys, 1869 (Colombia; reports suggest that the species may occur in Ecuador and Brazil).
- The abdomen is 29 to 35 mm long. There are 14 to 18 antenodal cross veins. The superior appendage lacks a distinct ridge on the dorsal side near the transverse ridge; an ill defined ridge is present anterior to and approximately parallel with the transverse ridge (**Fig. 3.1.148**).
.....*Hetaerina simplex* Selys, 1853, pars (Paraguay, Minas Gerais, possibly Pará). Syn: *Hetaerina perplex* Selys, 1869.

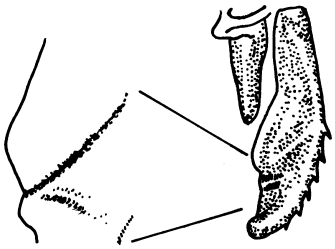


Fig. 3.1.148 *Hetaerina simplex* male: anal appendages in dorsal view (right) with an enlargement of the dorsal and transverse ridges (left), showing the angle they form. Based on Garrison (2006).

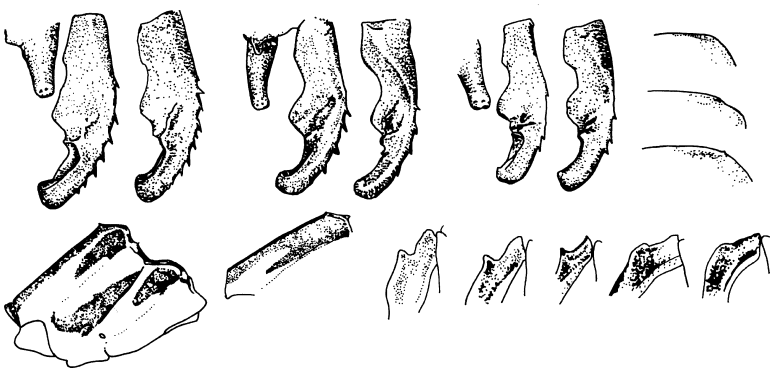


Fig. 3.1.149 *Hetaerina longipes* (above, left to right), anal appendages on the right side of three males in dorsomedial and dorsal view (each left and right, respectively); posterolateral corners of the tenth abdominal segments of three male specimens in lateral view; and (below, left to right): synthorax of a female in lateral view; upper part of the thorax of another specimen with a different color pattern; apices of the intersternites of five female specimens. Based on Garrison (1990).

32. The fore-wing is hyaline at the apex (**Fig. 3.1.148**). 33
- The fore-wing is red at the apex (**Fig. 3.1.149**). 35

33. The median lobe forms a gradually curving arc near the distal 1/3 of the superior appendage. The superior ridge is absent near the transverse ridge (**Fig. 3.1.148**).
.....*Hetaerina simplex* Selys, 1853, pars
(Paraguay, Minas Gerais, possibly Pará). Syn: *Hetaerina perplex* Selys, 1869.
- The median lobe is strongly arcuate in the middle of the superior appendage. The superior ridge is well developed anterior to the transverse ridge (**Fig. 3.1.150**). 34

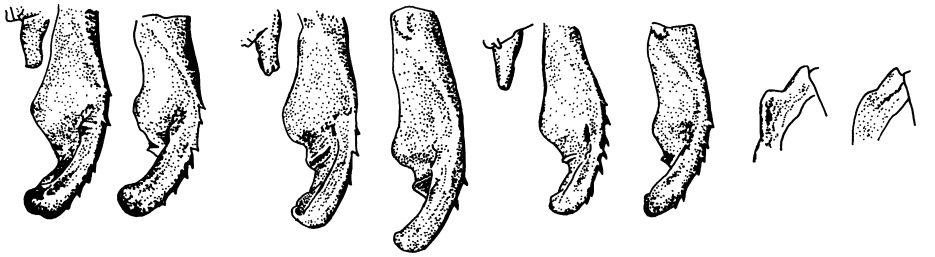


Fig. 3.1.150 *Hetaerina proxima* (left to right): the anal appendages of three male specimens, each in dorsomedial and dorsal view; intersternites of two females in lateral view. Based on Garrison (1990).

34. The distal process of the inferior appendage does not reach the widest part of the median lobe. Viewed mediodorsally, the middle margin is almost straight or slightly concave anterior to the median lobe (**Fig. 3.1.150**).
.....*Hetaerina proxima* Selys, 1853, pars (Argentina, Bolivia?, Paraná, São Paulo, Rio de Janeiro). Syn: *Hetaerina bogotensis* Förster, 1914, *nomen nudum*.
- The distal process of the inferior appendage is relatively long, reaching very nearly to the widest part of the median lobe. The middle margin anterior to the median lobe is angularly concave (**Fig. 3.1.151**).
.....*Hetaerina hebe* Selys, 1853 (Paraiba to Rio de Janeiro and Southeastern Brazil). Syn: *Hetaerina sanguinolenta* Hagen in Selys, 1853.

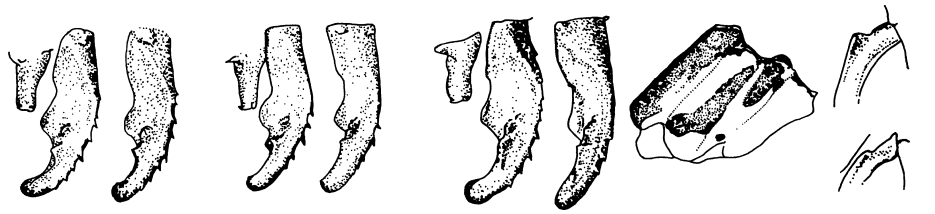


Fig. 3.1.151 *Hetaerina hebe* (left to right): the anal appendages of three male specimens, each in dorsomedial and dorsal view; female synthorax in lateral view; apices of the intersternites of two females (above and below). Based on Garrison (1990).

35. The distal process of the inferior appendage does not reach the widest part of the median lobe. The transverse ridge is confined to the middle part of the appendage and does not connect with the superior ridge (**Fig. 3.1.150**).
.....*Hetaerina proxima* Selys, 1853, pars (Argentina, Bolivia?, Paraná, São Paulo, Rio de Janeiro). Syn: *Hetaerina bogotensis* Förster, 1914, *nomen nudum*.
- The distal process of the inferior appendage is relatively long, reaching very nearly to the widest part of the median lobe. The transverse ridge is complete and connects with the superior ridge (**Fig. 3.1.149**). 36
36. The males of the species in this couplet are not positively distinguishable. Some specimens have a mid-dorsal carina on the tenth abdominal segment that terminates in a small spine and ends at about the level of the posterior margin of the segment (**Fig. 3.1.152**).
.....*Hetaerina aurora* Ris, 1918 (Colombia, Ecuador, Peru).
- Mid-dorsal carina on the tenth abdominal segment forms a low ridge. The appendages are highly variable (**Fig. 3.1.149**).
.....*Hetaerina longipes* Hagen in Selys, 1853 (Argentina, Paraguay, Rio de Janeiro, São Paulo, Santa Catarina). Syn: *Hetaerina carnifex* Hagen in Selys, 1853; *Hetaerina carnifex* race *fulgens* Selys, 1853.

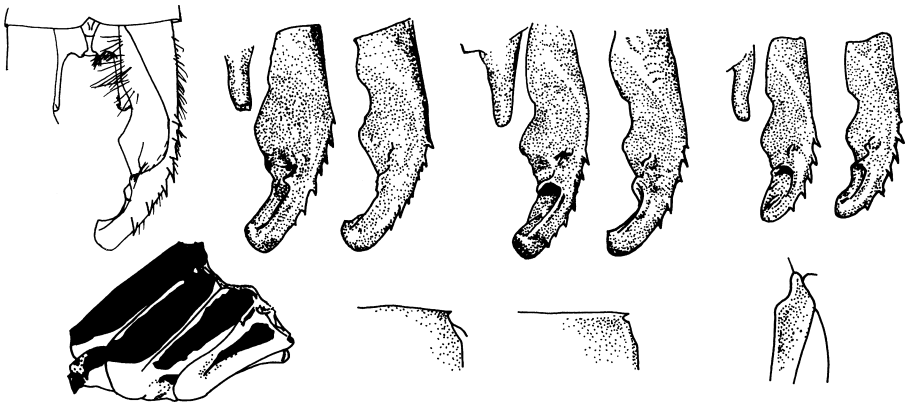


Fig. 3.1.152 *Hetaerina aurora* (above, left to right): apex of a male abdomen with the superior anal appendage on one side removed; anal appendages of three male specimens, each in dorsomedial and dorsal view; and (below, left to right): synthorax of a female in lateral view, posterolateral corners of the tenth abdominal segments of two males in dorsal view, and apex of a female intersternite. Based on Ris (1918) and Garrison (1990).

Tentative key to the adult females reported from South America

Information for the key was provided by Ris (1918), Machet (1989), and Garrison (1990). The females of *Hetaerina indeprensa* and *Hetaerina erythrokalamus* have not yet been described, and some can still not be distinguished with a reasonable degree of certainty.

1. The anterior arm of the intersternite forms a dorsally directed finger-like process. The prothorax has laterally directed horns (**Fig. 3.1.127**). A more detailed description of this species is needed.
.....*Hetaerina occisa* Hagen in Selys, 1853 (Mexico, Central America, Trinidad, Colombia, Venezuela, Ecuador, Peru, Brazil). Syn: *Hetaerina macropus* Selys, 1853; *Hetaerina heterosticta* Selys, 1854; *Hetaerina occisa* race *albistigma* Hagen in Selys, 1853; *Hetaerina occisa* var. *asticta* Selys, 1873; *Hetaerina occisa* var. *sublimbata* Selys, 1873.
- The dorsal end of the intersternite is planar and flattened, not finger-like and directed dorsad (**Fig. 3.1.135**). The prothorax lacks laterally directed horns, except on *H. vulnerata*. 2
2. There is a faint color pattern only on the first three abdominal segments. The remaining segments are often totally blackish metallic with bluish green reflections. All four wings are clouded yellow and have bright red basal and apical markings. The intersternite has a hook-like process at the dorsal end (**Fig. 3.1.135**). Total length of female: c. 35 mm. Length of female abdomen: c. 28 mm. Hind wing length of female: c. 25 mm. The general color is metallic black with greenish or bluish green reflections. There are few paler markings, which are mostly brownish, reddish, or beige.
.....*Hetaerina gallardi* Machet, 1989 (French Guiana, Surinam).
- The distinct color pattern on the abdomen is typically a dark metallic green or copper color on the dorsum, turning dark brown in older individuals. There is a thin pale mid-dorsal line. The line separating the dorsal green coloration and the pale lateral parts is straight. The green area on the dorsum often extends as ventral offshoots onto the posterior 1/5 of the sternites (**Fig. 3.1.123**). 3
3. The wing has a pterostigma (**Fig. 3.1.126**). 4
- The wing has no pterostigma (**Fig. 3.1.134**). 11
4. The color on the dark parts of the thorax is a dark metallic red.
.....5
- The color on the dark parts of the thorax is a dark metallic green. 6
5. The entire labrum and postclypeus are dark metallic blue green. The epicranium often has a metallic blue-green luster. The thorax has a metallic reddish copper color. There are three dorsal spines of equal length at the tip of the tenth abdominal segment (**Fig. 3.1.126**).
.....*Hetaerina sempronia* Hagen in Selys, 1853 (Mexico to Colombia).

- The labrum is ivory with an inverted black triangle along the basal margin. The postclypeus and epicranium are black with a slight metallic red luster. There are three spines on the tenth abdominal segment, but the middorsal spine is much longer than the dorsolaterals (**Fig. 3.1.124**).
.....*Hetaerina miniata* Selys, 1879 (Guatamala to Ecuador, Colombia, Venezuela).

6. The apex of the tenth abdominal segment has three spines on the dorsal side (**Fig. 3.1.91**). 7
- The apex of the tenth abdominal segment has only one long spine on the dorsal side (**Fig. 3.1.137**). 8

7. The intersternite is linear with a small anterior shoulder followed by a bluntly pointed or slightly rounded posterior branch. The vertex is deep black. The thorax is metallic green or coppery (**Fig. 3.1.91**). The wings are usually yellowish, darker near the apex. Length of male abdomen: 38 to 41 mm; female abdomen: 30 to 36 mm. Fore-wing length: 28.5 to 32 mm.
.....*Hetaerina capitalis* Selys, 1873 (Central America, Colombia, Ecuador, Venezuela).
- The intersternite is broad and flat, appearing slightly truncate; its dorsal margin is prominent and not emarginated. The superior anal appendage of the male has robust spines on its dorsal and lateral surfaces (**Fig. 3.1.122**). Length of male abdomen: 39 to 47 mm. Fore-wing length of male: 31 to 38 mm.
.....*Hetaerina majuscula* Selys, 1853 (Costa Rica to Colombia, Guyana, and Surinam).

8. The intersternite is broad with a well developed anterior branch almost as prominent as the posterior branch. The anterior margin of the green mesepimeral stripe is strongly concave, or it nearly covers the entire sternite (**Fig. 3.1.137**).
.....*Hetaerina brightwelli* (Kirby, 1823) (Pará, Rio de Janeiro, São Paulo). Syn: *Agrion brightwelli* Kirby, 1823.
- The intersternite is generally linear; if an anterior branch is present, it is small and poorly developed. The anterior margin of the mesepimeral stripe is straight or only slightly concave (**Fig. 3.1.138**). 9

9. The pale area along the median suture is confined to a thin line along both edges of the suture. The sides of the dark green stripes on the mesepisternum and mesepimeron are parallel in the lower half and confluent in the upper half. The pale humeral line is obliterated in some specimens, leaving the entire thorax a metallic green or bronze. The pterostigma is long and dark and usually in contact with two cross veins. The intersternite is entirely black and planar with an anterior branch that forms a rounded shoulder (**Fig. 3.1.138**).
.....*Hetaerina medinai* Rácenis, 1968 (Venezuela, Amazonas).
- The pale area along the humeral suture is considerably widened in its lower half. The sides of the dark green stripe on the mesepisternum and mesepimeron are not parallel on the lower half and broadly converge toward the upper half. The pterostigma is short and contacts only one cross vein, except in the

Venezuela population of *H. westfalli*, which has an ivory colored pterostigma. The intersternite is rather linear and not entirely black (**Fig. 3.1.136**). 10
10. The intersternite is flat; its anterior branch forms a truncate process. There are poorly defined stripes on the lower half of the metapisternm and the metepimeron, each of which forms an obscure pattern differing from the vivid dark green of the mesepisternum. The dorsal end of the green mesepimeral stripe is isolated from the rest of the stripe (**Fig. 3.1.136**).
.....*Hetaerina moribunda* Hagen in Selys, 1853
(Venezuela, Guyana, French Guiana, Surinam, Ecuador, Amazonas, Rondônia, Mato Grosso).
- The anterior branch of the intersternite is deflected from the plane of the body. The structure is rather linear. The lower half of the metapisternal and the entire metepimeral stripe are well defined and similar in color to the metallic green of the mesepisternum. The upper end of the green mesepisternal stripe is connected to the mesepimeral stripe (**Fig. 3.1.128**).
.....*Hetaerina westfalli* Rácenis, 1968 pars
(Southern Venezuela, Amazonas, Rondônia, Mato Grosso).
11. The darker parts of the thorax are colored metallic red. 12
- The darker parts of the thorax are metallic green or bronze. 15
12. The anterior branch of the intersternite is much smaller than the posterior branch (**Fig. 3.1.152**). 13
- The intersternite is bilobed, and the anterior and posterior branches are similar (**Fig. 3.1.141**). 14
13. Length of female abdomen: 32 to 34 mm. Hind wing length of female: 31.5 to 33.5 mm. The females of the two species in this couplet cannot reliably be distinguished, and there may be an overlap in the size range. That reported here was recorded for a few specimens by Ris (1918). Although the dorsal process of the intersternite appears longer (**Fig. 3.1.152**), this may also be subject to intraspecific variation.
.....*Hetaerina aurora* Ris, 1918
(Colombia, Ecuador)
- Length of female abdomen: 35 to 40 mm. Hind wing length of female: 33 to 37 mm. There is sometimes a dark brown marking at the base of the wings, which reaches the posterior margin of the fore-wing but not the anterior margin, except at the very base of the wing. A similar dark marking on the hind wing usually reaches the anterior margin but not the posterior (**Fig. 3.1.147**). The dorsal process of the intersternite is small and broadly rounded at the apex.
.....*Hetaerina duplex* Selys, 1869
(Colombia).
14. The pale area between the mesepisternal and mesepimeral stripes is usually narrow, 1/3 the width of the mesepimeral stripe or narrower. If not, the upper end of the mesepisternal stripe connects to the mesepimeral stripe (**Fig. 3.1.141**).
.....*Hetaerina fuscoguttata* Selys, 1878
(Costa Rica, Panama, Colombia, Venezuela, Ecuador; a doubtful report from Mato Grosso).

- The pale area between the mesepisternal and mesepimeral stripes is almost as wide as the mesepimeral stripe. The upper end of the mesepisternal stripe is not connected to the mesepimeral stripe (**Fig. 3.1.139**). Length of male abdomen: 42 to 44 mm; female abdomen: 32 to 34 mm. Fore-wing length: 31.5 to 34 mm. .....*Hetaerina charca* Calvert, 1909 (Ecuador, Peru, Bolovia).

15. There is a broadly pointed spine on the posterior part of ventrolateral margin of the tenth abdominal segment (**Fig. 3.1.129**). 16

- There are at least two small pointed spines on the posterior part of the ventrolateral margin of the tenth abdominal segment (**Fig. 3.1.149**). 17

16. The metallic green mesepisternal stripe is connected with the humeral suture. There is a round sclerotized structure just dorsal to the episternite. The dorsal area of the intersternite is relatively wide and its anterior arm is deflected from the plane of the rest of the structure (**Fig. 3.1.133**). Length of female abdomen: 29 to 33.5 mm. Hind wing length of female: 27 to 32.5 mm. .....*Hetaerina vulnerata* Hagen in Selys, 1853 pars (Southern United States to Colombia).

- The metallic green mesepisternal stripe is not connected with the humeral suture (**Fig. 3.1.129**). There is no round sclerotized structure just dorsal to the episternite, or if one is present, it is very small and barely noticeable. The dorsal area of the intersternite is relatively narrow and its anterior arm is never deflected from the plane of the rest of the structure. Length of female abdomen: 27 to 32 mm. Hind wing length of female: 24.5 to 28.5 mm. .....*Hetaerina cruentata* (Rambur, 1842) (Mexico, Central America, Colombia, Peru, Venezuela, Surinam, Brazil?). Syn: *Calopteryx cruentata* Rambur, 1842; *Calopteryx luteola* Rambur, 1842; *Hetaerina brasiliensis* Selys, 1853, *nomen nudum*; *Hetaerina lineata* Hagen in Selys, 1853, *nomen nudum*.

17. There is a round sclerotized structure just dorsal to the intersternite. The dorsal carina of the tenth abdominal segment lacks a mid-dorsal spine (**Fig. 3.1.133**). Length of female abdomen: 29 to 33.5 mm. Hind wing length of female: 27 to 32.5 mm. .....*Hetaerina vulnerata* Hagen in Selys, 1853 pars (Southern United States to Colombia).

- There is no round sclerotized structure just dorsal to the intersternite. The dorsal carina of the tenth abdominal segment ends in a mid-dorsal spine or keel that may or may not extend posterior to the posterior margin of the segment (**Fig. 3.1.146**). 18

18. The intersternite is wide and flat with the anterior branch well developed; the cleft between the branches is U or V-shaped (**Fig. 3.1.149**). 19

- The intersternite is narrow with an anterior branch that is rudimentary in lateral view, usually forming no more than a cleft or a curved shoulder; the cleft is obtuse, except in some *H. rosea*, which has a very small notch obscured by a deflected anterior shoulder (**Fig. 3.1.134**). 25

19. Posterior branch of the intersternite is two to three times longer than the anterior branch (**Fig. 3.1.149**).
.....*Hetaerina longipes* Hagen in Selys, 1853 (Paraguay, Argentina, Rio de Janeiro, São Paulo, Santa Catarina). Syn: *Hetaerina carnifex* Hagen in Selys, 1853; *Hetaerina carnifex* race *fulgens* Selys, 1853. Some *H. amazonica* will key out here, but they can be distinguished by other features described in Couplet 31 and illustrated in **Figure 3.1.143**.
- Posterior branch of the intersternite is only slightly longer or shorter than the anterior branch (**Fig. 3.1.140**). 20
20. The anterior arm of the intersternite forms a U or V-shaped angle with the posterior branch. The arms of the intersternite are subequal or the anterior arm is longer (**Fig. 3.1.146**). 21
- The anterior arm and posterior branch of the intersternite meet at an angle of about 90°, or, if the indentation at the junction is U or V-shaped, the posterior arm is more prominent than the anterior arm (**Fig. 3.1.134**). 22
21. The junction of the anterior and posterior arms of the intersternite meet at variable angles, but the angle is seldom U-shaped with the anterior arm longer (**Fig. 3.1.146**). Due to the degree of variability of the females, those of the two species in this couplet must be considered indistinguishable until a reliable morphological difference is discovered.
.....*Hetaerina caja* (Drury, 1773) (Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana). Syn: *Libellula caja* Drury, 1773; *Hetaerina hera* Hagen in Selys, 1853, *nomen nudum*. Two subspecies are recognized: *Hetaerina caja caja* (Drury, 1773) from Mexico and Trinidad to Peru and *Hetaerina caja dominula* Hagen in Selys, 1853, from Guyana, French Guiana, Surinam, Venezuela, Brazil, and possibly Argentina.
- The dorsal apex of the intersternite has a wide U-shaped excavation with the anterior branch slightly longer than the posterior branch (**Fig. 3.1.140**).
.....*Hetaerina auripennis* (Burmeister, 1839) (Pará, Amazonas, Rondônia, Mato Grosso, São Paulo, Espirito Santo). Syn: *Calopteryx auripennis* Burmeister, 1839; *Hetaerina divina* Hagen in Selys, 1854; *Hetaerina purpurea* Selys, 1854.
22. The dorsal apex of the intersternite has a narrow notch separating lobes equal in height or with the posterior lobe slightly higher (**Fig. 3.1.134**).
.....*Hetaerina rosea* Selys, 1853 pars (Peru, Bolivia, Paraguay, Uruguay, Argentina, Bahia, Minas Gerais, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso, Rondônia). Syn: *Hetaerina donna* Selys, 1873.
- The anterior arm of the intersternite forms an angle of about 90^{o} with the posterior branch, or, if it is U or V-shaped, then the posterior arm is more prominent than the anterior (**Fig. 3.1.132**). 23
23. The wings are entirely tinged honey yellow.
.....*Hetaerina flavipennis* Garrison, 1990 (Ecuador).

- The wings are hyaline or very lightly tinged (**Fig. 3.1.132**). 24
24. The anterior branch of the intersternite is prominent and almost as large as the posterior branch. The upper end of the green mesepimeral stripe does not touch the subalar carina (**Fig. 3.1.132**).
.....*Hetaerina laesa* Hagen in Selys, 1853 pars (Peru, Venezuela, Guyana, Surinam, French Guiana, Pará, Rondônia, Mato Grosso). Syn: *Hetaerina klugi* Schmidt, 1942; *Hetaerina papavarina* Fraser, 1946.
- The anterior branch of the intersternite is not prominent and is often obscure, forming a rounded shoulder; it is much smaller than the longer posterior branch. The upper end of the green mesepimeral stripe touches the subalar carina, at least as a thin line in the vicinity of the second lateral suture (**Fig. 3.1.145**).
.....*Hetaerina mortua* Hagen in Selys, 1853 pars (Venezuela, Guyana, French Guiana, Surinam, Rondônia, Roraima).
25. Viewed laterally, the anterior branch of the intersternite is deflected from the plane of the body (**Fig. 3.1.123**). 26
- Viewed laterally, the anterior branch of the intersternite, if present, is not deflected from the plane of the body (**Fig. 3.1.143**). 29
26. The posterior part of the intersternite forms a small distinct lobe about as thick as the anterior part, which is not distinctly divided from the posterior lobe proximal to the apex (**Fig. 3.1.134**). 27
- The posterior part of the intersternite is narrow and usually has a narrower anterior ridge beginning well proximal to the apex but not extending to the apex (**Fig. 3.1.123**). 28
27. The occipital tubercles are prominent and acutely pointed. The posterior branch of the intersternite is much longer than the rounded shoulder (**Fig. 3.1.144**).
.....*Hetaerina mendezi* Jurzitza, 1982 (Argentina, Santa Catarina).
- The occipital tubercles are small and rounded. The posterior branch of the intersternite is only slightly higher than the deflected anterior branch (**Fig. 3.1.133**).
.....*Hetaerina rosea* Selys, 1853 pars (Peru, Bolivia, Paraguay, Uruguay, Argentina, Bahia, Minas Gerais, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso, Rondônia). Syn: *Hetaerina donna* Selys, 1873.
28. The green episternal stripe is connected to the mesepimeral stripe near the upper end of the humeral suture (**Fig. 3.1.128**).
.....*Hetaerina westfalli* Rácenis, 1968 pars (Southern Venezuela, Amazonas, Rondônia, Mato Grosso).
- The green episternal stripe is not connected to the mesepimeral stripe (**Fig. 3.1.123**).
.....*Hetaerina curvicauda* Garrison, 1990 (Peru, Bolivia, Rondônia).

29. The intersternite is linear; its posterior branch is two to three times longer than the abbreviated anterior branch (**Fig. 3.1.143**). 30
- The intersternite is widened; the posterior branch is small and extends only slightly beyond the cleft (**Fig. 3.1.145**). 32
30. The green mesepisternal stripe is confined to the upper half of the sclerite. The mesepimeron is pale with only a trace of green (**Fig. 3.1.151**). The females of two and possibly three species key out here and are considered indistinguishable until reliable morphological differences can be discovered.
.....*Hetaerina hebe* Selys, 1853 (Paraiba to Southeastern Brazil). Syn: *Hetaerina sanguinolenta* Hagen in Selys, 1853.
.....*Hetaerina simplex* Selys, 1853, pars (Paraguay, Minas Gerais, possibly Pará). Syn: *Hetaerina perplex* Selys, 1869.
.....possibly some *Hetaerina longipes* Hagen in Selys, 1853 (Paraguay, Argentina, Santa Catarina). Syn: *Hetaerina carnifex* Hagen in Selys, 1853; *Hetaerina carnifex* race *fulgens* Selys, 1853.
- Thorax with a full set of green thoracic stripes or the ventral 1/3 of the metepisternal stripe is vestigial (**Fig. 3.1.143**). 31
31. The intersternite is usually dark. The mesinfraepisternum is marked with black on the upper half. The margins of the green thoracic stripes are boldly outlined in black (**Fig. 3.1.143**).
.....*Hetaerina amazonica* Sjostedt, 1918 pars (Venezuela, Pará, Amazonas).
- The intersternite is pale. The mesinfraepisternum is entirely pale or at most with obscure smudges of black. The margins of the green thoracic stripes, except occasionally some of the ventral ones, are not outlined in black (**Fig. 3.1.132**).
.....*Hetaerina laesa* Hagen in Selys, 1853 pars (Peru, Venezuela, Guyana, Surinam, French Guiana, Pará, Rondônia, Mato Grosso). Syn: *Hetaerina klugi* Schmidt, 1942; *Hetaerina papavarina* Fraser, 1946.
32. Occipital tubercles well developed. The intersternite is black. The clypeal ridge and antefrons are metallic green, sometimes with a white spot on either side of the postclypeus (**Fig. 3.1.145**). Positive identification of the females is not yet possible because of overlap in the characteristics with those of other species.
.....*Hetaerina mortua* Hagen in Selys, 1853 pars (Venezuela, Guyana, French Guiana, Surinam, Rondônia, Roraima).
- Occipital tubercles lacking or poorly developed. The intersternite, clypeal region, and ventral part of the antefrons are usually pale (**Fig. 3.1.125**). Length of male abdomen: c. 38 mm; female abdomen: c. 32 mm. Fore-wing length: c. 28.5 mm. Hind wing length: c. 27.5 mm.
.....*Hetaerina sanguinea* Selys, 1853 (Colombia, Ecuador, Peru, Venezuela, Bolivia, Argentina, Amazonas). Syn: *Hetaerina brevistyla* Selys, 1879.

Information on known *Hetaerina* larvae reported from South America

Information for the keys was provided by Santos (1970b, 1972c) and De Marmels (1985c, 2007a).

1. There is a small but distinct spine directed posteriad along the lateral margin of the seventh abdominal segment, and there is a large mid-dorsal spine on the tenth segment, arising at or anterior to the midlength of the segment. There are always well-developed lateral spines at the midlength of the prothorax, clearly visible in dorsal and ventral view (**Fig. 3.1.153**). 2
- Lateral spines are absent or indistinct on the seventh abdominal segment. If tiny spines are present, they are not clearly directed posteriad, and lateral spines on the eighth abdominal segment are tiny and indistinct, as well. Any dorsal spine at the apex of the tenth abdominal segment arises at or near the posterior margin (**Fig. 3.1.154**). 3

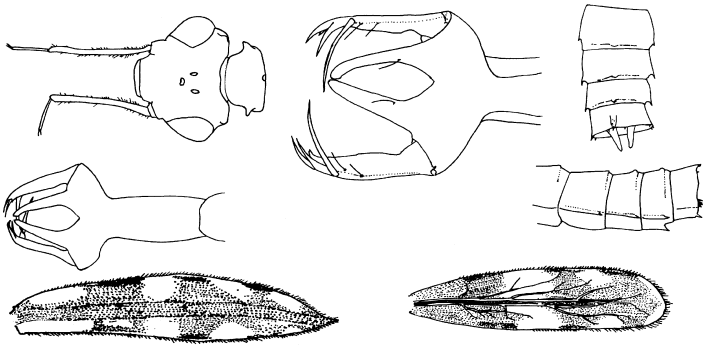


Fig. 3.1.153 *Hetaerina medinai* male larva: head (upper left), labium in ventral view (middle left), anterior part of the prementum and labial palps in dorsal view (upper center), seventh through tenth abdominal segments in dorsal view (upper right), and sixth through tenth segments in lateral view (middle right), and the lateral (lower left) and middle gill lamella (lower right). Based on De Marmels (2007a).

2. The long processes along the anterior margin of the prementum are parallel or divergent at their apices. The mid-dorsal spine on the tenth abdominal segment is bifid at the apex. The posterolateral corners of the head posterior to the compound eyes are angled, so that each margin between the compound eye and the corner is clearly convex (**Fig. 3.1.24**).
.....*Hetaerina auripennis* (Burmeister, 1839) (Pará, Amazonas, Rondônia, Mato Grosso, São Paulo, Espirito Santo). Syn: *Calopteryx auripennis* Burmeister, 1839; *Hetaerina divina* Hagen in Selys, 1854; *Hetaerina purpurea* Selys, 1854.

- The long processes along the anterior margin of the prementum are strongly convergent at their apices. The mid-dorsal spine on the tenth abdominal segment is not bifid at the apex. The posterolateral corners of the head posterior to the compound eyes are rounded, so that each margin between the compound eye and the corner is no more than slightly convex (**Fig. 3.1.153**).
.....*Hetaerina medinai* Rácenis, 1968 (Venezuela, Amazonas).

3. There are no small spines evident at the posterolateral corners of the tenth abdominal segment, but small setae may be present. There are short, blunt dorsal processes on the dorsal surface of the pronotum, which are directed dorsolaterad and not visible in ventral view (**Fig. 3.1.154**).
.....*Hetaerina brightwelli* (Kirby, 1823) (Pará, Rio de Janeiro, São Paulo). Syn: *Agrion brightwelli* Kirby, 1823.

- There are small spines, sometimes more than one, evident at the posterolateral corners of the tenth abdominal segment (**Fig. 3.1.155**). 4

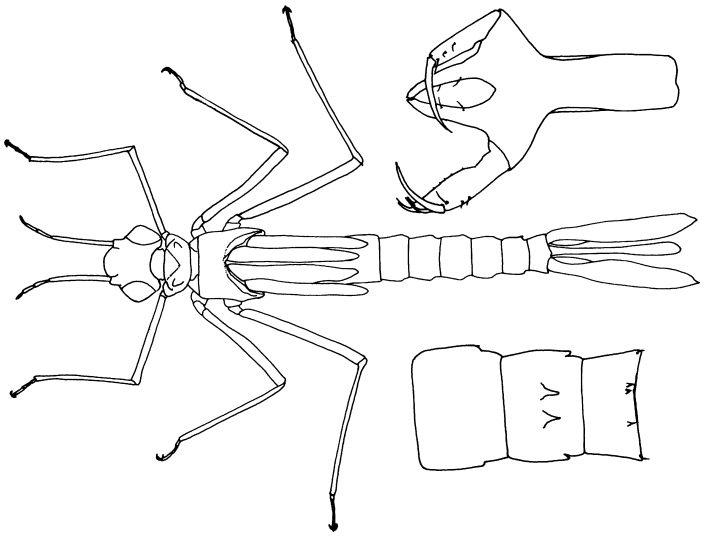


Fig. 3.1.154 *Hetaerina brightwelli* larva: habitus (left), labium with palps in dorsal view (upper right), and ventral view of distal abdominal segments (lower right). Based on Santos (1972c).

4. The proximal part of the prementum tapers continuously to the apex. The median caudal gill lamella is about ¾ as long as a lateral lamella (**Fig. 3.1.155**).
.....*Hetaerina hebe* Selys, 1853 (Paraiba to Southeastern Brazil). Syn: *Hetaerina sanguinolenta* Hagen in Selys, 1853.

- The proximal part of the prementum is parallel sided. The median caudal gill lamella is considerably shorter than ¾ as long as a lateral lamella (**Fig. 3.1.156**). .....*Hetaerina capitalis* Selys, 1873 (Central America, Colombia, Ecuador, Venezuela).

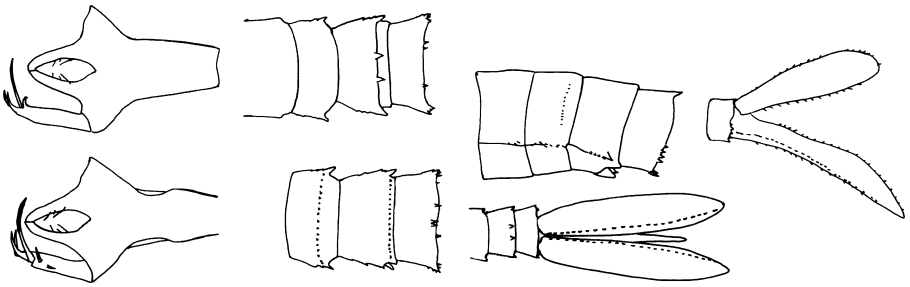


Fig. 3.1.155 *Hetaerina hebe* larva: labium with one palp removed in ventral (upper left) and dorsal view (lower left), seventh through tenth abdominal segments in ventral (upper left center) and lateral view (upper right center), eighth through tenth abdominal segments in dorsal view (lower left center), and apex of the abdomen with the gill lamellae in dorsal view (lower right), and a lateral view of one median and one lateral lamella. Based on Santos (1970b).

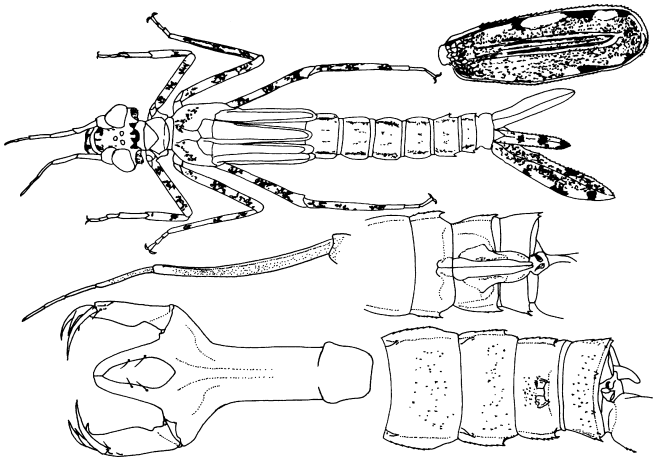


Fig. 3.1.156 *Hetaerina capitalis* larva: habitus with one lateral gill lamella regenerating (upper left), antenna (middle left), labium with palps in dorsal view (lower left), ventral view of the seventh to tenth abdominal segments of a male (middle right) and a female (lower right), a lateral gill lamella (upper right). Based on De Marmels (1985c).

Heliocharitidae

Key to the genera of adults in South America

Information for the key was taken from Needham (1903b), Munz (1919), and Lencioni (2005). No key to the larvae can be prepared until the larva of *Dicterias atrosanguinea* is described.

1. Vein R_3 forks from R_2 approximately two cells distal to the subnodus. Intercalary veins between R_2 and IR_2 arise distal to the level of the proximal margin of the pterostigma. The basal space is sometimes crossed. There is always one cross vein in the quadrangle (**Fig. 3.1.157**).
.....*Heliocharis* Selys, 1853

The only species in this genus is *Heliocharis amazona* Selys, 1853, known from Colombia, Venezuela, Guyana, French Guiana, Surinam, Ecuador, Peru, Bolivia, Paraguay, Argentina, and the Brazilian states of São Paulo, Minas Gerais, Goiás, and Mato Grosso. Syn: *Heliocharis brasiliensis* Hagen in Selys, 1859; *Heliocharis libera* Selys, 1869; *Cyanocharis valga* Needham, 1903; *Dicterias cothurnata* Förster, 1906; *Dicterias umbra* Ris, 1918; *Dicterias peruviana* Navás, 1920; *Heliocharis paraensis* Costa and Santos, 1991.

- Vein R_3 forks from R_2 less than one cell from the subnodus. Some intercalary veins between R_2 and IR_2 arise a considerable distance proximal to the proximal margin of the pterostigma. The basal space is never crossed. There are always two cross veins in the quadrangle (**Fig. 3.1.16**).
.....*Dicterias* Selys, 1853

The only known species in this genus is *Dicterias atrosanguinea* Selys, 1853, from the Brazilian states of Amazonas and Pará. Syn: *Dicterias procera* Hagen in Selys, 1859.

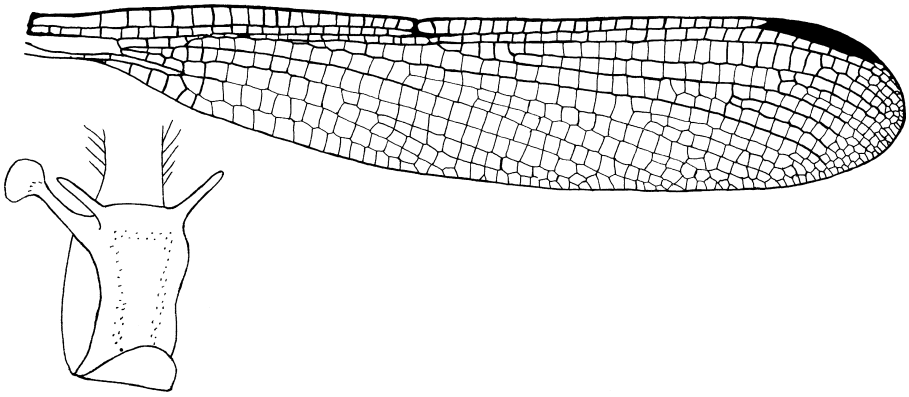


Fig. 3.1.157 Fore-wing of a male *Heliocharis amazona* (above) and the penis (below left). Based on Munz (1919) and Dunkle (1991a).

Perilestidae

Key to the genera of adults in South America

Information for the key was taken from Williamson and Williamson (1924a) and Kennedy (1941a).

1. Vein IR_2 arises at the level of the proximal end of the stigma or more distal. The blade of the second hamule is very broadly spoon shaped or angled in cross-section. The flat or external surface is transverse to the longitudinal axis of the abdomen. The face is sexually dichromatic, being patterned with black and bright blue in the male and less distinctly patterned in the female, with no bright blue coloration; the black or dull labrum is pale basally or dark edged. The anterior lamella is less than 1.5 mm, slender, and mainly pale in color. The metasternum and femora are not largely or entirely black. The third through sixth abdominal segments each have a pale basal ring with a dark area distal to it contiguous with the dark median area. The eighth through tenth sternites of the male are bright blue or bright yellow. The superior appendage of the male does not have a basal dilation, or, if one is present, it ends at the inner border in a tongue-like blade with a rounded apex (**Fig. 3.1.158**).
.....*Perilestes* Hagen, 1862..p. 167
- Vein IR_2 arises at a level one cell proximal to the stigma or more proximal. The blade of the second hamule is slender, narrowly spoon shaped. or tapering. If the blade is flattened, the flat surface is in line with the longitudinal axis of the abdomen. The face of both sexes is dark without a distinct pattern. The anteclypeus may be slightly paler, but it is not very much different in color from the labrum and postclypeus. The anterior lamella is 1.5 mm or longer, slender, and usually mainly dark in color. The metasternum and femora are usually largely or entirely black. The third through sixth abdominal segments each have a pale postbasal ring or patch proximal to an extensive dark area in the middle. The ninth and tenth sternites of the male, and sometimes also the eighth, are yellowish or blue. The superior appendage of the male has a basal dilation that ends at the inner border as an acute spine (**Fig. 3.1.13**).
.....*Perissolestes* Kennedy, 1941..p. 170

Key to the genera of known larvae in South America

Information for the key was provided by Kennedy (1941a) and Novelo Gutiérrez and González Soriano (1986b). The key is tentative because the larvae of most species have not been described.

1. Most of the abdominal segments have large lateral spines that arise anterior to the posterior corners of the segments (**Fig. 3.1.33**).
.....*Perissolestes* Kennedy, 1941..p. 170

- If any of the abdominal segments have lateral spines, they are small and arise at the posterolateral angles of the segments (**Fig. 3.1.159**).
.....*Perilestes* Hagen in Selys, 1862..p. 167

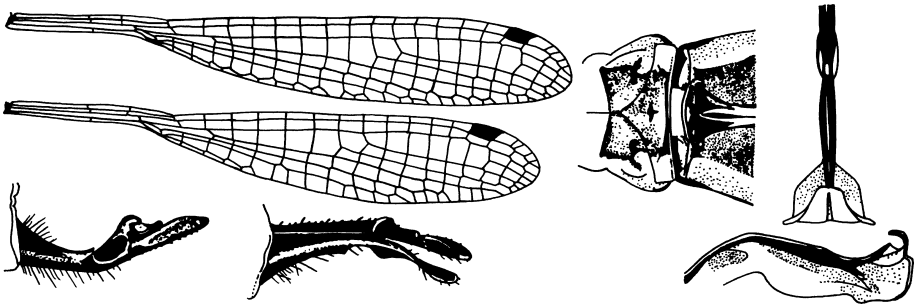


Fig. 3.1.158 *Perilestes gracillimus* male: fore and hind wing (upper left), prothorax and anterior portion of the synthorax in dorsal view (upper right center), penis in ventral (upper right) and lateral view (lower right), and superior anal appendage in dorsal (lower left) and lateral view (lower center). Based on Kennedy (1941a).

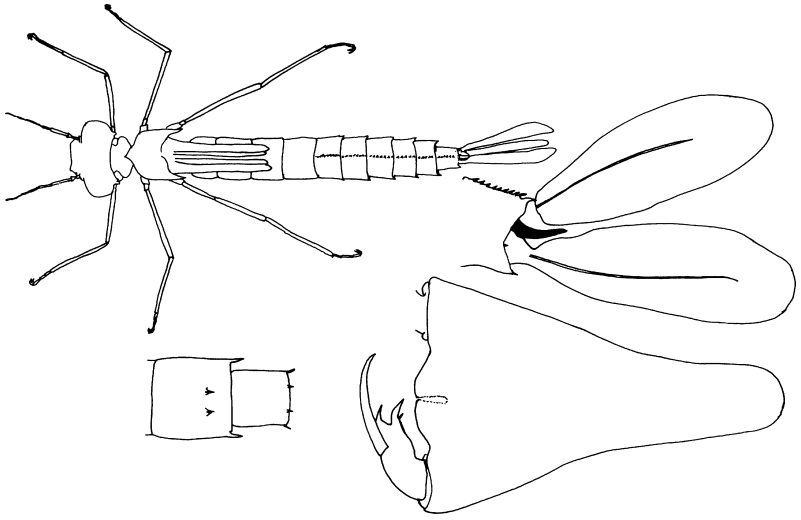


Fig. 3.1.159 *Perilestes fragilis* larva: habitus from an exuvia (upper left), ventral view of the ninth and tenth abdominal segments (lower left), labium in dorsal view with one palp removed (lower right), and a median and lateral caudal gill in lateral view (upper right). Based on Santos (1969a).

Key to the species of *Perilestes* in South America

Information for the key was taken from Williamson and Williamson (1924a), Kennedy (1941a), Kimmins (1958), and Lencioni (2005).

1. There are no more than six cells posterior to vein Cu_2 in the hind wing (**Fig. 3.1.158**). 2
- There are more than six cells posterior to Cu_2 in the hind wing (**Fig. 3.1.160**). 4

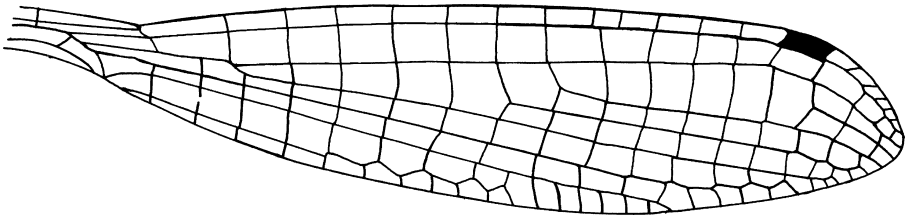


Fig. 3.1.160 The fore-wing of *Perilestes fragilis*.

2. In the hind wing, only two cells separate vein A_1 from the margin. The superior anal appendage of the male bears two strong basal spines on its dorsal surface near the base and a large lobe on the inner surface (**Fig. 3.1.161**). The branches of the anterior lamina curve outward and ventrad. The pterostigma is dark brown. Length of male abdomen with appendages: c. 56 mm. Hind wing length of male: c. 21 mm.
.....*Perilestes bispinus* Kimmins, 1958 (Amazonas).
- In the hind wing, more than two cells separate vein A_1 from the margin (**Fig. 3.1.158**). 3

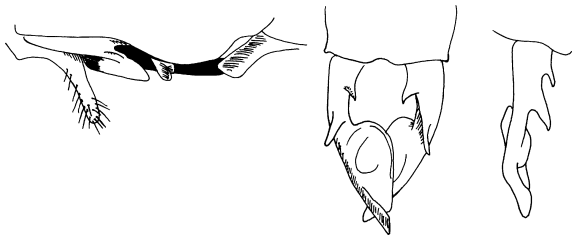


Fig. 3.1.161 *Perilestes bispinus* male (left to right): male genitalia on the second segment of the abdomen in lateral view, apex of the male abdomen in dorsal view, and one superior anal appendage in lateral view with the dorsal side to the right. Based on Kimmins (1958).

3. The pterostigma is orange red. There is a strong, broad-based, short spine or angulate internal lobe at the midlength of the superior appendage of the male (**Fig. 3.1.158**). Length of male abdomen: 46.8 mm; hind wing length of male: 21.5 mm. The female has not been described.
.....*Perilestes gracillimus* Kennedy, 1941 (Peru, Amazonas?).
- The pterostigma is black or brown but not reddish brown. The appendages of the male lack a spine or plate in the basal half distal to the midlength of the bipartate, spoon-like dilation on the inner edge (**Fig. 3.1.162**). The male labrum and anteclypeus are bright pale blue or almost white with a black anterior border; the labrum of the female is black. The postclypeus is shiny greenish black. The valvular styles are attached at about the level of the apices of the abdominal appendages. The hind border of the prothorax is straight, nearly horizontal, and with a nearly vertical lateral margin. The mesostigmal lamina is low and of uniform height. Length of male abdomen: 43.5 to 48 mm; female: 37 to 37.5 mm. Hind wing length of male: 20 to 21.5 mm; female: 20.5 to 22 mm.
.....*Perilestes attenuatus* Selys, 1886 (Peru, Venezuela, Bolivia, Pará, Amazonas, Rondônia, Mato Grosso).

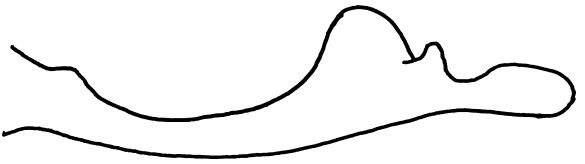


Fig. 3.1.162 The superior anal appendage of *Perilestes attenuatus* in dorsomedial view. Based on Williamson and Williamson (1924a).

4. The pterostigma is black (**Fig. 3.1.160**). 5
- The pterostigma is reddish brown. 6
5. The labrum is mainly black. The process nearest the base of the male superior anal appendage is broadly rounded and strongly curved posteriad (**Fig. 3.1.163**). Length of male abdomen: 40 to 41 mm. Hind wing length of male: c. 20 mm. The female has not been described.
.....*Perilestes minor* Williamson and Williamson, 1924 (Rondônia).
- Less than the anterior half of the labrum of the male is black. The outer edge of the mesostigmal lamina of the female is low and rounded and not more than slightly elevated. The valular styles of the female are inserted proximally to the apex of the tenth abdominal segment. The dorsum of the ninth segment is mainly brown, shading gradually to a pale lateral basal area on either side (**Fig.**

3.1.160). Length of male abdomen: 50 to 52 mm; female: c. 50 mm. Hind wing length of male: 25 to 26 mm; female: c. 27.5 mm.
.....*Perilestes fragilis* Hagen in Selys, 1862 (Guyana, Amazonas, Espirito Santo, Minas Gerais, Rio de Janeiro, São Paulo).

Fig. 3.1.163 The superior anal appendage of *Perilestes minor* in dorsomedial view. Based on Williamson and Williamson (1924a).

Fig. 3.1.164 The superior anal appendages of two specimens of *Perilestes kahli* in dorsomedial view. Based on Williamson and Williamson (1924a) and De Marmels (1982d).

Fig. 3.1.165 The superior anal appendage of *Perilestes solutus* in dorsomedial view. Based on Williamson and Williamson (1924a).

6. Abdominal segments eight through ten are black dorsally; the basal third of segment eight of the male is blue or yellow, while the lateral parts of the basal area on the ninth segment of the female is distinctly pale. There is only an angle on the inner edge of the male appendage about 2/7 of the way from its base. The dorsal apex of the tenth segment of the male is slightly elevated at the midline and concave on either side of this elevation and dorsal to the appendages. The inside process on the basal half of the superior anal appendage is reduced to a small swelling (**Fig. 3.1.164**). Length of male abdomen: 47 to 50 mm; female: c. 43 mm. Hind wing length of male: 22 to 24 mm; female: c. 25 mm.
.....*Perilestes kahli* Williamson and Williamson, 1924 (Venezuela, Ecuador, Bolivia, Rondônia).

- Abdominal segments eight through ten dark but not all distinctly black dorsally; less than the basal third of segment eight of the male is pale, while only widely separated lateral parts of the basal area on the ninth segment of the female are pale. There is a flattened, tongue-like blade or lobe on the inner edge of the male appendage about 1/3 of the way from its base. The dorsal apex of the tenth segment of the male is low and flat, not elevated. The inside process on the basal half of the superior anal appendage appears longer than the width of the appendage in dorsomedial view (**Fig. 3.1.165**). Length of male abdomen: 42 to 46 mm; female: 38 to 40 mm. Hind wing length of male: 20 to 21 mm; female: 21 to 24 mm.
.....*Perilestes solutus* Williamson and Williamson, 1924 (Venezuela, Pará, Roraima, Rondônia, Mato Grosso).

Key to the species of male *Perissolestes* in South America

Information for the key was taken from Williamson and Williamson (1924a), Kennedy (1941a,b), and De Marmels (1989a).

1. The pterostigma is red or brown (**Fig. 3.1.13**). 2
- The pterostigma is black. 7
2. The legs and ventral side of the thorax are pale. Only the basal third of the male appendages are black (**Fig. 3.1.165**). Length of male abdomen: 45 mm; hind wing length: 22 mm. The female has not been described.
.....*Perissolestes klugi* Kennedy, 1941 (Ecuador, Peru, Amazonas?).
- The femora, at least at the apices, and ventral side of the thorax are black or dark brown (**Fig. 3.1.166**). 3

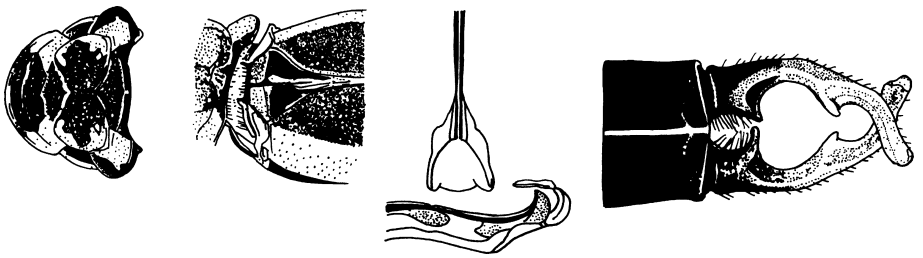


Fig. 3.1.166 *Perissolestes klugi* male (left to right): prothorax in dorsal view, posterior part of the prothorax and anterior part of the synthorax in dorsomedial view, penis in ventral (above) and lateral view (below), and the apex of the abdomen in dorsal view. Based on Kennedy (1941a).

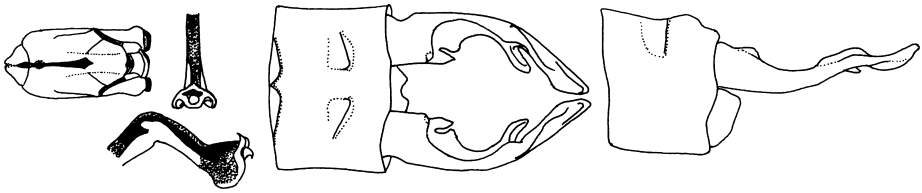


Fig. 3.1.167 *Perissolestes flinti* male (left to right): color pattern on the ventral surface of the synthorax, penis in ventral (above) and lateral view (below), and apex of the abdomen in dorsal and lateral view. Based on De Marmels (1989a).

3. The anal appendages of the male are black or dark brown, except for white along the inner surface or on the basal lobe (**Fig. 3.1.167**). 4
- The ental edge of the internal basal lobe of the superior appendage is somewhat concave or straight. The appendages are white, yellow, or pale reddish, sometimes tipped with brown or black (**Fig. 3.1.168**). 5

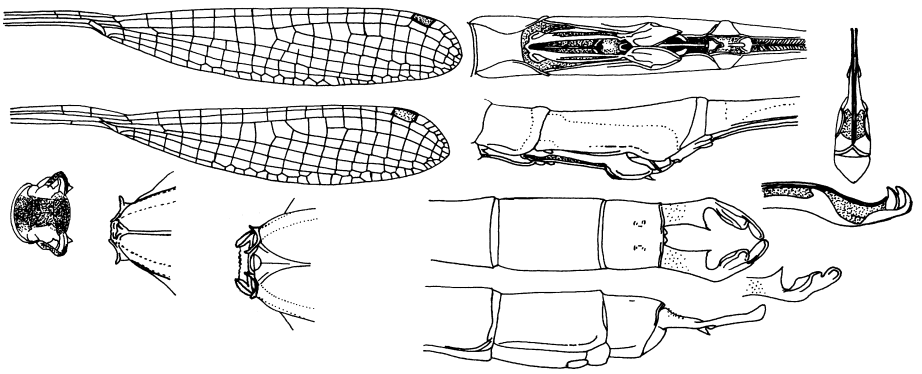


Fig. 3.1.168 *Perissolestes cornutus* male: fore and hind wing (upper left); prothorax in dorsal view (lower left); anterior part of the synthorax in dorsal and posterior view (lower left center, left and right); first, second, and anterior port of the third abdominal segment in ventral and lateral view (upper right center, above and below); penis and ventral and lateral view (upper right, above and below); apex of the abdomen in dorsal and lateral view (lower right center, above and below); superior anal appendage enlarged (lower right). Based on Kennedy (1937), illustrated under the synonym, *Perilestes pollux*.

4. The ental edge of the internal basal lobe of the superior anal appendage is convex and extends caudad to form a minute, triangular spine (**Fig. 3.1.169**). The ental edge is white, while the rest of the appendages are black. Length of male abdomen: 48 mm; hind wing length: 24 mm.
.....*Perissolestes aculeatus* Kennedy, 1941
(Rondônia, Mato Grosso). Syn: *Perilestes cornutus* Williamson and Williamson, 1924 non Selys, 1886.
- The ental edge of the superior anal appendage is continuously concave between a deep excavation distal to the basal lobe and a finger-like process beyond the mid-length; there is no triangular spine (**Fig. 3.1.167**). The ninth and tenth abdominal segments and appendages are black or dark brown with white only on the basal tooth on the inner surface of the superior anal appendage. Total length of male: c. 60.5 mm. Length of male abdomen: c. 52 mm; hind wing length: c. 26 to 26.5 mm. The head of the male is coppery black and whitish. The thorax of the male is brown with pale markings. The first two abdominal segments are brown with white lateral surfaces, while the third through eight segments are ringed with black, brown, and pale. The female has not been described.
.....*Perissolestes flinti* De Marmels, 1989
(Venezuela).

Fig. 3.1.169 The superior anal appendage of *Perissolestes aculeatus* in dorsomedial view. Based on Williamson and Williamson (1924a), who misidentified it as *Perilestes cornutus*.

5. The inner or posterior edge of the internal basal lobe of the superior anal appendage is perpendicular to the longitudinal axis of the appendage (**Fig. 3.1.168**). The eighth through tenth abdominal appendages are black, or the eighth and ninth are brown and the tenth is black dorsally and yellow laterally. Length of male abdomen: 46 to 50.5 mm. Hind wing length of male: 22.5 to 25 mm.
.....*Perissolestes cornutus* (Selys, 1886)
(Ecuador, Peru, Amazonas). Syn: *Perilestes pollux* Kennedy, 1937; *Perissolestes pollux* (Kennedy, 1937).
- The inner edge of the internal basal lobe of the superior anal appendage slopes at an angle of 45^{o} or less basad and entad from the longitudinal axis of the body (**Fig. 3.1.170**). 6

6. The labrum is yellow. The posterior edge of the internal basal lobe of the superior anal appendage slopes at an angle of 45° basad and entad from the longitudinal axis of the body. Length of male abdomen: c. 51 mm; hind wing length: c. 24.5 mm.
.....*Perissolestes romulus* Kennedy, 1941 (Peru).
- The labrum is dull orange with a black basal spot. The posterior edge of the internal basal lobe of the superior anal appendage slopes at an angle from 0° to about 40° basad and entad to the longitudinal axis of the body (**Fig. 3.1.170**). Length of male abdomen: c. 52 mm; hind wing length: c. 24 mm.
.....*Perissolestes paprzyckii* Kennedy, 1941 (Peru, Amazonas, Territory of Acre).

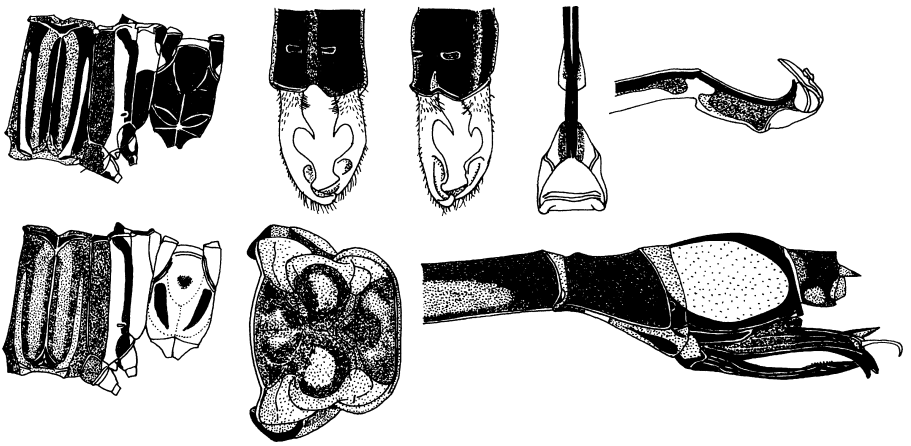


Fig. 3.1.170 *Perissolestes paprazyckii* (upper row, left to right): diagram of color pattern on the synthorax of a male, two views of the apex of the male abdomen, and the penis in ventral and lateral view, and (lower row, left to right): diagram of color pattern on the synthorax of a female, color pattern on the prothorax, and the apex of a female abdomen. Based on Kennedy (1941b).

7. The femora and the ventral part of the thorax are pale. 8
- The femora and the ventral part of the thorax are black. 9
8. A pale species with femora marked slightly darker at the apex and each with a postbasal ring. The superior anal appendage of the male has an inside spine-like process at about its midlength (**Fig. 3.1.171**). Length of male abdomen: 40 to 46 mm. Hind wing length of male: 21.5 to 23 mm.
.....*Perissolestes guianensis* (Williamson and Williamson, 1924) (French Guiana, Surinam). Syn: *Perilestes guianensis* Williamson and Williamson, 1924.

- A dark species well marked with black and brown and with a dark brown fore femur and pale brown middle and hind femora (**Fig. 3.1.13**). Length of abdomen: 51 to 53 mm.
.....*Perissolestes castor* (Kennedy, 1937) (Ecuador). Syn: *Perilestes castor* Kennedy, 1937.

Fig. 3.1.171 The superior anal appendage of *Perissolestes guianensis* in dorsomedial view. Based on Williamson and Williamson (1924a).

9. The superior appendage has a bifurcated basal lobe and spine consisting of a minute, acute basal spine and a much larger rounded lobe. Length of male abdomen: 48 mm; hind wing length: 23 mm.
.....*Perissolestes remus* Kennedy, 1941 (Ecuador).
- The superior appendage has a single, unforked basal lobe (**Fig. 3.1.172**). 10

Fig. 3.1.172 *Perissolestes remotus*: diagram of color pattern on the synthorax of a male (left) and the apex of the male abdomen (right). Based on Kennedy (1941a).

10. The basal lobe of the superior appendage is nearer the base of the appendage than the apex of the middle lobe (**Fig. 3.1.172**). Length of male abdomen: 50 to 54 mm. Hind wing length of male: 23.5 to 25.5 mm.
.....*Perissolestes remotus* (Williamson and Williamson, 1924) (Panama, Colombia, Peru). Syn: *Perilestes remotus* Williamson and Williamson, 1924.

- The basal lobe of the superior appendage is beyond the middle of the appendage (**Fig. 3.1.173**). The basal hairiness extends beyond the middle of the appendage. Length of male abdomen: 49 to 52.5 mm. Hind wing length of male: 23.5 to 25 mm.
.....*Perissolestes magdalenae* (Williamson and Williamson, 1924) (Mexico, Central America, Colombia, Peru). Syn: *Perilestes magdalenae* Williamson and Williamson, 1924.

Fig. 3.1.173 The superior anal appendage of *Perissolestes magdalenae* in dorsomedial view, not showing the hair-like setae on the appendage. Based on Williamson and Williamson (1924a).

Key to the species of female *Perissolestes* in South America

Information for the key was taken from Williamson and Williamson (1924a), Kennedy (1941a,b), and De Marmels (1989a). The females of *Perissolestes flinti* and *P. klugi* have not been described.

1. The posterior lobe of the prothorax bears an erect median spine. 2
- The prothorax is not spined (**Fig. 3.1.170**). 4
2. The stigma is black. The valvular styles are attached at the level of the cerci. The basal hairiness extends beyond the middle of the appendage. Length of female abdomen: c. 46 mm. Hind wing length of female: 26 to 27 mm.
.....*Perissolestes magdalenae* (Williamson and Williamson, 1924) (Mexico, Central America, Colombia, Peru). Syn: *Perilestes magdalenae* Williamson and Williamson, 1924.
- The stigma is red or brown. 3
3. The labrum is black.
.....*Perissolestes cornutus* (Selys, 1886) (Ecuador, Peru, Amazonas). Syn: *Perilestes pollux* Kennedy, 1937; *Perissolestes pollux* (Kennedy, 1937).
- The labrum is yellow.
.....*Perissolestes romulus* Kennedy, 1941 (Ecuador, Peru).
4. The insertions of the valvular styles of the ovipositor are distal to the level of the apices of the superior anal appendages (**Fig. 3.1.170**). 5
- The insertions of the valvular styles of the ovipositor are ventral to the superior anal appendages. 6

5. The venter of the female thorax is pale with three dark spots (**Fig. 3.1.170**). Length of female abdomen: c. 44 mm. Hind wing length of female: c. 28 mm.
.....*Perissolestes paprzyckii* Kennedy, 1941 (Peru, Amazonas, Territory of Acre).
- The venter of the female thorax is pale without dark markings. Length of female abdomen: 41.5 to 43.5. Hind wing length of female: 25 to 26 mm.
.....*Perissolestes remotus* (Williamson and Williamson, 1924) (Central America, Colombia, Peru).
6. The femora are pale and marked with a slightly darker apex and anteapical and postbasal rings, which are more or less confluent along the anterior row of spines. Length of female abdomen: 39 to 42 mm. Hind wing length of female: 24 to 25 mm.
.....*Perissolestes guianensis* (Williamson and Williamson, 1924) (French Guiana, Surinam). Syn: *Perilestes guianensis* Williamson and Williamson, 1924.
- The fore-femur is dark brown, and the middle and hind femora are pale brown (**Fig. 3.1.158**). Length of abdomen: 45 mm.
.....*Perissolestes castor* (Kennedy, 1937) (Ecuador). Syn: *Perilestes castor* Kennedy, 1937.

Lestidae

Key to the genera of adult Lestidae in South America

Information for the key was provided by Munz (1919), Williamson (1921), Fraser (1951), and Smith and Pritchard (1963). More recently, various authors have only recognized two of the genera, as mentioned in the key. The species formerly placed in the genera *Cyptolestes* Williamson, 1921, and *Superlestes* Williamson, 1921, are now considered species of *Archilestes.*

1. The proximal side of the quadrangle in the fore-wing is one third or less the length of the posterior side. Vein M_{1+2} forks more than two cells distal to the subnodus, at least in one wing. The third antenodal space is not more that 1.5 times the length of the first. Vein M_3 reaches the wing margin at a level beneath the stigma or distal to it in both wings. Cell M_2 originates several cells distal to the nodus (**Fig. 3.1.174**).
..... *Lestes* Leach, 1815..p. 182
- Either the proximal side of the quadrangle in the fore-wing is almost half the length of the posterior side, or vein M_3 in the fore-wing reaches the wing margin at the level of the proximal side of the stigma, and in the hind wing, it reaches the wing margin proximal to this level. Vein M_{1+2} often forks less than two cells distal to the subnodus in both wings. In most species, the third antenodal space is almost twice the length of the first (**Fig. 3.1.175**).
.....*Archilestes* Selys, 1862..p. 179

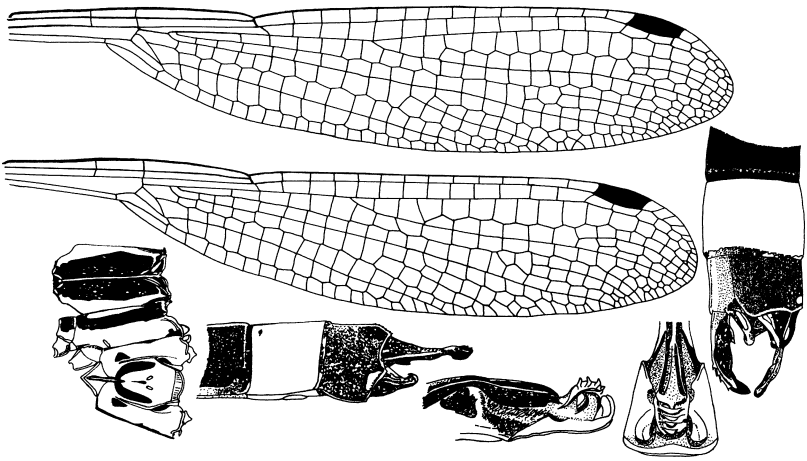


Fig. 3.1.174 *Lestes henshawi* male: fore and hind wings (above) and (lower row, left to right): diagram of the color pattern on the synthorax, the apex of the abdomen in lateral view, penis in lateral and ventral view, and apex of the abdomen in ventral oblique view. Based on Kennedy (1942a).

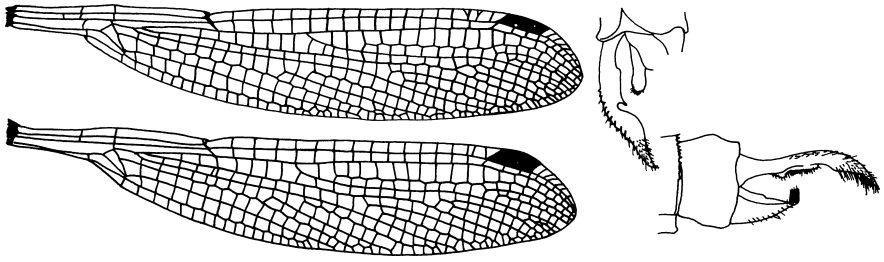


Fig. 3.1.175 *Archilestes exoletus* male: fore and hind wing (left), apex of the abdomen in dorsolateral view with the right superior appendage broken off (upper right), and in lateral view (lower right). Based on Williamson (1921).

Key to the genera of larval Lestidae in South America

Information for the key was provided by Smith and Pritchard (1963).

1. There is a smooth-edged upper notch in the trifid lateral lobe of the labium (**Fig. 3.1.176**).
.....*Archilestes* Selys, 1862..p. 179

-The inner edge of the upper notch of the trifid lateral lobe of the labium is serrated (**Fig. 3.1.177**).

.....*Lestes* Leach, 1815..p. 182

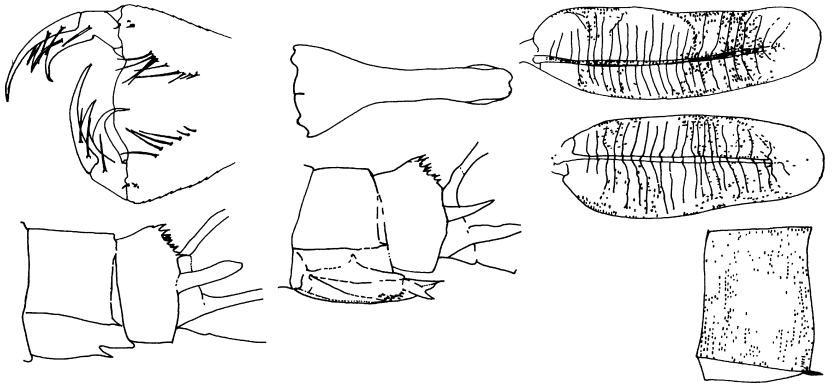


Fig. 3.1.176 *Archilestes tuberalatus* larva: apical part of the labium of a female in dorsal view (upper left), ventral view of the prementum (upper center), lateral view of the sixth segment of the abdomen (lower right), lateral (upper right) and middle gill lamella (middle right), and apex of the abdomen of a male (lower left) and female larva (lower center). Based on De Marmels (2004).

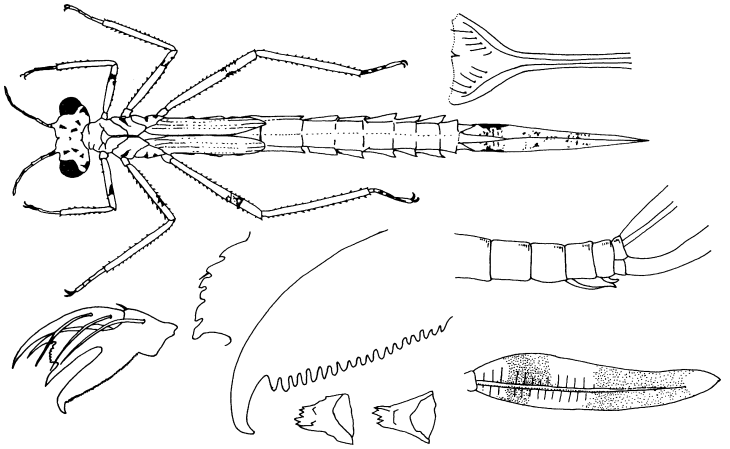


Fig. 3.1.177 *Lestes bipupillatus* larva: habitus (upper left), labial palp (lower left), enlargements of the distal edge of the middle part (lower left center) and terminal spine of the labial palp (center), internal views of the left and right mandibles (lower center, left and right, respectively), prementum (upper right), apical segments of the abdomen of a female larva (lower middle right), and a lateral gill lamella. Based on Costa and Carneiro (1994).

Key to the species of adult *Archilestes* in South America

Information for the key was taken from Calvert (1907), Ris (1918), and De Marmels (1982e).

1. The proximal side of the quadrangle in the fore-wing is one third or less the length of the posterior side. Vein M_{1+2} forks more than two cells distal to the subnodus, at least in one wing. The third antenodal space is not more that 1.5 times the length of the first. In the fore-wing, vein M_3 reaches the wing margin at the level of the proximal side of the stigma, and in the hind wing, it reaches the wing margin proximal to this level (**Fig. 3.1.175**). Length of male abdomen: c. 55 mm. Hind wing length of male: c. 35 mm. The male is brightly colored, and the female has not been described.
..... *Archilestes exoletus* (Hagen in Selys, 1862) (Argentina, Santa Catarina, Rio de Janeiro). Syn: *Lestes exoletus* Hagen in Selys, 1862; *Superlestes exoletus* (Hagen in Selys, 1862).
- The proximal side of the quadrangle in the fore-wing is almost half the length of the posterior side. Vein M_{1+2} forks less than two cells distal to the subnodus in both wings. The third antenodal space is almost twice the length of the first (**Fig. 3.1.178**). 2

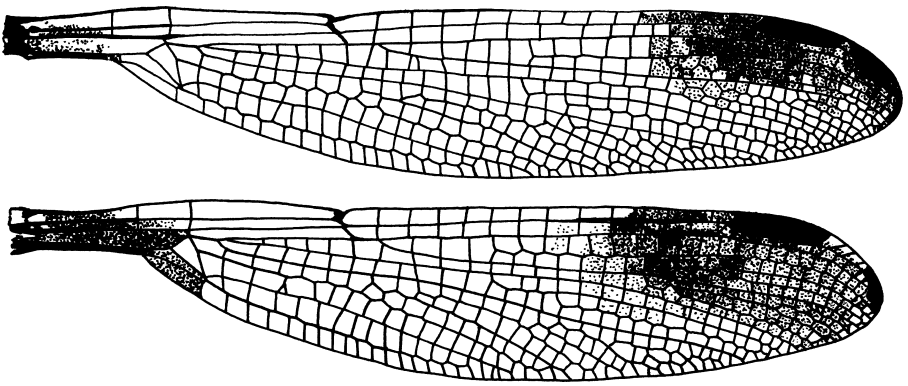


Fig. 3.1.178 Fore and hind wing of *Archilestes grandis.* Based on Williamson (1921).

2. There are no more than 15 postnodal cross veins between the nodus and the pterostigma in both the fore and hind wing. Both wings have extensive dark markings covering a large area around the nodus. The distance from the wing base to the nodus is more than 1/3 the wing length. Vein M_2 originates about one cell distal to the nodus. The distance from the arculus to the forking of M_{1+2}

and M_3 is much less than the second antenodal costal space. The anterior side of the postquadrangular cell is equal to the proximal side and the posterior side is about equal to the distal side. Vein M_3 reaches the wing margin at the level of the stigma (**Fig. 3.1.178**). Length of abdomen: 37 to 50 mm. Hind wing length: 29 to 39 mm.

.....*Archilestes grandis* Rambur, 1842 (North and Central America, Colombia, Venezuela).

- There are at least 16 postnodal cross veins between the nodus and pterostigma, and there are no distinct dark markings covering a large area around the pterostigma on both wings (**Fig. 3.1.17**). 3

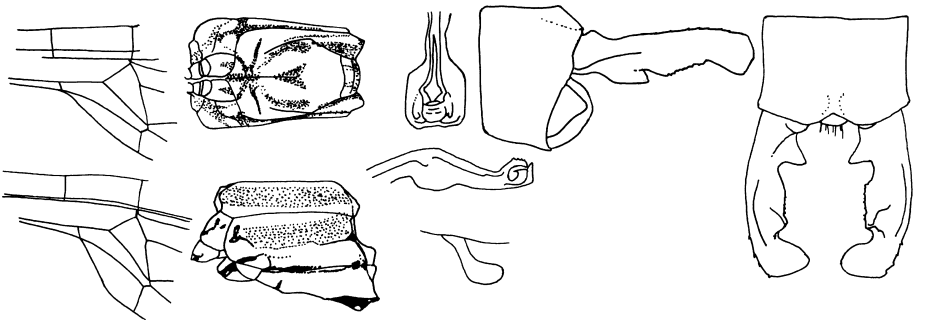


Fig. 3.1.179 *Archilestes guayaraca* male: veins near the base of the fore and hind wing (left), color pattern on the thorax in ventral and lateral view (left center, above and below, respectively), penis in ventral (upper center) and lateral view (center), posterior hamulus in lateral view (lower center), and apex of the abdomen in lateral (right center) and dorsal view (right). Based on De Marmels (1982e).

3. The superior anal appendage of the male has distinct dorsal and ventral lobes with an apical excavation between them. The distance from the wing base to the nodus is less than 1/3 the wing length. The distance from the arculus to the forking of M_{1+2} and M_3 is as long as the second antenodal costal space. The anterior side of the postquadrangular cell is longer than the proximal side and the posterior side is longer than the distal side. Vein M_3 reaches the wing margin at a level proximal to the stigma, which is very short (**Fig. 3.1.17**). Length of male abdomen: 47.5 to 54 mm. Hind wing length of male: 37 to 39 mm. It is a multicolored species.

.....*Archilestes tuberalatus* (Williamson, 1921) (Venezuela). Syn: *Cyptolestes tuberalatus* Williamson, 1921. The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).

- The superior anal appendage is bluntly rounded at the apex and lacks a trace of an apical excavation (**Fig. 3.1.179**). Total length of the male: c. 66 mm. Length of male abdomen: c. 53 mm. Hind wing length of male: c. 37.5 mm. Length of pterostigma in the fore-wing measured along the costal margin: c. 2.9 mm. The thorax is dark red and metallic green, and the abdomen is metallic black with a green sheen and yellow lateral markings on the first two segments. The female has not been described.
.....*Archilestes guayaraca* De Marmels, 1982 (Venezuela).

Comparison of the known species of *Archilestes* larvae in South America

Information for the key was provided by Williamson (1921) and Novelo-Gutiérrez (1994). The larvae of only two South American species have been described adequately enough to be included.

1. The cerci of the male larvae remain about the same thickness or expand slightly near the apex, after which they narrow abruptly to a rounded apex (**Fig. 3.1.176**).
.....*Archilestes tuberalatus* (Williamson, 1921) (Venezuela). Syn: *Cyptolestes tuberalatus* Williamson, 1921. The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).
- The cerci of the male larvae taper more or less continuously to an acute point (**Fig. 3.1.180**).
.....*Archilestes grandis* Rambur, 1842 (North and Central America, Colombia, Venezuela).

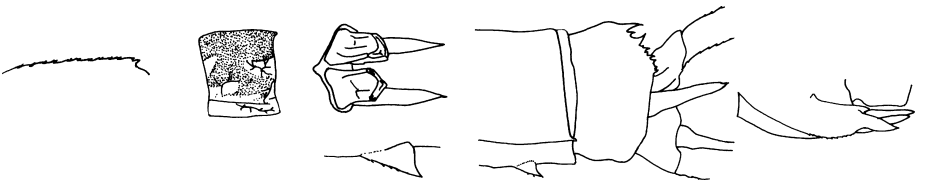


Fig. 3.1.180 *Archilestes grandis* larva (left to right): left carina of the sixth abdominal segment in dorsal view, sixth abdominal segment in lateral view, male cerci in ventral view (above) and male gonapophyses in lateral view (below), apex of the male abdomen without the gill lamellae in lateral view, and female gonapophyses in lateral view. Based on Novelo-Gutiérrez (1994).

Key to the species of adult *Lestes* in South America

Information for the key was taken from Selys (1862a), Calvert (1907, 1909), Ris (1918), Navás (1924a), De Marmels (1992a), Donnelly (1996), Belle (1997), Tennessen (1997), and Muzón (1997). The features in the key pertain predominantly to male specimens, and all females cannot yet be identified. The South American species of this genus require redescription and revision.

1. In dorsal view, the most prominent color is bright blue, which is usually abundant on the head, thorax, and abdomen (**Fig. 3.1.181**). The female may be less intensely colored than the male. 2
- Bright blue is not the predominant color, although it may be one of the principal colors on either the head or thorax (**Fig. 3.1.182**). 7

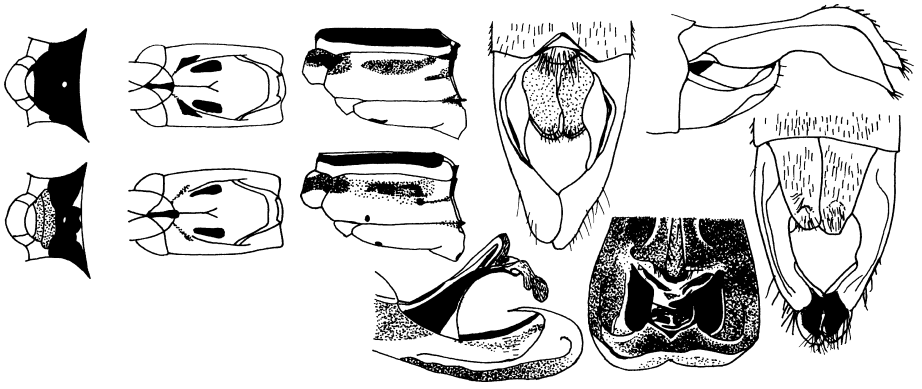


Fig. 3.1.181 *Lestes auritus:* color pattern on the dorsal surface of the head between the compound eyes and on the thorax in dorsal and lateral view of a male (above, left to center) and a female (below, left to center); apex of the abdomen of a male in dorsal (upper; right center), ventral (lower right), and lateral view (upper right); apex of the penis in ventral (lower right center) and lateral view (lower center). Based on Muzón (1997).

2. The superior anal appendage of the male lacks a basal tooth and is about twice as long as the inferior appendage (**Fig. 3.1.181**). 3
- The superior anal appendage of the male has a distinct basal tooth (**Fig. 3.1.183**). 5

3. The posterior surface of the head is mainly yellow. The thorax and legs of the male are bright blue with black stripes, one with a greenish tinge. The abdomen of the male is black with narrow blue margins between the segments and an entirely blue first segment. Females are black with yellowish markings instead

of blue. The inferior anal appendages of the male are relatively short (**Fig. 3.1.181**). Length of male abdomen without appendages: 30 to 32 mm; female: 27 to 28 mm. Hind wing length: 20 to 22 mm.
.....*Lestes auritus* Hagen in Selys, 1862 (Argentina, Minas Gerais, Rio de Janeiro, Santa Catarina).
- The posterior surface of the head is mainly dark reddish brown. The inferior anal appendage is about half as long as the superior anal appendage (**Fig. 3.1.184**). 4

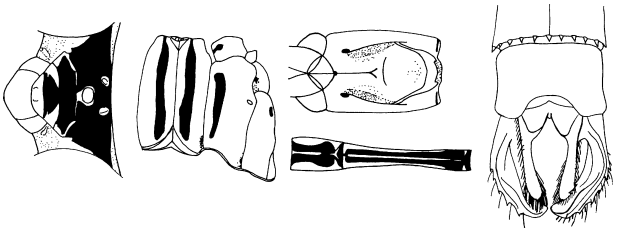


Fig. 3.1.182 *Lestes spatula* male (left to right): pattern on the dorsal surface of the head between the compound eyes, diagram of the color pattern on the synthorax, thoracic sternum showing the blackish spots and diffuse brownish stripes (above), dorsal color pattern of iridescent black and pale blue on the second and third abdominal segments (below), and apex of the abdomen in dorsal view. Based on Fraser (1946b) and Múzon (1993).

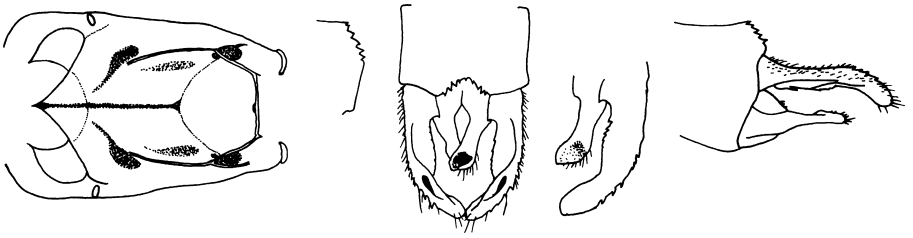


Fig. 3.1.183 *Lestes jerrelli* male (left to right): color pattern on the ventral side of the thorax, pattern of teeth on the left side of the tenth abdominal segment, apex of the abdomen in dorsal view, the anal appendages on the right side in dorsal view, and the apex of the abdomen in lateral view. Based on Tennessen (1997).

4. In dorsal view, the apices of the inferior anal appendages diverge, and in lateral view, they appear to narrow abruptly (**Fig. 3.1.184**).
.....*Lestes debellardi* De Marmels, 1992 (Venezuela).

- In dorsal view, the apices of the inferior anal appendages converge, and in lateral view, they appear to narrow gradually throughout the apical half (**Fig. 3.1.185**).
.....*Lestes pictus* Hagen in Selys, 1862 (Peru, Argentina, Espirito Santo, Rio de Janeiro, São Paulo, Mato Grosso).

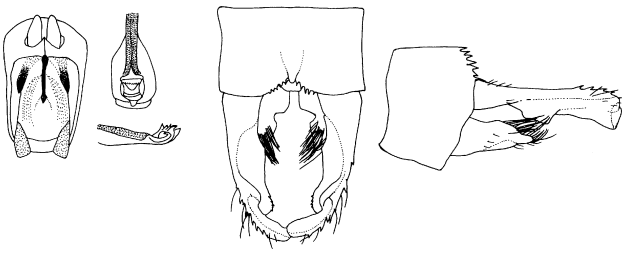


Fig. 3.1.184 *Lestes debellardi* (left to right): color pattern on the ventral side of the synthorax, apex of the penis in ventral (above) and lateral view (below), and apex of the abdomen of a male in dorsal and lateral view. Based on De Marmels (1992a).

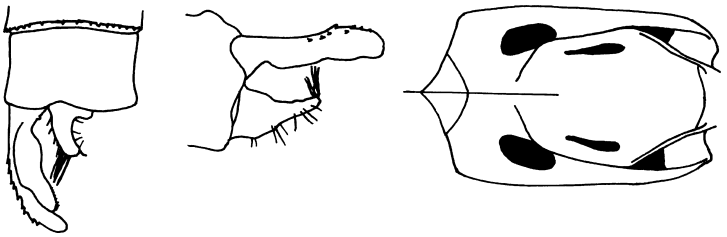


Fig. 3.1.185 *Lestes pictus* male (left to right): apex of the abdomen showing only one superior and one inferior anal appendage in oblique dorsal view, apex of the abdomen in lateral view, and synthorax in ventral view. Based on Calvert (1909).

5. The inferior anal appendages are angled inward near the base to that the apices cross each other in most specimens; at the apex, they are expanded and excavated on the dorsal side. The posterior margin of the tenth abdominal segment has teeth that are relatively coarse (**Fig. 3.1.183**). The dark stripes on the thorax are dark metallic green. Total length: 36 to 41 mm. Length of abdomen: 28 to 33 mm. Hind wing length: 21 to 23.3 mm. The range is for both sexes, with the males tending to have longer abdomens than the females.
.....*Lestes jerrelli* Tennessen, 1997 (Ecuador).
- The inferior anal appendages are either angled outward near the base or are acuminate and not excavated on the dorsal side at the apex (**Fig. 3.1.186**). 6

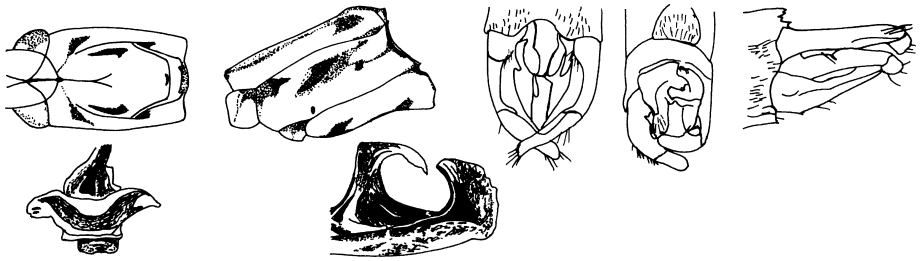


Fig. 3.1.186 *Lestes jurzitzai* male (above, left to right): color pattern on the thorax in dorsal and lateral view, apex of the abdomen in dorsal, oblique ventral, and lateral view, and the apex of the penis in posterior (lower left) and lateral view (lower center). Based on Múzon (1994).

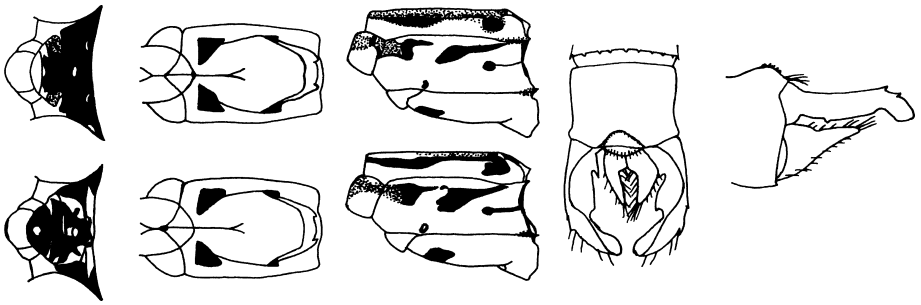


Fig. 3.1.187 *Lestes paulistus:* color pattern on the dorsal surface of the head between the compound eyes and on the thorax of a male in ventral and lateral view (above, left to center) and those of a female (below, left to center); the apex of a male abdomen in dorsal (right center) and lateral view (right). The pale areas shown are mainly bright blue, and the dark areas are black or dark green. Based on Calvert (1909) and Muzón (1997).

6. In dorsal or ventral view, the inferior anal appendages of the male appear to have parallel sides and curve slightly away from each other. The posterior margin of the tenth abdominal segment has teeth that are relatively fine (**Fig. 3.1.186**). The dark stripes on the thorax and dark abdominal markings are black. Length of abdomen without appendages: 28 to 31 mm. Hind wing length: 20 to 22 mm.

.....*Lestes jurzitzai* Muzón, 1994
(Bolivia, Rondônia).

- In dorsal or ventral view, the inferior anal appendages of the male appear to curve inward and are acuminate at the apex (**Fig. 3.1.187**). Dark stripes on the thorax are either dark green or black. Length of abdomen without the anal appendages: 29 to 30 mm. Hind wing length: 20 to 22 mm. Pterostigma: 1.3 to 1.4 mm.
.....*Lestes paulistus* Calvert, 1909 (Argentina, Uruguay, Mato Grosso, São Paulo).

7. The superior and inferior anal appendages are about equal in length, and each is longer than the tenth but not the ninth abdominal segment. These appendages curve toward each other toward the apex, and the superior appendages also curve sharply toward each other, as best seen in dorsal view. The superior appendages have an acutely pointed basal tooth visible in oblique dorsal view and a small thickening just distal to it. The apical part of the appendage does not notably narrow after the mid-length. Both anal appendages are black, which is not shown in the figure. The ventral side of the synthorax is pale, probably bluish green in the male and yellow in the female, with a pair of small elliptical black spots anterior to the midlength (**Fig. 3.1.188**). There are blue markings on both the head and the abdomen, but there are no distinct markings of this color on the thorax. Length of abdomen: 23 to 29 mm. Hind wing length: 16 to 19 mm. The first abdominal segment of the male is blackish, and that of the female is metallic green with a pair of yellow spots dorsally. The second through seventh abdominal segments are blackish with pale bluish rings, some interrupted along the dorsal midline. The eighth through tenth segments or both are dark brown or blackish and pruinose.
.....*Lestes bipupillatus* Calvert, 1909 (Venezuela, Argentina, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso).

- The inferior anal appendage is obviously shorter than the superior appendage, or, if they are only slightly shorter, the superior appendage has an acute basal tooth and a prominent enlargement on the inner margin at the midlength. Apical to this enlargement, the appendage narrows considerably (**Fig. 3.1.182**). 8

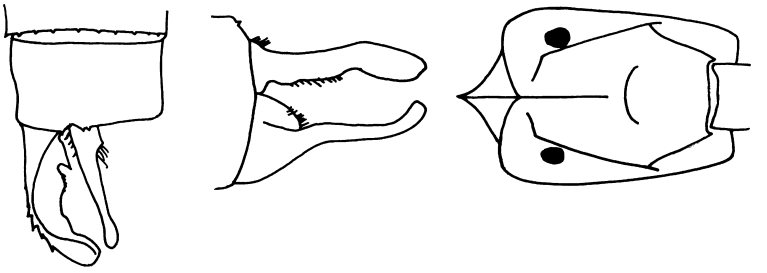


Fig. 3.1.188 *Lestes bipupillatus* male (left to right): apex of the male abdomen showing only one superior and one inferior anal appendage in oblique dorsal view, apex of the abdomen in lateral view, and synthorax in ventral view. Based on Calvert (1909).

8. In lateral view, the superior anal appendages appear straight and have only a basal tooth on the inner margin. The inferior anal appendages bear a basal carina on the internal margin and are almost as long as the superior appendages. The penis bears an internal lobe that is half the width of the second abdominal segment; its posterior part is kidney-shaped with two lobes, and its anterior part is small with an anterior groove. The mesepisternal stripe covers 1/3 of the width of the mesepisternum, and the sternum has two tiny black dots on the anterior portion and two diffuse brown stripes (**Fig. 3.1.182**). Length of male abdomen: 27 to 30 mm; female: 27 to 31 mm. Hind wing length of male: 19 to 21.5 mm; female: 21 to 23 mm.
.....*Lestes spatula* Fraser, 1946 (Paraguay, Uruguay, Argentina).
- In lateral view, the superior anal appendages of the male do not appear straight, or there are more teeth than just a basal one, or the inferior anal appendage does not bear a basal carina on its internal margin, or the inferior anal appendage is much shorter than the superior appendage (**Fig. 3.1.189**). 9

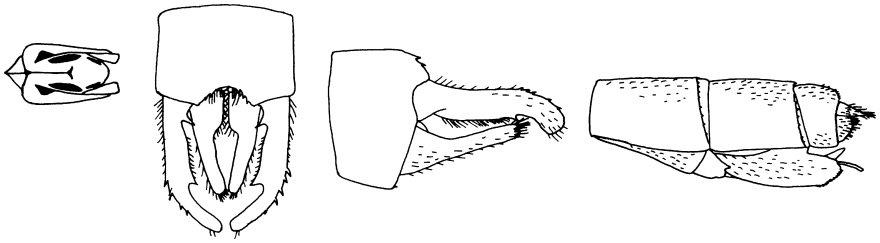


Fig. 3.1.189 *Lestes minutus* (left to right): markings on the ventral surface of the thorax, the apex of the male abdomen in dorsal and lateral view, and the apical three segments of the female abdomen. Based on Belle (1997), who called his specimens by the junior synonym, *Lestes mediorufus*.

9. The length of the male abdomen is 26 to 29.5 mm, and that of the female is 25 to 28 mm. The hind wing length of the male is 16 to 19 mm, and that of the female is 18 to 19 mm. The superior anal appendage bears two strong spiniform teeth on the inner surface, one at the base and the other just proximal to the apex; a row of minute teeth is located between them (**Fig. 3.1.189**).
.....*Lestes minutus* Selys, 1862 (Trinidad, Venezuela, São Paulo, Mato Grosso, Roraima). Syn: *Lestes mediorufus* Calvert, 1909.
- The length of the male abdomen is 30 to 37.5 mm, and that of the known females is 27 to 37 mm. The hind wing length of the male is 20 to 26.5 mm, and that of the female is 21 to 26 mm. 10
10. The hind wing length of the male is about 25.5 to 26.5 mm. Beware of overlaps in size, due to greater variability than reported in the descriptions. If in doubt, check both possibilities in the key. 11

- The hind wing length of the male is about 20 to 24 mm, and that of the female is 21 to 26 mm. The length of the male abdomen is 30 to 38 mm, and that of the female is 26 to 37 mm. 12

11. The length of the male abdomen is 36.5 to 37.5 mm. The head is about 4.7 mm wide, and the thorax is about 3 mm wide. The labium is creamy white. The genae, labrum, and external surfaces of the mandibles are pale bluish green, and the rest of the head is black. The thorax is pale bluish green with the following metallic black markings: a pair of spots on the middle prothoracic lobe and sometimes another on the ventrolateral margins, a middorsal mesothoracic stripe divided in the middle by a pale mid-dorsal carina, a mesepimeral stripe reaching the humeral suture, a much narrower stripe along the second lateral suture, an anterior and a posterior metepimeral spot both in contact with the ventral metathoracic carina, and a spot on each side of the metasternum. The anterior section of the abdomen is mainly metallic green, and the posterior section is black, but there are also black stripes on the first segment, black ventrolateral stripes and a posteroventral spot on the second, pale yellowish green on the middle 3/5 of the ventral surfaces of the third through fifth, and yellow on the ventral surface of the tenth. The ventral surface of the eighth and ninth abdominal segments and the dorsal surface of the ninth and anterior part of the tenth are pruinose. In lateral view, the basal 2/3 of the male superior anal appendage are almost straight, and the posterior half curves ventrad somewhat; there is a large tooth on the inner surface about 1/3 of the way from the base to the apex and fine denticulations about 2/3 of the way (**Fig. 3.1.174**).
.....*Lestes henshawi* Calvert, 1907 (Costa Rica, Colombia, Ecuador, Peru, Venezuela).

- The male abdomen is proportionately shorter, reaching approximately 31 mm. The total length of the male is c. 39.5 mm, and the fore-wing length is c. 27 mm. The head is shiny metallic green dorsally, yellow on the ventral and occipital surfaces, with pale setae on the ventral part of the head. The antennae are black, and the clypeus is darkened. The labrum is yellow with a ferrugineous tinge. The prothorax is shiny dark ferrugineous, while the synthorax is dark, shiny, metallic green. The carina and antehumeral stripe are yellow, as are the pleruae. There is a greenish black, oblique dorsal stripe with coppery reflections. The abdomen is mainly yellow, somewhat ferrugineous dorally and paler ventrally, but the second segment is almost entirely green with violet reflections and has a yellow mid-dorsal stripe. The third is dark green, sometimes with violet reflections. The fourth through sixth segments are yellow with blackish on the apical fifth of each segment. The superior anal appendage is twice as long as the tenth segment and much longer than the inferior appendage; it has about eight teeth along its external margin (**Fig. 3.1.190**).
.....*Lestes sternalis* Navás, 1930 (Colombia). Syn: *Lestes confusus* Fraser, 1950; *Lestes pallidus* Navás, 1924 (nec Rambur, 1842).

12. The prothorax and anterior part of the synthorax are uniformly pale ferrugineous with indistinct greenish or darker stripes (**Fig. 3.1.191**). 13

- There are markings on the anterior part of the synthorax, including antehumeral stripes (**Fig. 3.1.192**). 14

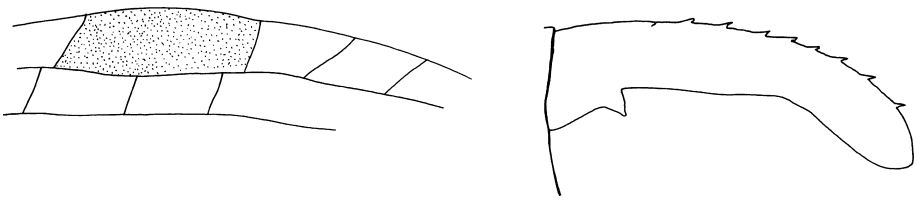


Fig. 3.1.190 *Lestes sternalis* (male): pterostigma of the hind wing (left) and superior anal appendage of the male in dorsal view (right). Based on Navás (1924a), misidentified as *Lestes pallidus* and later described as a new species.

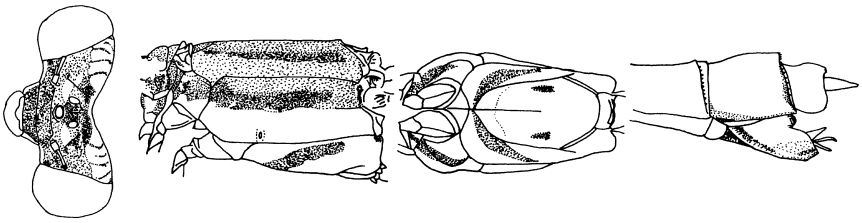


Fig. 3.1.191 *Lestes helix* (left to right): head and thorax in lateral and ventral view of a male and the apex of the abdomen of a female, not showing the inferior anal appendage, which was not visible on the specimen drawn. Based on Schmidt (1943).

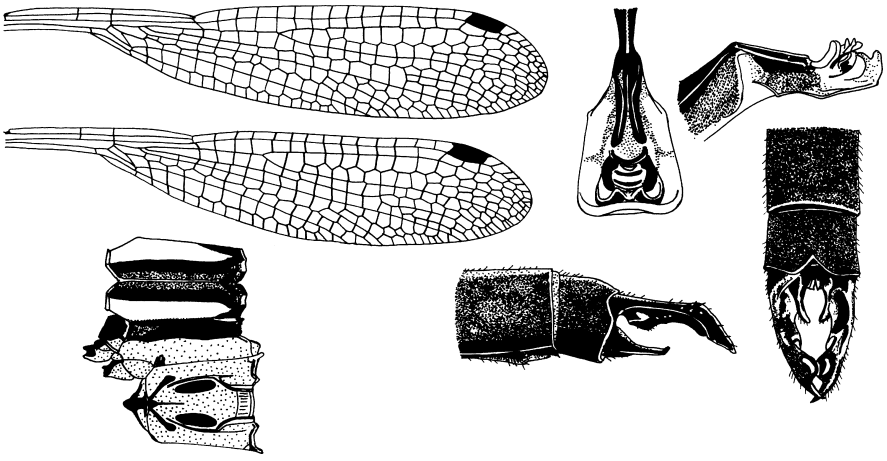


Fig. 3.1.192 *Lestes urubamba* male: fore and hind wing (upper left), diagram of the color pattern on the thorax (lower left), penis in ventral (upper right center) and lateral view (upper right), and apex of the abdomen in dorsal (lower right) and lateral view (lower right center). Based on Kennedy (1942a).

13. The ovipositor extends well below the ventral surface of the abdomen and reaches posteriad about as far as the ventral margin of the tenth abdominal segment of the female. The ferrugineous color on the thorax transitions laterally to a yellowish color. There is a narrow oval black marking on the mesepimeron and a diffuse blackish band on the metepimeron. The superior anal appendage is much longer than the inferior appendage, and it curves ventrad and anteriad about 120º at the apex (**Fig. 3.1.191**).
.....*Lestes helix* Ris, 1918 (Peru, Venezuela, Territory of Acre, Roraima, Amazonas?).
- The ovipositor remains parallel and close to the ventral margin of the abdomen, and it extends well beyond the ventral margin of the tenth abdominal segment of the female. The superior anal appendage of the male has an apical group of long setae. There are two metallic green bands on the synthorax. Length of male abdomen: c. 30 mm; female: 27 to 29 mm. Hind wing length: 20 to 22 mm. The abdomen is yellowish brown with metallic patches on the posterior parts of the second through fifth segments (**Fig. 3.1.193**).
..... *Lestes undulatus* Say, 1839 (Argentina, Chile, Uruguay, Rio Grande do Sul). Syn: *Lestes vittatus* Hagen in Selys, 1850; *Agrion viridivittatus* Blanchard, 1851.

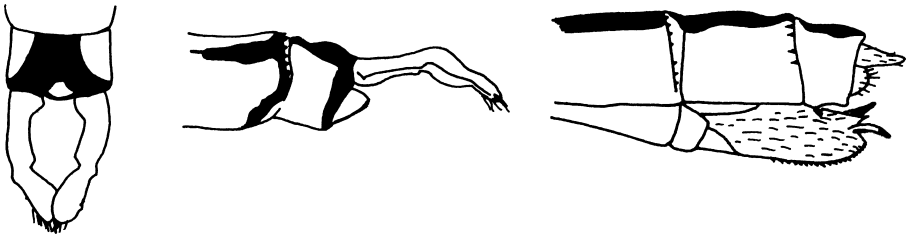


Fig. 3.1.193 *Lestes undulatus* (left to right): apex of the male abdomen in dorsal and lateral view, and apex of the female abdomen in lateral view. Based on Böttger and Jurzitza (1967).

14. The color of the antehumeral stripes is brassy black without notable reddish reflections; they are exceptionally large, covering the whole length of the mesepisternum, laterally to the mid-dorsal carina. The synthorax is all yellow laterally except for a small black metepimeral spot. The posterior part of the head is black, except for a yellow area around the occipital foramen. The thorax is mainly yellowish, but a broad fuscous middle stripe typically appears after death. Length of abdomen: 28 to 36 mm; hind wing length: 20 to 25 mm.
.....*Lestes alacer* Hagen, 1861 (North and Central America, Surinam). Syn: *Lestes sublatus* Hagen in Selys, 1862.

- The lateral surface of the synthorax is not all yellow with small black spots, or the antehumeral stripes are relatively narrow and do not reach the mid-dorsal carina (**Fig. 3.1.192**). If a female somewhat resembles the description of *Lestes alacer,* the dark colors have a reddish tinge and are not brassy. 15

15. The superior anal appendage of the male curves strongly ventrad toward the apex. The anal appendages of the female are usually stoutly built and do not taper evenly from the base to the apex (**Fig. 3.1.192**). 16

- The anal appendages are dark. The apical part of the superior anal appendage does not curve strongly ventrad. The anal appendages of the female are conical and taper evenly from the base to the apex (**Fig. 3.1.194**). 20

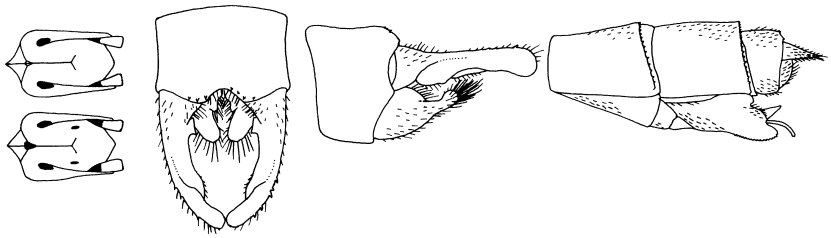


Fig. 3.1.194 *Lestes tenuatus* (left to right): markings on the ventral surface of the thorax of two specimens, the apex of the male abdomen in dorsal and lateral view, and the apical three segments of the female abdomen. Based on Belle (1997).

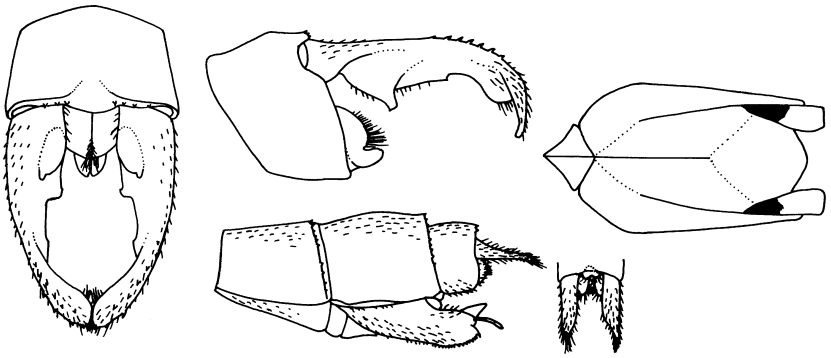


Fig. 3.1.195 *Lestes curvatus* (above, left to right): apex of the male abdomen in dorsal and lateral view and male synthorax in ventral view, and (below) apex of a female abdomen in lateral (left) and dorsal view. Based on Belle (1997).

16. The color of the anal appendages is pale. The dark coloration on the ventral surface of the thorax is limited to two dark spots on the posterior part (**Fig. 3.1.195**).

.....*Lestes curvatus* Belle, 1997 (Surinam).

- The anal appendages are at least partially dark, often with the base lighter in color than the apical half (**Fig. 3.1.192**). 17

17. The first abdominal segment is blue with a black posterior margin in the male and a black triangular marking in the female. The second segment is mainly black in the male and blue in the female. The third through seventh segments are black with narrow blue basal markings, sometimes with dark brown replacing blue on the seventh segment of the female. The eighth through tenth segments are black, usually with a metallic sheen in the female. Narrow blue antehumeral stripes are present. The superior anal appendage of the male angles ventrad about 45º about 2/3 of the way from the base to the apex, and in dorsal view, it appears to be the shape of a cat's claw (**Fig. 3.1.192**). Length of abdomen: c. 35 mm. Hind wing length: c. 23 mm. Length of pterostigma: c. 1.75 mm in the male and c. 1.50 mm in the female.
.....*Lestes urubamba* Kennedy, 1942 (Peru).

- The first abdominal segment is not predominantly blue, and the other segments are not marked with blue (**Fig. 3.1.196**). 18

18. In lateral view, a ventral row of small, acute teeth located about 2/3 of the way from the base to the apex is evident on the superior anal appendage of the male (**Fig. 3.1.196**). Length of male abdomen: c. 34 mm. Hind wing length: 20 to 22 mm. Length of pterostigma in the fore-wing: 1.3 to 1.5 mm. The head is mainly blackish brown with bluish green and cream markings. The thorax is apparently pale bluish with metallic greenish stripes and brownish and yellowish markings, which may have a bluish tinge in life. The first abdominal segment is pale green; the second through eighth segments are blackish bronze with pale green markings, and the ninth and tenth are obscure and pruinose.
.....*Lestes quadristriatus* Calvert, 1909 (Mato Grosso).

- In lateral view, there is no ventral row of small, acute teeth located about 2/3 of the way from the base to the apex of the male superior anal appendage (**Fig. 3.1.197**). 19

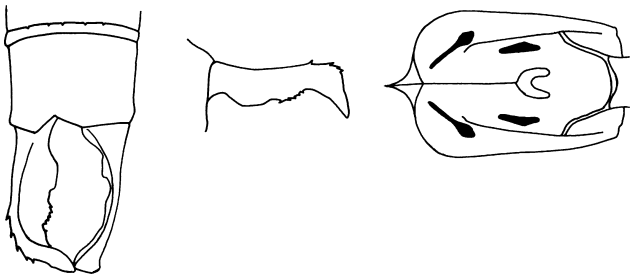


Fig. 3.1.196 *Lestes quadristriatus* male (left to right): apex of the abdomen with only the superior anal appendages in oblique dorsal view, a lateral view of the superior anal appendage, and the synthorax in ventral view. Based on Calvert (1909).

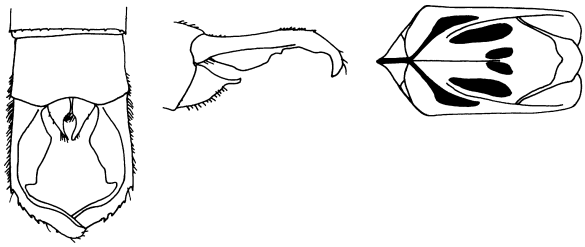


Fig. 3.1.197 *Lestes dichrostigma* male (left to right): apex of the abdomen in dorsal and lateral view and synthorax in ventral view. Based on Calvert (1909).

19. The ventral surface of the synthorax is yellowish with a single black marking in the form of a V with lateral branches. The superior anal appendage of the male has a subapical ventral enlargement, which bears a tuft of long setae on its posterior margin (**Fig. 3.1.198**). Length of male abdomen: c. 38 mm; female: c. 26 mm. Hind wing length of male: c. 23 mm; female: c. 24.5 mm. The head is greenish blue on the face, bronzed and brown on the dorsal surface, and dark yellow posteriorly. The prothorax is mainly bluish, and the synthorax is black, blue, and green with yellow and black ventrally. The abdomen of the male is mainly black dorsally and reddish laterally.
.....*Lestes tricolor* Erichson, 1848
(Guyana, Argentina, Rio de Janeiro, Santa Catarina, Bahia).
- The dark markings on the ventral side of the synthorax include a narrow V-shaped marking and two additional pairs of spots. The apex of the superior anal appendage is sharply hooked and lacks a tuft of long setae (**Fig. 3.1.197**). Length of male abdomen: 35 to 36.5 mm; female abdomen: 31 to 34 mm. Hind wing length: 21 to 21.5 mm. Length of pterostigma in the fore-wing: c. 1.4 mm. The head is dull brown with blue and yellow markings. The thorax is mainly violaceous with metallic greenish stripes and brownish and yellowish markings, which may have a bluish tinge in life. The abdomen is bronzy brown with yellowish markings.
.....*Lestes dichrostigma* Calvert, 1909
(Venezuela, Argentina, São Paulo, Mato Grosso).

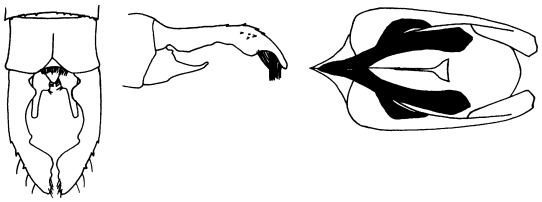


Fig. 3.1.198 *Lestes tricolor* male (left to right): apex of the abdomen in dorsal and lateral view and the synthorax in ventral view. Based on Calvert (1909).

20. The short, thick inferior anal appendages converge strongly toward their apices and do not quite reach as far posteriad as the small tooth on the inner margin of the superior anal appendage. Proximal to that small tooth, each superior anal appendage has nearly straight margins in dorsal view. The posterior lobe of the prothorax of both males and females is narrow laterally and broadens into a medial process broadly and shallowly excavated at the apex (**Fig. 3.1.199**). The ovipositor does not reach as far posteriad as the apex of the tenth abdominal segment. Total length of male: c. 39 mm. Length of male abdomen: c. 31.5 mm. Hind wing length of male: c. 23.5 mm. The head is predominantly dark with white on the labium and blue on the labrum and anteclypeus. There are some pale markings near the occipital foramen. The thorax of the male is dark dorsally with pale blue stripes and lateral surfaces transitioning to yellow ventrally. Two small dark spots are the only dark markings on each lateral surface. The female markings are similar, but yellow replaces the blue. The dark colors have red reflections, which are more prominent in the females.
.....*Lestes apollinaris* Navás, 1934 (Colombia, Ecuador, Peru, Venezuela).

- The inferior anal appendages extend beyond the first interior tooth on the superior appendage, or the prothorax does not have a broad medial process broadly and shallowly excavated at the apex (**Fig. 3.1.194**), or each superior anal appendage does not appear to have nearly straight margins proximal to the first internal tooth in dorsal view. 21

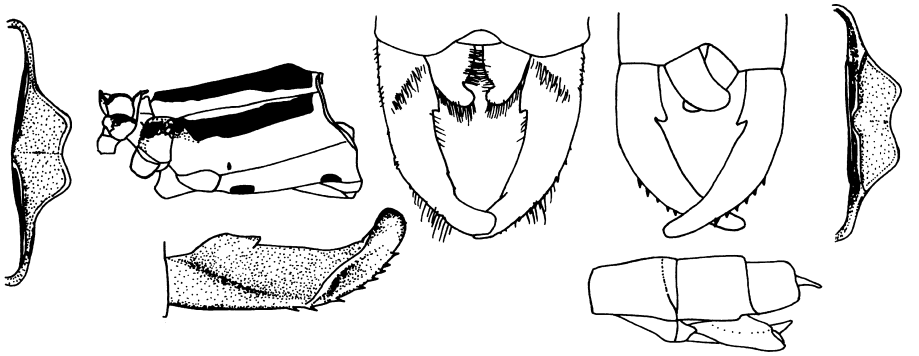


Fig. 3.1.199 *Lestes apollinaris:* dorsal view of the posterior lobe of the prothorax of a male (left) and female (right), thorax in lateral view (upper left center), apex of the male abdomen in dorsal view (center) and the illustration by Navás (1934a) provided with his original description (upper right center), superior anal appendage of a male in dorsal view (lower left center), and apex of the female abdomen in lateral view (lower right center). Based on Navás (1934a) and Donnelly (1996).

21. The inner surface of the superior anal appendage of the male bears no spines, whatsoever. The dark coloration on the ventral surface of the thorax is limited to three oval spots near the ventrolateral carina (**Fig. 3.1.200**). The length of the anal appendages of the female is about 3.5 times the width of the appendage at the base.
.....*Lestes falcifer* Sjöstedt, 1918 (Peru, Venezuela, Amazonas). Syn: *Lestes edentatus* Belle, 1997.
- The inner surface of the superior anal appendage of the male bears spines. The length of the anal appendages of the female is about 2 to 2.5 times the width of the appendage at the base (**Fig. 3.1.194**). 22

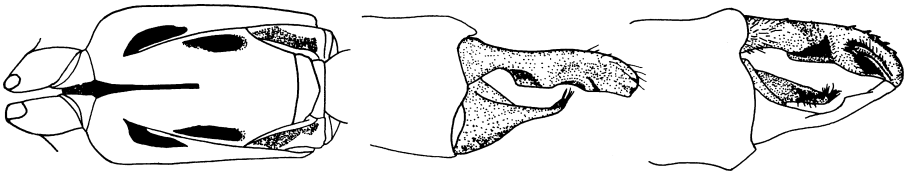


Fig. 3.1.200 *Lestes falcifer* male (left to right): color pattern on the ventral side of the thorax and the apex of a male abdomen in lateral and dorsomedial view. Based on Lencioni (2005).

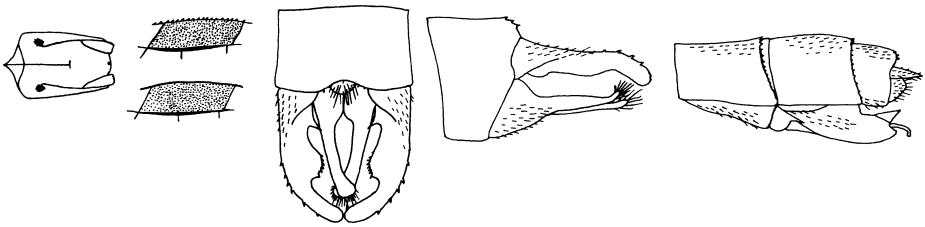


Fig. 3.1.201 *Lestes forficula* (left to right): markings on the ventral surface of the thorax of a male, pterostigma on the fore and hind wing (above and below, respectively), the apex of the male abdomen in dorsal and lateral view, and the apical three segments of the female abdomen. Based on Belle (1997).

22. The inner surface of the superior anal appendage of the male bears a truncate tooth at the base and a row of minute spines proximal to the apex. The inferior anal appendage of the male bears a process extending to a point 1/3 of the way from the base to the apex of the superior appendage. The ventral surface of the

female thorax is completely free from setae, and if dark metasternal spots are present, they are very weakly developed (**Fig. 3.1.194**). Total length: c. 44 mm. Length of abdomen: c. 37 mm. Hind wing length of male: c. 22.5 mm; female: 26 mm. The thorax of the male is yellowish with a metallic greenish sheen.
.....*Lestes tenuatus* Rambur, 1842
(North and Central America, West Indies, Colombia, Ecuador, Venezuela, Surinam).

- The inner surface of the superior anal appendage of the known males bears an acutely pointed tooth at the base adjacent to a row of minute spines running further posteriad (**Fig. 3.1.201**). 23

23. The total length of the male and female is about 37 mm. The inferior appendages of the male converge, and the apex of one covers the other in dorsal view. Some individuals have a small spot at the posterior end of the ventral midline of the metasternum (**Fig. 3.1.201**). Length of the abdomen: 29 to 31 mm. Hind wing length of the male: 19 to 20 mm; female: 21 to 22 mm. Length of the costal margin of the pterostigma of a male: 1.2 to 1.3 mm; female: 1.3 to 1.5 mm.
.....*Lestes forficula* Rambur, 1842
(North and Central America, West Indies, Venezuela, Peru, French Guiana, Guyana, Argentina, Bahia, Minas Gerais, Mato Grosso). Syn: *Lestes striatus* Selys, 1862.

- The total length of males and females is about 40 mm or more. The inferior anal appendages of the known male are directed parallel to one another and do not cross over at the apex in dorsal view. The inferior anal appendage of the known males bears a process extending to a point 2/3 of the way from the base to the apex of the superior appendage. The male of one species is unknown. The species for which a female has been described is characterized by a ventral surface of the female thorax covered by pale, hair-like setae and prominent dark metasternal spots (**Fig. 3.1.202**). The identification of the species in the next couplet remains tentative because only the male of one and the female of the other has been described. 24

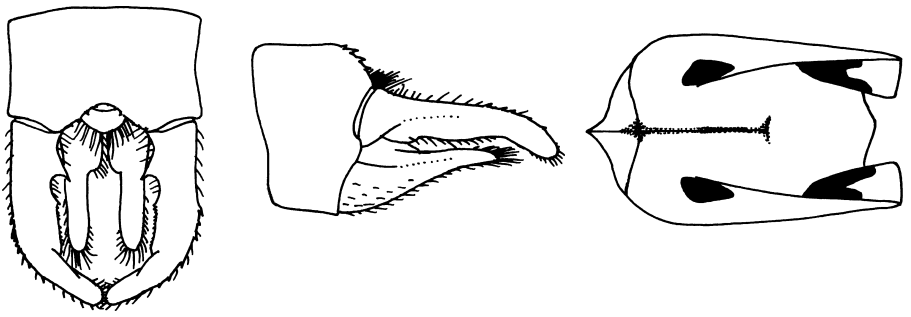


Fig. 3.1.202 *Lestes basidens* male (left to right): apex of the abdomen in dorsal and lateral view and ventral surface of the synthorax. Based on Belle (1997).

24. The head of the male has a dorsal surface that is black with a bluish luster and irregular brownish markings. The occipital surface of the head is brown, becomes darker ventrally, and is slightly pruinose. The ventral surface of the male thorax is pruinose, and there are four prominent dark spots on the ventral surface, and one faint darkening on the ventral median suture (**Fig. 3.1.202**). Total length of male: c. 40 mm. Length of male abdomen: c. 30 mm. Hind wing length of male: 20 mm. Length of the costal margin of the pterostigma in the fore-wing: 1.4 mm. The female has not been described.
.....*Lestes basidens* Belle, 1997 (Surinam).

- The head of the female has a dorsal surface that is yellowish brown, both on its anterior and posterior parts. The ventral surface of the female thorax is covered by pale, hair-like setae and prominent dark metasternal spots (**Fig. 3.1.203**). Total length of female: c. 42 mm. Length of female abdomen: c. 33.5 mm. Hind wing length of male: 21.5 mm. Length of the costal margin of the pterostigma in the fore-wing: 1.6 mm. The male has not been described.
.....*Lestes trichonus* Belle, 1997 (Surinam).

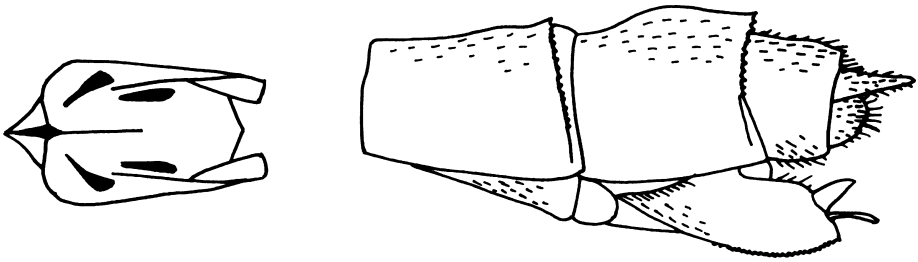


Fig. 3.1.203 *Lestes trichonus* female: ventral markings on the thorax (left) and apex of the abdomen in lateral view (right). Based on Belle (1997).

Key to the known species of *Lestes* larvae in South America

Information for the key was taken from Costa and Carneiro (1994).

1. In the distal half of the lateral gill lamella, most of the dorsal edge is obviously concave, and there are two dark bands across the lamella, a narrow one in the basal half and a broad one covering most of the apical half (**Fig. 3.1.177**). There are no black lateral spots on the ventral surfaces of the abdominal segments.
.....*Lestes bipupillatus* Calvert, 1909 (Venezuela, Argentina, Rio de Janeiro).

- In the distal half of the lateral gill lamella, most of the dorsal edge is straight (**Fig. 3.1.204**). There are black lateral spots on the ventral surfaces of the abdominal segments. 2

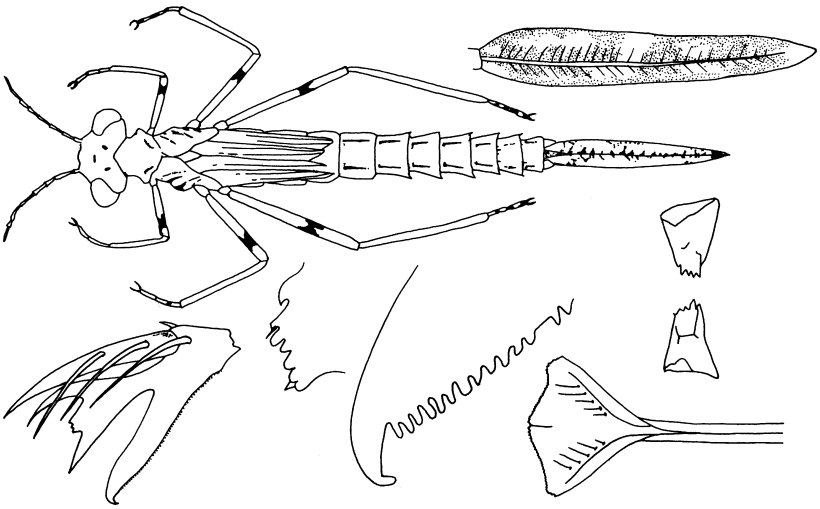


Fig. 3.1.204 *Lestes pictus* larva: habitus (upper left), labial palp (lower left), enlargements of the distal edge of the middle part (lower left center) and terminal spine of the labial palp (center), internal views of the left and right mandibles (middle and lower middle right), prementum (lower right), and lateral gill lamella (upper right). Based on Costa and Carneiro (1994).

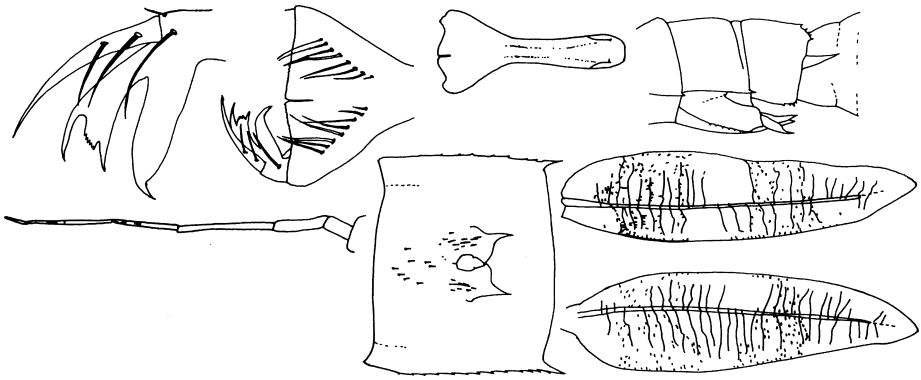


Fig. 3.1.205 *Lestes apollinaris* larva (above, left to right): dorsal views of the labial palp and the labium with one palp removed, prementum in ventral view, and the apex of the abdomen of a female, and an antenna (lower left), ventral view of a male gonapophyses (lower center), and a lateral (middle right) and middle gill lamella (lower right). Based on De Marmels (2004).

2. The anterior margin of the prementum clearly protrudes anteriad and extends in the middle noticeably farther anteriad than the anterolateral corners (**Fig. 3.1.204**). 3
- The anterolateral corners of the prementum extend almost as far as or farther anteriad than the middle of the anterior margin (**Fig. 3.1.205**). 4

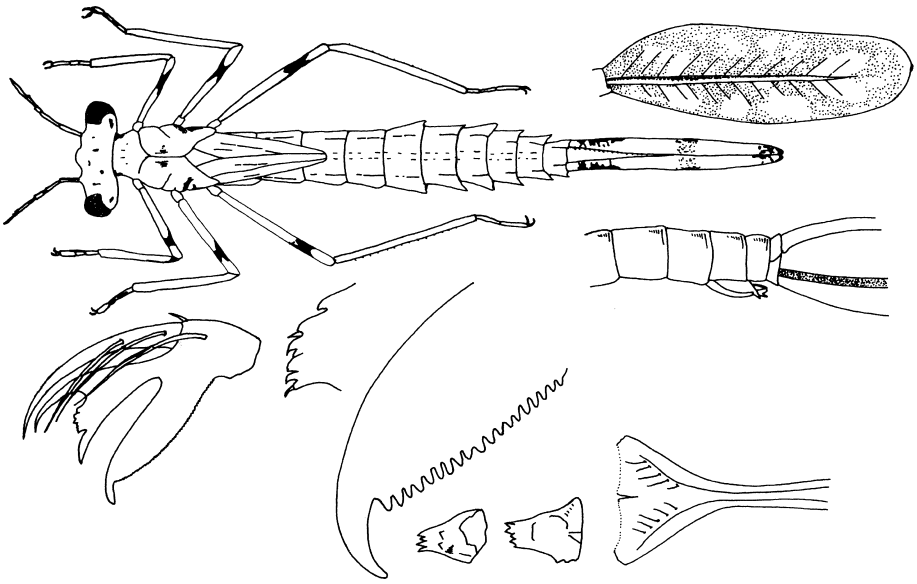


Fig. 3.1.206 *Lestes tricolor* larva: habitus (upper left), labial palp (lower left), enlargements of the distal edge of the middle part (lower left center) and terminal spine of the labial palp (center), internal views of the left and right mandibles (lower center, left and right, respectively), prementum (lower right), apical segments of the abdomen of a female larva (lower middle right), and a lateral gill lamella (upper right). Based on Costa and Carneiro (1994).

3. The terminal spine on the lateral palp is sharply curved to form a hook just proximal to the apex. There are black lateral spots at the apices of the ventral surfaces of the first to seventh abdominal segments. A dark band is present on each femur and each apical tarsal segment, but there are no dark bands on the tibiae. The apex of each gill lamella forms an acute angle (**Fig. 3.3, 3.1.204**).
.....*Lestes pictus* Hagen in Selys, 1862
(Peru, Argentina, Espirito Santo, Rio de Janeiro, São Paulo, Mato Grosso).

- The terminal spine on the lateral palp is not hook-like but claw-like and evenly curved to the apex. A dark band is present on the middle and hind femora but only weakly indicated of the fore-femur; the apical tarsal segments are not ringed with black. The apex of each gill lamella is broadly rounded (**Fig. 3.1.28**).
.....*Lestes tenuatus* Rambur, 1842
(North and Central America, West Indies, Colombia, Ecuador, Venezuela, Surinam).

4. There are about eight setae in each row on the prementum. The caudal gill lamellae are notably broader in the basal half, where the width is more than ¼ the length; they taper to an acute angle (**Fig. 3.1.205**).
.....*Lestes apollinaris* Navás, 1934
(Colombia, Ecuador, Peru, Venezuela).

- There are five setae in each row on the prementum. The gill lamellae are almost as wide in the apical half as in the basal half and end in a broadly rounded curve with an angle more than 90º, or, if not, the maximum basal width is less than 1/5 the length. There are black lateral spots at the apices of the ventral surfaces of the first to eighth abdominal segments, which may or may not be connected to lateral stripes. A dark band is present on each femur (**Fig. 3.1.206**). 5

5. There are no dark bands on the tibiae or the apical tarsal segments. The apex of each gill lamella is broadly rounded (**Fig. 3.1.206**).
.....*Lestes tricolor* Erichson, 1848
(Guyana, Argentina, Rio de Janeiro, Santa Catarina, Bahia).

- There are dark apical bands on the tibiae and tarsi of all legs. The apex of the median gill lamella is broadly rounded with a slight tubercle at the apex and a subapical concavity on the ventral side. The lateral gill lamella ends in a rounded acute angle (**Fig. 3.1.207**).
.....*Lestes spatula* Fraser, 1946
(Paraguay, Uruguay, Argentina).

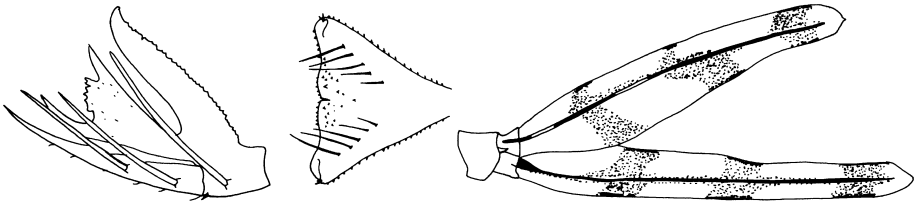


Fig. 3.1.207 *Lestes spatula* final larval instar (left to right): labial palp, labium without palps (prementum), and the median (above) and a lateral gill lamella (below). Based on Múzon (1993).

Pseudostigmatidae

Key to the genera of adults in South America

Information for the key was provided by Munz (1919) and Hedström and Sahlén (2001).

1. There are few secondary sectors in the wing, and there is only one rather long rows of cells between veins IR_2 and R_3, although a second, short row may also be present The origin of vein R_3 is located closer to the nodus than to the apex of the wing. Vein Cu_2 ends halfway between the origin of R_3 and the apex of the wing or closer to the apex of the wing. Vein A_1 has no forks, and only one or two rows of cells separate it from the posterior margin of the wing. The superior anal appendage of the male curves inward to resemble a forceps. The width and height of the superior anal appendage of the male are roughly equal (**Fig. 3.1.208**).
.....*Mecistogaster* Rambur, 1842..p. 204
- There are many secondary sectors in the wing, and there are two or more rather long rows of cells between veins IR_2 and R_3. The origin of vein R_3 is located equidistant from the apex of the wing and the nodus or closer to the apex. Vein Cu_2 ends closer to the origin of R_3 than to the apex of the wing. Vein A_1 has many forks, and at least several rows of cells separate it from the posterior margin of the wing (**Fig. 3.1.209**). 2

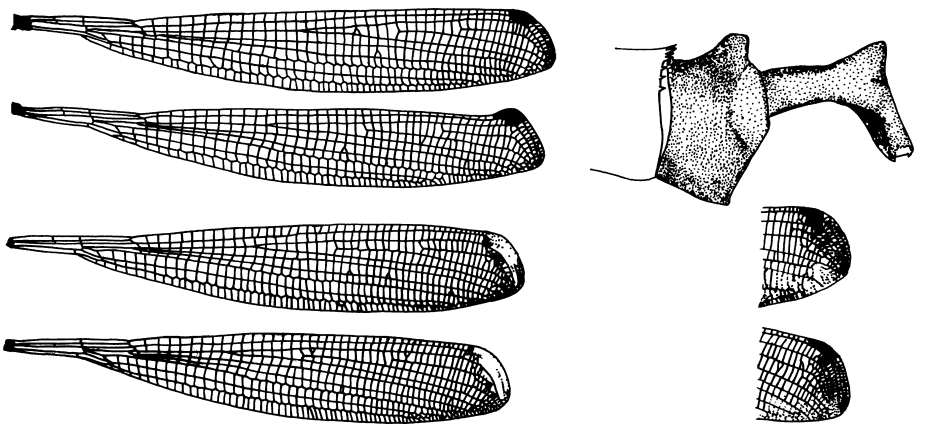


Fig. 3.1.208 *Mecistogaster amalia* fore and hind wing of a male (upper left) and a female (lower left), apices of the wings of a female enlarged (lower right), and the apex of the male abdomen in lateral view (upper right). Based on Lencioni (2005).

2. There are two or three cross veins in the quadrangle and several in the subquadrangle, some of which appear continuous. The origin of vein R_3 is located midway between the nodus and the apex of the wing. At least along the middle section of the wing, two rows of cells separate vein A_1 from the posterior margin of the wing (**Fig. 3.1.18**).
.....*Anomisma* McLachlan, 1877

The only species described in this genus is *Anomisma abnorme* McLachlan, 1877, known from Venezuela, Colombia, Ecuador, and Peru. Syn: *Microstigma terminatum* McLachlan, 1877.

- The quadrangle is not crossed, and its length is about five times its width. There is no cross vein in the subquadrangle. The origin of vein R_3 is located closer to the apex of the wing than to the nodus (**Fig. 3.1.209**). 3

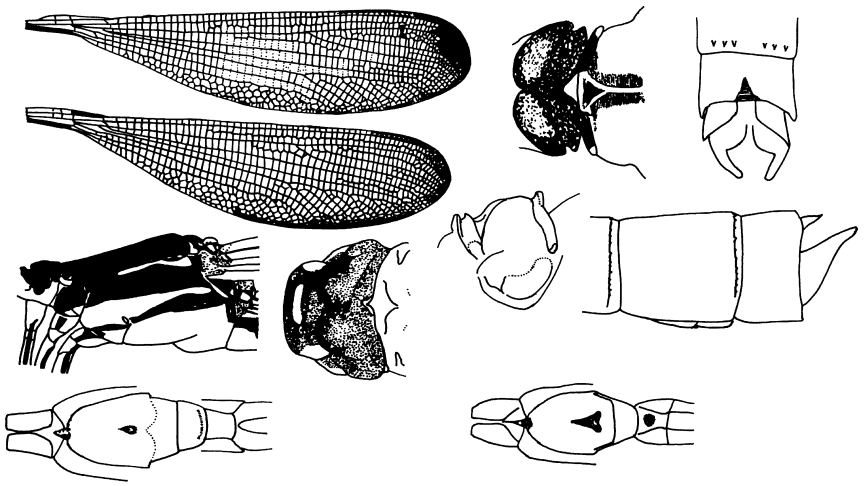


Fig. 3.1.209 *Microstigma maculatum:* fore and hind wing of a male (upper left), posterior part of prothorax and anterior part of the synthorax of a male in dorsal view (upper right center), pattern on the male thorax in lateral (lower middle left) and ventral view (lower left), apex of the male abdomen in dorsal (upper right) and lateral view (middle right), prothorax of a female in dorsal (lower left center) and lateral view (right center), and the female thorax in ventral view (lower right). Based on Schmidt (1958).

3. The nodus is located 1/6 of the way from the wing base to the apex. Vein R_3 arches strongly anteriad posterior to the pseudostigma. Vein Cu_2 forks numerous cells before reaching the posterior margin of the wing. The wings are relatively broad and have a rectangular pseudostigma on each wing surrounded by a hyaline area. Proximal to the hyaline area around the pseudostigma, there is usually a shiny metallic blue band across the entire width of each wing. Proximal to this band, the wing is milk white. The apex of the female wing is

also milky, while that of the male is hyaline. The inferior anal appendage of the male is longer than the superior anal appendage (**Fig. 3.1.210**). Abdomen length of male: 73 to 101 mm; female: 64 to 85 mm. Hind wing length of male: 65 to 91 mm; female: 54 to 78 mm.

.....*Megaloprepus* Rambur, 1842

Only one species has been described in this genus, *Megaloprepus caerulatus* (Drury, 1782), found from Mexico to Bolivia. Three subspecies have been described: *Megaloprepus caerulatus caerulatus* from Mexico, Central America, Colombia, Ecuador, Guyana, and Bolivia; *Megaloprepus caerulatus brevistigma* Selys, 1860, from Peru and Venezuela; and *Megaloprepus caerulatus latipennis* Selys, 1860, from Central America. The pterostigma of *M. c. caerulatus* is almost always at least 3 mm long, while that of *M. c. brevistigma* is seldom longer than 2 mm. Calvert (1907) did not believe that *M. c. latipennis* could be considered distinct.

- The nodus is located 1/5 of the way from the wing base to the apex. Vein R_3 arches only slightly posterior to the pseudostigma. Vein Cu_2 forks only about five cells before reaching the posterior margin of the wing (**Fig. 3.1.209**).

.....*Microstigma* Rambur, 1842..p. 211

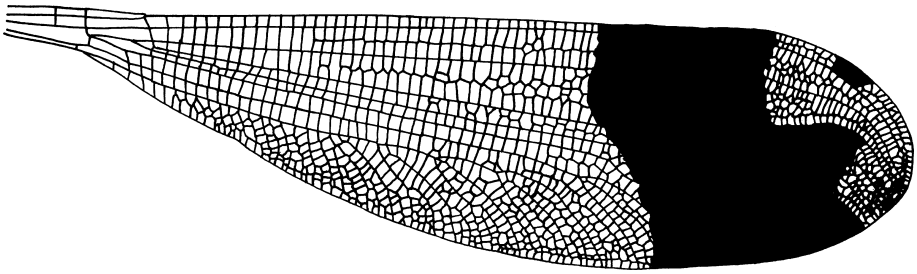


Fig. 3.1.210 Hind wing of a female *Megaloprepus caerulatus.* Based on Munz (1919).

Information on the genera of known larvae in South America

The key is based on descriptions of larvae provided by Ramírez (1995) and Lencioni (2005). There is not enough information on intrageneric variability to provide a reliable key. Information on the larvae of South American pseudostigmatids is fragmentary, and adequate descriptions of the larvae of only three species in two genera are presently available.

1. The third segment of the antenna is more than twice as long as the second. There are five long setae proximal to the moveable hook on the labial palp (**Fig. 3.1.211**).

.....*Microstigma* Rambur, 1842..p. 211

- The third segment of the antenna is less than 1.5 times as long as the second. There are six long setae proximal to the moveable hook on the labial palp (**Fig. 3.1.29**).
.....*Mecistogaster* Rambur, 1842..p. 204

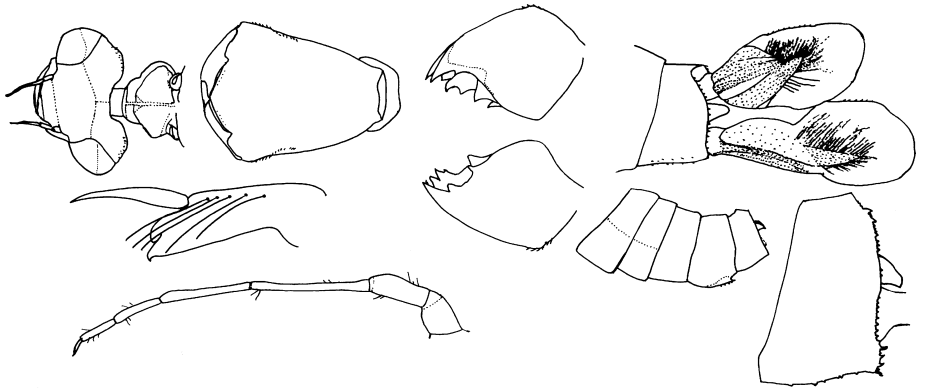


Fig. 3.1.211 *Microstigma rotundatum* male larva: head of an exuvia in dorsal view (upper left), labium in ventral view (upper left center), labial palp in dorsal view (middle left), antenna (lower left), mandibles (upper center), apical segments of the abdomen in lateral view (lower right center), tenth abdominal segment in lateral view (lower right), and apex of the abdomen with a middle and lateral gill lamella (upper right). Based on De Marmels (2007a).

Key to the species of adult *Mecistogaster* in South America

Information for the key was provided by Förster (1903), Eaton and Calvert (1892-1908), Calvert (1948a), Ris (1918), Sjöstedt (1918), Machado (1985a), Hedström and Sahlén (2001), and Lencioni (2005). The key is tentative because descriptions of both males and females of all species are not available or are unreliable. The genus is also in need of revision because the shading on the wings is too variable to provide a reliable means of distinguishing the species. The Latin endings for the names used by Ris (1918) were corrected for the key.

1. The posterior lobe of the female pronotum is truncate and not curved on the dorsal side; its straight posterior margin is interrupted by wide, rounded, medial excavations. The pronotum is black with yellow markings, covering almost the entire lateral lobes. The wings are hyaline, except for a whitish clouding at the apex and a light yellowish pseudostigma, a structure resembling a pterostigma near the site of this structure in the wings of other families. It covers six or seven cells in this species. The head, prothorax, and anterior part of the synthorax are

predominantly black, although the labium and the margins of the lateral lobes on the pronotum are yellow, and part of the head between the eyes, mouthparts, and the bases of the antennae are pale. The humeral stripes and the venter of the thorax are yellow. The abdomen is black with a bluish metallic sheen dorsally and yellow ventrally; there is an incomplete white ring on the third abdominal segment and sometimes less distinct whitish rings on the middle segments. The tarsal claw lacks a basal tooth. Total length: c. 60 mm. Length of abdomen: c. 54 mm. Hind wing length: c. 40 mm. Maximum width of the hind wing: c. 8 mm. The male has not been described, making a redescription of this rare or unrecognized species imperative.
.....*Mecistogaster pronoti* Sjöstedt, 1918 (Espirito Santo).

- The posterior lobes of the female prothorax are not truncate but rather curved dorsad (**Fig. 3.1.212**). 2

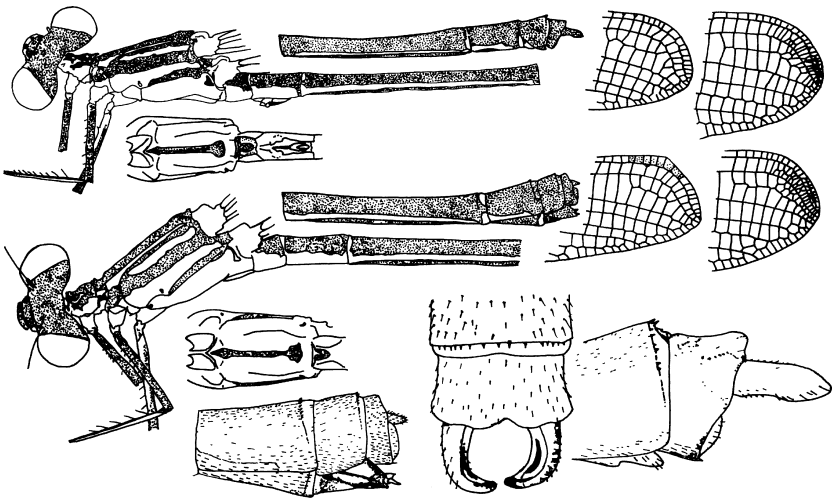


Fig. 3.1.212 *Mecistogaster asticta:* lateral views of the head, thorax, and first three abdominal segments below the seventh through tenth abdominal segments of a male (upper left) and a female (lower left); ventral view of the synthorax and first two abdominal segments of a male (below lateral view) and a female (below lateral view); apices of the fore (above) and hind wing (below) of a male (upper right center) and a female (upper right); apex of the male abdomen in dorsal (lower right center) and lateral view (lower right), and the apex of the female abdomen in lateral view (lower left center). Based on Lencioni (2005).

2. A well-defined pseudostigma is absent from both wings of the female and in the only known male (**Fig. 3.1.208**). 3

- Either the fore or the hind wing has a distinct dark marking at the site of the pseudostigma (**Fig. 3.1.213**). 4

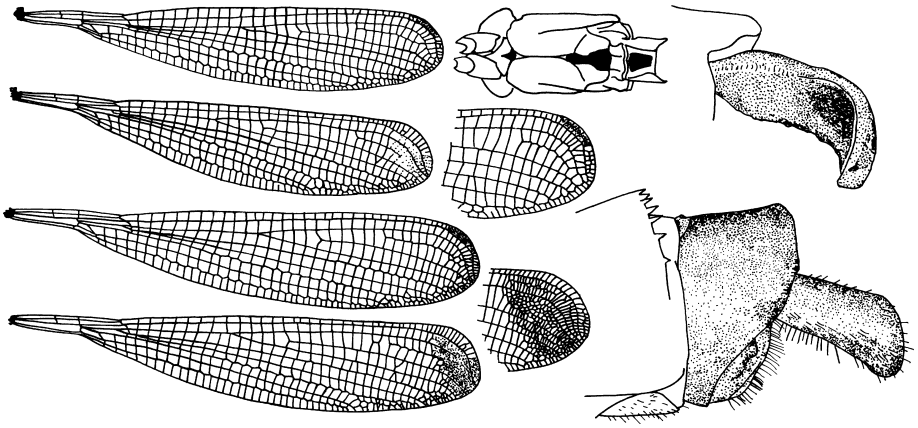


Fig. 3.1.213 *Mecistogaster buckleyi:* fore and hind wing of a male (upper left) and a female (lower left), apices of the wings of another specimen designated holotype for *Mecistogaster amazonica* (center), male synthorax in ventral view (upper center), superior anal appendage of a male in dorsomedial view (upper right), apex of the male abdomen in lateral view (lower right). Based on Lencioni (2005).

3. The antehumeral stripes are complete or nearly so. Pectoral markings on the thorax are more extensive than two small spots. Only the hind wing of the male is obtusely angled and slightly darkened in the area where the pseudostigma is located in other species. Both wings of the female are more extensively clouded in that region, but neither wing is angled. In dorsal view, the superior anal appendages of the male appear curved inward almost 90° from the body axis (**Fig. 3.1.212**).
.....*Mecistogaster asticta* Selys, 1860
(Venezuela, Minas Gerais, São Paulo).
- The pale antehumeral stripes are reduced to a triangle at the base near the humeral suture; its maximum dimensions are 1.8 to 2.7 mm in length and 0.47 to 0.54 mm in width, and it covers somewhat less than half of the mesepisternum. The pseudostigma is vaguely indicated by 6 to 8 yellowish costal cells in the fore-wing and 12 to 15 in the hind wing, or all traces of it are absent in some specimens. The apical clouds on the wings are milky white bordered basally by brown, and they reach vein IR_2 in the fore-wing and IR_3 in the hind wing. The only markings on the ventral side of the thorax are two small pectoral spots. The posterior lobe of the prothorax has a rounded posterior margin. Length of female abdomen: 54 to 62 mm. Hind wing length of female: 43 to 49 mm. The females

spawn by throwing the eggs into water-filled holes in trees. The male has not been described.
.....*Mecistogaster martinezi* Machado, 1985 (Bolivia).
4. The fore-wing is mainly hyaline or uniformly but weakly shaded, while the hind wing has dark or yellow markings (**Fig. 3.1.213**). 5
- Both the fore and hind wing are heavily shaded, or the apices of one or both wings are hyaline or slightly whitish (**Fig. 3.1.214**). 6

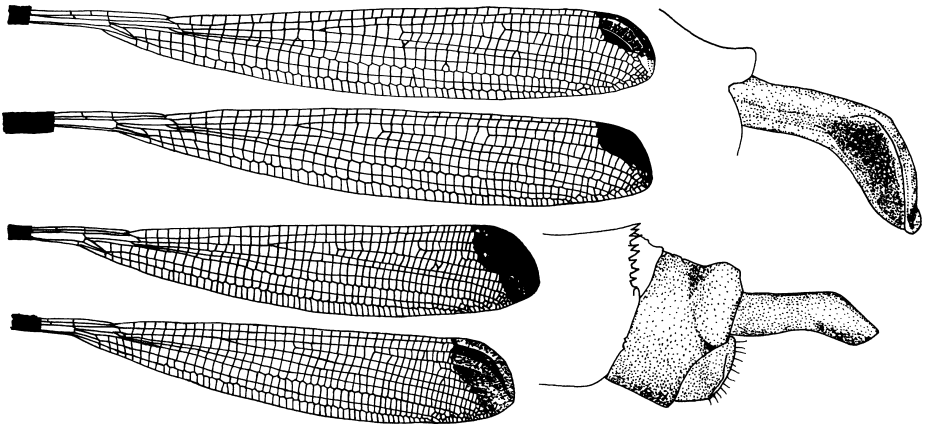


Fig. 3.1.214 *Mecistogaster ornata:* fore and hind wing of a male (upper left) and a female (lower left), superior anal appendage of a male in dorsomedial view (upper right), and apex of the male abdomen in lateral view (lower right). Based on Lencioni (2005).

4. The fore-wing is hyaline or slightly yellowish in the female, but the hind wing is blackish in the middle, either with an opaque black band and white membrane at the apex or with a diffuse obscure area starting with a yellow clouding at the arculus and darkening across the middle of the wing. The pseudostigma covers only the costal area, that is, one row of cells.
.....*Mecistogaster jocaste* Hagen, 1869 (Colombia, Ecuador, Peru, Venezuela, Brazil). Three subspecies have been described: *Mecistogaster jocaste jocaste* Hagen, 1869, with an opaque dark band across the middle of the hind wing and a white area at the apex; *Mecistogaster jocaste vicentia* Ris, 1918, with a vaguely darkened area starting as a yellow clouding at the arculus and becoming darker toward the middle of the wing; *Mecistogaster jocaste sincera* McLachlan, 1877.

- The fore-wing is hyaline and iridescent, while the hind wing is iridescent basally and bright yellow on the apical 1/7. The bright yellow pseudostigma in the fore-wing covers one row of seven or eight cells in the costal field only, while that in the hind wing covers 15 to 17 cells, also in one row (**Fig. 3.1.213**). Length of abdomen: c. 50 mm. Hind wing length: c. 39 mm.
.....*Mecistogaster buckleyi* McLachlan, 1881..pars
(Ecuador, Peru, Amazonas). Syn: *Mecistogaster amazonica* Sjöstedt, 1918, and probably *Mecistogaster garleppi* Förster, 1903. Specimens with unmarked wings were given the name *Mecistogaster amazonica.*

6. Colored areas at the apices of both the fore and hind wings are yellow or pinkish, often gradually turning orange or brown in older males, and they cover most of the pseudostigma, which are very dark areas covering the cells at or near the usual site of the pterostigma on the wings of other dragonflies (**Fig. 3.1.214**). The superior anal appendages of the male are frequently light in color, except for a dark subapical marking.
.....*Mecistogaster ornata* Rambur, 1842
(Mexico, Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, French Guiana, Guyana, Surinam, Argentina, Roraima, Mato Grosso). Syn: *Mecistogaster luctuosa* Hagen in Selys, 1860. Two subspecies have been described: *Mecistogaster ornata ornata* Rambur, 1842; *Mecistogaster ornata acutipennis* Selys, 1886.
- The apices of the wing are transparent with colorless veins, smoky, or whitish, especially in young individuals (**Fig. 3.1.215**). 7

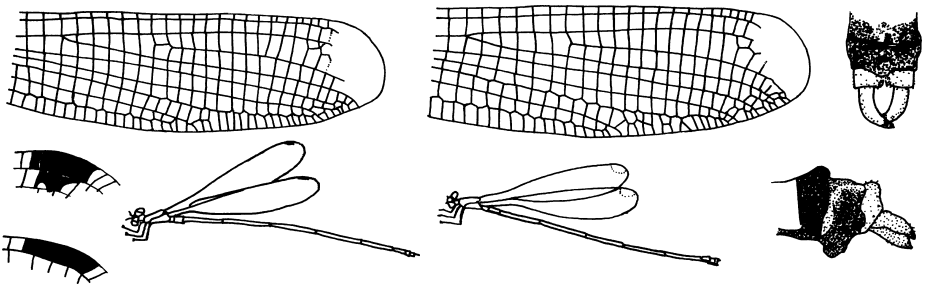


Fig. 3.1.215 *Mecistogaster modesta:* apical parts of the male (upper left) and female fore-wing (upper right center), pseudostigma of a male fore (middle left) and hind wing (lower left), outline of a male (lower left center) and a female (lower right center), and the apex of the male abdomen in dorsal (upper right) and lateral view (lower right). Based on Hedström and Sahlén (2001).

7. The hind wing is shorter than 47 mm, and the abdomen is shorter than 75 mm. At least young adult males and females have whitish, clouded areas at the apices of the wings and white or bright yellow pseudostigmata (**Fig. 3.1.215**). 8
- The hind wing of the male is at least 49 mm long. The male abdomen is at least 80 mm. Young adult males and females have whitish, clouded areas at the apices of the wings and white pseudostigmata. The markings in mature males and females turn red, brown, or black. The pseudostigma in the fore-wing covers two rows of cells, while that in the hind wing covers only one. The superior anal appendage of the male is entirely black (**Fig. 3.1.216**). 9

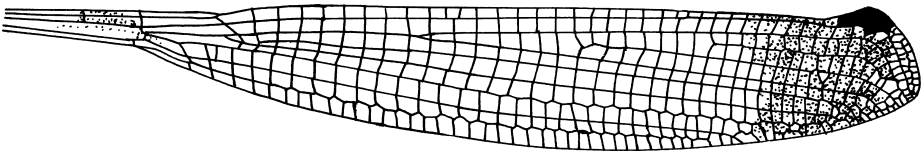


Fig. 3.1.216 Hind wing of a male *Mecistogaster lucretia.* Based on Needham (1903a).

8. The anterior margin of the fore-wing of the male does not bulge at the pseudostigma. Young adult males and females have whitish, clouded areas at the apices of the wings and white pseudostigmata. The markings in mature males turn reddish brown, while those of older females become hyaline. The superior anal appendage of the male is pale at the base and black at the apex (**Fig. 3.1.215**).
.....*Mecistogaster modesta* Selys, 1860
(Mexico, Central America, Colombia, Venezuela). Syn: probably *Mecistogaster marchali* var. *selysia* Navás, 1923. Two subspecies have been described: *Mecistogaster modesta modesta* Selys, 1860; *Mecistogaster modesta iphigenia* Selys, 1886. The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).
- The anterior margin of the fore-wing of the male curves at the pseudostigma to form a slight bulge. Both the fore and hind wings are hyaline with cloudy white at the apex of the hind wing, more extensive on the wings of the female than on those of the male (**Fig. 3.1.214**). Dorsally, the entire prothorax is black, except for a white spot in the middle of the anterior section; ventrally and on a narrow lateral line, it is whitish. The pseudostigma is whitish and covers about nine cells. The abdomen of the male is entirely greenish black dorsally and somewhat lighter ventrally. Length of abdomen: 52 to 54 mm. Hind wing length: 39 to 41 mm.
.....*Mecistogaster buckleyi* McLachlan, 1881..pars
(Ecuador, Peru, Amazonas). Syn: *Mecistogaster amazonica* Sjöstedt, 1918, and probably *Mecistogaster garleppi* Förster, 1903.

9. A pair of large greenish or reddish spots covers most of the dorsal surface of the middle prothoracic lobe. There is a reddish or reddish brown mesepimeral band. The black stripe on the second lateral suture is interrupted dorsal to the base of the hind coxa. The metasternum has a black midventral stripe but lacks marginal stripes. The anterior margin of the hind wing of the male is strongly produced anteriad at the pseudostigma (**Fig. 3.1.208**). Length of male abdomen: 120 to 130 mm; of female: 85 to 110 mm; hind wing length of male: 58 to 85 mm; female: 55 to 70 mm.

.....*Mecistogaster amalia* (Burmeister, 1839)

(Central America, West Indies, Peru, Argentina, Paraguay, Bahia, Pará, Minas Gerais, São Paulo, Rio de Janeiro). Syn: *Agrion amalia* Burmeister, 1839; *Agrion filiformis* Rambur, 1842; *Mecistogaster leucostigma* Rambur, 1842; *Agrion virgata* Rambur, 1842; *Agrion linearis* Blanchard (nec Fabricius, 1777), *Mecistogaster linearis* Rambur (nec Fabricius, 1777).

- A pair of greenish or reddish spots are not present on the dorsal surface of the middle prothoracic lobe, or the mesepimeral band is not reddish or reddish brown (**Fig. 3.1.216**). The metasternum may have marginal stripes. 10

10. The pale antehumeral and humeral stripes are nearly the same length with a difference not exceeding 15%. The pterostigma on the fore-wing is longer than 4.5 mm. The anterior margin of the hind wing of the male is not produced anteriad near the apex. In lateral view, the superior appendages are not curved ventrad, and their apices are obliquely truncate caudad and ventrad. Some females have a yellow lateral spot on each side of each abdominal segment from the seventh to the tenth, or on some of them (**Fig. 3.1.217**). Length of male abdomen: 100 to 125 mm; of female: 63 to 98 mm; hind wing length of male: 49 to 60 mm; female: 43 to 75 mm.

.....*Mecistogaster linearis* (Fabricius, 1777)

(Costa Rica, Ecuador, Peru, Colombia, Guyana, French Guiana, Surinam, Venezuela, Argentina, Bolivia, Roraima, Mato Grosso, São Paulo). Syn: *Agrion linearis* Fabricius, 1777; *Mecistogaster filigera* Rambur, 1842; *Mecistogaster flavistigma* Rambur, 1842. Two subspecies have been described, *Mecistogaster linearis linearis* found in all countries within the range of the species and *Mecistogaster linearis infumata* Fraser, 1946, from Colombia and Peru.

- The pale antehumeral and humeral stripes are very unequal in length, with the antehumeral stripe less than 1/3 as long as the humeral. The pseudostigma on the fore-wing is shorter than 4.5 mm, that of the female not exceeding 3 mm. The anterior margin of the hind wing of the male is gradually produced anteriad in an elliptical curve at the pseudostigma. In lateral view, the superior appendages are bent ventrad beyond the midlength and slightly bifid at the apex. Some females have no yellow lateral spot on the seventh to the tenth abdominal segments (**Fig. 3.1.216**). Length of male abdomen: 117 to 137 mm; of female: 85 to 110 mm; hind wing length of male: 51 to 68 mm; female: 49 to 70 mm.

.....*Mecistogaster lucretia* (Drury, 1773)

(Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Argentina, Amazonas, Pará). Syn: *Libellula lucretia* Drury, 1773; *Libellula longissima*

Fee, 1832; *Agrion linearis* Olivier, 1792; *Agrion tullia* Burmeister, 1839; *Mecistogaster fila* Rambur, 1842; *Mecistogaster marchali* Rambur, 1842; *Mecistogaster pedicillata* Rambur, 1842; *Mecistogaster signata* Rambur, 1842. There are two subspecies in South America, *Mecistogaster lucretia lucretia* from Venezuela and probably the Guianas, and *Mecistogaster lucretia hauxwelli* Selys, 1886, from Brazil and Peru.

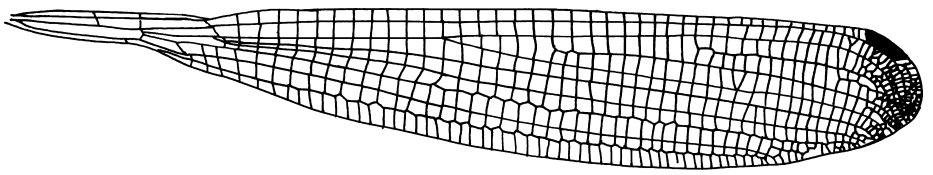


Fig. 3.1.217 Fore-wing of a male *Mecistogaster linearis.* Based on Munz (1919).

Key to the species of adult *Microstigma* in South America

Information for the key was provided by Schmidt (1958).

1. There is a single dark median fleck on the caudal end of the metasternum in addition to the paired black intercoxal spots. There is a deep median invagination on the posterior edge of the prothorax of the male; in the female, this invagination is shallow and narrow. The fore-wing or the male has a dark apical marking from the area of the pseudostigma to the apex, and only the apical edge of the hind wing is narrowly darkened. In dorsal view, the visible part of the superior anal appendage of the male is about as wide as long. The posterior margin of the female prothorax is curved dorsad (**Fig. 3.1.209**).
..... *Microstigma maculatum* Hagen, 1860 (Venezuela, Surinam, Guyana, French Guiana, Amazonas). Three subspecies are recognized. *Microstigma maculatum maculatum* from Guyana, Surinam, and French Guiana, distinguished by the fore-wing of the female, which has a fleck reaching as far as M_{3a}, M_2, or almost to Ms (see **Figure 3.1.1** for terminology); its orange wing tip transitioning to chestnut brown proximally; the yellow wing veins; only the apical fleck on the hind wing has white veins. The female of *Microstigma maculatum albopictum* Schmidt, 1958, from Amazonas and Surinam, is the same color but has white veins in the apical flecks of both fore and hind wings, while the fleck of *Microstigma maculatum fassli* Schmidt, 1958, from Amazonas is all orange, and the veins in the fore-wing are yellow. The validity of these subspecies has never been confirmed.

- There is no dark median fleck on the caudal end of the metasternum, but a weak indication of such a fleck and paired round spots may be present. The posterior edge of the prothorax only rarely has a deep invagination and is usually shallowly indented (**Fig. 3.1.218**). 2

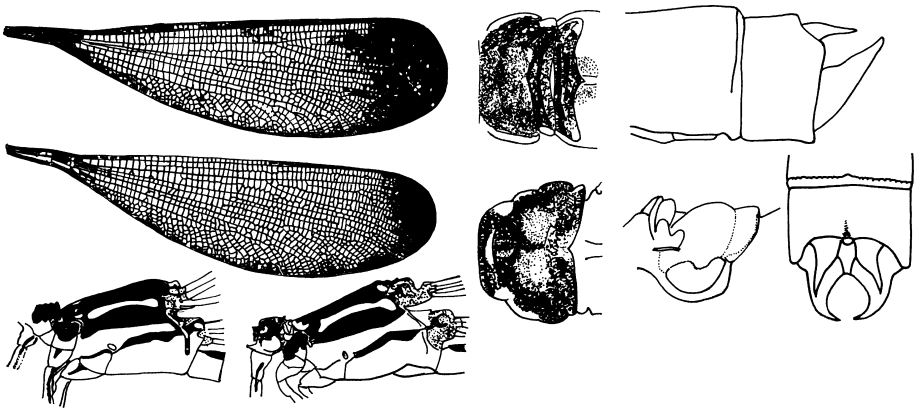


Fig. 3.1.218 *Microstigma rotundatum:* fore and hind wing of a female (upper left), male prothorax in dorsal view (upper center) and female prothorax in dorsal (lower center) and lateral view (lower right center), pattern on the thoraces of two female specimens (lower left and left center), and apex of the male abdomen in dorsal (lower right) and lateral view (upper right). Based on Lencioni (2005).

2. The fleck at the apex of the fore-wing, which is always yellow, is large and extends at least across vein M_2. The venation is very densely arranged, with the spaces between them in the male never larger than the thickness of the veins. There is a strong tendency to form glands. The veins proximal to the spots are strongly lined with brown along a stripe about 1 cm wide. The pseudostigma in the fore-wing contains many cells in both the male and the female; that in the hind wing of the male contains only one or two cells, while that in the female often contains many cells, like the fore-wing. Distal to the pterostigma in the hind wing, there are usually one or two cell rows between veins C and R, which are sometimes interrupted by irregular cells. In the female there are usually two or three rows, with glands often formed in the outer cells. The apex of the wing and edge of the anal cell are often brownish, especially in the female. The wing tip of the female has light-colored veins. In dorsal view, the visible part of the superior anal appendage of the male is almost twice as long as its width. The posterior margin of the female prothorax continues in almost the same plane as the rest of the prothorax, so that its posterior margin points posteriad in lateral

view (**Fig. 3.1.218**). Length of abdomen: 64 to 78 mm. Hind wing length: 47 to 68 mm.

.....*Microstigma rotundatum* Selys, 1860 (Peru, Ecuador, Colombia, Venezuela, Bolivia, Amazonas, Rondônia). Schmidt (1958) recognized two subspecies: *Microstigma rotundatum rotundatum* and *Microstigma rotundatum exustum* Selys, 1860. In the former, the fleck at the tip of the fore-wing is less than twice as wide as long, while in the latter, it is more than twice as wide as long. These names and *Microstigma rotundatum lunatum* Selys, 1860, are usually treated as synonyms.

- The fleck at the apex of the fore-wing of the male is formed by a rather dense network; that of the female is either similar or with a less dense network. Proximal to the fleck, almost the entire wing is brownish due to shading along the wing veins (**Fig. 3.1.219**). The pseudostigma in the fore and hind wing contain three or four cells.

.....*Microstigma anomalum* Rambur, 1842 (Peru, Bolivia, Pará, Amazonas). Syn: *Microstigma proximum* Rambur, 1842; *Microstigma anomalum* var. *minor* Selys, 1886; *Microstigma calcipenne* Fraser, 1946. Three subspecies have been described: *Microstigma anomalum anomalum* from Bolivia and Brazil; *Microstigma anomalum sjoestedti* Schmidt, 1958, from Brazil; and *Microstigma anomalum vicinum* Schmidt, 1958, from Brazil, all of which are generally considered to be additional synonyms.

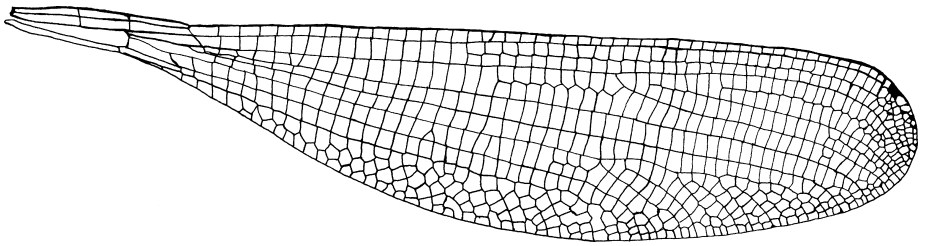


Fig. 3.1.219 Hind wing of *Microstigma anomalum.* Based on Munz (1919).

Megapodagrionidae

Key to the genera of adults in South America

Information for the key obtained from Munz (1919), Rácenis (1959a), De Marmels (2001), and Garrison and von Ellenrieder (2005).

1. There are no supplementary sectors in the apical parts of the wings. The petiole of the wing extends beyond the arculus (**Fig. 3.1.220**).

.....*Archaeopodagrion* Kennedy, 1939..p. 225

- There is at least one supplementary sector in the apical parts of each wing (**Fig. 3.1.221**). 2

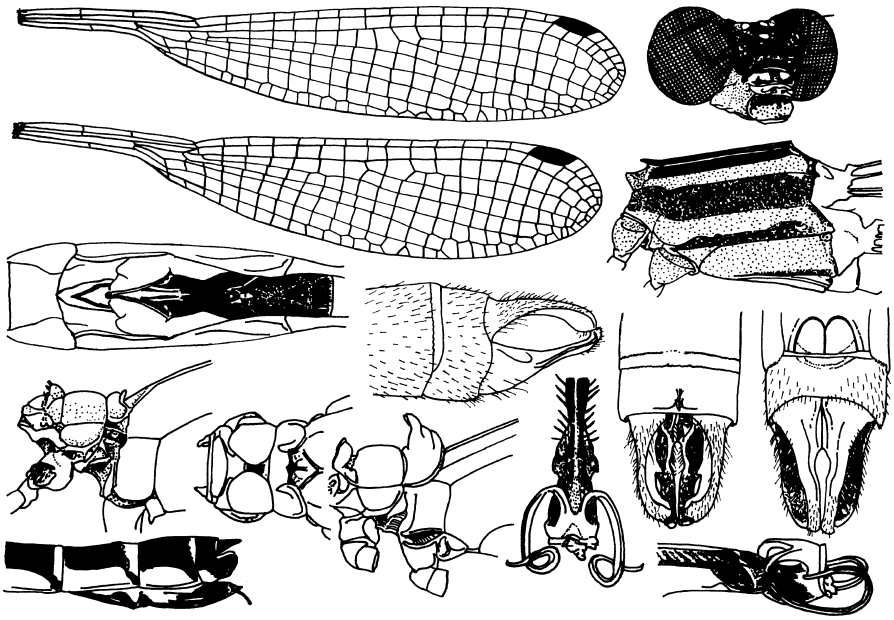


Fig. 3.1.220 *Archaeopodagrion bicorne:* fore and hind wing of a male (upper left), face of a female (upper right), lateral color pattern on the thorax of a male (upper middle right), prothorax of a female in lateral view (lower middle left), anterior part of the male thorax in dorsal (right of female prothorax) and lateral view (lower center), second segment of a male in ventral view (middle left), the apex of a female abdomen in lateral view (lower left), the apex of a male abdomen in dorsal and ventral view (lower right center, left and right, respectively) and in lateral view (middle), and the penis in dorsal (lower right center) and lateral view (lower right). Based on Kennedy (1939b).

2. Vein IR_3 arises at or very close to the subnodal vein; vein R_{4+5} arises at least one cell length proximal to the subnodal vein (**Fig. 3.1.221**). 3
- Vein IR_3 arises at least one cell distal from the subnodal vein; R_{4+5} arises from the subnodal vein, or, if not, never more than one cell length proximal to it (**Fig. 3.1.222**). 9

3. The apical segment of the penis is absent, or it is vestigial, consisting of two long, narrow processes. Vein A_1 is usually separated from the posterior margin of the wing proximal to the level of the arculus (**Figs. 3.1.19, 3.1.223**). 4
- The main part of the distal segment of the penis is well-developed but lacks narrow processes. Vein A_1 is separated from the posterior margin of the wing distal to the level of the arculus (**Fig. 3.1.221**). 6

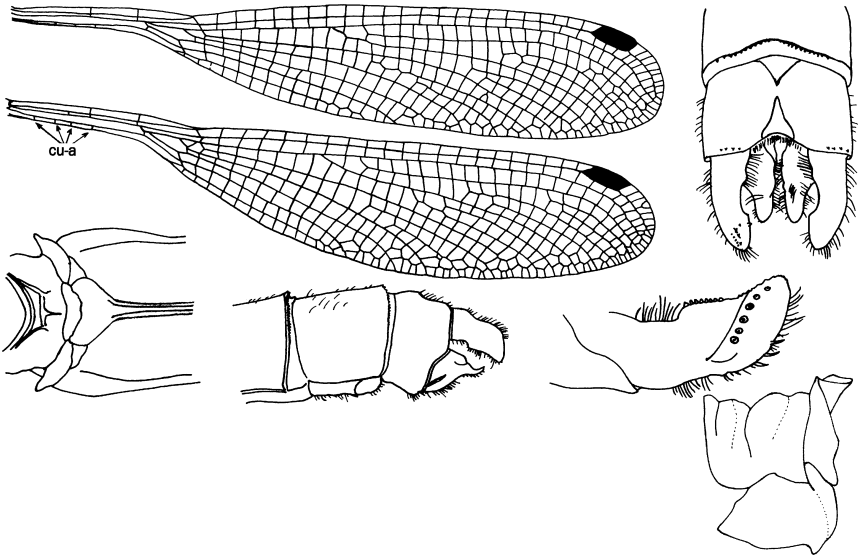


Fig. 3.1.221 *Sciotropis cyclanthorum*: fore and hind wing of a male (upper left), prothorax of a female in lateral view (lower right), posterior part of the prothorax and anterior part of the synthorax of a male in dorsal view (lower left), apex of the male abdomen in lateral (lower center) and dorsal view (upper right), and an enlarged superior appendage (middle right). Based on Rácenis (1959a) and De Marmels (1994).

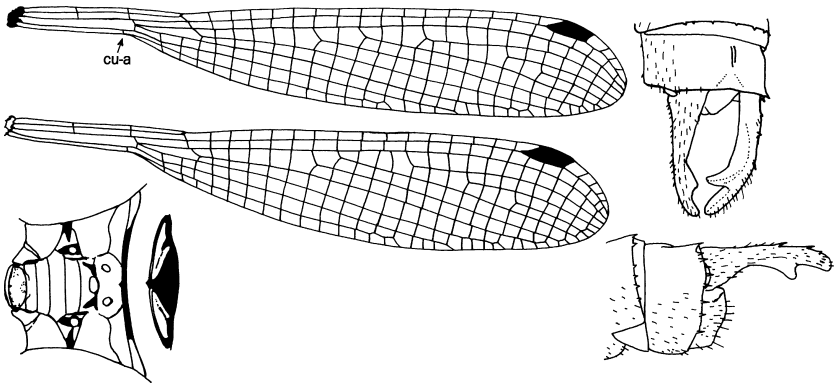


Fig. 3.1.222 *Heteragrion melanarum* male: fore and hind wing (upper left), head between the compound eyes and posterior lobe of the pronotum in dorsal view (lower left), apex of the male abdomen in oblique dorsal (upper right) and lateral view (lower right). Based on Williamson (1919).

4. The hind wing is noticeably longer than the fore-wing. There are two or more cells directly posterior to the pterostigma. There are two cells in the discal field between the subnodus and the quadrangle. Vein cu-a is near the level of the second antenodal cross vein. The apical segment of the penis appears to be absent, and no long processes are evident. There is an enlarged internal fold that appears like a spine at the apex. The legs are long and bear spurs. The inferior anal appendages of the male of the only known South American species are parallel or slightly divergent at their apices (**Fig. 3.1.224**).
.....*Megapodagrion* Selys, 1885

The only South American species still maintained in this genus is *Megapodagrion megalopus* (Selys, 1869), known from Peru, Venezuela, Guyana, Pará, Amazonas, and Rondônia. Its synonyms are *Podagrion megalopus* Selys, 1869, and *Megapodagrion arachne* Rácenis, 1959.

- The fore and hind wings are nearly equal in length. There is only one or rarely as many as two complete cells directly posterior to the pterostigma. There are from three to five cells in the discal field between the subnodus and the quadrangle. The penis has well-developed internal and terminal folds (**Fig. 3.1.223**). 5

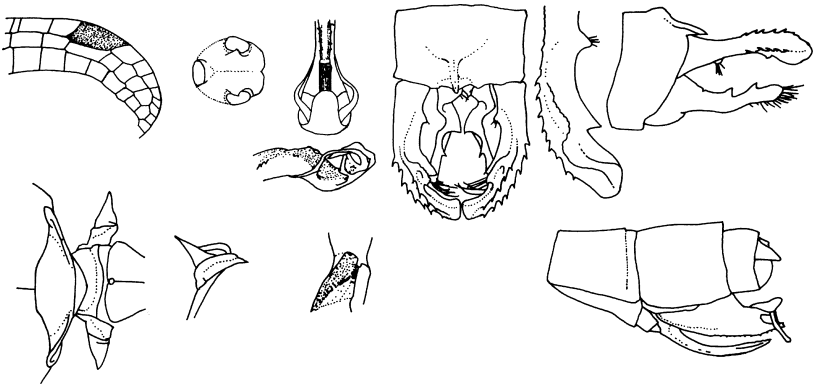


Fig. 3.1.223 *Allopodagrion contortum* male (above, left to right): pterostigma and apex of the wing, vertex showing the small processes beside the lateral ocelli, penis in ventral (above) and lateral view (below), apex of the abdomen in dorsal view, superior anal appendage in dorsomedial view, apex of the abdomen in lateral view, and female (below, left to right): posterior lobe of the prothorax in dorsal and lateral view, intersternite, and apex of the abdomen in lateral view. Based on De Marmels (2001).

5. The posterior lobe of the pronotum is elongated at its lateral ends to form triangular or finger-like processes. The superior anal appendage of the male has a denticulated dorsal crest but lacks a subbasal tubercle or spine (**Fig. 3.1.225**).
.....*Teinopodagrion* De Marmels, 2001..p. 226

- The posterior lobe of the pronotum is not elongated to form a process at its lateral end. The quadrangle in the hind wing is longer than that in the fore-wing. The legs are long and bear spurs. The superior anal appendage of the male lacks a basal denticulated dorsal crest, but it bears a subbasal tubercle or spine. The edges of the valves of the ovipositor are serrated (**Figs. 3.1.19, 3.1.223**).
.....*Allopodagrion* Förster, 1910..p. 251

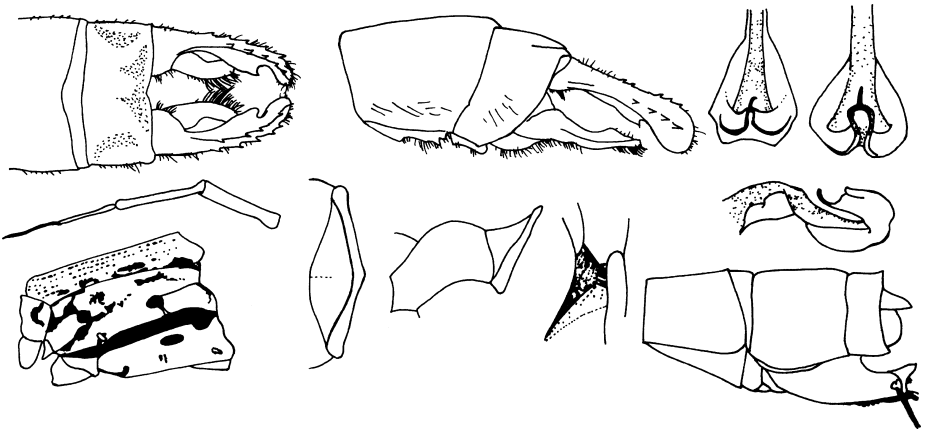


Fig. 3.1.224 *Megapodagrion megalopus* male: apex of the abdomen in dorsal (upper left) and lateral view (upper center), penis of two specimens in ventral view (upper right) and of one in lateral view (middle right), antenna of a male (middle left), synthorax of a male in lateral view (lower left), prothorax of a female in dorsal and lateral view (lower left center, left and right, respectively), female intersternite (lower right center), and apex of a female abdomen in lateral view (lower right). Based on Rácenis (1959a) and Lencioni (2005).

6. More than one cu-a vein is present. An anterior supplementary sector between IR_3 and R_{4+5} is longer than the posterior one, and three transversal veins are present behind the pterostigma (**Fig. 3.1.221**).
.....*Sciotropis* Rácenis, 1959..p. 252
- There is only one cu-a (**Fig. 3.1.3**). 7
7. There is an anterior supplementary sector between IR_3 and R_{4+5}, and it is shorter than the posterior one. Four or more transversal veins are present behind the pterostigma (**Fig. 3.1.226**).
.....*Philogenia* Selys, 1862..p. 254
- There is an anterior supplementary sector between IR_3 and R_{4+5}, and it is longer than the posterior one. There are no more than three transversal veins behind the pterostigma (**Fig. 3.1.3**). 8

Fig. 3.1.225 *Teinopodagrion setigerum* (above, left to right): posterior lobes of the prothoraces of two male specimens in dorsal view and lateral views of the same prothoraces, apex of the male abdomen in dorsal and lateral view, and (below, left to right): left intersternite of a female, posterior lobe of the female prothorax in lateral and dorsal view, and superior anal appendage of a male in dorsomedial view. Based on De Marmels (2001).

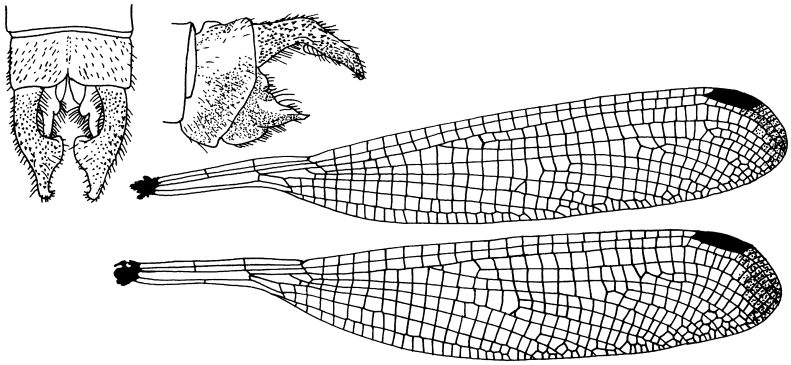


Fig. 3.1.226 *Philogenia margarita* male: apex of the abdomen in dorsal (above left) and lateral view (above center) and the fore and hind wing (below). Based on Calvert (1924) and Lencioni (2005).

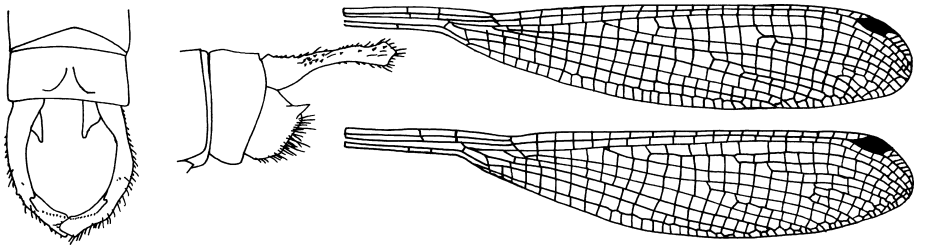


Fig. 3.1.227 *Heteropodagrion superbum* male (left to right): apex of the abdomen in dorsal and lateral view and the fore and hind wing. Based on Ris (1918).

8. Vein IR_3 arises just proximal to the subnodal vein. There are two short sectors between R_2 and IR_2 (**Figs. 3.1.3, 3.1.227**).
.....*Heteropodagrion* Selys, 1885..p. 267
- Vein IR_3 arises about one cell or less distal from the subnodal vein. There are no sectors between R_2 and IR_2 (**Fig. 3.1.228**). The length of the abdomen is about 35 to 36 mm. The hind wing length is about 23 mm.
.....*Mesagrion* Selys, 1885
The only species described in this genus is *Mesagrion leucorhinum* Selys, 1885, from Colombia. The abdomen is red with blackish pigmentation covering the second, third, ninth, and tenth segments almost entirely and forming a vague dorsal line on the other segments.
9. There is usually one supplementary sector between IR_3 and R_{4+5}, and usually more than one vein cu-a. The inferior anal appendage of the male is usually long and tapers into a long process apically (**Fig. 3.1.229**).
.....*Dimeragrion* Calvert, 1913..p. 267
- There are no supplementary sectors between IR_3 and R_{4+5}, and there is only one cu-a (**Fig. 3.1.222**). 10
10. Vein cu-a is located nearer to the second antenodal cross vein than the first. The front of the head is high and more or less angular (**Fig. 3.1.222**).
.....*Heteragrion* Selys, 1862..p. 270

- Vein cu-a is approximately midway between the first and second antenodal cross veins. The head is high but rounded (**Fig. 3.1.230**).
.....*Oxystigma* Selys, 1862..p. 296

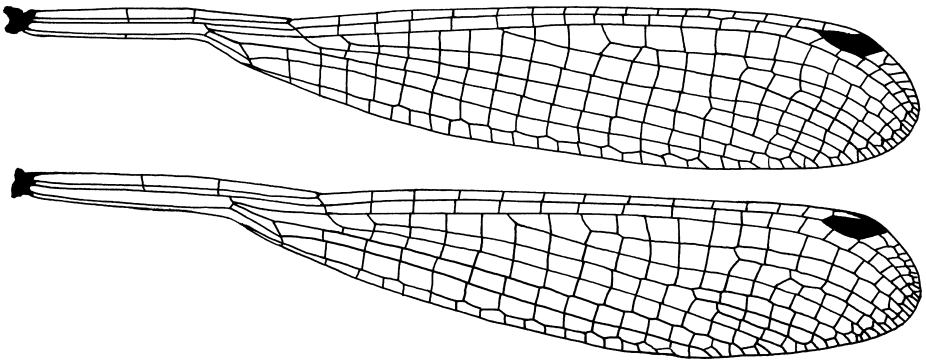


Fig. 3.1.228 Fore and hind wing of *Mesagrion leucorhinum.* Based on Garrison and von Ellenrieder (2005).

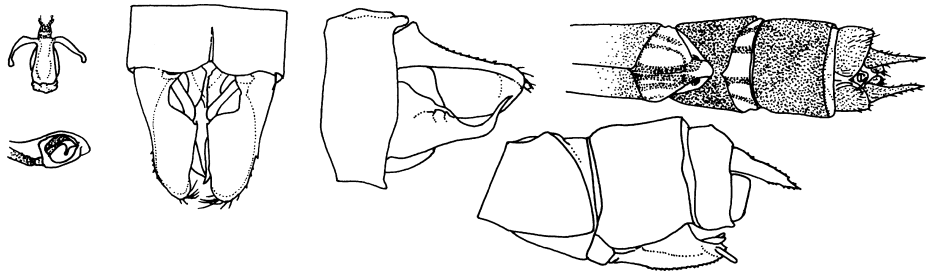


Fig. 3.1.229 *Dimeragrion clavijoi:* penis in ventral and lateral view (left, above and below, respectively), tenth abdominal segment and appendages of a male in dorsal (right center) and lateral view (center), apical segments of the female abdomen in dorsal (upper right) and lateral view (lower right). Based on De Marmels (1999b).

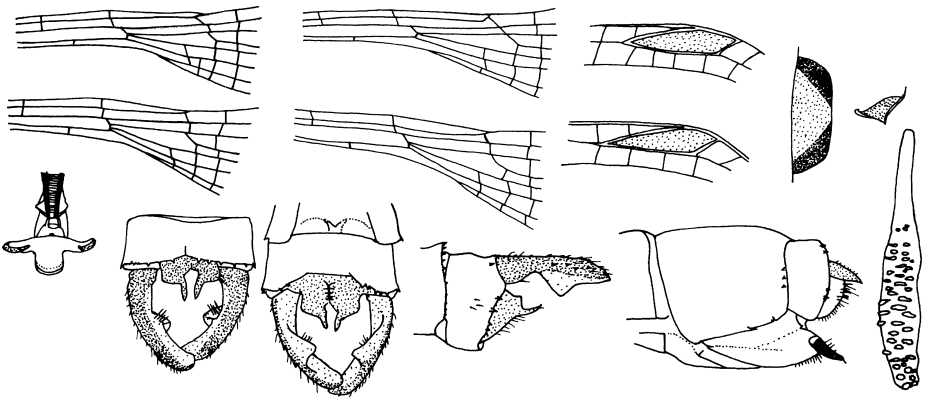


Fig. 3.1.230 *Oxystigma petiolatum* (upper row, left to right): basal portion of the fore and hind wings of a male; those of a female; pterostigmas on the fore and hind wings; markings on the posterior lobe of the prothorax of a female in dorsal view, left mesostigmal lamina of a female, and (lower row, left to right): penis after maceration in ventral view; apex of the abdomen of a male in dorsal, ventral, and lateral view; apex of the abdomen of a female in lateral view; right genital valve of a female in ventral view. Based on Geijskes (1976).

Key to the genera of known larvae in South America

Information for the key was obtained from De Marmels (1982d, 2004) and Costa *et al.* (2004). This incomplete key is based on known larvae of just a few species. Whether the distinguishing characters apply to all species of each genus remains to be determined after more larvae have been described.

1. There are mid-dorsal spines along the posterior margins of the abdominal segments. There are long setae on the prementum or labial palps. The caudal appendages lack distal filaments (**Figs. 3.1.32, 3.1.231**).
.....*Teinopodagrion* De Marmels, 2001..p. 226
- There are no mid-dorsal spines on the abdominal segments. The antenna consists of seven segments, although the sixth and seventh may be partially fused (**Fig. 3.1.232**). 2
2. Each lateral gill lamella has an articulated segment at the apex, which is spindle-shaped and densely covered by short, hair-like setae. There are supracoxal processes on the fore and middle legs; the one on the fore-leg is spine-like, while there are two on each middle leg: one short and shaped like an obtuse triangle, and the other, finger-like and curving dorsad (**Fig. 3.1.232**).
.....*Sciotropis* Rácenis, 1959..p. 252

- There are no spindle-shaped segments articulating with the apices of the lateral gill lamellae. There are no prominent supracoxal processes on the fore and middle legs (**Fig. 3.1.233**). 3

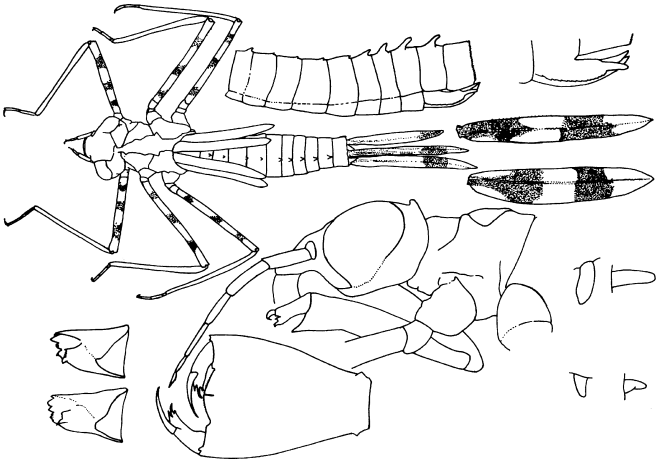


Fig. 3.1.231 *Teinopodagrion decipiens* larva: habitus of a female from an exuvia (upper left), head and thorax in lateral view (center), labium (lower left center), mandibles (lower left), a lateral (upper middle right) and median gill lamella (middle right), abdomen in lateral view (upper center), female gonopophyses (upper right), cercus of a male in dorsal and lateral view (lower middle right, left and right, respectively), and the cercus of a female in dorsal and lateral view (lower right, left and right, respectively). Based on von Ellenrieder (2006).

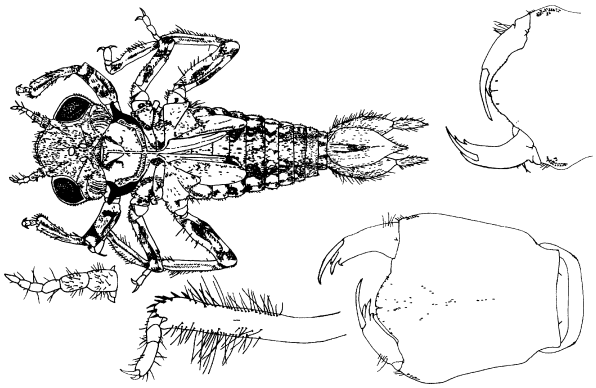


Fig. 3.1.232 *Sciotropis cyclanthorum* larva: habitus (upper left), antenna (lower left), labium in ventral view (lower right), apical part of the labium with palps in dorsal view (upper right), and middle tibia and tarsus (lower center). Based on De Marmels (2004).

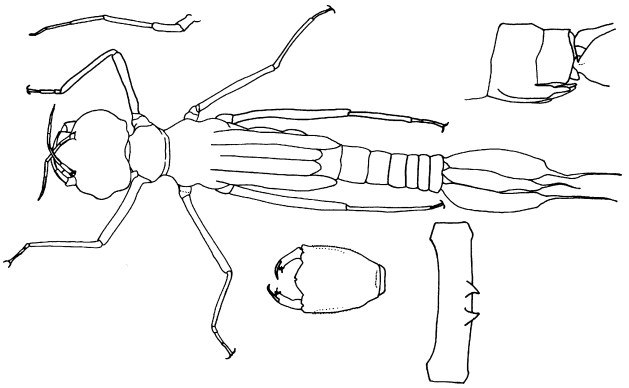


Fig. 3.1.233 *Philogenia cassandra* larva: habitus (center), antenna (upper left), labium (lower center), apex of a female abdomen in lateral view (upper right), ninth abdominal segment of a male in ventral view (lower right). Based on De Marmels (1982d).

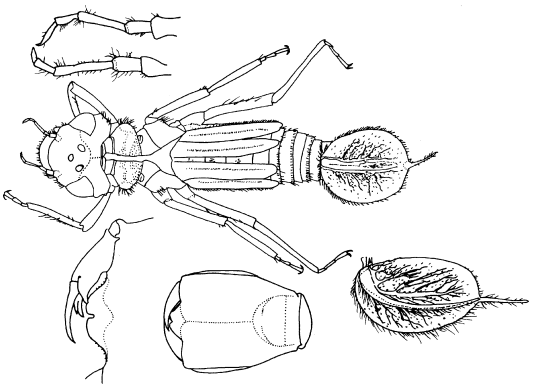


Fig. 3.1.234 *Dimeragrion percubitale* larva: habitus from an exuvia (center), antennae (above), and (below, left to right) the labial palp and anterior border of the mentum, the labium, and a lateral gill lamella. Based on De Marmels (1999b).

3. The gill lamellae are less than twice as long as their maximum width, not including the length of their relatively short, thin apical filaments. The antenna consists of about four segments (**Fig. 3.1.234**).
.....*Dimeragrion* Calvert, 1913..p. 267
- The gill lamellae are well over twice as long as their maximum width. The antenna consists of six segments (**Fig. 3.1.233**). 4

4. The head is large and flattened; it is much wider than the pronotum, and all of the legs have carinae. The three caudal gill lamellae end in long, tapering filaments (**Fig. 3.1.233**).
.....*Philogenia* Selys, 1862..p. 254
- The head is relatively small, or it is not flattened, or some of the legs lack carinae (**Fig. 3.1.235**). 5

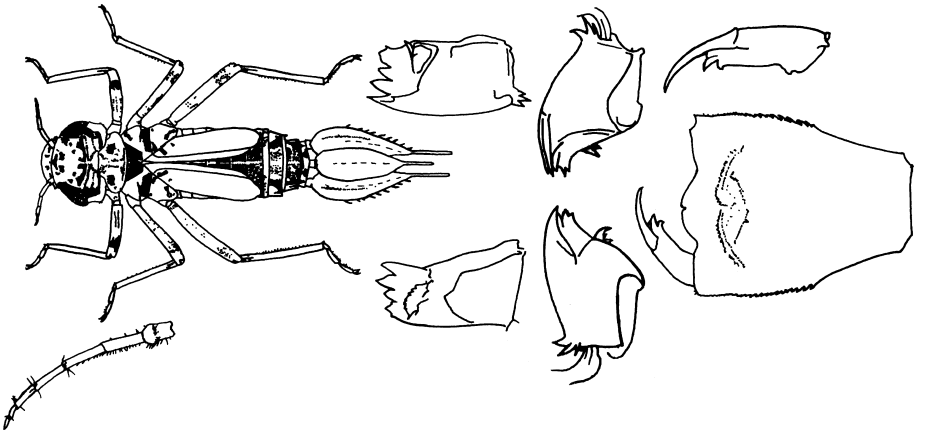


Fig. 3.1.235 *Oxystigma petiolatum* larva: habitus (upper left), enlarged antenna (lower left), inner surfaces of mandibles (left center, above and below), mandibles in lateral view (right center), inner surface of the mentum with an outline of its median portion enlarged superimposed in the middle of the outline (lower right), and the right labial palp (upper right). Based on Geijskes (1943).

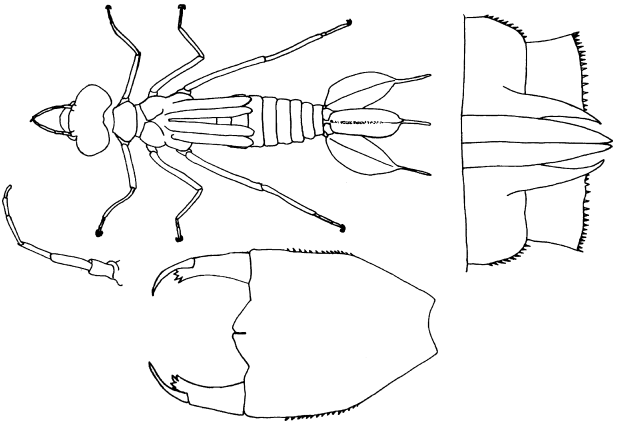


Fig. 3.1.236 *Heteragrion aurantiacum* larva: habitus from an exuvia (upper left), antenna (middle left), labium (lower center), and apex of the male abdomen in ventral view (right). Based on Santos (1968a).

5. Three spines are visible at the base of the mandible (**Fig. 3.1.235**).
.....*Oxystigma* Selys, 1862..p. 296
- There are no spines at the base of the mandible (**Fig. 3.1.236**). The caudal appendages become very narrow at the distal ends.
.....*Heteragrion* Selys, 1862..p. 270

Key to the species of adult male *Archaeopodagrion* in South America

Information for the key was provided by Kennedy (1939b, 1946). Descriptions of the females are lacking.

1. The superior anal appendage is curved less than 90°, mainly in a horizontal plane. The inferior anal appendages extend only slightly farther posteriad then the superior appendages and curve sharply dorsad at their apices (**Fig. 3.1.220**).
.....*Archaeopodagrion bicorne* Kennedy, 1939 (Ecuador).
- The superior anal appendage is curved more than 90°, mainly in a vertical plane. The inferior anal appendages extend much farther posteriad then the strongly curving superior appendages, and they curve sharply inward at their apices (**Fig. 3.1.237**). Length of male abdomen: c. 35 mm. Hind wing length of male: c. 25 mm. The female has not been described. The color of the badly faded specimen described seems to have been mainly black and blue.
.....*Archaeopodagrion bilobatum* Kennedy, 1946 (Ecuador).

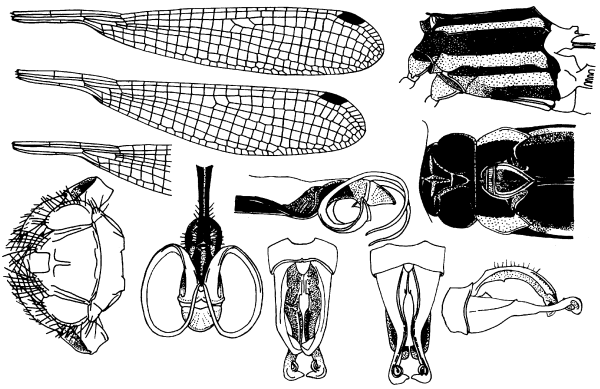


Fig. 3.1.237 *Archaeopodagrion bilobatum* male: fore and hind wing and basal section of the other fore-wing from the same specimen (upper left); labium and maxillae (lower left); the synthorax, which is black and probably blue in life but faded on the specimen shown (middle right); penis in ventral (lower left center) and lateral view (center); apex of the abdomen in dorsal, ventral, and lateral view (lower right, left to right). Based on Kennedy (1946).

Key to the species of adult male *Teinopodagrion* in South America

Information for the key was provided by Rácenis (1959a) and De Marmels (2001). The male of *Teinopodagrion muzanum* has not yet been found, so only female specimens can be identified, albeit with difficulty because of sketchy descriptions.

1. The distal process of the inferior anal appendage appears robust with an enlarged, setose apex in lateral view; it curves sharply dorsad and is spatulate and truncate at the apex (**Fig. 3.1.238**). 2
- The distal process of the inferior anal appendage does not have an enlarged, setose apex, or it does not curve sharply dorsad or is not spatulate and truncate at the apex (**Fig. 3.1.239**). 3

Fig. 3.1.238 *Teinopodagrion curtum* (above, left to right): posterior lobe of the prothorax of two male specimens in dorsal view and one in lateral view; apex of the abdomen of two male specimens in dorsal view, one without the setae at the apex of the inferior anal appendage; one male superior anal appendage in mediodorsal view; apex of the male abdomen in lateral view, and (below, left to right): posterior lobe of the female prothorax in dorsal and lateral view, left intersternite of a female; outline of the occipital margin on the right side of the head of a male in dorsal view showing the development of the occipital tubercle; and the apex of the abdomen of a second male specimen in lateral view, not showing the setae at the apex of the inferior anal appendage. Based on De Marmels (2001).

2. The posterior lobe of the pronotum lacks lateral processes, or they are very small. A black stripe covers most of the mesepimeron and does not taper evenly posteriorly. The occipital tubercles are prominent. The inner branch of the superior anal appendage appears broad with a short apex when viewed dorsally;

and its strong ridge forms a weak internal plate (**Fig. 3.1.238**). Total length: 32.5 to 36 mm. Length of abdomen: 23.5 to 27.5 mm. Hind wing length: 20 to 22.5 mm.

.....*Teinopodagrion curtum* (Selys, 1886) (Ecuador, Peru, Colombia). Syn: *Megapodagrion curtum* Selys, 1886.

- The posterior lobe of the pronotum has somewhat long and triangular lateral processes. The mesepimeron has only a black marking that tapers evenly posteriorly along the humeral suture. The occipital tubercles are low and inconspicuous. The inner branch of the superior anal appendage appears long, slender, and triangular when viewed dorsally; and it has no internal plate (**Fig. 3.1.240** Total length: 35 to 44 mm. Length of abdomen: 26 to 34 mm. Hind wing length: 20.5 to 27.5 mm.

.....*Teinopodagrion venale* (Hagen in Selys, 1862) (Venezuela, Colombia?). Syn: *Podagrion venale* Hagen in Selys, 1862; *Megapodagrion venale* (Hagen in Selys, 1862).

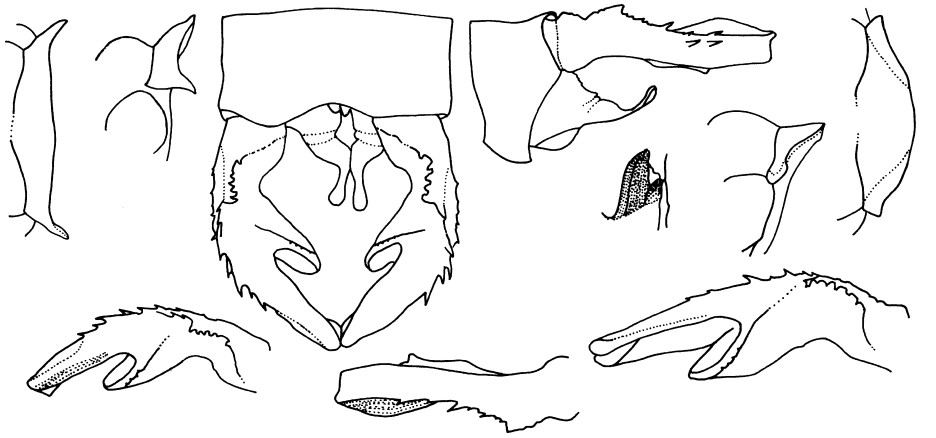


Fig. 3.1.239 *Teinopodagrion waynu* (above, left to right): posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in dorsal and lateral view (above), left intersternite of a female (below), and posterior lobe of the female prothorax and in lateral (right of intersternite) and dorsal view, and (below) three views of the superior anal appendage of males. Based on De Marmels (2001).

3. The superior anal appendage lacks an internal branch, or only a vestige of it is present. The apex of the inferior anal appendage is setiform and acutely pointed (**Fig. 3.1.241**). The pale mark across the ocelli is broad. 4

- The superior anal appendage has a well-developed internal branch, although it may be short and truncate at the apex. The apex of the inferior anal appendage is not setiform, or if it is, its apex is slightly enlarged, ladle-like, paddle-shaped, or lanceolate (**Fig. 3.1.239**). The pale mark across the ocelli is narrow. 5

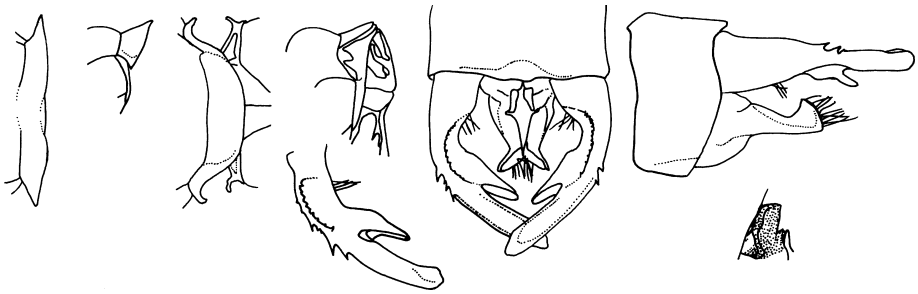


Fig. 3.1.240 *Teinopodagrion venale* (left to right): posterior lobe of the male prothorax in dorsal and lateral view, posterior lobe of the female prothorax in dorsal and lateral view (above), superior anal appendage of the male in dorsointerior view (below), apex of the male abdomen in dorsal and lateral view (above), left intersternite of a female (below). Based on De Marmels (2001).

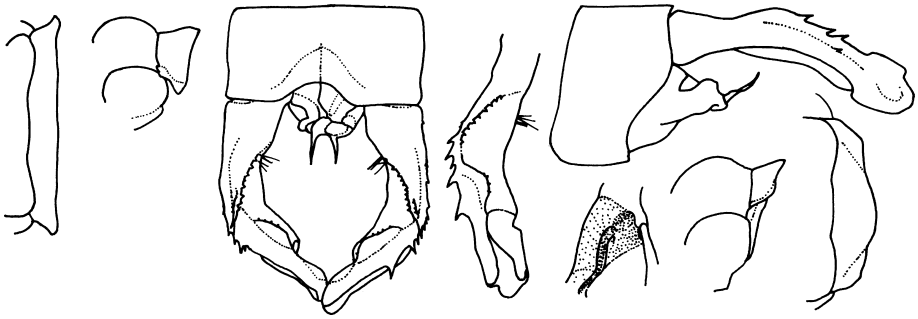


Fig. 3.1.241 *Teinopodagrion oscillans* (left to right): posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in dorsal view, superior anal appendage in dorsomedial view, and apex of the male abdomen in lateral view (above), and (below, left to right), left intersternite of a female and posterior lobe of the female prothorax in lateral and dorsal view. Based on De Marmels (2001).

4. The mesepisternum has a mid-dorsal stripe that is strongly narrowed in the anterior third. The mesepimeron has a dark marking in the form of an obscure brownish shade or a short black cuniform spot. In dorsal view, the internal branch of the superior anal appendage appears to be an obtusely truncated

vestige, and the terminal branch of the appendage has a distinct distal emargination (**Fig. 3.1.241**). Total length: 30.5 to 46 mm. Length of abdomen: 32 to 36 mm. Hind wing length: 25.5 to 32 mm.
.....*Teinopodagrion oscillans* (Selys, 1862) (Venezuela, Colombia). Syn: *Podagrion oscillans* Selys, 1862; *Megapodagrion oscillans* (Selys, 1862).
- The mesepisternum has a mid-dorsal stripe that is not narrowed in the anterior third. The mesepimeron has a black stripe that is not narrowed toward the antealar sinus. In dorsal view, the internal branch is only indicated by a slight swelling, and the terminal branch of the appendage is only slightly emarginated (**Fig. 3.1.242**). Total length: c. 45.5 mm. Length of abdomen: c. 35 mm. Hind wing length: c. 29 to 29.5 mm.
.....*Teinopodagrion turikum* De Marmels, 2001 (Venezuela, Colombia?).

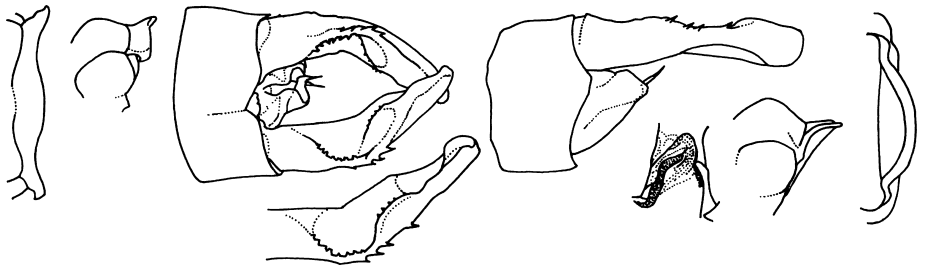


Fig. 3.1.242 *Teinopodagrion turikum* (left to right): posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in oblique dorsal view (above) with one of the superior anal appendages in dorsomedial view (below), apex of the male abdomen in lateral view (above), left intersternite of a female, and the posterior lobe of the female prothorax in lateral (below) and dorsal view. Based on De Marmels (2001).

5. There is an internal plate on the superior anal appendage, which may be poorly developed but is always there; if it does not project caudad, the distal process of the inferior anal appendage is not spoon-shaped (**Fig. 3.1.243**). 6
- There is no internal plate on the superior anal appendage (**Fig. 3.1.244**). 14
6. The posterior lobe of the pronotum has long, finger-like or narrowly triangular processes at the posterolateral corners. The distal end of the internal plate on the superior anal appendage is rounded and ends just proximal to the distal angle (**Fig. 3.1.243**). 7
- The posterior lobe of the pronotum has relatively short, triangular lateral processes. The distal end of the internal plate on the superior anal appendage ends in a pointed angle, is truncate, or extends beyond the distal; the internal angle is usually obviously greater than 90º (**Fig. 3.1.245**). 8

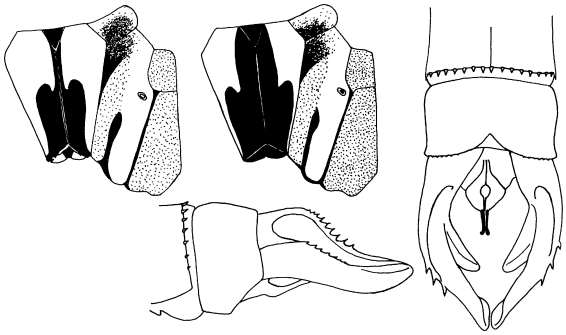


Fig. 3.1.243 *Teinopodagrion macropus:* diagram of the color pattern on the thorax of a male (upper left) and a female (upper center), and the apex of the abdomen of a male in dorsal (right) and lateral view (lower center). Based on Fraser (1948b).

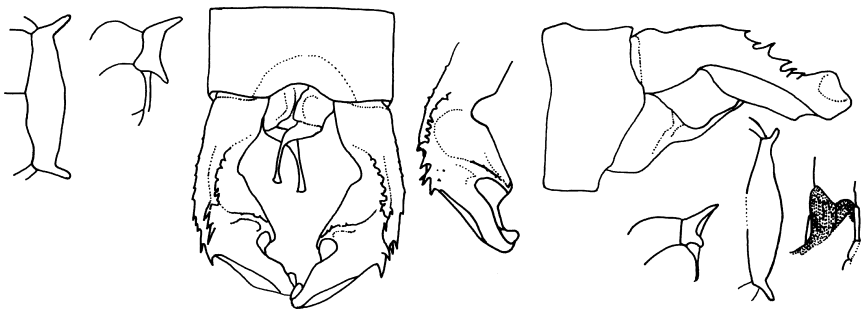


Fig. 3.1.244 *Teinopodagrion decipiens* (left to right): posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in dorsal view, superior anal appendage in dorsomedial view, and apex of the male abdomen in lateral view (above), and (below, left to right), posterior lobe of the female prothorax in lateral and dorsal view and left intersternite of a female. Based on De Marmels (2001).

7. In dorsal view, the superior anal appendage appears to curve evenly along its middle third. The distal end of the internal plate on the superior anal appendage is rounded, ends just proximal to the distal angle, and never extends caudad beyond it; the internal angle is about 90º. The inferior anal appendage is somewhat spindle-shaped and ends in an obtuse angle (**Fig. 3.1.243**). The posterior lobe of the pronotum has long, finger-like lateral processes. Total length: 35.5 to 43.5 mm. Length of abdomen: 27.5 to 34 mm. Hind wing length: 21 to 26 mm.

.....*Teinopodagrion macropus* (Selys, 1862) (Venezuela, Bolivia, Argentina). Syn: *Podagrion macropus* Selys, 1862; *Megapodagrion macropus* (Selys, 1862).

- In dorsal view, the superior anal appendage of the male appears sharply bent just beyond the midlength. The apical process of the inferior anal appendage ends in a blunt, acute angle (**Fig. 3.1.246**). Total length with the appendages: c. 37 to 37.5 mm. Length of male abdomen with appendages: c. 28 to 28.5 mm. Hind wing length of male: c. 22.5 to 23 mm. The female has not been described. .....*Teinopodagrion croizati* De Marmels, 2002 (Ecuador).

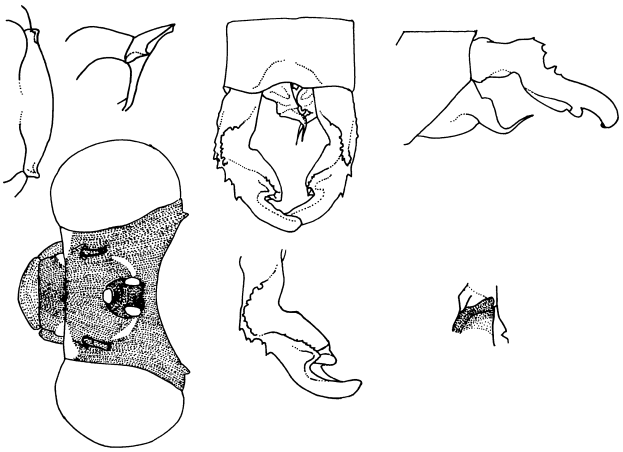


Fig. 3.1.245 *Teinopodagrion temporale* (above, left to right): posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in dorsal and lateral view, and (below, left to right): head of a male showing the occipital tubercles, superior anal appendage of a male in dorsointerior view, and left intersternite of a female. Based on De Marmels (2001).

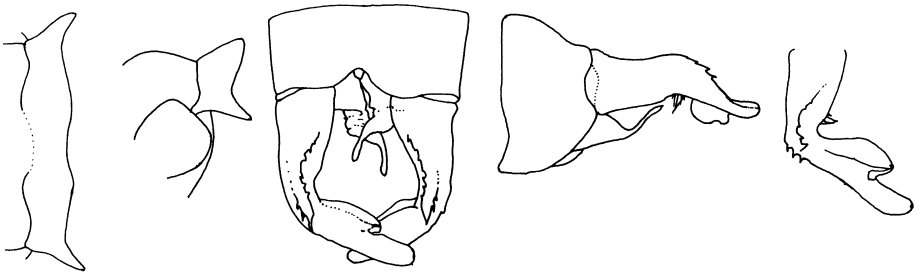


Fig. 3.1.246 *Teinopodagrion croizati* male (left to right): posterior lobe of the pronotum in dorsal and lateral view, apex of the abdomen in dorsal and lateral view, and the superior anal appendage in dorsomedial view. Based on De Marmels (2002).

8. The apical process of the inferior anal appendage is straight, parallel-sided, and very narrow or spiniform; its apex is usually acutely pointed. The occipital tubercles are usually well-developed and usually pointed at the apex (**Fig. 3.1.245**). Total length: 35 to 38.5 mm. Length of abdomen: 21 to 22.5 mm. Hind wing length: 20 to 22.5 mm.
.....*Teinopodagrion temporale* (Selys, 1862) (Colombia). Syn: *Podagrion temporale* Selys, 1862; *Megapodagrion temporale* (Selys, 1862).
- In dorsal view, the apical process of the inferior anal appendage appears spindle-shaped, lamelliform, or narrow with an apex enlarged and spoon-shaped (**Fig. 3.1.247**). 9

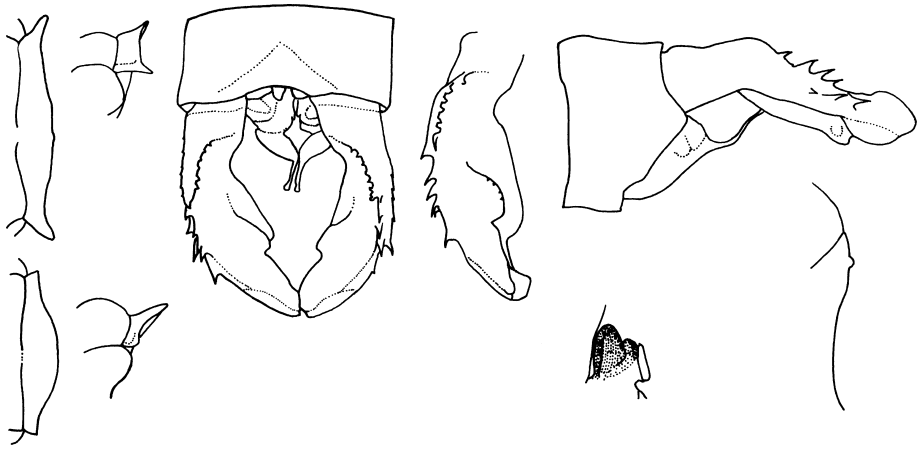


Fig. 3.1.247 *Teinopodagrion chinchaysuyum* (above, left to right): posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in dorsal view, one superior anal appendage in mediodorsal view, apex of the male abdomen in lateral view, and (below, left to right): posterior lobe of the female prothorax in dorsal and lateral view, left intersternite of a female, and outline of the occipital margin on the right side of the male head in dorsal view showing the development of the occipital tubercle. Based on De Marmels (2001).

9. The inner branch of the superior anal appendage and internal plate are short and truncate or obtusely angled at the apex. The inferior anal appendage has a distal process that is very delicate and has a short, spoon-shaped apex (**Fig. 3.1.247**). Total length: 42 to 44 mm. Length of abdomen: 32.5 to 34 mm. Hind wing length: 25 to 28.5 mm.
.....*Teinopodagrion chinchaysuyum* De Marmels, 2001 (Peru).
- The inner branch of the superior anal appendage and internal plate are well developed and project caudad (**Fig. 3.1.248**). 10

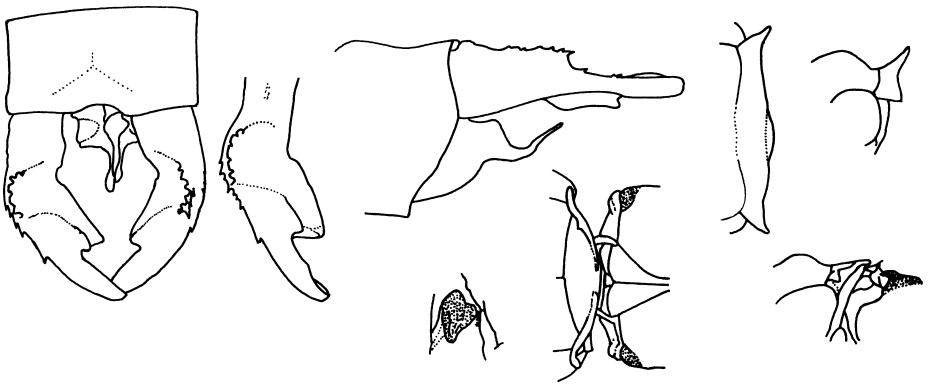


Fig. 3.1.248 *Teinopodagrion epidrium* (above, left to right): apex of the abdomen in dorsal view, a mediodorsal view of the superior anal appendage, apex of the male abdomen in lateral view, posterior lobe of the male prothorax in dorsal and lateral view, and (below, center to right): intersternite and posterior lobe of the prothorax and anterior part of the synthorax of a female in dorsal and lateral view. Based on De Marmels (2001).

10. In dorsal view, the distal process of the inferior anal appendage is delicate with a somewhat spoon-shapted apex (**Fig. 3.1.248**). The posterior lobe of the pronotum has moderately large, obtusely triangular lateral processes. Total length: 33.5 to 40 mm. Length of abdomen: 25.5 to 31 mm. Hind wing length: 21 to 24.5 mm.
.....*Teinopodagrion epidrium* De Marmels, 2001 (Venezuela).
- In dorsal view, the distal process of the inferior anal appendage is robust and lamelliform or somewhat spindle-shaped (**Fig. 3.1.249**). 11
11. In dorsal view, the distal process of the inferior anal appendage appears as a narrow, parallel-sided lamella, which runs straight posteriad in both dorsal and lateral view. The lateral borders of the hind lobe of the pronotum form broad triangles of moderate size. The occipital tubercles are well developed (**Fig. 3.1.249**). Total length: 36.5 to 41.5 mm. Length of abdomen: 28 to 32 mm. Hind wing length: 22 to 25.5 mm.
.....*Teinopodagrion lepidum* (Rácenis, 1959) (Venezuela). Syn: *Megapodagrion lepidum* Rácenis, 1959.
- In dorsal view, the distal process of the inferior anal appendage appears spindle-shaped, and in lateral view, it is arched dorsally (**Fig. 3.1.250**). 12
12. The occipital tubercles are well-developed. The lateral borders of the posterior lobe of the pronotum form roughly triangular processes. The internal plate of the superior anal appendage projects only a short distance posteriad, and the apices of these appendages curve to become slightly convergent (**Fig.**

3.1.250). Total length: c. 35 to 36 mm. Length of abdomen: c. 26.5 to 28 mm. Hind wing length: c. 21 to 22 mm. The female has not been described. .....*Teinopodagrion caquetanum* De Marmels, 2001 (Colombia).

- The occipital tubercles are absent or small. The lateral borders of the posterior lobe of the pronotum have long and slender processes. The internal plate of the superior anal appendage obviously projects posteriad, and the apices of these appendages do not curve toward one another (**Fig. 3.1.251**). 13

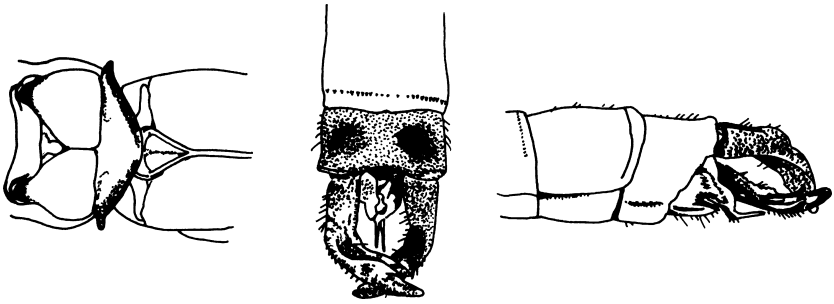


Fig. 3.1.249 *Teinopodagrion lepidum* (left to right): prothorax and anterior part of the synthorax of a female in dorsal view, apical segments of a male in dorsal and lateral view. Based on Rácinis (1959a).

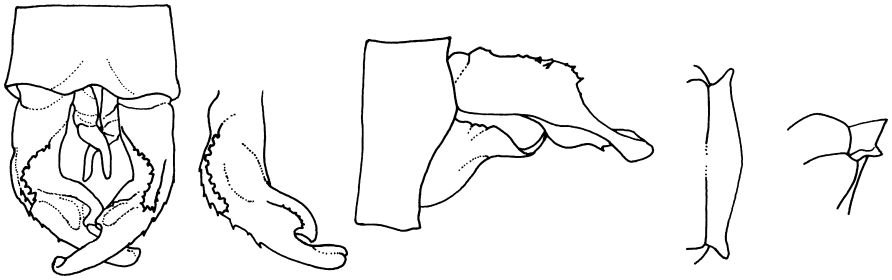


Fig. 3.1.250 *Teinopodagrion caquetanum* (left to right): apex of the male abdomen in dorsal view, superior anal appendage in dorsointernal view, apex of the male abdomen in lateral view, and posterior lobe of the female prothorax in dorsal and lateral view. Based on De Marmels (2001).

13. Occipital tubercles are vestigial or absent. The pterostigma is yellowish brown. In dorsal view, the crest of the superior anal appendage appears steeply arched, and its internal angle is almost 90º (**Fig. 3.1.251**). Total length: 40.5 to 42 mm. Length of abdomen: 29 to 32.5 mm. Hind wing length: 23 to 26.5 mm. .....*Teinopodagrion vallenatum* De Marmels, 2001 (Colombia).

- Occipital tubercles are small but obviously present. The pterostigma is dark brown. In dorsal view, the crest of the superior anal appendage appears slightly arched, and its internal angle is greater than 90º (**Fig. 3.1.252**). Total length: 37.5 to 39 mm. Length of abdomen: 29 to 30.5 mm. Hind wing length: 22.5 to 25 mm.
.....*Teinopodagrion vilorianum* De Marmels, 2001 (Colombia, Venezuela).

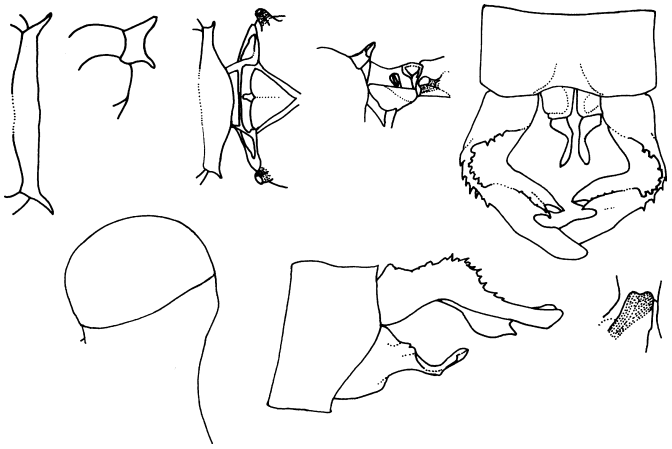


Fig. 3.1.251 *Teinopodagrion vallenatum* (above, left to right): posterior lobe of the male prothorax in dorsal and lateral view, posterior lobe of the female prothorax in dorsal and lateral view, apex of the male abdomen in dorsal view, and (below, left to right): right compound eye and posterior margin of the right side of the head of a male in dorsal view, apex of the male abdomen in lateral view, and left intersternite of a female. Based on De Marmels (2001).

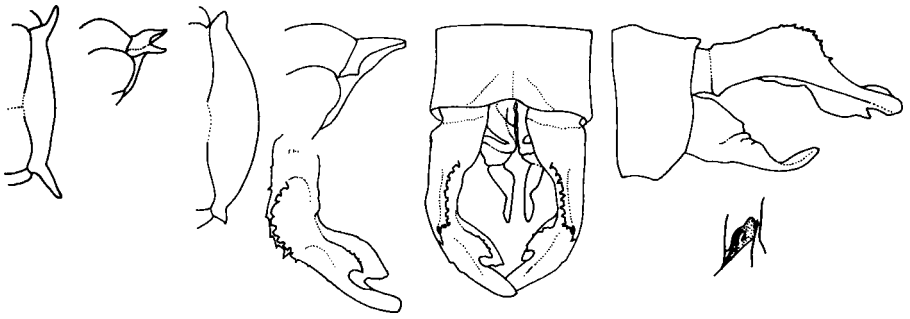


Fig. 3.1.252 *Teinopodagrion vilorianum* (left to right): posterior lobe of the male prothorax in dorsal and lateral view, posterior lobe of the female prothorax in dorsal and lateral view (above), superior anal appendage of the male in dorsointerior view (below), apex of the male abdomen in dorsal and lateral view (above), left intersternite of a female (below). Based on De Marmels (2001).

14. The superior branch of the superior anal appendage is truncate at the apex and does not extend caudad. In lateral view, it appears as a trapezoid. Its distal angle is greater than 90º (**Fig. 3.1.243**). Total length: 39 to 45.5 mm. Length of abdomen: 30 to 35.5 mm. Hind wing length: 23 to 28.5 mm.
.....*Teinopodagrion decipiens* De Marmels, 2001 (Peru, Bolivia).
- The superior branch of the superior anal appendage extends caudad, at least at its apex. In lateral view, it does not appear trapezoidal. Its distal angle is much less than 90º (**Fig. 3.1.239**). 15

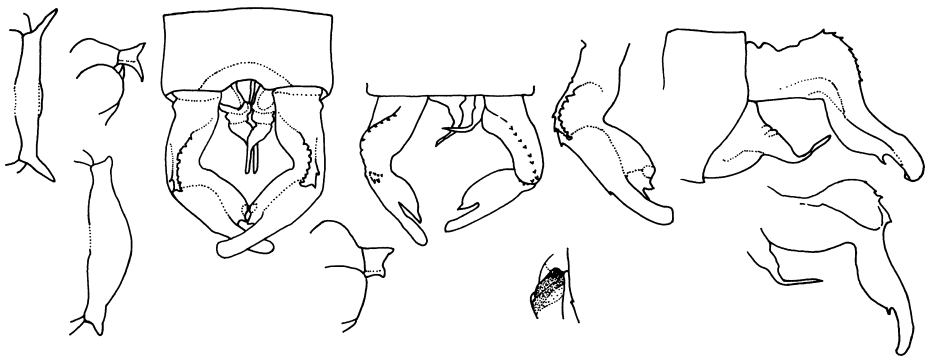


Fig. 3.1.253 *Teinopodagrion mercenarium* (above, left to right): posterior lobe of the male prothorax in dorsal and lateral view, apices of the abdomens of two male specimens in dorsal view, a superior anal appendage in dorsomedial view, apex of the male abdomen in lateral view, and (below, left to right): posterior lobe of the female prothorax in dorsal and lateral view, left intersternite of a female, and the anal appendages of a second male specimen in lateral view. Based on De Marmels (2001).

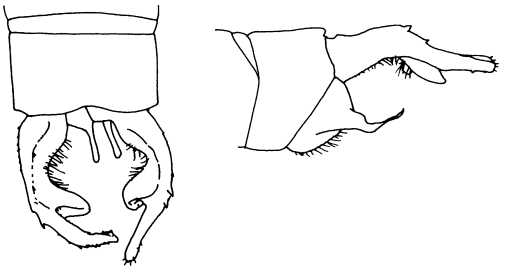


Fig. 3.1.254 *Teinopodagrion nebulosum* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Ris (1918).

15. In dorsal view, the internal branch of the superior anal appendage is truncate but with a distinct small point at the apex; the internal angle is about 110º. The inferior anal appendage has a parallel-sided, lamelliform distal process, which is not enlarged at the apex (**Fig. 3.1.253**). The lateral borders of the posterior lobe of the pronotum form long and narrow processes. Total length: 36.5 to 40 mm. Length of abdomen: 28 to 31 mm. Hind wing length: 21.5 to 26 mm.
..... *Teinopodagrion mercenarium* (Hagen, 1869) (Colombia, Venezuela, Peru, Bolivia). Syn: *Podagrion mercenarium* Hagen, 1869; *Megapodagrion mercenarium* (Hagen, 1869).
- In dorsal view, the internal branch of the superior anal appendage tapers to a blunt apex. The apex of the inferior anal appendage is at least slightly enlarged in the shape of a spoon or paddle (**Fig. 3.1.239**). 16
16. The lateral borders of the posterior lobe of the pronotum form long and narrow processes; the internal angle is 90º to 100º. In posterolateral view, the terminal branch of the process does not show a subapical expansion (**Fig. 3.1.254**). Total length: 36 to 41.5 mm. Length of abdomen: 27.5 to 32 mm. Hind wing length: 21.5 to 27 mm.
.....*Teinopodagrion nebulosum* (Selys, 1886) (Peru). Syn: *Megapodagrion nebulosum* Selys, 1886.
- The lateral processes on the posterior lobe of the pronotum are not long and slender, or the internal angle is greater than 100º, or the terminal process appears expanded subapically in posterolateral view (**Fig. 3.1.255**). 17

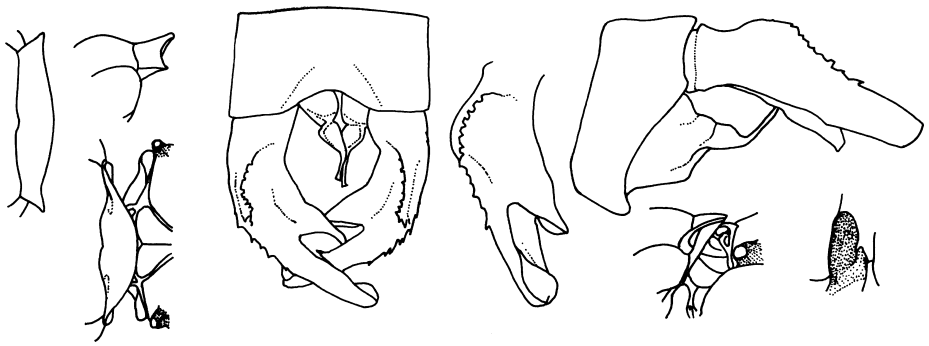


Fig. 3.1.255 *Teinopodagrion meridionale* (left to right): posterior lobe of the male prothorax in dorsal and lateral view (above), posterior lobe of the female prothorax and anterior part of the synthorax in dorsal view (below), apex of the male abdomen in dorsal view, superior anal appendage in dorsomedial view, and apex of the male abdomen in lateral view (above), posterior lobe of the female prothorax and anterior part of the synthorax in lateral view (lower right center), and left intersternite of a female (lower right). Based on De Marmels (2001).

17. The ocellar markings are broad. The lateral processes on the posterior lobe of the pronotum are short and broadly triangular. The eighth and ninth abdominal segments are pale laterally and usually contrast strongly with the black markings on the abdomen. There is no ridge on the superior anal appendage, but there is a thickening on the posteriodorsal rim of its inner branch (**Fig. 3.1.255**). Total length: 35 to 41.5 mm. Length of abdomen: 24.5 to 32 mm. Hind wing length: 21.5 to 26.5 mm.
.....*Teinopodagrion meridionale* De Marmels, 2001 (Argentina, Bolivia).
- The ocellar markings are narrow. The eighth and ninth abdominal segments are brownish laterally and do not contrast strongly with the rest of the segments. There is a ridge on the superior anal appendage (**Fig. 3.1.256**). 18

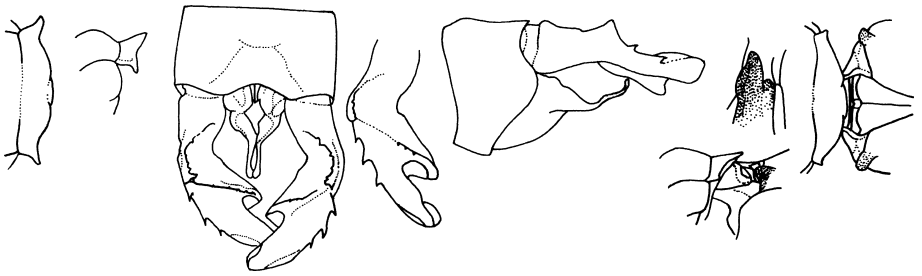


Fig. 3.1.256 *Teinopodagrion angulatum* (left to right): posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in dorsal view, a superior anal appendage in dorsomedial view, apex of the male abdomen in lateral view, left intersternite of a female (above), posterior lobe of the female prothorax and anterior part of the synthorax in lateral (below) and dorsal view (right). Based on De Marmels (2001).

18 In lateral view, a high, triangular crest is visible on the superior anal appendage, and there is a subapical enlargement of the appendage. The apical process of the inferior anal appendage is slender and shaped like an oar (**Fig. 3.1.256**). Total length: 32.5 to 38 mm. Length of abdomen: 25 to 29 mm. Hind wing length: 19.5 to 23 mm.
.....*Teinopodagrion angulatum* De Marmels, 2001 (Ecuador).
- In lateral view, there is no high, triangular crest visible on the superior anal appendage, or, if there is a high crest, there is a subapical constriction of the appendage (**Fig. 3.1.257**). 19

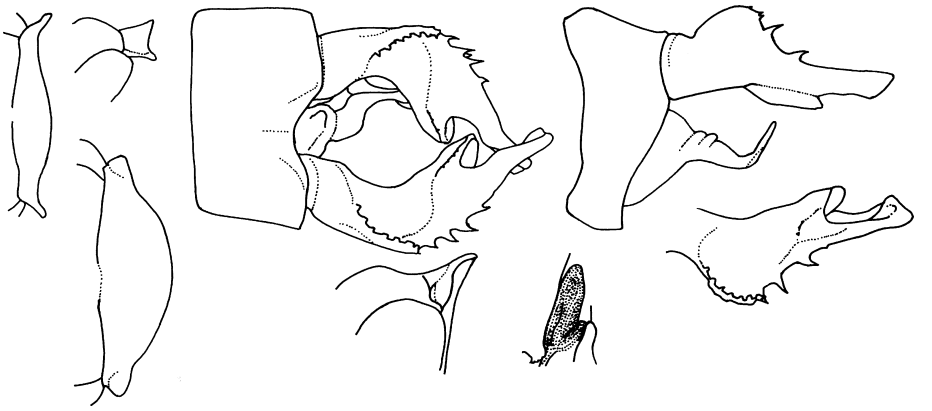


Fig. 3.1.257 *Teinopodagrion schiessi* (above, left to right): posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in oblique dorsal and lateral view, and (below, left to right): posterior lobe of the female prothorax in dorsal and lateral view, left intersternite of a female, and superior anal appendage of a male in dorsomedial view. Based on De Marmels (2001).

19 The crest on the superior anal appendage is high, and very strong external spines are usually present. The apices of the superior anal appendages have slight subapical constrictions, and they are slightly divergent (**Fig. 3.1.257**). Total length: 40 to 46.5 mm. Length of abdomen: 31 to 36 mm. Hind wing length: 24.5 to 28 mm.
.....*Teinopodagrion schiessi* De Marmels, 2001 (Bolivia).
- The crest on the superior anal appendage is not high, or, if it is, very strong external spines are not present, and the apices of the superior appendages do not have slight subapical constrictions, or they are not divergent (**Fig. 3.1.257**). 20
20. The apex of the internal branch of the superior anal appendage is bent strongly ventrad. Occipital tubercles are prominent. The posterior lobe of the pronotum has long, strong lateral processes. The crest on the superior anal appendage is low. The apex of the inferior anal appendage is short, narrow, delicate, and spoon-like (**Fig. 3.1.225**). Total length: 42 to 43 mm. Length of abdomen: 32.5 to 33.5 mm. Hind wing length: 25.5 to 26.5 mm.
.....*Teinopodagrion setigerum* (Selys, 1886) (Ecuador). Syn: *Megapodagrion setigerum* Selys, 1886.
- The apex of the internal branch of the superior anal appendage is not bent strongly ventrad (**Fig. 3.1.258**). 21

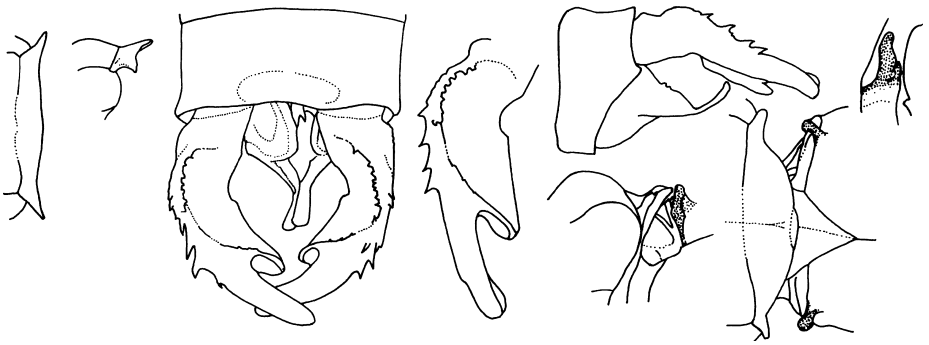


Fig. 3.1.258 *Teinopodagrion eretes* (left to right): posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in dorsal view, superior anal appendage in dorsomedial view, and apex of the male abdomen in lateral view (upper right center), left intersternite of a female (upper right), and posterior lobe of the female prothorax and anterior part of the synthorax in lateral (lower right center) and dorsal view (lower right). Based on De Marmels (2001).

21. In lateroposterior view, no subapical widening of the superior anal appendage is apparent (**Fig. 3.1.258**). 22
- In lateroposterior view, a subapical widening of the superior anal appendage is apparent (**Fig. 3.1.259**). 23

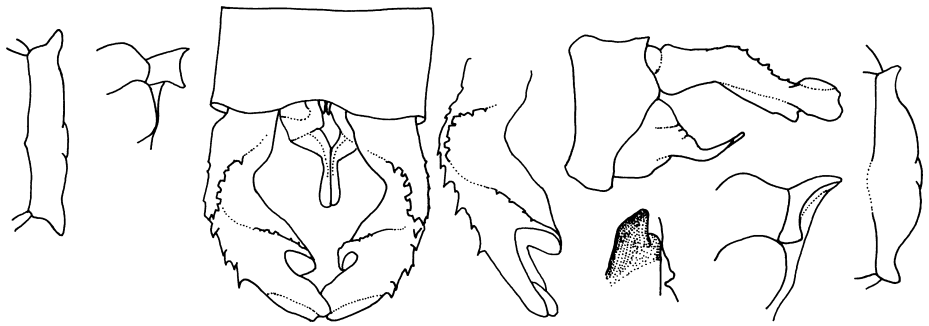


Fig. 3.1.259 *Teinopodagrion depressum* (left to right): posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in dorsal view, superior anal appendage in dorsomedial view, apex of the male abdomen in lateral view (upper right center), posterior lobe of the female prothorax in dorsal view and in lateral view (lower right center), and left intersternite of a female (left of female prothorax). Based on De Marmels (2001).

22. The occipital tubercles are absent or very low. The lateral processes on the hind lobe of the pronotum are moderately large and triangular. In lateral view, the crest on the superior anal appendage appears low. The apical part of the inferior anal appendage is robust and shaped like an oar, broadening gradually to a rounded apex (**Fig. 3.1.258**). Total length: 36.5 to 39 mm. Length of abdomen: 28.5 to 31 mm. Hind wing length: 21.5 to 24.5 mm.
.....*Teinopodagrion eretes* De Marmels, 2001 (Peru).

- The occipital tubercles are of moderate height. The lateral processes on the posterior lobe of the pronotum are short and knob-like. In lateral view, the crest on the superior anal appendage is obviously well developed. The apical part of the inferior anal appendage is slender, and the apex is barely enlarged (**Fig. 3.1.260**). Total length: c. 39 to 39.5 mm. Length of abdomen: c. 29.5 to 30 mm. Hind wing length: c. 23.5 to 24 mm. The female has not been described.
.....*Teinopodagrion yunka* De Marmels, 2001 (Bolivia).

Fig. 3.1.260 *Teinopodagrion yunka* (left to right): apex of the male abdomen in dorsal view, superior anal appendage in dorsointernal view, apex of the male abdomen in lateral view, and posterior lobe of the female prothorax in dorsal and lateral view. Based on De Marmels (2001).

23. The occipital tubercles are low or of moderate height. The lateral processes on the posterior lobe of the pronotum are short and obtusely triangular. In lateral view, the crest on the superior anal appendage is low, and the two branches of the appendage are short but robust. The apical part of the inferior anal appendage gradually broadens toward the apex (**Fig. 3.1.259**). Total length: 35 to 39.5 mm. Length of abdomen: 26.5 to 30 mm. Hind wing length: 21.5 to 24.5 mm.
.....*Teinopodagrion depressum* De Marmels, 2001 (Ecuador).

- The occipital tubercles are usually well developed. The lateral processes on the hind lobe of the pronotum are long and triangular. In lateral view, the crest on the superior anal appendage is short and raised near the apex, and the two branches of the appendage are fairly long. The apical part of the inferior anal appendage is broadly spoon-shaped (**Fig. 3.1.239**). Total length: 36 to 40.5 mm. Length of abdomen: 27.5 to 30.5 mm. Hind wing length: 21 to 25.5 mm.
.....*Teinopodagrion waynu* De Marmels, 2001 (Peru).

Key to the species of adult female *Teinopodagrion* in South America

Information for the key was provided by Rácenis (1959a) and De Marmels (2001). The females of a few species still cannot be distinguished with certainty, and those of *Teinopodagrion caquetanum, Teinopodagrion croizati, Teinopodagrion waynu,* and *Teinopodagrion yunka* have not been described.

1. Near the external angle of the mesostigmal lamina, there is an upright stylus or triangular process (**Fig. 3.1.240**). Total length: 32 to 39 mm. Length of abdomen: 24 to 29.5 mm. Hind wing length: 21.5 to 28.5 mm.
.....*Teinopodagrion venale* (Hagen in Selys, 1862) (Venezuela, Colombia). Syn: *Podagrion venale* Hagen in Selys, 1862; *Megapodagrion venale* (Hagen in Selys, 1862).
- There is no upright stylus or triangular process near the external angle of the mesostigmal lamina (**Fig. 3.1.255**). 2
2. Near the external angle of the mesostigmal lamina, there is an upright, semi-circular, scale-like process. The lateral borders of the posterior lobe of the pronotum are abruptly raised but lack processes. The intersternite has an elongated, tongue-like anterior part that reaches the dorsal edge of the mesokatepisternal swelling. There is a chitinized humeral hummock (**Fig. 3.1.255**). The eighth and ninth abdominal segments are pale on the lateral surfaces and sometimes have strongly contrasting black dorsal markings. Total length: 35 to 38 mm. Length of abdomen: 26.5 to 28 mm. Hind wing length: 26 to 27.5 mm.
.....*Teinopodagrion meridionale* De Marmels, 2001 (Argentina, Bolivia).
- The mesostigmal lamina is either uniform or rises near its external angle, but there is never an upright, semi-circular, scale-like process near its external angle (**Fig. 3.1.258**). 3
3. There is a tongue-like anterior portion of the intersternite that extends dorsad farther than the setifer, usually considerably farther (**Fig. 3.1.258**). 4
- The anterior portion of the intersternite is never tongue-like and may be absent or indistinguishable from the posterior part; it is never more than slightly higher than the posterior portion, but it is sometimes membranous and extends from the surface of the body like an auricle (**Fig. 3.1.251**). 12

4. The mesostigmal lamina does not extend toward the lateral angle (**Fig. 3.1.258**). 5
- The mesostigmal lamina extends at least slightly toward the lateral angle (**Fig. 3.1.256**). 7
5. The anterior part of the intersternite does not approach the dorsal edge of the mesokatepisternal swelling, and the plug-like humeral hummock is considerably higher than the mesostigmal lamina (**Fig. 3.1.258**). Total length: 34.5 to 36 mm. Length of abdomen: 25.5 to 26.5 mm. Hind wing length: 24 to 24.5 mm.
.....*Teinopodagrion eretes* De Marmels, 2001 (Peru).
- The anterior part of the intersternite reaches or almost reaches the dorsal edge of the mesokatepisternal swelling; the humeral hummock is not plug-like and extends no more than slightly above the mesostigmal lamina (**Fig. 3.1.239**). 6
6. The occipital tubercles are at least moderately well-developed. The posterior lobe of the pronotum has a short triangular process, sometimes little more than an angle, at each lateral margin (**Fig. 3.1.239**). Total length: 33 to 36 mm. Length of abdomen: 24.5 to 26.5 mm. Hind wing length: 23 to 23.5 mm.
.....*Teinopodagrion waynu* De Marmels, 2001 (Peru).
- The occipital tubercles are reduced to low swellings. The posterior lobe of the pronotum has a narrow, fairly long process with an acute apex at each lateral margin (**Fig. 3.1.254**). Total length: 31 to 37.5 mm. Length of abdomen: 22.5 to 28 mm. Hind wing length: 21.5 to 27 mm.
.....*Teinopodagrion nebulosum* (Selys, 1886) (Peru). Syn: *Megapodagrion nebulosum* Selys, 1886.
7. The humeral hummock resembles a plug and extends considerably farther dorsad than the mesostigmal lamina. The occipital tubercles are well developed. The posterior lobe of the pronotum has short, triangular, lateral lobes with acutely pointed apices. The intersternite has an anterior portion that is long but fails to reach the dorsal margin of the mesokatepisternal swelling (**Fig. 3.1.256**). Total length: 28 to 32.5 mm. Length of abdomen: 20 to 24 mm. Hind wing length: 20.5 to 21.5 mm.
.....*Teinopodagrion angulatum* De Marmels, 2001 (Ecuador).
- The humeral hummock, if present at all, extends only to a height no greater than slightly above the mesostigmal lamina, and it never resembles a plug (**Fig. 3.1.256**). 8
8. There is no humeral hummock. The anterior part of the intersternite does not extend as much as half the distance from the dorsal margin of the setifer to the dorsal margin of the mesokatepisternal swelling. The posterior lobe of the pronotum has fairly long, triangular lateral processes (**Fig. 3.1.225**). Total length: 38.5 to 42 mm. Length of abdomen: 28.5 to 31 mm. Hind wing length: 27 to 31 mm.
.....*Teinopodagrion setigerum* (Selys, 1886) (Ecuador). Syn: *Megapodagrion setigerum* Selys, 1886.

- A humeral hummock is always evident, even if low. The anterior part of the intersternite extends more than half the distance from the dorsal margin of the setifer to the dorsal margin of the mesokatepisternal swelling (**Fig. 3.1.257**). 9

9. The anterior part of the intersternite usually extends as far as the dorsal margin of the mesokatepisternal swelling. The humeral hummock is low but borders on the suture between the mesepisternum and the mesokatepisternum. The lateral processes on the posterior lobe of the pronotum are short and truncate or rounded at the apex, and the lateral margins of the lobe are raised above the plane of the pronotum (**Fig. 3.1.257**). Total length: 40 to 41.5 mm. Length of abdomen: 29.5 to 31.5 mm. Hind wing length: 27 to 30 mm.
.....*Teinopodagrion schiessi* De Marmels, 2001 (Bolivia).

- The anterior part of the intersternite never even approaches the dorsal margin of the mesokatepisternal swelling (**Fig. 3.1.244**). The humeral hummock is obviously separated from the suture between the mesepisternum and the mesokatepisternum. 10

10. The lateral processes on the posterior lobe of the pronotum are short and triangular but always well developed. There are low tubercles on the occiput. The intersternite may have an acutely pointed anterior part. The humeral hummock is usually as high or higher than the mesostigmal lamina, from which it is separated by a furrow (**Fig. 3.1.244**). Intraspecific variability may cause females of this species to be misidentified, so positive identification may require male specimens. Total length: 34.5 to 40 mm. Length of abdomen: 26 to 29.5 mm. Hind wing length: 24 to 28.5 mm.
.....*Teinopodagrion decipiens* De Marmels, 2001 (Peru, Bolivia).

- Lateral processes on the posterior lobe of the pronotum are usually absent or very short. If not, then the humeral hummock is reduced to a vestige, or the occipital tubercles are relatively large (**Fig. 3.1.247**). 11

11. The lateral margins of the posterior lobe of the pronotum form obtuse angles and lack processes. The mesostigmal lamina is higher than the humeral hummock, and there is a superficial furrow between them (**Fig. 3.1.247**). Total length: 35.5 to 38 mm. Length of abdomen: 26.5 to 29 mm. Hind wing length: 25 to 26.5 mm.
..... *Teinopodagrion chinchaysuyum* De Marmels, 2001 (Peru).

- At the lateral margins of the posterior lobe of the pronotum, there are very short triangular or rounded processes. The low humeral hummock is frequently fused with the mesostigmal lamina (**Fig. 3.1.259**). Total length: 32.5 to 37.5 mm. Length of abdomen: 24 to 27.5 mm. Hind wing length: 21.5 to 25 mm.
.....*Teinopodagrion depressum* De Marmels, 2001 (Ecuador).

12. The posterior lobe of the pronotum has long, slender, acutely pointed lateral processes but is not raised laterally. The small intersternite is not divergent from the surface of the body along its anterior rim. A humeral hummock is lacking.

Total length: 35 to 40.5 mm. Length of abdomen: 26 to 30.5 mm. Hind wing length: 23 to 27.5 mm.
.....*Teinopodagrion macropus* (Selys, 1862) (Venezuela, Bolivia, Argentina). Syn: *Podagrion macropus* Selys, 1862; *Megapodagrion macropus* (Selys, 1862).
- Lateral processes on the posterior lobe of the pronotum are absent, vestigial, or very short (**Fig. 3.1.251**). 13
13. The humeral hummock resembles a plug and is much higher than the mesostigmal lamina. There is no trace of occipital tubercles. The posterior lobe of the prothorax has vestigial lateral processes (**Fig. 3.1.251**). Total length: 34.5 to 39 mm. Length of abdomen: 25.5 to 29.5 mm. Hind wing length: 24.5 to 27 mm.
.....*Teinopodagrion vallenatum* De Marmels, 2001 (Colombia).
- The humeral hummock, if present at all, may equal but never exceed the mesostigmal lamina in height (**Fig. 3.1.238**). 14
14. Toward its lateral margins, the posterior lobe of the pronotum curves to an almost vertical position; its lateral parts are sometimes fused with the median lobe, and if present at all, its lateral processes are vestigial (**Fig. 3.1.242**). The humeral hummock is present and equal in height to the mesostigmal lamina. ..15
- Toward its lateral margins, the posterior lobe of the pronotum is not or is only somewhat raised, or, if it is considerably raised, it bears short, triangular lateral processes (**Fig. 3.1.248**). 16
15. Only vestigial occipital tubercles are present. The hind lobe of the pronotum is fused with the median lobe forming no free angles. The anterior rim of the intersternite projects away from the body (**Fig. 3.1.242**). The ovipositor does not extend posteriad as far as the superior anal appendage. Total length: c. 41 to 41.5 mm. Length of abdomen: c. 31 to 31.5 mm. Hind wing length: c. 30 mm.
.....*Teinopodagrion turikum* De Marmels, 2001 (Venezuela, Colombia?).
- The occipital tubercles are large. The hind lobe of the pronotum is not fused with the median lobe, and the free angles are obtuse. The anterior rim of the band-shaped intersternite does not project away from the body. The ovipositor extends as far or farther posteriad than the superior anal appendage (**Fig. 3.1.238**). Total length: 31 to 33.5 mm. Length of abdomen: 23 to 25 mm. Hind wing length: 21 to 22.5 mm.
.....*Teinopodagrion curtum* (Selys, 1886) (Ecuador, Peru, Colombia). Syn: *Megapodagrion curtum* Selys, 1886.
16. The lateral part of the posterior lobe of the prothorax is strongly raised, and it bears short, triangular, lateral processes. Low occipital tubercles are present. The intersternite has an anterior part shaped like a rounded lobe (**Fig. 3.1.248**). Total length: 34.5 to 37 mm. Length of abdomen: 26 to 27.5 mm. Hind wing length: 23.5 to 25.5 mm.
.....*Teinopodagrion epidrium* De Marmels, 2001 (Venezuela).

- The lateral part of the posterior lobe of the prothorax is only moderately raised or it is not raised at all. The anterior part of the intersternite does not form a rounded lobe, prominent dorsally (**Fig. 3.1.253**). 17

17. The mesokatepisternum has a remarkably prominent swelling that protrudes dorsoexternally. The lateral part of the posterior lobe of the pronotum is not raised at all, and short or obtuse triangular lateral processes are present. The anterior rim of the band-like intersternite does not project from the body (**Fig. 3.1.253**). A humeral hummock can barely be detected. The ovipositor extends as far posteriad as the superior anal appendage. Total length: 33.5 to 35 mm. Length of abdomen: 24.5 to 26 mm. Hind wing length: 24 to 24.5 mm.
.....*Teinopodagrion mercenarium* (Hagen, 1869) (Colombia, Venezuela, Peru, Bolivia). Syn: *Podagrion mercenarium* Hagen, 1869; *Megapodagrion mercenarium* (Hagen, 1869).

- The swelling on the mesokatepisternum does not protrude strongly dorsoexternally (**Fig. 3.1.245**). 18

18. The anterior rim of the band-like intersternite does not project away from the body. The occipital tubercles project considerably. The apex of the humeral hummock is fused with the lateral angle of the mesostigmal lamina. The dark marking on the mesepimeron frequently forms a stripe covering 50% or more of the height of the sclerite (**Fig. 3.1.245**). Total length: 32 to 33 mm. Length of abdomen: 23.5 to 24.5 mm. Hind wing length: 21 to 22.5 mm.
.....*Teinopodagrion temporale* (Selys, 1862) (Colombia). Syn: *Podagrion temporale* Selys, 1862; *Megapodagrion temporale* (Selys, 1862).

- The intersternite is not band-like; it is small and membranous and has a rim that may project away from the body (**Fig. 3.1.252**). 19

19. The ovipositor and the anterior anal appendage extend posteriad approximately an equal distance (**Fig. 3.1.252**). 20

- The superior anal appendage reaches slightly farther posteriad than the ovipositor (**Fig. 3.1.241**). 21

20. The lateral part of the hind lobe of the pronotum is not raised, and the lateral processes are short and rounded at the apices. The humeral hummock is barely discernible (**Fig. 3.1.252**). Total length: 35.5 to 38.5 mm. Length of abdomen: 26 to 29 mm. Hind wing length: 24 to 25 mm.
.....*Teinopodagrion vilorianum* De Marmels, 2001 (Colombia, Venezuela).

- The lateral part of the hind lobe of the pronotum is raised moderately, and the lateral processes are narrow and moderately long (**Fig. 3.1.261**). The humeral hummock is absent. There is a mesokatepisternal swelling, but it is not remarkable produced dorsoexternally. Total length: c. 33.5 mm. Length of abdomen: c. 25 mm. Hind wing length: c. 23 mm. The male has not been described.
.....*Teinopodagrion muzanum* (Navás, 1934) (Colombia). Syn: *Argia muzana* Navás, 1934; *Megapodagrion muzana* (Navás, 1934).

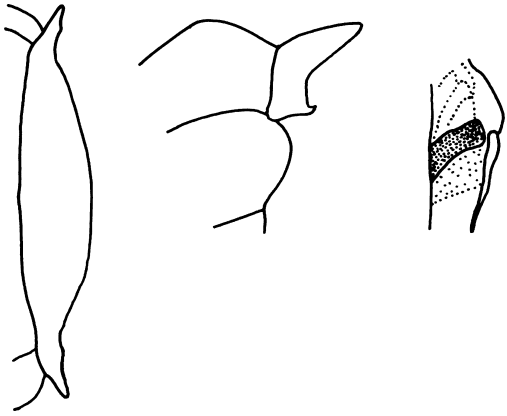


Fig. 3.1.261 *Teinopodagrion muzanum* female (left to right): posterior lobe of the female prothorax in dorsal and lateral view and left intersternite of a female. Based on De Marmels (2001).

21. The humeral hummock is barely discernable. The lateral part of the hind lobe of the pronotum is slightly raised, and it lacks a lateral process. The occipital tubercles are variable (**Fig. 3.1.241**). Total length: 38.5 to 44.5 mm. Length of abdomen: 28 to 34.5 mm. Hind wing length: 26.5 to 29.5 mm.
.....*Teinopodagrion oscillans* (Selys, 1862) (Venezuela, Colombia). Syn: *Podagrion oscillans* Selys, 1862; *Megapodagrion oscillans* (Selys, 1862).
- The humeral hummock is easily discernable and bends toward the mesostigmal lamina. The lateral part of the hind lobe of the pronotum is somewhat raised, and it has short, triangular lateral processes. The occipital tubercles are large (**Fig. 3.1.249**). Total length: 33 to 37 mm. Length of abdomen: 24 to 27.5 mm. Hind wing length: 23 to 26 mm.
.....*Teinopodagrion lepidum* (Rácenis, 1959) (Venezuela). Syn: *Megapodagrion lepidum* Rácenis, 1959.

Key to the species of the known *Teinopodagrion* larvae in South America

Information for the key was provided by De Marmels (2001), von Ellenrieder (2006), and Pérez-Gutiérrez (2007). Descriptions are of the last larval instar.

1. The cercus of the male tapers to its apex. The abdomen is shorter than the caudal gill lamellae (**Fig. 3.1.262**). 2
- The cercus of the male is cylindrical and broadly rounded at the apex (**Fig. 3.1.231**). 5

2. The wing buds reach to the anterior part of the eighth abdominal segment. There are dorsal hooks on the sixth through ninth abdominal segments with that on the sixth very small and those on the seventh through ninth larger and subequal in size (**Fig. 3.1.263**). The second and third segments of the antenna have dark stripes. The femora are banded, but the tibiae and tarsi are pale and unmarked.
..... *Teinopodagrion vallenatum* De Marmels, 2001 (Colombia).
- The wing buds reach no farther than the end of the fifth abdominal segment (**Fig. 3.1.262**). 3

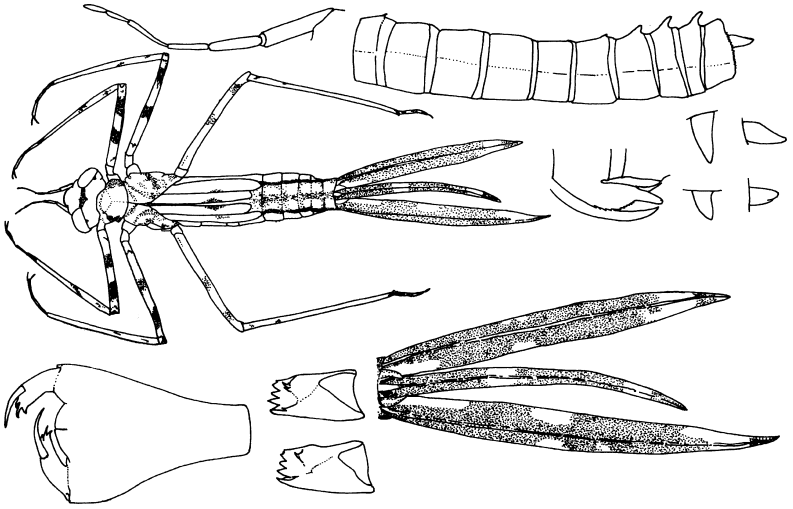


Fig. 3.1.262 *Teinopodagrion meridionale* larva: habitus of a male (middle left), antenna (upper left), labium (lower left), mandibles (lower left center), caudal gill lamellae (lower right), abdomen in lateral view (upper right), anlage of the ovipositor (right center), cercus of a male in dorsal and lateral view (upper middle right, left and right, respectively), and the cercus of a female in dorsal and lateral view (middle right, left and right, respectively). Based on von Ellenrieder (2006).

3. The tibiae each have two or three dark spots near their bases and are darkened at their apices. There are medial dorsal hooks on the first through ninth abdominal segments; those on the second through fifth are tiny. The wing buds reach to the posterior margin on the fifth abdominal segment (**Fig. 3.1.262**).
..... *Teinopodagrion meridionale* De Marmels, 2001 (Argentina, Bolivia).
- The tibiae have no markings. The abdomen is longer than the lateral caudal gill lamella (**Fig. 3.1.264**). 4

4. Only the fifth through ninth abdominal segments bear medial hooks. The wing buds reach the anterior part of the fifth abdominal segment (**Fig. 3.1.32**).
.....*Teinopodagrion venale* (Hagen in Selys, 1862) (Venezuela, Colombia). Syn: *Podagrion venale* Hagen in Selys, 1862; *Megapodagrion venale* (Hagen in Selys, 1862).
- There are medial dorsal processes only on the sixth through ninth abdominal segments, with a blunt protuberance on the sixth and slender hooks increasing progressively in size on the seventh through ninth. The wing buds reach the anterior margin of the fifth abdominal segment. The abdomen is longer than the caudal gill lamellae (**Fig. 3.1.264**). There are no markings on the antennae.
.....*Teinopodagrion caquetanum* De Marmels, 2001 (Colombia).

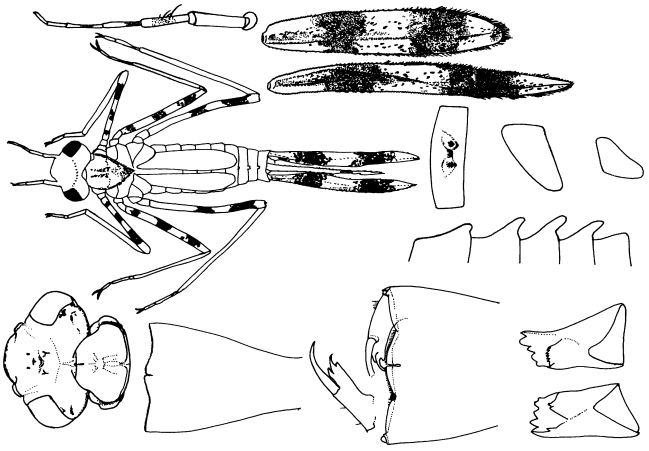


Fig. 3.1.263 *Teinopodagrion vallenatum* larva: habitus (middle left), antenna (upper left), head in dorsal view (lower left), outline of prementum (lower left center), anterior portion of labium with one labial palp separated (lower right center), inner surface of mandibles (lower right), outline of the dorsum of the sixth through tenth abdominal segments (middle right), middle and lateral gill lamellae (upper right, above and below, respectively), gonopophyses (right center), cercus in dorsal and lateral view (upper middle right, left and right, respectively). Based on Pérez-Gutiérrez (2007).

5. The labium reaches posteriad to a point between the fore and middle coxa. The wing buds extend to the posterior margin of the fifth abdominal segment. There is one dark basal band on each tibia. On the pale abdomen, there are medial dorsal hooks on the first through ninth segments, but those on the second through fifth are tiny (**Fig. 3.1.231**).
.....*Teinopodagrion decipiens* De Marmels, 2001 (Peru, Bolivia).

- The labium reaches posteriad to a point beyond the middle coxa. The wing buds extend to the posterior margin of the sixth abdominal segment. There are no dark markings on the tibiae. The abdomen has a pattern of dark longitudinal stripes, and there are medial dorsal hooks only on the fifth through ninth segments (**Fig. 3.1.265**).
.....*Teinopodagrion oscillans* (Selys, 1862) (Venezuela, Colombia). Syn: *Podagrion oscillans* Selys, 1862; *Megapodagrion oscillans* (Selys, 1862).

Fig. 3.1.264 *Teinopodagrion caquetanum* larva (above, left to right): head in dorsal view, anterior part of the labium with one labial palp separated, inner view of the mandibles, gonapophyses, dorsal and lateral views of a cercus, and an antenna (middle left), middle and lateral gill lamellae (right, above and below, respectively), fore-leg in dorsal view (lower left) and an outline of the dorsum of the posterior part of the fifth through the tenth abdominal segments. Based on Pérez-Gutiérrez (2007).

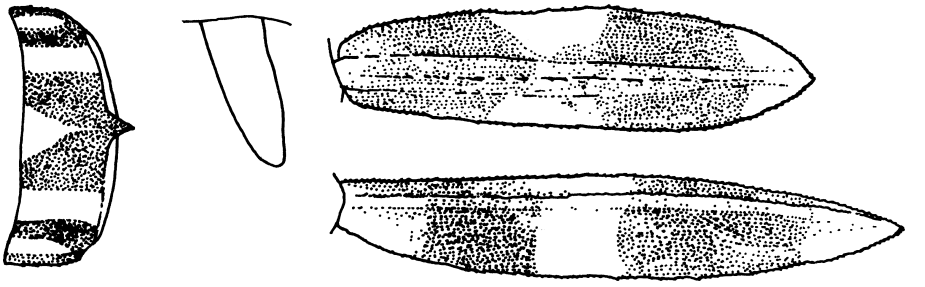


Fig. 3.1.265 *Teinopodagrion oscillans* larva (left to right): prothorax in dorsal view, a cercus, and the middle (above) and a lateral gill lamella (below). Based on De Marmels (2001).

Key to the species of adult *Allopodagrion* in South America

Information for the key was provided by De Marmels (2001). Larvae of this genus have not been described.

1. The labrum and clypeus of the male are blue, and the postocular lobes are light blue with a wide black band posterior to the vertex separating them. The pale postocular lobes of the female vary in color but are bordered on their anterior and posterior margins by black bands, one running posterior to the antennae and the other running across the occipital tubercles. The proepimeron and mesepimeron are brassy black, except for the pale distal portion of the ventral rim of the proepimeron and sometimes small areas of the mesepimeron. The internal branch of the male superior anal appendage is rounded obtusely; its mesal margin is denticulated. The male inferior anal appendage ends in a knob and is shorter than half the length of the superior appendage. The female has an intersternite with a narrow chitinized portion and a dorsal extension of the setifer beyond the constriction dorsal to the setae (**Fig. 3.1.266**). The ninth abdominal segment of the female has two parallel, longitudinal black stripes, which are sometimes confluent but fail to reach the posterior margin of the segment. The dorsal surface of the tenth abdominal segment of the female is pale. Total length: 35.5 to 39 mm. Length of abdomen: 26 to 29 mm. Hind wing length: 23.5 to 27 mm. Pterostigma length in the fore-wing: 1.7 to 2.0 mm.
.....*Allopodagrion brachyurum* De Marmels, 2001 (Argentina, Santa Catarina).
- The labrum and clypeus of the male are black or dark brown, and the postocular lobes are greenish or ferrugineous, confluent with areas of the same color posterior to the vertex, or the entire dorsal surface of the head is dark brown except for a narrow ferrugineous area on the occiput. The postocular lobes of the female vary in color but are bordered on the posterior margin by a ferrugineous area crossing the occipital tubercles. The internal branch of the male superior anal appendage is spine-like, and the inferior appendage is longer than half the length of the superior appendage. The female intersternite has a broad chitinized portion and no sign of a dorsal extension of the setifer (**Fig. 3.1.223**). The female proepimeron and mesepimeron are mainly brown. The ninth abdominal segment of the female has one broad black stripe, which reaches the posterior margin of the segment. The dorsal surface of the tenth abdominal segment of the female is black. 2
2. The proepimeron of the male is shiny black with a pale distal part of the ventral rim. The pterostigma is less than 0.5 mm wide. The inferior anal appendage has a sigmoid dorsal crest and resembles a blade (**Fig. 3.1.19**). The female has not been described, but it is believed to have a pterostigma less than 0.5 mm wide (De Marmels, 2001). Total length: c. 39.4 mm. Length of abdomen: 26 to 30 mm. Hind wing length: 24 to 26 mm.
.....*Allopodagrion erinys* Ris, 1913 (Argentina).

- The proepimeron of the male is dark brown. The pterostigma is at least 0.5 mm wide. The dorsal surface of the inferior anal appendage of the male has two spiniform processes (**Fig. 3.1.223**). Total length: 36 to 42.5 mm. Length of abdomen: 26 to 33.5 mm. Hind wing length: 23.5 to 28.5 mm. Length of pterostigma of fore-wing: 1.6 to 2.2 mm.
.....*Allopodagrion contortum* (Hagen in Selys, 1862) (Argentina, Santa Catarina, Paraná, São Paulo, Minas Gerais, Rio de Janeiro, Espirito Santo). Syn: *Podagrion contortum* Hagen in Selys, 1862; *Megapodagrion contortum* (Hagen in Selys, 1862).

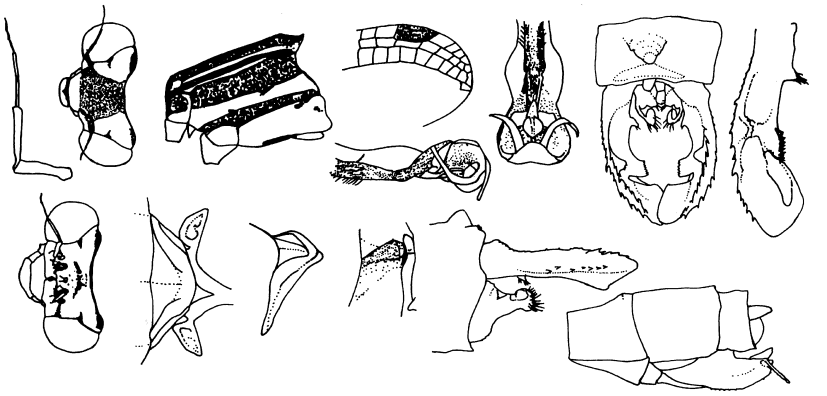


Fig. 3.1.266 *Allopodagrion brachyurum* (above, left to right): antenna of a male, head of a male in dorsal view, male synthorax in lateral view, region of the pterostigma on the fore-wing of a male (above) and lateral view of the penis (below), ventral view of the penis, apex of the male abdomen in dorsal view, a view of the inner side of the right the superior anal appendages of a male, and (below, left to right): head of a female in dorsal view, posterior lobe of the female prothorax in dorsal and lateral view, female intersternite, lateral views of the apices of a male and a female abdomen. Based on De Marmels (2001).

Key to the species of adult *Sciotropis* in South America

Information for the key was provided by De Marmels (1994), who recommended that both species be submitted for the national Red Data Book of Venezuela (De Marmels, 1999a), the only country in which they have been found. The larva of *Sciotropis lattkei* has not been described.

1. The color is mainly black, but there are bluish pruinose areas on the synthorax along a narrow antehumeral stripe on the distal half of the mesepisternum, on a rather broad patch on the distal half of the mesepimeron, on a dorsal spot on the metepisternum, and along a wide band from the metastigma to the posterior

lateral suture. Bluish pruinosity also covers the apical part of the eighth and the dorsal areas of the ninth and tenth abdominal segments of the male; the same areas of the female are pale but not pruinose. The superior anal appendage of the male has a large internal process just proximal to its mid-length ending in a row of about four teeth; the process extends mesad and is not visible in lateral view. The apical margin of the posterior lobe of the female prothorax is not raised to form a projection (**Fig. 3.1.267**). Total length, including the anal appendages: 37.5 to 42 mm. Length of abdomen, including appendages: 29 to 34 mm. Hind wing length: 24.5 to 28 mm. The wings are clear with black veins, a blackish brown marking at their apices, and a brownish black pterostigma. The legs are mainly yellowish brown.

.....*Sciotropis lattkei* De Marmels, 1994 (Venezuela).

- There are no bluish pruinose areas on the synthorax or abdomen. The superior anal appendage of the male has only a small swelling just proximal to its mid-length, which lacks apical teeth. The apical margin of the posterior lobe of the prothorax is raised as a projection appearing triangular in lateral view (**Fig. 3.1.221**).

.....*Sciotropis cyclanthorum* Rácenis, 1959 (Venezuela).

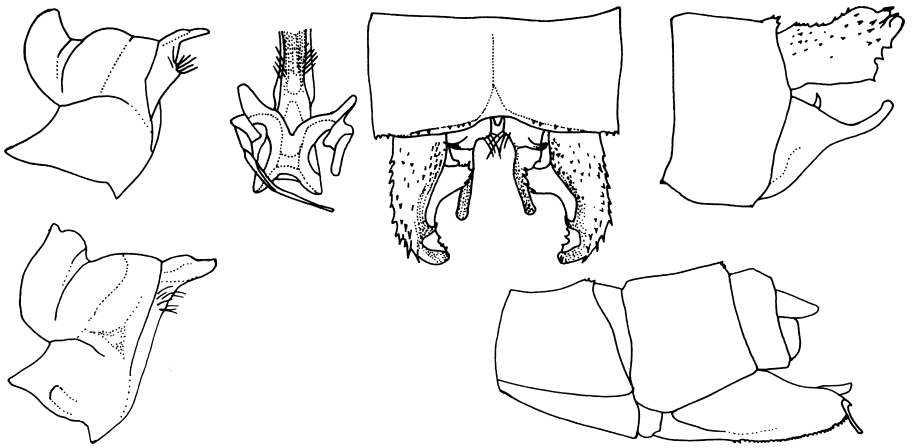


Fig. 3.1.267 *Sciotropis lattkei* (above, left to right): the prothorax of a male in lateral view, the penis in ventral view, and the apex of the male abdomen in dorsal and lateral view, and (below, left and right): the prothorax of a female in lateral view and the apical segments of a female abdomen in lateral view. Based on De Marmels (1994).

Key to the species of adult *Philogenia* in South America

Information for the key was taken from Calvert (1924), Kennedy (1941c), Bick and Bick (1988), Cook (1989), and Dunkle (1986, 1990a,b). The descriptions are based mainly on males; many females have not been described.

1. There are three antenodal cross veins, the middle one being incomplete, that is, absent from the subcostal space; there are about 30 postnodal veins in the fore-wing and 28 in the hind wing of the female. This characteristic seems to occur more inconsistently than Kennedy (1941c) thought, so other features should be considered when few specimens are available for examination. The legs bear long, slender spines, some more than four times as long as the spaces between them. The ovipositor reaches as far posteriad as the anal appendages (**Fig. 3.1.268**). Length of female abdomen including appendages: c. 44 mm. Hind wing length of female: c. 42 mm. The head and thorax of the female are black and brown. The prothorax is reddish brown, light brown, and black. The abdomen of the female is mainly black with paired pale spots on all but the tenth segment. The male has not been described, making the identity and validity of this species questionable.
.....*Philogenia monotis* (Kennedy, 1941) (Ecuador). Syn: *Agnophilogenia monotis* Kennedy, 1941.
- There are usually only two antenodal cross veins, or the abdomen of the female is shorter than about 40 mm, and the hind wing of both sexes is not longer than about 38 mm. If not, the coloration of the female does not fit the above description (**Fig. 3.1.268**). 2

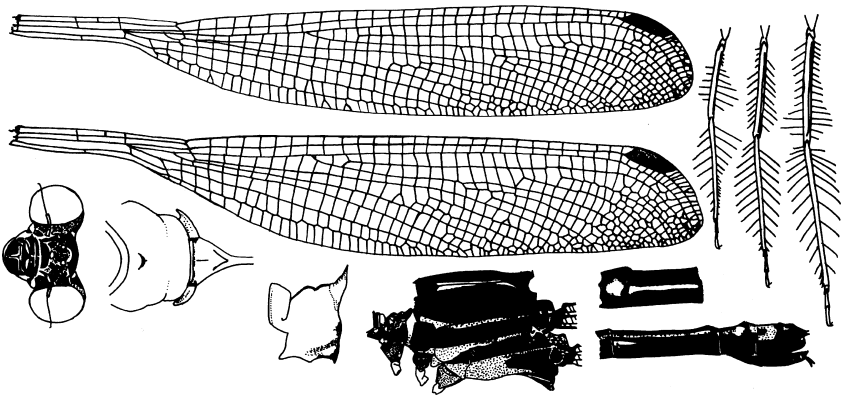


Fig. 3.1.268 *Philogenia monotis* female: fore and hind wing (upper left); fore, middle, and hind leg (upper right, left to right); and (below wings, left to right): head in dorsal view; prothorax and mesostigmal plates, prothorax in dorsolateral view; thorax in lateral view; first and second (above) and seventh through tenth abdominal segments (below) in lateral view. Based on Kennedy (1941c) and von Ellenrieder (2003).

2. The elongate superior anal appendage of the male, in lateral view, appears to curve almost 90º from its mid-length to its apex so that the apex points ventrad. It lacks a mid-ventral process and is acutely pointed at the apex (**Fig. 3.1.269**). Total length: c. 49 mm. Length of abdomen: c. 39 mm. Hind wing length: c. 31 mm. The female has not been described.

.....*Philogenia boliviana* Bick and Bick, 1988 (Bolivia).

- The superior appendage in lateral view does not curve almost 90º near the mid-length and point ventrad, or it bears a medial or subapical ventral process, or it is not acutely pointed at the apex (**Fig. 3.1.270**). 3

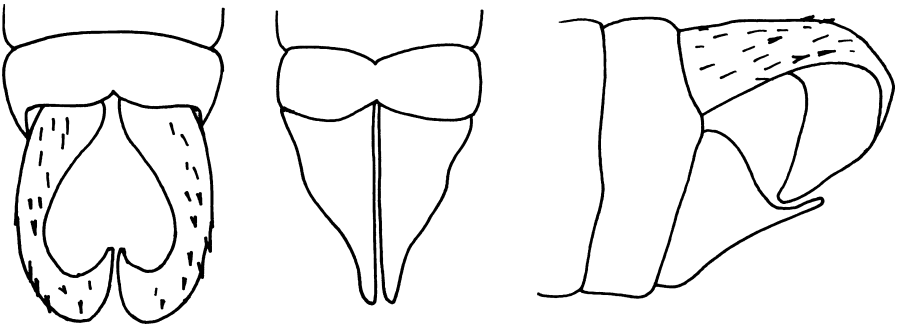


Fig. 3.1.269 *Philogenia boliviana* male (left to right): superior anal appendages in dorsal view, inferior anal appendages in ventral view, and apex of the abdomen in lateral view. Based on Bick and Bick (1988).

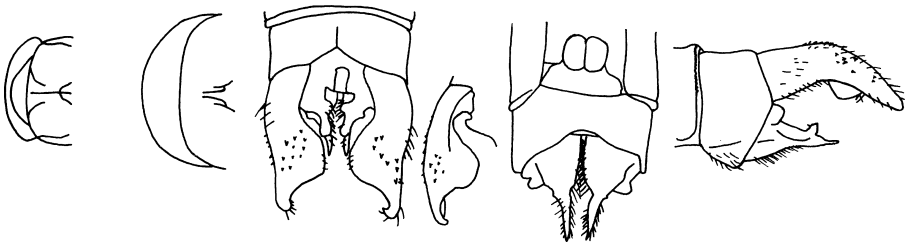


Fig. 3.1.270 *Philogenia elisabeta* (left to right): middle and posterior lobe of the prothorax of a female in dorsal view, part of the middle and the posterior lobe of a male prothorax, apex of the male abdomen in dorsal view, oblique inner dorsal view of the superior anal appendage, and apex of the male abdomen in ventral view showing only the inferior anal appendages, and the apex in lateral view. Based on Calvert (1924).

3. The proximal end of the mid-ventral process of the superior appendage has an extension pointing toward the base of the appendage, best observed in dorsomesal view (**Fig. 3.1.271**). 4
- The superior appendage lacks a mid-ventral process that points toward the base of the appendage, although a subapical process directed anteromesad may be present (**Fig. 3.1.270**). 5
4. The base of the inferior appendage appears large dorsoventrally when observed in lateral view, and it bears a basal tooth on the dorsal surface (**Fig. 3.1.271**). The female has not been described.
.....*Philogenia ebona* Dunkle, 1986 (Colombia). The superior appendages of several species known only from Costa Rica or Panama also fit this description, but their inferior appendages lack a basal tooth and do not appeal enlarged dorsoventrally.
- The base of the inferior appendage does not appear large dorsoventrally when observed in lateral view, and it lacks a basal tooth on the dorsal surface. The anterior third of the lateral margin of the female prothorax is concave, and the middle third is generally convex (**Fig. 3.1.272**). Length of abdomen: 35.5 to 43 mm. Hind wing length: 28 to 35 mm. The thoraces of both males and females are dull ferrugineous. The pterostigma is black, and the wing membrane is weakly clouded with grayish brown. The abdomen of the male is mainly blackish brown with diffuse yellow lateral markings on the first two segments and pale markings on the third through seventh segments, which may join to form rings.
.....*Philogenia silvarum* Ris, 1918 (Peru?, Amazonas).

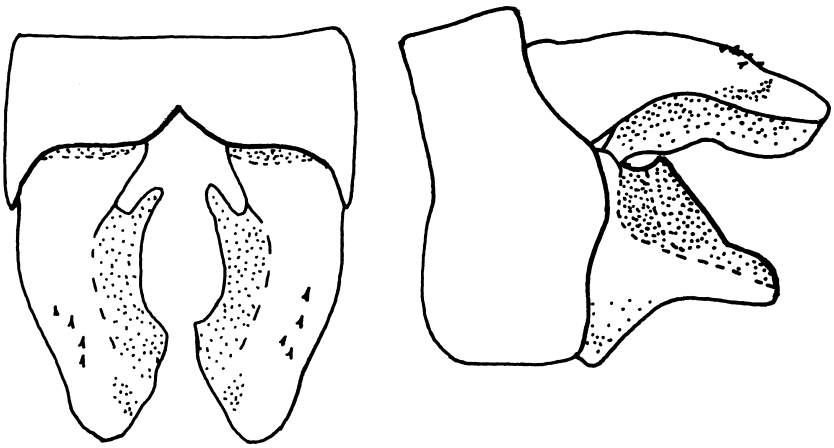


Fig. 3.1.271 Apex of the abdomen of a male *Philogenia ebona* in dorsal (left) and lateral view (right). Based on Dunkle (1986).

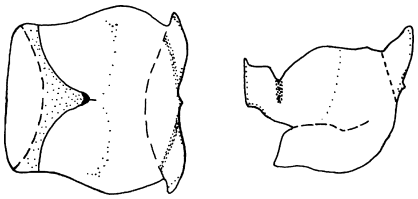


Fig. 3.1.272 The prothorax of a female *Philogenia silvarum* in dorsal (left) and lateral view (right). Based on Dunkle (1986).

5. There is a ventral subapical process directed anteromesad that supports a flattened plate attached to the apical half of the superior anal appendage of the male. The prothorax of the female bears lateral processes extended into short horns observable in dorsal or lateral view. The ovipositor extends posteriad beyond the apices of the female anal appendages (**Fig. 3.1.273**). Total length: 52 to 55 mm. Length of abdomen including the appendages: 41 to 44 mm. Hind wing length: 37 to 37.5 mm. The head is tan and yellow; only the female has a dark brown labrum. The thorax is mainly tan with dark brown stripes. The abdomen is dark brown with pale markings including pale basal rings on the third through seventh segments and pale lateral areas, more extensive on the female. The eighth to tenth segments are black on some specimens.
.....*Philogenia redunca* Cook, 1989 (Ecuador).

- There is no ventral subapical process supporting a flattened plate on the superior anal appendage of the male. The prothorax of the female does not bear short, lateral horn-like processes (**Fig. 3.1.270**). 6

6. The inferior anal appendages are widened and plate-like so that their inner margins are pressed together and sometimes touching for most of their length, as best viewed in dorsal or ventral view. In lateral view, they appear to curve dorsad, so that their broad, truncate apices point more dorsad than posteriad. The ovipositor of the female extends posteriad well beyond the anal appendages (**Fig. 3.1.274**). Total length of male, including appendages: c. 51 mm; female: c. 43 mm. Length of male abdomen: c. 40 mm; female abdomen: c. 34 mm. Hind wing length of male: c. 34 mm; female: c. 31 mm. The color is predominantly black and brown. The head is brown and black with green ventral to the clypeus of the male. The thorax is mainly brown dorsally and black laterally. The abdomen is mainly black with brown markings.
.....*Philogenia compressa* Dunkle, 1990 (Peru).

- The inferior anal appendages of the male are not broadened so that they appear pressed together along their median margins, or they appear acutely pointed at their appices in lateral view (**Fig. 3.1.270**). 7

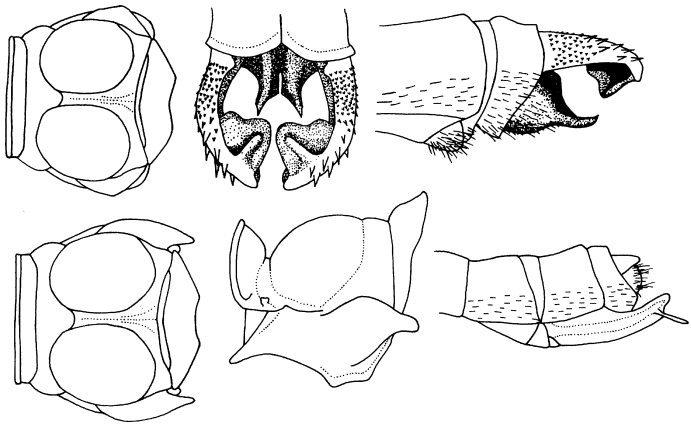


Fig. 3.1.273 *Philogenia redunca* (above, left to right): male prothorax in dorsal view and apex of the male abdomen in dorsal and lateral view, and (below, left to right): prothorax of a female in dorsal and lateral view and the apex of a female abdomen with the ovipositor. Based on Cook (1989).

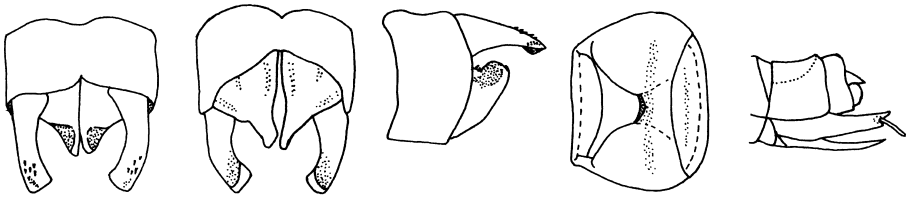


Fig. 3.1.274 *Philogenia compressa* (left to right): tenth segment of the male abdomen in dorsal, ventral, and lateral view; prothorax of the female in dorsal view; apex of the female abdomen in lateral view. Based on Dunkle (1990a).

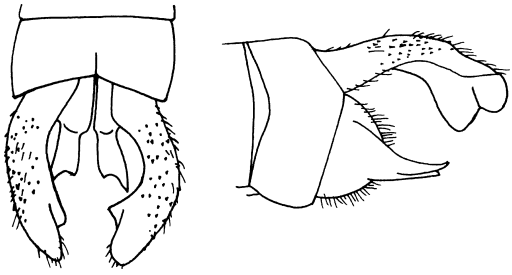


Fig. 3.1.275 *Philogenia umbrosa* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Calvert (1924).

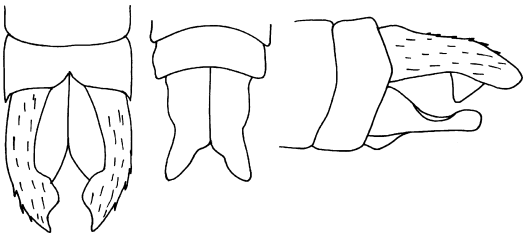


Fig. 3.1.276 *Philogenia peruviana* male (left to right): apex of the abdomen in dorsal, ventral, and lateral view, with the superior anal appendage not shown in the ventral view. Based on Bick and Bick (1988).

7. The apex of the superior anal appendage is very narrow in lateral view and claw-like or narrowed and inflated, and the basal section is always much thicker than the apical section (**Fig. 3.1.270**). 8
- The apex of the superior anal appendage is not claw-like or narrowed and inflated at the apex (**Fig. 3.1.275**). 11
8. The wings are hyaline. The mid-ventral process of the superior appendage extends ventrad a distance that is nearly equal to or greater than the width of the appendage (**Fig. 3.1.276**). 9
- There is a brownish black band at the apex of each wing. The mid-ventral process of the superior anal appendage extends ventrad a distance clearly less than the width of the appendage (**Fig. 3.1.270**). 10

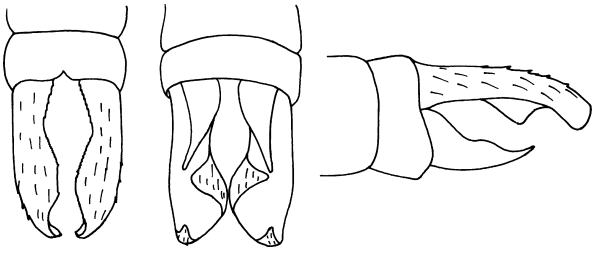


Fig. 3.1.277 *Philogenia mangosisa* male (left to right): apex of the abdomen in dorsal view with the inferior anal appendages not shown and complete in ventral and lateral view. Based on Bick and Bick (1988).

9. The apex of the inferior appendage is inflated (**Fig. 3.1.276**). Total length: c. 47 mm. Length of abdomen: c. 37 mm. Hind wing length: c. 30 mm. The thorax and abdomen are brown with light brown markings and a white ventral surface of the thorax. The female has not been described.
.....*Philogenia peruviana* Bick and Bick, 1988 (Peru).

- The apex of the inferior appendage is acutely pointed (**Fig. 3.1.277**). Total length: c. 57 mm. Length of abdomen: c. 45 mm. Hind wing length: c. 38 mm. The thorax and abdomen are brown with light brown or tan markings, black on the lateral surface of the synthorax, and pale yellow on its ventral surface. The female has not been described.
.....*Philogenia mangosisa* Bick and Bick, 1988 (Ecuador).
10. The inferior appendage has a dorsal tooth, which is visible in lateral view (**Fig. 3.1.270**). Length of male abdomen: 47 to 50.5 mm; female: c. 44 mm. Hind wing length of male: 40.5 to 42 mm; female: c. 42 mm. The thorax is mainly lighter and darker shades of brown with black markings.
.....*Philogenia elisabeta* Calvert, 1924 (Peru).
- The inferior appendage lacks a dorsal tooth (**Fig. 3.1.226**).
.....*Philogenia margarita* Selys, 1862 (Amazonas). Syn: *Euclea terminalis* Hagen, 1861, *nomen nudum*.
11. The mid-ventral process on the superior appendage extends ventrad a distance equal to or greater than the width of the appendage (**Fig. 3.1.275**). 12
- The mid-ventral process on the superior anal appendage, if it is present at all, extends ventrad a distance less than its own width (**Fig. 3.1.278**). 16

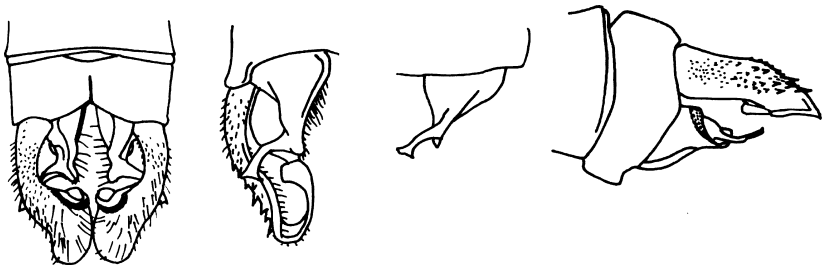


Fig. 3.1.278 *Philogenia helena* male (left to right): apex of the male abdomen in dorsal view, right anal appendages in ventral view, inferior anal appendage in lateral view, and apex of the male abdomen in lateral view. Based on Calvert (1924).

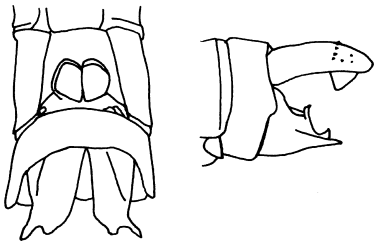


Fig. 3.1.279 *Philogenia polyxena* male: apex of the abdomen in ventral (left) and lateral view (right). Based on Calvert (1924).

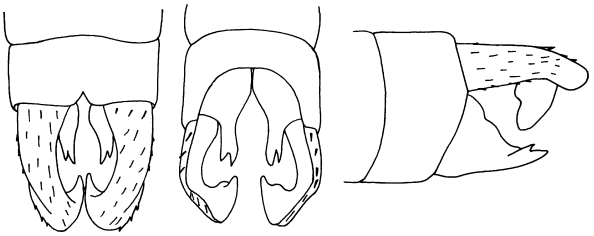


Fig. 3.1.280 *Philogenia buenavista* male (left to right): apex of the abdomen in dorsal, ventral, and lateral view. Based on Bick and Bick (1988).

12. The apex of the superior appendage has two lobes, plainly evident in lateral view (**Fig. 3.1.275**). Length of male abdomen: c. 43 mm. Hind wing length of male: c. 33 mm.
.....*Philogenia umbrosa* Ris, 1918 (Peru).
- The apex of the superior appendage is not divided into two lobes (**Fig. 3.1.279**). 13
13. There are two dorsal spines on each inferior appendage (**Fig. 3.1.279**). 14
- Each inferior appendage does not bear two spines (**Fig. 3.1.280**). 15

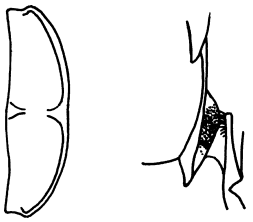


Fig. 3.1.281 *Philogenia cassandra* female: posterior lobe of the pronotum in oblique dorsal view (left) and the left intersternite in lateral view (right). Based on De Marmels (2004).

14. The two dorsal spines on the male inferior anal appendage both point dorsad and appear connected in lateral view. The posterior lobe of the prothorax in dorsal view has an evenly rounded posterior margin, sometimes with a very slight emargination at the midline. In the female, the intersternite and setifer are located almost at the same height (**Fig. 3.1.281**). Length of male abdomen: 37.5 to 42.5 mm; female: 34.5 to 41 mm. Hind wind length of male: 30 to 35 mm; female: 29.5 to 35 mm.

.....*Philogenia cassandra* Hagen in Selys, 1862 (Colombia, Ecuador, Peru, Venezuela).

- The two dorsal spines on the inferior anal appendage point dorso-mesad in lateral view, so they appear to be separate (**Fig. 3.1.279**). Length of male abdomen: 40.5 to 45 mm; female: 36 to 39 mm. Hind wind length of male: 32 to 35 mm; female: 30 to 34 mm.
.....*Philogenia polyxena* Calvert, 1924 (Venezuela). The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).

15. Each inferior appendage ends in a forked tip, of which the medial branch is longer, as best seen in lateral view (**Fig. 3.1.280**). Total length: c. 62 mm. Length of male abdomen: c. 50 mm. Hind wing length of male: 38 to 39 mm. The thorax is black with brown and yellow markings, including a brown ventral surface. The abdomen is brownish black with obscure paler markings.
.....*Philogenia buenavista* Bick and Bick, 1988 (Bolivia).

- The inferior appendage is not forked at the apex. The lateral lobes of the penis are long and filamentous (**Fig. 3.1.282**). Length of male abdomen: 36 to 43 mm; female abdomen: 33 to 37 mm. Hind wing length of male: 28 to 31 mm; female: 28 to 32 mm. The thorax is mainly black with yellow markings and white pruinescence. The male abdomen is black with greenish markings on the first two segments and yellow basal rings and lateral stripes on the third through seventh segments. The female is somewhat paler than the male. The wings are mainly hyaline with only a light gray tinge between the pterostigma and apex of the wing.
.....*Philogenia schmidti* Ris, 1918 (Peru, Bolivia).

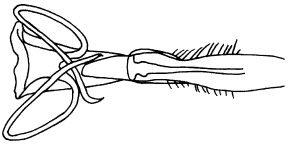


Fig. 3.1.282 The penis of *Philogenia schmidti* in ventral view. Based on Calvert (1924).

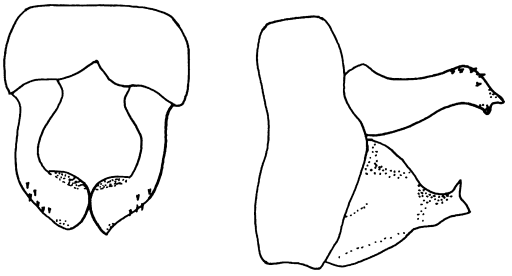


Fig. 3.1.283 Apex of the abdomen of a male *Philogenia sucra* in dorsal (left) and lateral view (right). Based on Dunkle (1986).

16. The mid-ventral process is present on the superior appendage and appears shorter than the width of the appendage in lateral view (**Fig. 3.1.278**). 17
- There does not seem to be a mid-ventral process on the superior appendage (**Fig. 3.1.283**). 22
17. The lateral margin at the apex of the inferior appendage forms a slender, arcing process that is swollen at its apex (**Fig. 3.1.278**). The wings of mature specimens have a brown marking from the midlength of the pterostigma to the apex. Length of abdomen: c. 48 mm. Hind wing length: 44 to 46 mm. The thorax of the male is matt black and yellow, and the wings are clouded with blackish brown at their apices.
.....*Philogenia helena* Hagen, 1869 (Colombia, Peru).
- The inferior appendage lacks a slender apical process (**Fig. 3.1.284**). 18

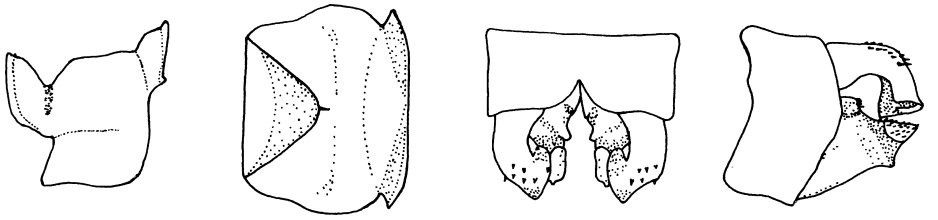


Fig. 3.1.284 *Philogenia minteri* (left to right): prothorax of a female in lateral and dorsal view and the apex of the male abdomen in dorsal and lateral view. Based on Dunkle (1986).

18. The superior appendage appears short, sharply bent ventrad, and truncate at the apex, when observed in lateral view (**Fig. 3.1.284**). 19
- In lateral view, the superior appendage does not appear short, sharply bent ventrad, and truncate at the apex. The inferior appendages do not appear strongly divergent in ventral view (**Fig. 3.1.285**). 21

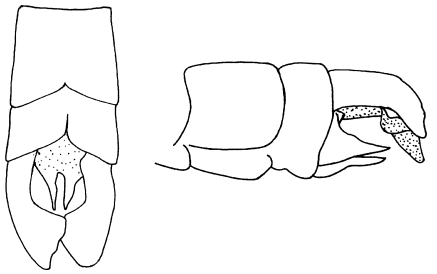


Fig. 3.1.285 *Philogenia raphaella* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Calvert (1924).

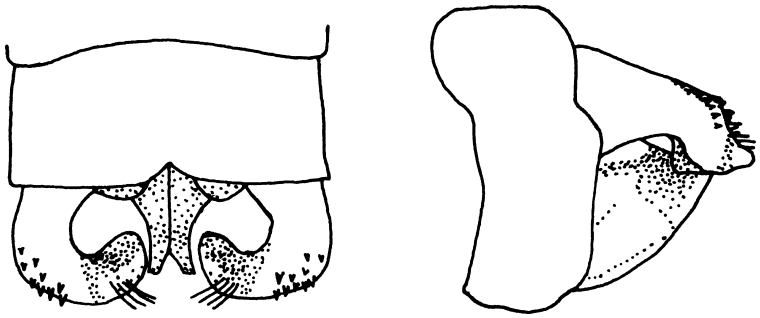


Fig. 3.1.286 *Philogenia macuma* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Dunkle (1986).

19. The apex of the inferior appendage, in dorsal view, appears broad and irregular (**Fig. 3.1.284**).
.....*Philogenia minteri* Dunkle, 1986 (Ecuador).
- The apex of the inferior appendage, in dorsal view, appears evenly tapering and not irregular in shape (**Fig. 3.1.286**). 20
20. The inferior anal appendage is chisel-shaped at the apex and lacks a dorsal tooth (**Fig. 3.1.286**).
.....*Philogenia macuma* Dunkle, 1986 (Ecuador).
- The inferior anal appendage is conical at the apex and has a large, pointed dorsal tooth (**Fig. 3.1.287**). Total length of male including appendages: c. 52 mm; female: c. 46 mm. Length of male abdomen: c. 42 mm. Female: c. 36 mm. Hind wing length of both sexes: c. 33 mm.
.....*Philogenia iquita* Dunkle, 1990 (Peru).

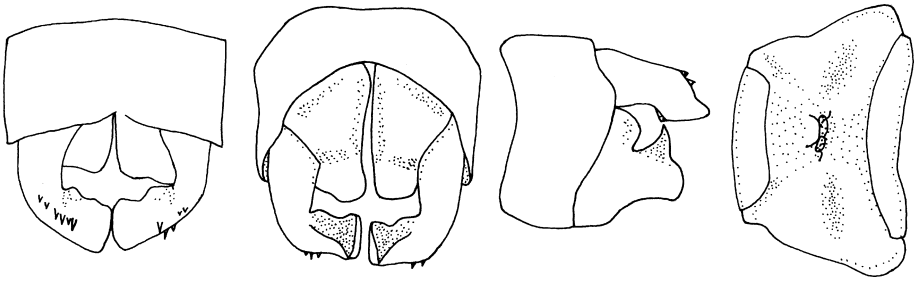


Fig. 3.1.287 *Philogenia iquita* (left to right): apex of male abdomen in dorsal, posteroventral, and lateral view and female prothorax in dorsal view. Based on Dunkle (1990b).

21. Every wing has a brownish black apical band beginning at about the apical third of the pterostigma. The inferior appendage appears acute at the apex in dorsal view (**Fig. 3.1.285**). Hind wing length of male: c. 38.5 mm.
.....*Philogenia raphaella* Selys, 1886 (Colombia).
- The wings lack brownish black apical bands. In dorsal view, the inferior appendage forms an obtuse angle at the apex (**Fig. 3.1.288**). Length of male abdomen: 39 to 41 mm. Hind wing length of male: 32.5 to 33 mm.
.....*Philogenia berenice* Higgins, 1901 (Peru).

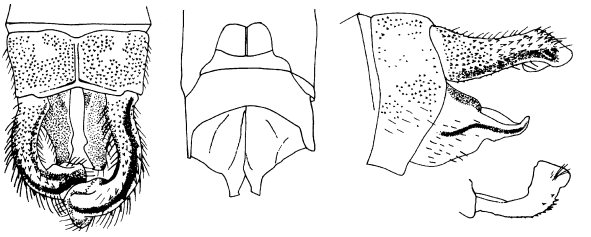


Fig. 3.1.288 *Philogenia berenice* male (left to right): apex of the abdomen in dorsal, ventral, and lateral view (above), and the superior anal appendage in ventral view (below). Based on Calvert (1924).

22. The inferior appendage appears long and tapering at the apex in lateral view, and it bears a dorsal tooth inserted at mid-length (**Fig. 3.1.289**). Length of abdomen: 36 to 49 mm. Hind wing length: 33 to 40 mm. Length of pterostigma: 2.2 to 2.9 mm.
.....*Philogenia cristalina* Calvert, 1924 (Colombia).
- The inferior appendage lacks a dorsal tooth at mid-length (**Fig. 3.1.283**). 23

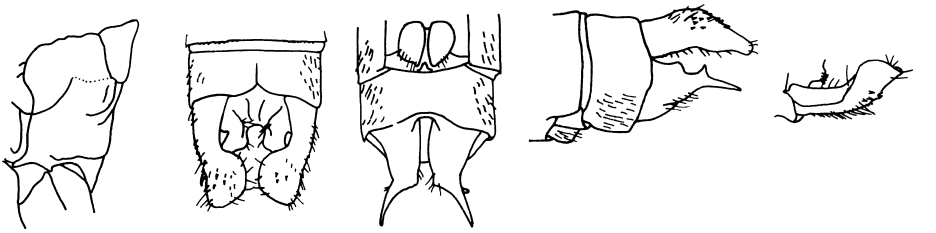


Fig. 3.1.289 *Philogenia cristalina* (left to right): posterior lobe of the female prothorax in lateral view, apex of the male abdomen in dorsal, ventral, and lateral view, and superior anal appendage of the male in oblique ventral view. Based on Calvert (1924).

23. The inferior anal appendage is bifid, with the outer branch longer and thicker. The posterior lobe of the prothorax in dorsal view is sinuate along the posterior margin. In the female, the intersternite extends farther dorsad than the setifer (**Fig. 3.1.290**). Total length: c. 50 mm. Length of abdomen: c. 37.5 to 38 mm. Hind wing length: c. 35.5 mm.
.....*Philogenia ferox* Rácenis, 1959 (Venezuela). The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).
- The inferior appendage is not bifid at the apex (**Fig. 3.1.283**). 24
24. There is a short ventrolateral tooth at the mid-length of each inferior appendage (**Fig. 3.1.291**). Total length: c. 59 mm. Length of abdomen: c. 47 mm. Hind wing length: c. 41 mm. The thorax of the male is black with brown and yellow markings. The male abdomen is mainly black with dull yellow markings. The female has not been described.
.....*Philogenia tinalandia* Bick and Bick, 1988 (Ecuador).
- There is no ventrolateral tooth at the mid-length of each inferior appendage (**Fig. 3.1.283**).
.....*Philogenia sucra* Dunkle, 1986 (Colombia).

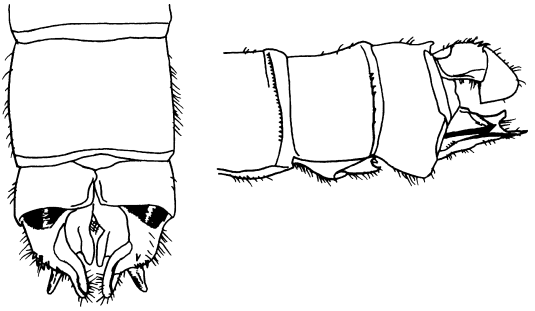


Fig. 3.1.290 *Philogenia ferox* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Rácenis (1959a).

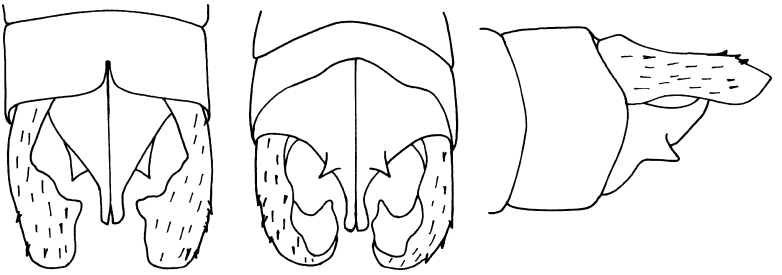


Fig. 3.1.291 *Philogenia tinalandia* male (left to right): apex of the abdomen in dorsal, ventral, and lateral view. Based on Bick and Bick (1988).

Key to the species of adult *Heteropodagrion* in South America

Information for the key was provided by Ris (1918) and Garrison and von Ellenrieder (2005). Known differences between these two nominal species are insufficient to determine whether they are actually distinct. No larvae have been described.

1. The abdomen of the male is c. 33 mm and scarlet red, with the anterior and posterior parts of the third through sixth abdominal segments darkened. The hind wing is 25 to 26 mm (**Fig. 3.1.3**).
.....*Heteropodagrion sanguinipes* Selys, 1885 (Ecuador). Syn: probably *Neuragrion mysticum* Karsch, 1891 (Garrison and von Ellenrieder, 2005).
- The abdomen of the male is 44 to 46 mm long. The first and anterior part of the second abdominal segment of the male are somewhat brownish, and the rest of the abdomen is scarlet red, without any darkening of the third through sixth segments. Hind wing length: 31 to 32 mm. The thorax is satiny blackish brown, lighter laterally, with a dark reddish brown median stripe. The wings are yellowish with bright scarlet red pterostigmata. Some of the veins near the wing margin are ferrugineous. The superior anal appendages are curved inward and overlap at the apices, like a forceps (**Fig. 3.1.227**).
.....*Heteropodagrion superbum* Ris, 1918 (Panama, Colombia).

Key to the species of adult *Dimeragrion* in South America

Information for the key was provided by De Marmels (1987a, 1989a, 1999b). The larva of only one species has been described, so a key to larvae cannot yet be provided.

1. Vein IR_3 originates at or near the subnodus. The fork in R_3 at which RP_{4+5} originates is proximal to the subnodus at a distance about equal to the length of the first cross vein between R_1 with R_2 distal to the subnodus (**Fig. 3.1.292**). 2
- Vein IR_3 originates at or near the first postnodal cross vein. The fork in R_3 from which RP_{4+5} originates is at or slightly proximal to the subnodus (**Fig. 3.1.293**). 3
2. The labrum has no black markings, and the entire face is yellow. The median lobe of the pronotum is light in color. The inferior anal appendages are distinctly shorter than the superior appendages, which each have a relatively broad internal plate that is directed obliquely ventrad forming a blunt, angulated recurrent lobe resembling a barb (**Fig. 3.1.292**). There is no cross vein in the space proximal to the anal crossing. Total length of male: c. 52 mm. Length of male abdomen: c. 44 mm. Hind wing length of male: c. 31 mm. The female has not been

described. The coloration is mainly greenish black with a yellow face and yellowish markings.
.....*Dimeragrion secundum* Needham, 1933 (Venezuela).
- The entire face, including the labrum, is black, except for a white band across the basal 2/3 of the labrum and the anteclypeus. The pronotum is mainly black with brassy reflections. The superior anal appendages each have an ax-shaped internal plate that is truncate at the proximal end (**Fig. 3.1.229**).
.....*Dimeragrion clavijoi* De Marmels, 1999 (Venezuela).

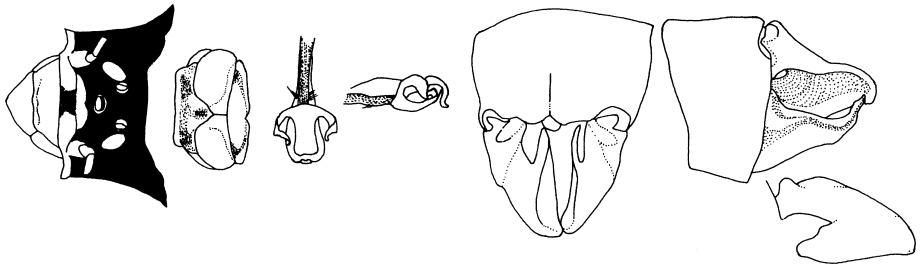


Fig. 3.1.292 *Dimeragrion secundum* male (left to right): color pattern on the dorsal surfaces of the head and prothorax, the penis in ventral and lateral view, and the apex of the male abdomen in dorsal and lateral view with a dorsointernal view of the superior anal appendage below it. Based on De Marmels (1987a).

3. There is no accessory cross vein in the cubito-anal space other than A_2. The superior anal appendages each have a relatively broad internal plate that is directed obliquely ventrad forming a blunt, angulated recurrent lobe resembling a barb (**Fig. 3.1.293**). Length of male abdomen: 35.5 to 39 mm; female: 31 to 34 mm. Hind wing length of male: 25 to 28.5 mm; female: 25.5 to 26 mm.
.....*Dimeragrion mesembrinum* De Marmels, 1989 (Venezuela).
- There are one or more accessory cross veins in the cubito-anal space in addition to A_2. The superior anal appendages each have an ax-shaped internal plate that is truncate at the proximal end (**Fig. 3.1.294**). 4
4. The inferior anal appendages are approximately as long as the superior appendages, which are as long as the tenth abdominal segment, and, in lateral view, do not appear to narrow rapidly to an acute apex. The apex of the superior anal appendage is, in fact, rather obtuse, and each appendage bears a relatively narrow internal plate. The dorsobasal tubercle is not obviously higher that the apical margin of the tenth abdominal segment. The intersternite of the female

narrows regularly to an acute apex (**Fig. 3.1.294**). Total length of male: 39 to 46 mm. Length of male abdomen: 32 to 38 mm. Hind wing length of male: 25 to 30 mm. The size seems to increase along a geographic cline.
.....*Dimeragrion percubitale* Calvert, 1913 (Guyana, Venezuela).

- The superior anal appendage is shorter than the tenth abdominal segment, and, in lateral view, it appears to taper strongly to an acutely pointed apex. The dorsobasal tubercle is obviously higher than the apical margin of the tenth abdominal segment. The intersternite of the female becomes slightly broader dorsad before reaching a pointed apex (**Fig. 3.1.7**).
.....*Dimeragrion unturanense* De Marmels, 1992 (Venezuela).

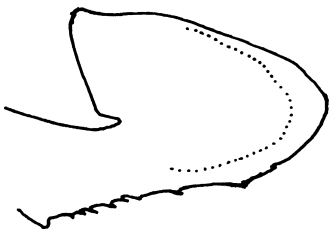


Fig. 3.1.293 The interior surface of the superior anal appendage of a male *Dimeragrion mesembrinum*. Based on De Marmels (1999b).

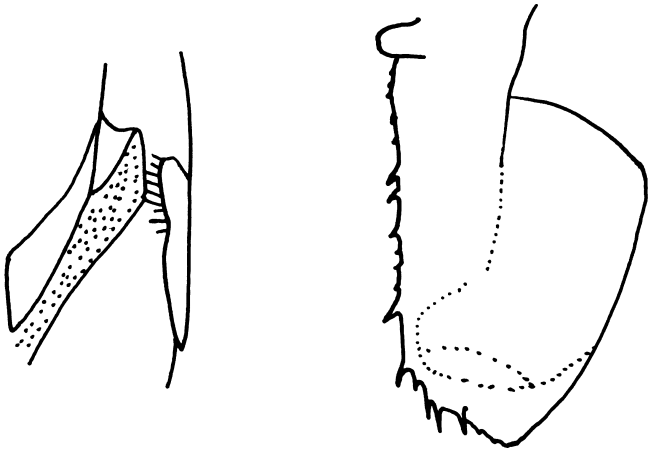


Fig. 3.1.294 *Dimeragrion percubitale:* intersternite of a female in left lateral view (left) and left superior anal appendage of a male in dorsomedial view. Based on De Marmels (1999b).

Key to the species of adult *Heteragrion* in South America

Information for the key was taken from Selys (1862b), Williamson (1919), De Marmels (1987a, 1989a, 2004), Costa and Santos (2000a), Daigle and Tennessen (2000), Hartung (2002), Daigle (2003), Lencioni (2005), Machado (1988), and Machado and Bede (2006). Only males can be reliably identified with this key. Good descriptions of most females are urgently needed, and the genus requires a general revision.

1. The superior anal appendage of the male has a long, narrow, basal process on the ventral side and a shorter ventral process on the apical half (**Fig. 3.1.295**). The inferior anal appendage is absent. The dorsal surfaces of the head, thorax, first six abdominal segments, anterior parts of the seventh and eighth, and markings on the ninth and tenth are black, and there are yellow lateral markings on the head, yellow dorsolateral areas on the thorax, and yellow posterior markings on the seventh and eighth abdominal segments. Much of the ninth and tenth segments are orange. The females also have yellowish lobes on the prothorax and narrow yellow markings on either side of the dorsal midline. The wings are hyaline with yellowish brown pterostigmas, which are margined in black in the male. Total length: 62 to 65 mm. Length of abdomen: 42 to 45 mm. Hind wing length: c. 34 mm. Length of pterostigma of the fore-wing along the costal margin: c. 5.2 mm; length along the costal margin of the hind wing: c. 2.0 mm.
.....*Heteragrion muryense* Costa and T. Santos, 2000 (Rio de Janeiro).
- The superior anal appendage of the male lacks a large basal process on the ventral side (**Fig. 3.1.296**). 2

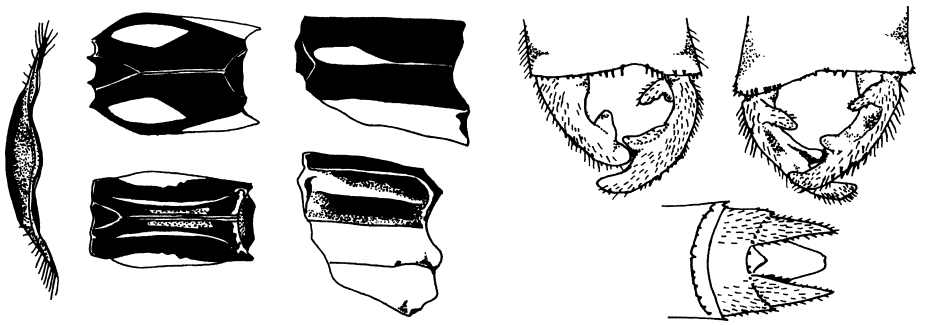


Fig. 3.1.295 *Heteragrion muryense:* posterior lobe of the male prothorax (left), synthorax of a male (upper left center) and a female (lower left center) in dorsal (left) and lateral view (right), superior anal appendages of a male in dorsolateral (upper right center) and ventrolateral view (upper right), and a dorsal view of the apex of a female abdomen (lower right). Based on Costa and Santos (2000a).

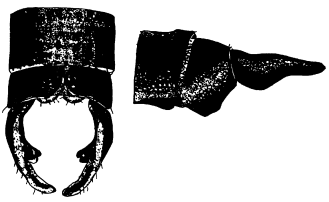


Fig. 3.1.296 *Heteragrion petiense* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Machado (1988).

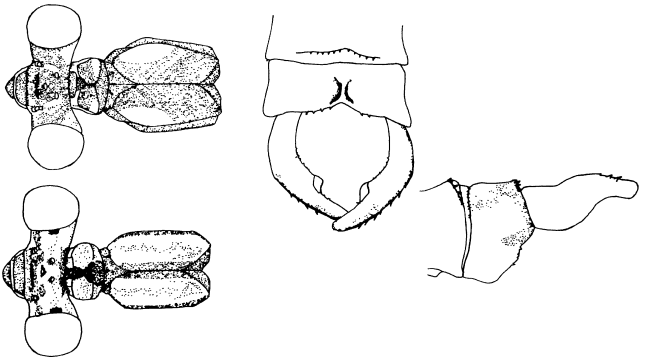


Fig. 3.1.297 *Heteragrion tiradentense:* dorsal view of a head and thorax of a male (upper left) and a female (lower left) and apex of the male abdomen in dorsal (center) and lateral view (right). Based on Machado and Bede (2006).

2. The synthorax of the male has a pair of large white spots with a tinge of turquoise on either side of a narrow black middorsal line. In preservative, these spots become less striking, appearing diffuse and more turquoise. The color is mainly black, but the apical third of the eighth, entire ninth, and lateral parts of the tenth segment are dull orange. There are narrow yellow basal rings on the otherwise black third through seventh segments. The inner surface of the superior anal appendage has two lobes about 2/3 of the way from the base to the apex. There is no inferior appendage (**Fig. 3.1.296**). The female lacks the white spots on the synthorax but has narrower yellow stripes in their place. Length of male abdomen: 32 to 38 mm; female: c. 31 to 32 mm. Hind wing length: 25 to 27 mm. Length of pterostigma along the costa of the fore-wing: 1.2 to 1.3 mm. .....*Heteragrion petiense* Machado, 1988 (Minas Gerais).

- The male does not have conspicuous white spots on the dorsal surface of the synthorax. Its superior anal appendage does not have two lobes beside each other on the inner surface about 2/3 of the way from the base to the apex (**Fig. 3.1.297**). 3

3. The pterostigma of the male is black with a reddish center and extends the length of two cells. The color is mainly yellow or otherwise pale with black and blue markings, including a bluish margin of the labrum and round bluish spots on the prothorax, one in the middle of the posterior lobe and a pair bordering the median lobe. The head is black on the dorsum with grayish between and behind the compound eyes. The thorax is pale with a greenish tinge and a black line on the carina and mesothoracic fossa and another on the first lateral antehumeral space; a black band covers the second space and ends before reaching the median suture. The abdomen of the male becomes wider toward the apex; its first seven segments are black dorsally with a pale basal ring and narrow middorsal line on the second through fourth segments. Ventrally, the third through seventh segments are olivaceous with a brown midline stripe. The anterior part of the eighth segment is black, and its posterior third is olivaceous. The ninth and tenth segments are light olivaceous with black dorsal and lateral lines on the ninth segment. The superior anal appendage of the male is more than twice as long as the tenth segment, olivaceous, and curved in a semi-circle; there is a thickening or internal tooth at that base that is rounded beyond its middle. The legs are yellowish with darker markings on the outer sides of the femora and inner sides of the tibiae. There are seven spines on the hind tibia. Length of male abdomen: c. 31 mm. Hind wing length of male: c. 25 mm. The female has not been described. Identification of this species will be subject to doubt because the original description is inadequate and the type specimen was damaged and may not be available at all. The apex of the abdomen of the male specimen described was lost before it could be better described. No illustrations were ever made. Whether the species is correctly assigned to this genus could also be doubted. Any specimens collected near Caxambu in Minas Gerais that fit this description should be preserved and examined to help determine the status of this nominal species, which may have been redescribed under another name. .....*Heteragrion obsoletum* Selys, 1886 (Minas Gerais)

- The length of the male abdomen is substantially shorter or longer than 31 mm, or the hind wing is not approximately 25 mm in length. However, the measurements of the female may fall near these figures. If the measurements are close, the color pattern varies from the description above, such as by lacking the conspicuous blue markings. 4

4. The inferior appendages of the male are small and flap-like, broadly rounded at the apex, and without an acutely pointed, spine-like apical process. The frons of the male is obtusely angled, while the anterior margins of the female frons meet at an angle of about 90º. The head of the male is brownish yellow with a reddish tinge on the epicranium. The prothorax is black with a yellow margin. The synthorax of the male is brownish yellow with a black middorsal carina and dark brown thoracic stripes, which are not clearly delimited from the lighter areas. The rest of the synthorax is predominantly yellow. The first two abdominal segments of the male are shiny dark yellow with a black cross on the

first and a darkening of the second. The third through seventh are dark with pale basal rings. The ninth and tenth are yellow with some darkening dorsally. The tenth segment is deeply and broadly excavated across the midline. The wings of the female are sometimes tinged with green. The ovipositor reaches posteriad beyond the apex of the tenth segment but not to the apex of the superior anal appendage. The valves of the ovipositor each bear two rows of spines without a notable space between them (**Fig. 3.1.298**). Total length of female: 39.5 mm. Fore-wing length of the male: 22.5 mm; hind wing length of male: 22 mm; hind wing length of female: 24 mm. Basic color of male: brownish yellow with dark markings; the wings are hyaline with a brown pterostigma.

.....*Heteragrion silvarum* Sjoestedt, 1918 (Amazonas).

- The inferior anal appendage of the male is absent, rudimentary, or small and spine-like with an acutely-tipped apical process (**Fig. 3.1.297**). In case of doubt, darker markings on the head, thorax, or abdomen are more extensive. 5

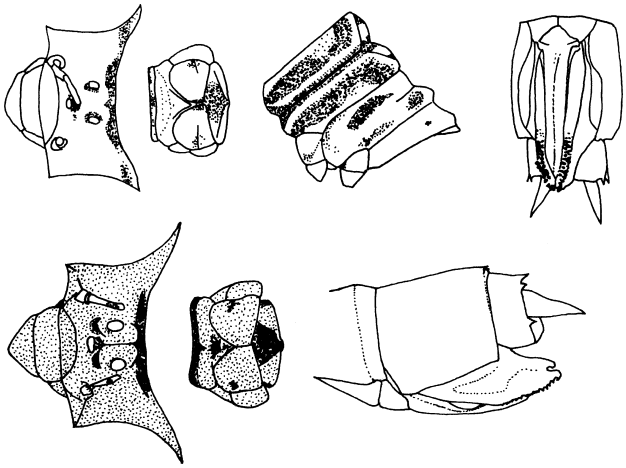


Fig. 3.1.298 *Heteragrion silvarum* (upper row, left to right): dorsal color pattern on the head of a male between the eyes, dorsal surface of the prothorax, and diagrammatically shown on the synthorax; ventral view of the apex of the female abdomen showing the ovipositor, and (lower row, left to right): dorsal color pattern on the head of a female between the eyes, dorsal surface of the female prothorax, and apex of the female abdomen in lateral view. Based on De Marmels (1987a).

5. The inferior appendages of the male are absent or rudimentary and barely visible. There are several rows of teeth on the genital valves of the known females. It appears that *H. cooki* is an exception to this, but the description and illustration provided is inadequate to determine this with certainty, although only one row of spines can be seen on the sketch of the ovipositor. Except for

H. tiradentense, the frons is obtusely angled and generally similar in both sexes. The anal vein is usually further separated from the hind margin of the wing distal to the cubito-anal cross vein than the arculus is (**Fig. 3.1.222**). 6
- The inferior appendages of the male are small and spine-like. There is only one row of teeth on the genital valves of the known females. The frons of males of some species is acutely angled, while those of males and females of others are right angled or evenly rounded. The anal vein is usually closer to the posterior margin of the wing distal to the cubito-anal cross vein than the arculus is to the cubito-anal cross vein (**Fig. 3.1.299**). 20

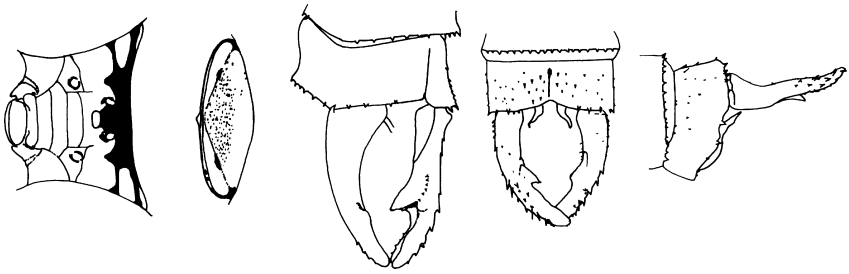


Fig. 3.1.299 *Heteragrion chrysops* male (left to right): pattern on the dorsal surface of the head between the compound eyes, posterior lobe of the pronotum, apex of the abdomen in oblique dorsal, dorsal, and lateral view. Based on Williamson (1919).

Fig. 3.1.300 *Heteragrion cinnamomeum* male (above, left to right): head in dorsal view, synthorax in lateral view, anal appendages of two specimens in dorsal view, and anal appendages in lateral view, and (below, left to right): posterior lobe of the prothorax in dorsal view, abdomen in lateral view from the posterior part of the first to the anterior part of the fourth segment, superior anal appendage of a second specimen in lateral view. Based on De Marmels (2004), who illustrated it under the name *Heteragrion macilentum*.

6. The head, thorax, and first seven abdominal segments of the male are mainly black dorsally. The apical half of the eighth and ninth abdominal segments of the male are mainly or entirely yellow or orange (**Fig. 3.1.297**). 7
- Either the apical half of the eighth or ninth abdominal segment of the male is mainly dark, or there are extensive light patterns on the dorsal surfaces of the head, thorax, or first seven abdominal segments (**Fig. 3.1.300**). 9
7. There are 16 or 17 postnodal cross veins in the fore-wing. There is a lens-shaped yellow spot on the mesepisternum. The dorsal tooth on the superior anal appendage is shorter than the ventral tooth (**Fig. 3.1.297**).
.....*Heteragrion tiradentense* Machado and Bede, 2006 (Minas Gerais).
- There are about 20 postnodal cross veins in the fore-wing. If a yellow spot is present on the mesepisternum, it is oval. The dorsal tooth on the superior anal appendage is shorter than the ventral tooth (**Fig. 3.1.301**). 8
8. A wide yellow humeral stripe is present, and there is a black spot on the dorsal surface of the tenth abdominal segment (**Fig. 3.1.301**). There is a distinct pattern on the dorsal part of the female thorax, which is mainly dark with a wide yellow antehumeral stripe covering 2/5 of the width of the mesepisternum, extending from the wings to the anterior edge of the prothorax. Length of male abdomen: 32 to 35 mm. Hind wing length of male: 27 to 28 mm.
.....*Heteragrion flavovittatum* Selys, 1862 (Minas Gerais, São Paulo).
- On each side of the dorsal surface of the male thorax is an oval yellow spot. There is no black spot on the tenth abdominal segment. The female has not been described. Length of the abdomen of a male: 44 mm; hind wing length of male: 31 mm.
.....*Heteragrion ovatum* Selys, 1862 (Rio de Janeiro).

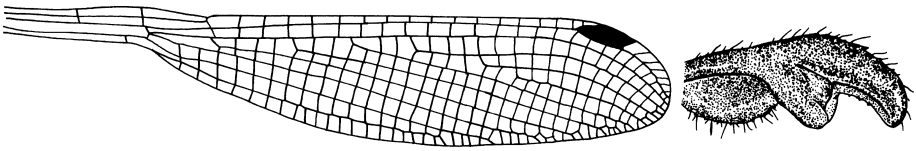


Fig. 3.1.301 Hind wing (left) and a superior anal appendage of *Heteragrion flavovittatum* (right). Based on Needham (1903a) and von Ellenrieder and Garrison (2007a).

9. The abdomen of the male is more than twice as long as the hind wing. The color is predominantly pale with vague, fragmented dark stripes between the compound eyes (**Fig. 3.1.300**). Total length of male: c. 52 mm. Length of male abdomen: c. 46 mm. Hind wing length of male: c. 22 mm. Previous descriptions of the female may refer to another species.
.....*Heteragrion cinnamomeum* Selys, 1862 (Venezuela, Amazonas?). Syn: *Heteragrion macilentum* Hagen in Selys, 1862. This species is considered rare and endangered in Venezuela (De Marmels, 1999a). The location at which the type specimen of *Heteragrion macilentum* was found remains uncertain (De Marmels, 2004). A recent study of type specimens revealed that *H. cinnamomeum* and *H. macilentum* are very probably conspecific (von Ellenrieder and Garrison, 2007a).
- The abdomen of the male is less than twice as long as the hind wing 10
10. The head of the male is blackish brown or black dorsally, yellow on the face, and pale on the occiput. The antenna is dark yellow, and the ninth and tenth abdominal segments of the male are dark brown or black dorsally and yellow laterally. The superior anal appendage of the male is swollen ventrally just posterior to the base and has a large triangular tooth on the ventral side well beyond the midlength (**Fig. 3.1.302**). Total length of male including appendages: c. 46.5 mm. Abdomen length of male without appendages: c. 38.5. Hind wing length of male: c. 25.5 mm. The female has not been described.
.....*Heteragrion pemon* De Marmels, 1987 (Venezuela).
- If the head of the male is largely dark in color, then the ninth and tenth abdominal segments are not mainly dark dorsally (**Fig. 3.1.222**). 11

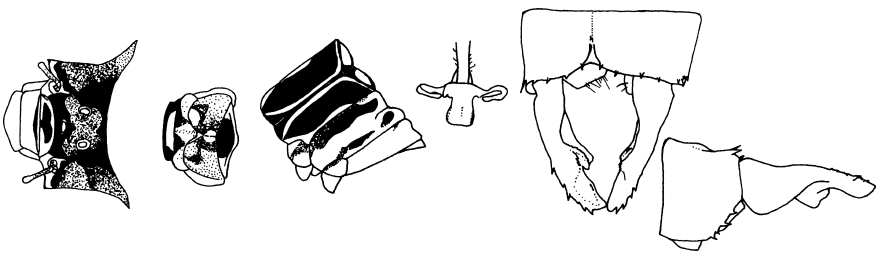


Fig. 3.1.302 *Heteragrion pemon* male (left to right): color pattern on the dorsal surface of the head and prothorax, diagram of the color pattern on the synthorax, penis in ventral view, and the apex of the male abdomen in dorsal and lateral view. Based on De Marmels (1987a).

11. The heads of the male and known female are largely pale. The ninth and tenth abdominal segments of the male are black dorsally, although the ninth may have a yellow basal ring. The pattern is obscure (**Fig. 3.1.222**). 12
- The ninth and tenth abdominal segments are mainly yellowish, reddish, or brownish dorsally, like the apical part of the eighth (**Fig. 3.1.303**). 14

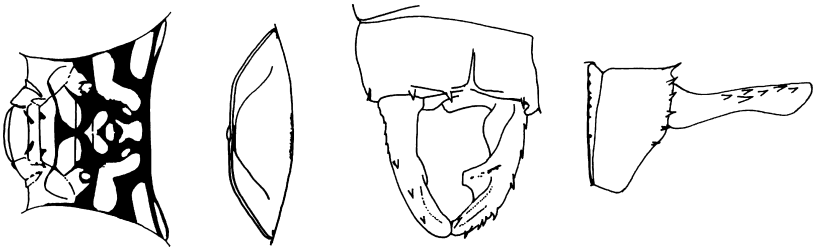


Fig. 3.1.303 *Heteragrion beschkii* male (left to right): dorsal color pattern on the head between the compound eyes, posterior lobe of the pronotum, apex of the abdomen in oblique dorsal and lateral view. Based on Williamson (1919).

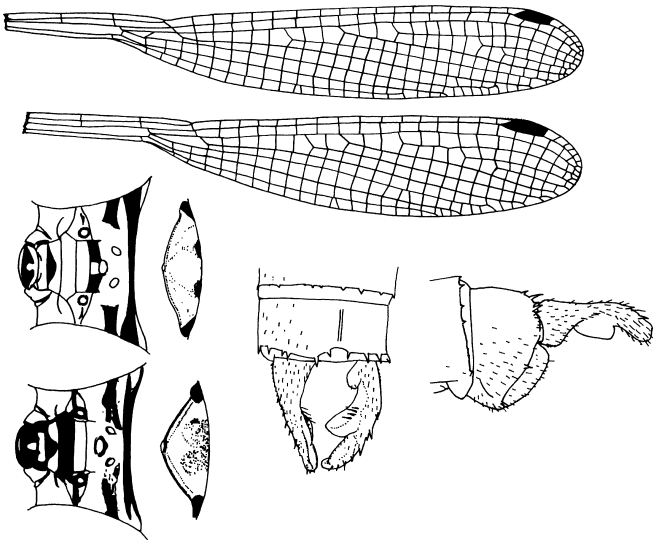


Fig. 3.1.304 *Heteragrion ictericum:* fore and hind wing of a male (above), head between the compound eyes and posterior lobe of the prothorax of a male (middle left) and female (lower left), apex of a male abdomen in oblique dorsal (lower center) and lateral view (lower right). Based on Williamson (1919).

12. The dorsum of the eighth segment of the male abdomen is black. The superior anal appendage of the male has a thick, blunt process between the midlength and the apex, directed inward and ventrad (**Fig. 3.1.222**). The female has not been described. Length of male abdomen: 32 to 34 mm. Hind wing length of male: 21 to 22 mm.
.....*Heteragrion melanarum* Williamson, 1919 (Guyana, French Guiana, Venezuela).

- Only the basal half or less of the eighth abdominal segments of males and the known female is black dorsally; the rest is brown, orange, or yellow (**Fig. 3.1.304**). 13

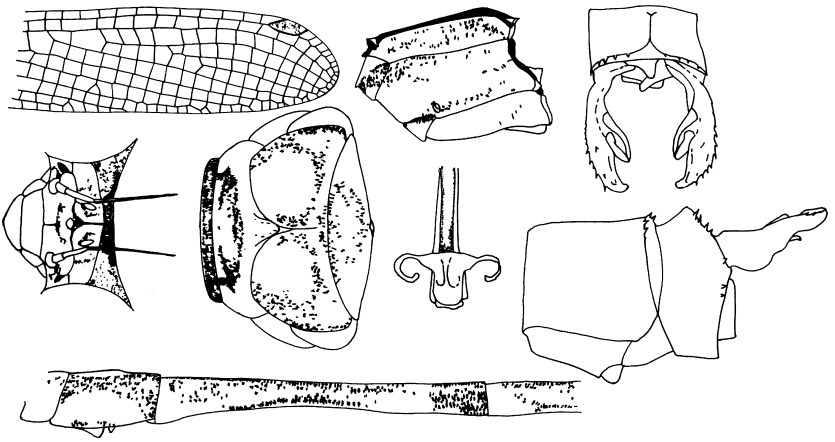


Fig. 3.1.305 *Heteragrion makiritare* male (upper row, left to right), apical part of the fore-wing, synthorax in lateral view, apex of the abdomen in dorsal view, and (middle row, left to right), pattern on the head between the compound eyes in dorsal view, prothorax in dorsal view, penis in ventral view, and apex of the abdomen in lateral view, and (below) pattern on the first three and anterior part of the fourth abdominal segment in lateral view. Based on De Marmels (2004).

13. The dorsum of the eighth segment of the male abdomen is mainly yellowish. The female has a distinct dark post-humeral stripe and lacks a median line on the proximal half of the ninth abdominal segment. The posterior lobe of the pronotum is mainly pale with obscure markings (**Fig. 3.1.304**). Length of male abdomen: 31 to 36 mm, female: 28.5 to 30 mm. Hind wing length of male: 22 to 23 mm, female: c. 24 mm.
.....*Heteragrion ictericum* Williamson, 1919 (French Guiana, Guyana, Venezuela, Amazonas).
- The basal half of the eighth abdominal segment of the male is black (**Fig. 3.1.305**). Total length of male: 52 to 54 mm. Length of male abdomen: 43 to 44.5 mm. Hind wing length of male: 26.5 to 28 mm. The female has not been described.
.....*Heteragrion makiritare* De Marmels, 2004 (Venezuela).
14. The head has a distinct broad black pattern. There is a broad black posthumeral stripe (**Fig. 3.1.303**). 15
- The head is largely pale dorsally, sometimes with an obscure pattern or small dark markings (**Fig. 3.1.306**). There is no posthumeral stripe. 18

15. There is no definite black marking on the posterior lobe of the prothorax (**Fig. 3.1.303**). Only the area near the mid-dorsal carina and that between the branches of the fork are dark. The rest of the dorsal surface of the thorax is pale. Length of male abdomen: c. 39 mm. Hind wing length: c. 25 mm. This species and the three in the next couplets are very similar and show only minor differences in the anal appendages of the male. Their validity should be checked by determining the natural variability within their populations.
.....*Heteragrion beschkii* Hagen in Selys, 1862 (Rio de Janeiro, São Paulo).
- The prothorax has either a round black marking on the posterior lobe, or it is almost entirely black with only small yellow markings. 16

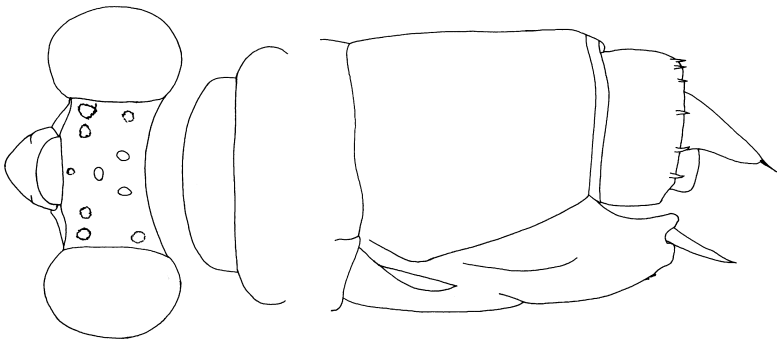


Fig. 3.1.306 *Heteragrion consors* female (left to right): head in dorsal view, outline of posterior lobe of the prothorax, and lateral view of the ninth and tenth abdominal segments. Based on Santos (1970c).

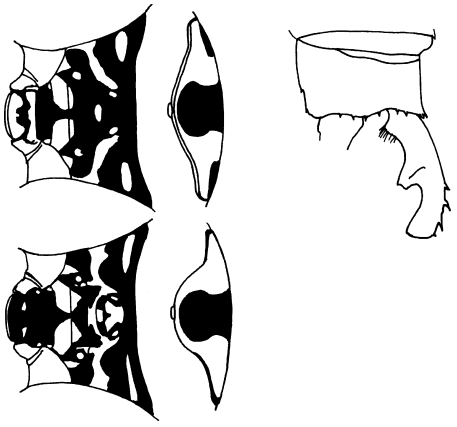


Fig. 3.1.307 *Heteragrion triangulare:* head between the compound eyes and prothorax of a male (upper left) and a female in dorsal view (lower left); the tenth abdominal segment of a male with one of its superior appendages in oblique dorsal view (right). Based on Calvert (1909) and Williamson (1919).

16. The posterior lobe of the prothorax is light brown with a round black marking connected to a broad base that contacts the posterior margin, and sometimes also narrow lateral black markings bordering the margin. The pterostigma is black and covers slightly more than two cells posterior to it. The synthorax is mainly black dorsally, with the area between the mid-dorsal carina and fork black and a round black spot covering the posterior lobe of the prothorax. The superior anal appendage of the male has a large truncate tooth at about mid-length on the inner margin (**Fig. 3.1.307**). Length of female abdomen: c. 36 mm. Hind wing length: c. 29 mm.
.....*Heteragrion triangulare* Hagen in Selys, 1862 (Argentina, Rio de Janeiro, Mato Grosso?).
- The prothorax is almost entirely black, although small yellowish markings may be present. 17
17. The interior process of the superior anal appendage of the male is robust and truncate at the apex; its origin is at or near the midlength of the appendage. The pterostigma is brown varying to black and covering three cells posterior to it. The synthorax is mainly yellow laterally, but it has distinct dark brown or black dorsal and dorsolateral stripes (**Fig. 3.1.308**). Length of male abdomen: c. 39 mm. Hind wing length: c. 28 mm.
.....*Heteragrion dorsale* Selys, 1862 (Rio de Janeiro, São Paulo?).
- The interior process of the superior anal appendage of the male is rather fine and acutely pointed at the apex; its origin is about ¾ of the way from the base to the apex. The thorax of the male is mainly reddish. Length of male abdomen: 37 to 41 mm. Hind wing length of the male: 24 to 30 mm.
.....*Heteragrion ochraceum* Hagen in Selys, 1862 (Rio de Janeiro, Bahia?). Syn: Selys's type is too badly damaged to identify, and it is possible that this nominal species and *Heteragrion cinnamomeum* Selys, 1862, are conspecific (von Ellenrieder and Garrison, 2007a).

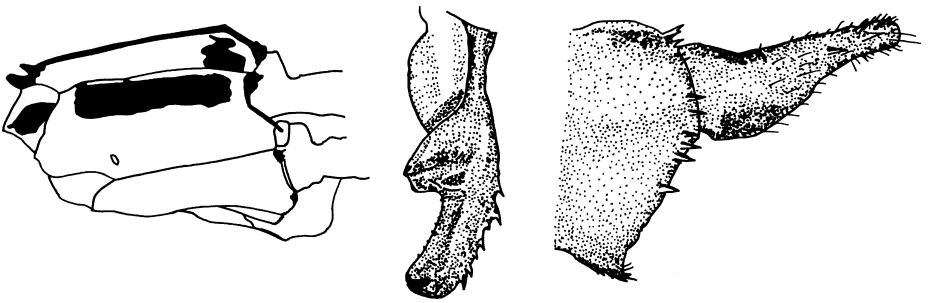


Fig. 3.1.308 *Heteragrion dorsale* male (left to right): synthorax in lateral view, superior anal appendage in dorsomedial view, and apex of the abdomen in lateral view. Based on Lencioni (2005).

18. In profile, the superior anal appendages of the male are swollen ventrally at the base. The apical parts of the seventh and basal parts of the eighth abdominal segment are black (**Fig. 3.1.306**).
.....*Heteragrion consors* Hagen in Selys, 1862 (Bahia, Rio de Janeiro, São Paulo).
- In profile, the superior anal appendages of the male do not appear swollen ventrally at the base (**Fig. 3.1.309**). 19

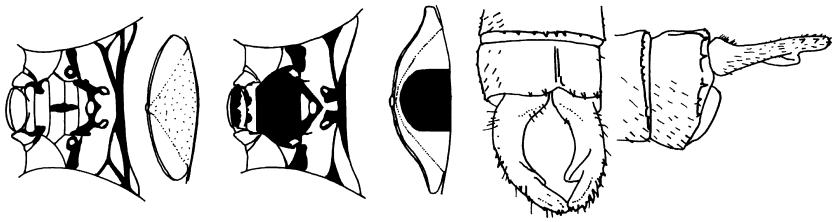


Fig. 3.1.309 *Heteragrion aurantiacum* (left to right): head and posterior lobe of the prothorax of a male and a female in dorsal view and apex of the male abdomen in oblique dorsal and lateral view. Based on Williamson (1919).

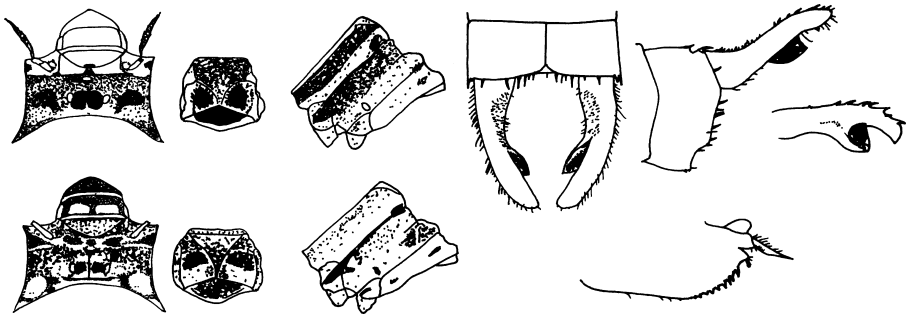


Fig. 3.1.310 *Heteragrion cooki* male (upper row, left to right): head in dorsal view, pronotum, thorax in lateral view, apex of the abdomen in dorsal and lateral view, and the right superior anal appendage in dorsomedial view; female (lower row, left to right): head in dorsal view, pronotum, thorax in lateral view, and the ovipositor in lateral view. Based on Daigle and Tennessen (2000).

19. The predominant pale colors are red and yellow, and the anterior margin of the frons is rounded (**Fig. 3.1.309**). The apex of the seventh abdominal segment and all of the eighth are red. Length of male abdomen: 38 to 41 mm. Hind wing length of male: 23 to 26 mm.
.....*Heteragrion aurantiacum* Selys, 1862 (Argentina, Paraguay, Bahia, Espirito Santo, São Paulo, Rio de Janeiro). Syn: *Heteragrion amazonicum* Selys, 1886.

- The predominant pale colors are yellowish and dull brown, and the anterior margin of the frons is obtusely angled in both sexes (**Fig. 3.1.310**). The sixth and seventh abdominal segments have yellow bands that are somewhat brownish dorsally. The eighth abdominal segment is yellow with a brown basal area, and the ninth and tenth are yellow with brownish dorsal areas. Total length of male including appendages: 43 to 44 mm; female: 41 to 43 mm. Length of the male abdomen: 35 to 36 mm; female: 33 to 35 mm. Hind wing length of male: 24 to 25 mm; female: c. 26 mm.
.....*Heteragrion cooki* Daigle and Tennessen, 2000 (Ecuador)

20. The first two abdominal segments of the male lack definite black markings on the dorsal surface, and none of the others are as much as ¼ covered with black. The eighth segment is pale or somewhat darkened (**Fig. 3.1.299**). 21
- One or both of the first two abdominal segments of the male have distinct black markings dorsally, or some of the other segments are largely or entirely black dorsally (**Fig. 3.1.309**). 23

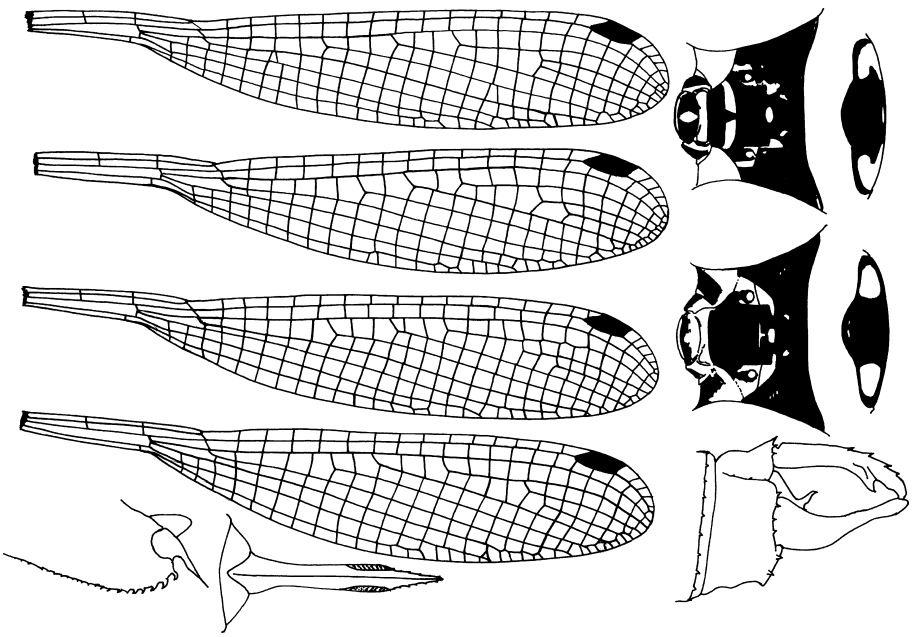


Fig. 3.1.311 *Heteragrion peregrinum:* fore and hind wing of a male (upper left) and a female (middle and lower middle left), dorsal view of the pattern on the head between the eyes and posterior lobe of the pronotum of a male (upper right, left and right, respectively) and a female (middle right, left and right respectively), apex of the male abdomen in dorsolateral view (lower right), genital valve of a female in lateral view (lower left), and ventral view of the ovipositor (lower left center). Based on Williamson (1919).

21. The abdomen of the male is flesh colored, reddish yellow, or almost red with distinct black markings on the apical parts of the third through sixth segments. The seventh abdominal segment is darker in color than the eighth. The face is yellow. The petiole of the hind wing ends slightly more proximal than the margin of the quadrangle. There is a tooth 2/3 of the way from the base to the apex of the superior anal appendage of the male (**Fig. 3.1.299**). Length of male abdomen: 37.5 to 42.5 mm; female abdomen: 32 to 33 mm. Hind wing length of male and female: 23 to 27 mm.
.....*Heteragrion chrysops* Hagen in Selys, 1862 (Mexico, Central America, Venezuela).
- The abdomen of the male is brilliant red with no black marks that are conspicuous. 22
22. The face of the male is black, and the abdomen lacks any black markings. There is a tooth 2/3 of the distance from the base to the apex of the male superior anal appendage. The inferior anal appendage is vestigial. The wings are narrow (**Fig. 3.1.2**). Length of male abdomen: 34 to 42 mm; female: 28 to 33 mm. Hind wing length of male and female: 22 to 26 mm.
.....*Heteragrion erythrogastrum* Selys, 1886 (Central America, Colombia, Ecuador).
- The face of the male is bright yellow, and some of the abdominal segments have narrow black markings at their apical margins.
.....*Heteragrion albifrons* Ris, 1918 (Costa Rica, not reported from South America).

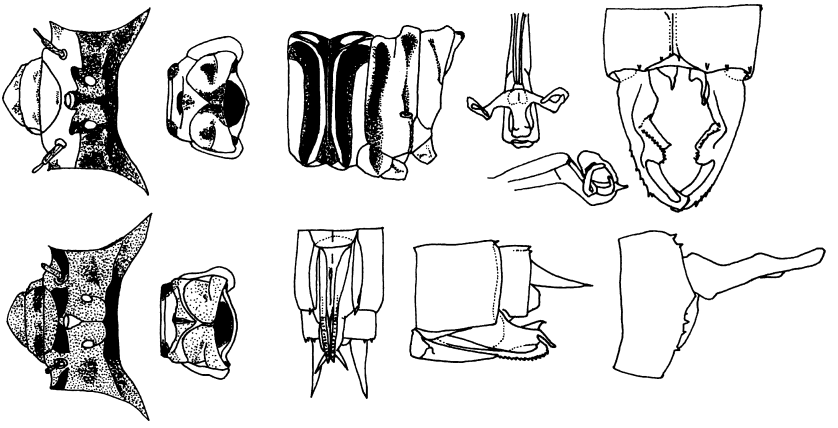


Fig. 3.1.312 *Heteragrion chlorotaeniatum* (above, left to right), color pattern on the surface of the head between the eyes and dorsal surface of the prothorax, and diagrammatically on the synthorax of a male; penis in ventral (above) and lateral view (below); apex of a male abdomen in dorsal view; and (below, left to right): color pattern on the head and dorsal surface of the prothorax of a female; apex of the female abdomen in ventral and lateral view; apex of the male abdomen in lateral view. Based on De Marmels (1989a).

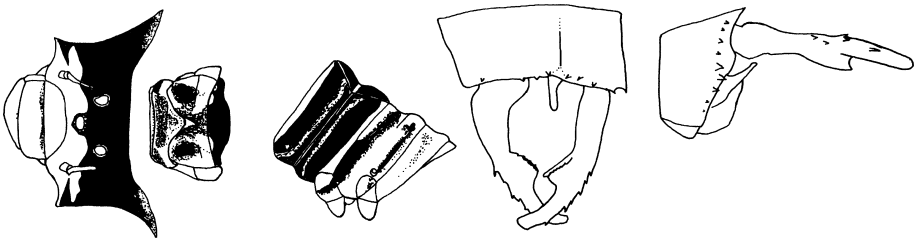


Fig. 3.1.313 *Heteragrion flavidorsum* male (left to right): color pattern on the dorsal surface of the head and prothorax, diagram of the color pattern on the synthorax, and apex of the male abdomen in dorsal and lateral view. Based on the illustration of *Heteragrion speciosum*, a synonym, by De Marmels (1987a).

23. The dorsal parts of the nasus and frons of the male are black, so the main color of the face is not bright yellow. A bright yellow middle lobe of the prothorax is the lightest colored part of the male body (**Fig. 3.1.311**). Length of abdomen: 30.5 to 35 mm. Hind wing length: 20.5 to 24 mm.
.....*Heteragrion peregrinum* Williamson, 1919 (Colombia).
- The face and frons of the male are bright yellow, greenish yellow, or orange, often with patches of bright, metallic reflections anterior to and on both sides of the anterior ocellus on most specimens (**Fig. 3.1.312**). 24
24. The light colors on the thorax of the male are bluish or greenish (**Fig. 3.1.312**). 25
- The light colors on the thorax of the male are yellowish without any greenish tinge. The eighth abdominal segment of the male is not black along the midline from the base to the apex (**Fig. 3.1.313**). 27
25. The eighth abdominal segment of the male is ochraceous with a dark spot near the base joining a narrow, dark, mid-dorsal stripe. The ninth and tenth segments of the male are reddish brown dorsally and yellow laterally with a narrow black middorsal line and a black rim on the posterior margin of the tenth segment. The anal appendages of the male are ferrugineous with a black apical part of the superior appendage. The dorsal surface of the thorax is greenish yellow with black markings. The ovipositor extends beyond the tenth abdominal segment of the female, and there is a single row of teeth on its valve (**Fig. 3.1.312**). The abdomen of the female is mainly dark brown with a beige first segment, a pale mid-dorsal stripe on the second, and pale basal bands on the third through seventh segments. Total length of male without appendages: c. 41 mm; female: c. 35.5 mm. Length of male abdomen: c. 34 mm; female: c. 28.5 mm. Hind wing length of male: c. 20.5 mm; female: c. 21 mm.
.....*Heteragrion chlorotaeniatum* De Marmels, 1989 (Venezuela).

- The eighth through tenth segments of the male abdomen are black dorsally. The black marking on the midline of the eighth segment narrows from the base to the apex. The bases of the third through seventh abdominal segments are narrowly ringed with a pale color. The occipital region of the head is black (**Fig. 3.1.314**). 26

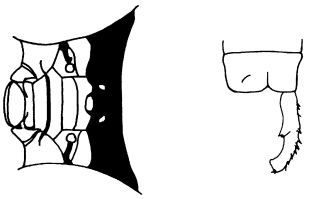


Fig. 3.1.314 *Heteragrion inca* head between the eyes in dorsal view (left) and tenth abdominal segment of a male with one appendage removed (right). Based on Calvert (1909).

26. The dorsal black coloration on the head extends anteriad only to the front of the median ocellus. There is a large tooth along the inner margin of the superior anal appendage located slightly beyond its mid-length (**Fig. 3.1.314**). The abdomen is about 37 mm long.
.....*Heteragrion inca* Calvert, 1909 (Ecuador Peru, Bolivia, Rondônia).
- The dorsal black coloration on the head extends anteriad to the space between the antennae. The large tooth on the inner margin of the male superior anal appendage is located about 2/3 of the distance from the base to the apex (**Fig. 3.1.315**). Total length: c. 36 mm. Length of abdomen: c. 31 to 32 mm. Hind wing length: c. 19 mm. Length of pterostigma: c. 1.3 mm.
.....*Heteragrion icterops* Selys, 1862 (Ecuador, Peru, Venezuela?, Pará, Amazonas). Syn: probably *Heteragrion romani* Sjoestedt, 1918.

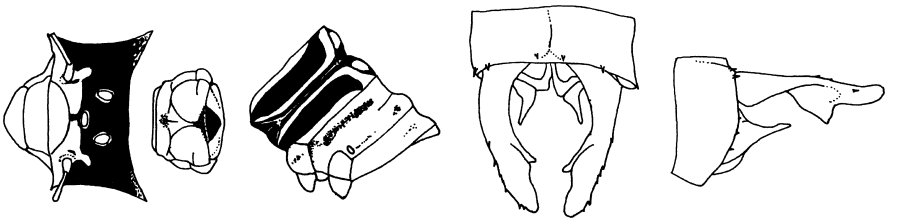


Fig. 3.1.315 *Heteragrion icterops* male (left to right): color pattern on the dorsal surface of the head and the prothorax, diagram of the color pattern on the synthorax, and the apex of the male abdomen in dorsal and lateral view. Based on an illustration by De Marmels (1987a) of *Heteragrion romani*, a presumed synonym.

27. On the third through fifth abdominal segments of the male, there is a wide yellow dorsal stripe along the midline extending for at least 2/3 of the length of the segment. This stripe is bordered laterally by a dark line separating the dorsal from the ventral yellow markings. The dark dorsal coloration on the eighth abdominal segment is confined to the basal half. The ninth and tenth segments are dark dorsally. Pale basal rings on the third through seventh abdominal segments are obscure or absent. The inferior anal appendage is much shorter than the superior appendage (**Fig. 3.1.313**).
.....*Heteragrion flavidorsum* Calvert, 1909 (Peru, Bolivia). Syn: *Heteragrion speciosum* Sjoestedt, 1918.
- On the third through fifth abdominal segments of the male, there is no yellow median dorsal stripe along the midline, which extends for at least 2/3 of the length of the segment. The posterior lobe of the prothorax is mainly black dorsally (**Fig. 3.1.316**). 28
28. The abdomen of the male is more than 40 mm long. 29
- The abdomen of the male is not more than 40 mm long. .....….32

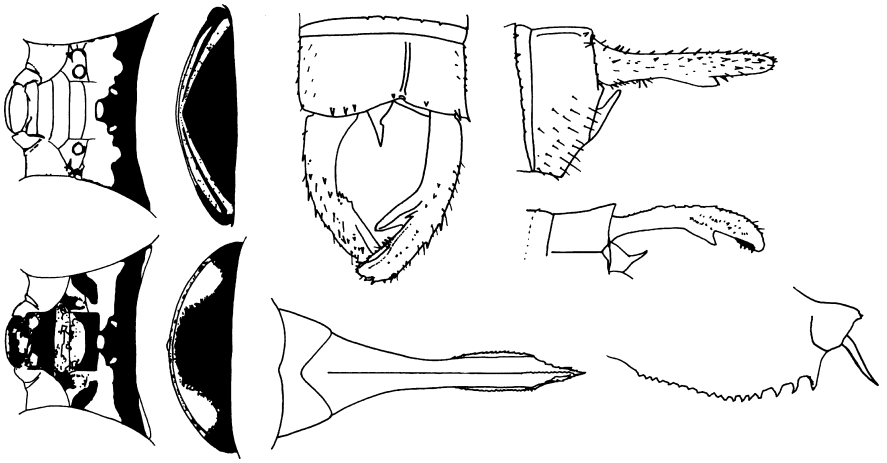


Fig. 3.1.316 *Heteragrion majus:* markings on the dorsal surface of the head between the compound eyes and the posterior lobe of the prothorax of a male (upper left) and a female (lower left), apex of the male abdomen in oblique dorsal (upper center) and lateral view (upper right), superior anal appendage of a male in oblique dorsal view (middle right), ovipositor in ventral view (lower center), and right genital valve of the female in lateral view (lower right). Based on Williamson (1919).

29. The third through sixth abdominal segments of the male are largely black dorsally and laterally, and some or all lack basal rings. The eighth through tenth segments and the basal parts of the appendages are bright yellow. There is a tooth just apical to the mid-length of the superior anal appendage (**Fig. 3.1.316**).

Length of male abdomen: 47 to 48 mm. Hind wing length of male: 32 to 33 mm. The female has not been described.
.....*Heteragrion majus* Selys, 1886 (Central America, Peru, Venezuela).
- The third through sixth abdominal segments have yellow basal rings (**Fig. 3.1.317**). 30

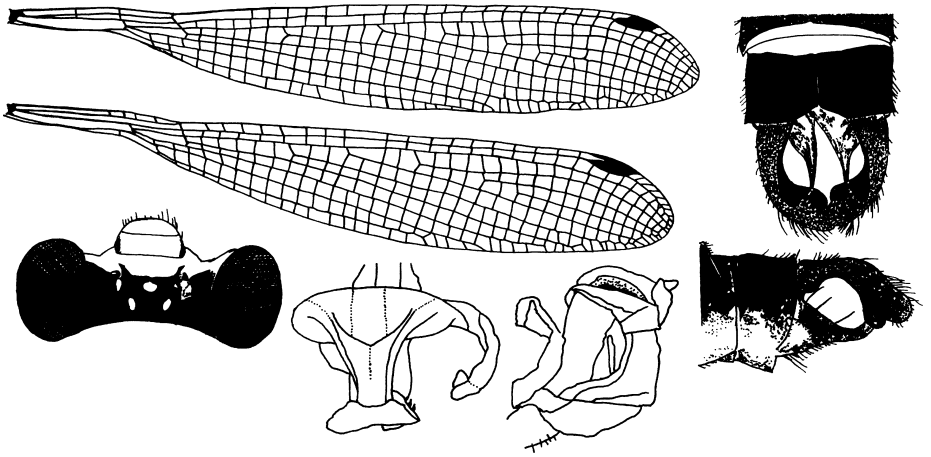


Fig. 3.1.317 *Heteragrion palmichale* male: fore and hind wing (upper left), head in dorsal view (lower left), apex of the abdomen in dorsal (upper right) and lateral view (lower right), and the penis in ventral and lateral view (lower center, left and right, respectively). Based on Hartung (2002).

30. The third through sixth abdominal segments are black with yellow basal rings; the eighth through tenth segments are orange with a black basal marking on the eighth segment and a black apical triangle on the ninth segment. The superior anal appendages are black, and the inferior appendages are yellow with black near the apex (**Fig. 3.1.317**). Length of male abdomen with appendages: 51.5 to 53.5 mm. Hind wing length of male: 29 to 29.5 mm. Pterostigma length of male: 0.9 to 1.1 mm. The female has not been described.
.....*Heteragrion palmichale* Hartung, 2002 (Venezuela).
- The third through sixth abdominal segments of the male are narrowly pale at the base, yellowish or reddish in the middle, and black apically. The yellowish or reddish color is darker on the basal half of each segment. The eighth segment is largely or completely yellowish. The ninth and tenth segments are black dorsally (**Fig. 3.1.318**). ……..31

31. The legs are blackish. There is a large tooth along the inner margin of the superior anal appendage located beyond a distance 3/4 of the way from the base to the apex (**Fig. 3.1.318**). Length of abdomen: 42 to 48 mm. Hind wing length: about 29 mm.
.....*Heteragrion aequatoriale* Selys, 1886 (Ecuador, Peru). The identity of this species has recently been investigated. According to von Ellenrieder and Garrison (2007a), reports of its presence in Colombia seem to have been the result of confusion with *H. mitratum*.
- The legs are largely yellowish. There is a large tooth along the inner margin of the superior anal appendage located beyond a distance about 2/3 of the way from the base to the apex (**Fig. 3.1.319**). Length of abdomen: c. 42 mm. Hind wing length: c. 29 mm.
.....*Heteragrion angustipenne* Selys, 1886 (Ecuador, Peru, Amazonas, Territory of Acre?).

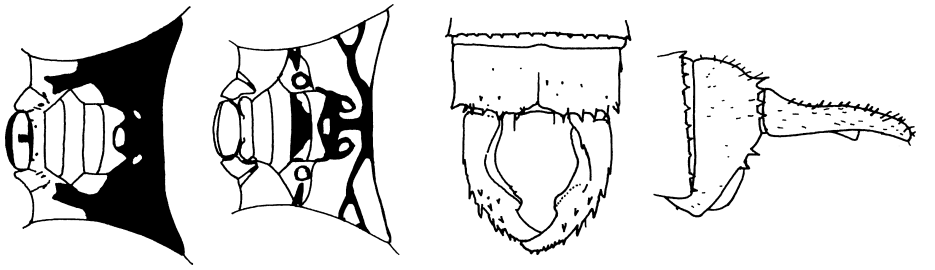


Fig. 3.1.318 *Heteragrion aequatoriale* (left to right): the head between the compound eyes of a male and a female and the apex of a male abdomen in dorsal and lateral view. Based on Williamson (1919).

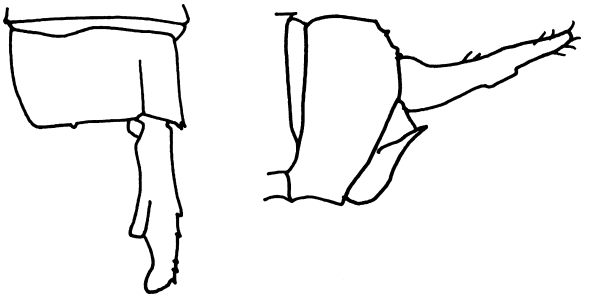


Fig. 3.1.319 *Heteragrion angustipenne* male: tenth abdominal segment of a male with one of its superior anal appendages in oblique dorsal view (left) and apex of the male abdomen in lateral view (right). Based on Calvert (1909).

32. The fourth and fifth abdominal segments of the male lack pale basal rings. The median pale areas on the sixth and seventh segments are so obscure that the entire segment appears blackish. The lighter color on the abdominal segments is dull or yellowish red. The eighth segment is reddish with indefinite black markings. The ninth and tenth segments are black dorsally. There is a large subapical tooth on the superior anal appendage (**Fig. 3.1.320**). Length of abdomen of male: about 36 mm. Hind wing length: about 23.5 mm. The female has not been described.
.....*Heteragrion calendulum* Williamson, 1919 (Colombia).
- The third through sixth, or sometimes seventh abdominal segment have narrow pale basal rings followed by large black areas, sometimes shading into a large pale area bordered by a narrow dark apical ring (**Fig. 3.1.321**). 33

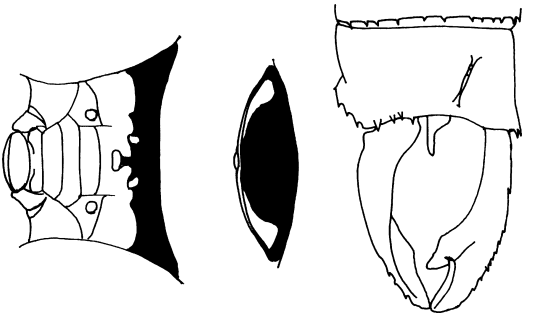


Fig. 3.1.320 *Heteragrion calendulum* male (left to right): pattern on the dorsal surface of the head between the compound eyes, posterior lobe of the pronotum, apex of the abdomen in oblique dorsal view. Based on Williamson (1919).

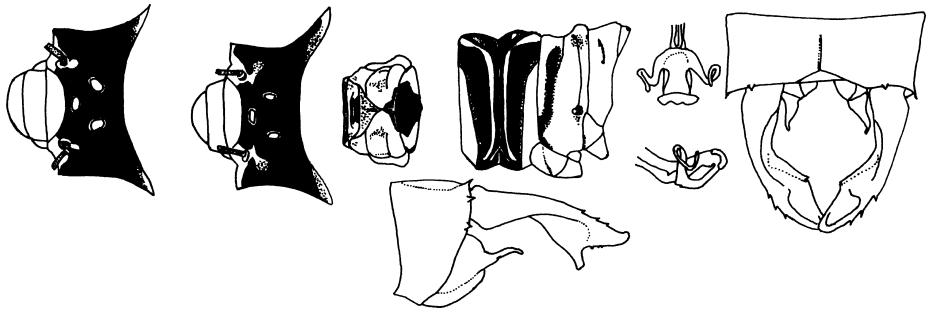


Fig. 3.1.321 *Heteragrion breweri* male (above, left to right): color pattern on the surfaces of two head between the eyes, dorsal surface of the prothorax, and diagrammatically shown on the synthorax; penis in ventral (above) and lateral view (below), and apex of the abdomen in dorsal and (below the row) in lateral view. Based on De Marmels (1989a).

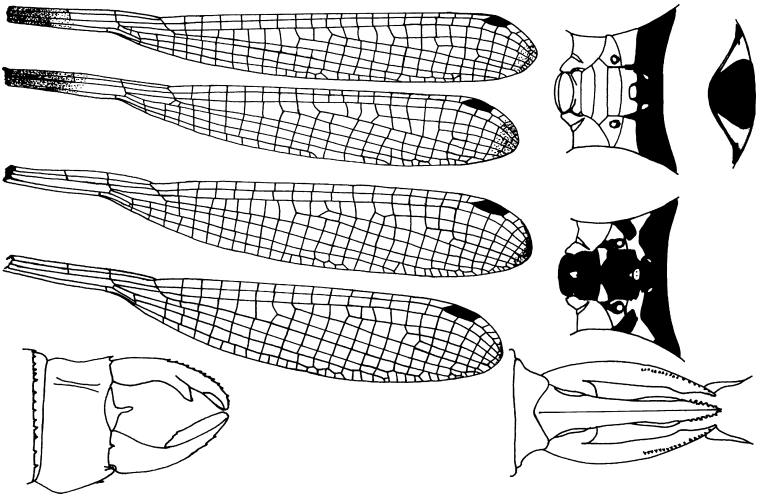


Fig. 3.1.322 *Heteragrion mitratum:* fore and hind wing of a male (upper left) and a female (middle and lower middle left), dorsal view of the pattern on the head of a male (upper right center) and a female (middle right), pronotum of a male in dorsal view (upper right), apex of the male abdomen in dorsolateral view (lower left), and genital valves and ovipositor of a female in ventral view (lower right). Based on Williamson (1919).

33. There is no pale subapical area on the third through seventh abdominal segments; they are rather black except for a yellow basal ring and yellow lateroventral areas, largest on the apical half of the segments. The pterostigma is dark brown. 34
- On the third through sixth abdominal segments, the large black area apical to the narrow pale basal ring shades into a large subapical pale area bordered by a narrow dark apical ring (**Fig. 3.1.322**). 36
34. The superior and inferior anal appendages are both reddish brown. The color of the male thorax is golden yellow or orange with black markings (**Fig. 3.1.321**). The yellow basal rings on the third through seventh abdominal segments are enlarged laterally and ventrally. The rest of the segments are dark with black apical bands. Total length of male without anal appendages: c. 36.5 mm. Length of male abdomen without appendages: c. 30 mm. Hind wing length of male: c. 19 to 20 mm. The female has not been described.
.....*Heteragrion breweri* De Marmels, 1989
Venezuela).
- The anal appendages of the male are black with a paler area at the concavity apical to the internal tooth (**Fig. 3.1.323**). The male abdomen is significantly longer than 30 mm, and the hind wing is considerably shorter than 2/3 the length of the male abdomen. 35

35. The compound eyes of the male are black dorsally and olivaceous ventrally. The ovipositor does not reach the apex of the tenth abdominal segment, and there is a row of strong teeth curved slightly posteriad on the valves with one or two rows of tiny denticles parallel to it. The male superior anal appendages are black with a dark reddish area at the internal tooth, and the inferior appendages are yellow, darkening at their apices. The inferior anal appendages are much smaller than the superior appendages (**Fig. 3.1.323**). Total length of male without anal appendages: c. 43 mm; female: c. 34.5 mm. Length of male abdomen: c. 35.5 mm without appendages; female abdomen: c. 27.5 mm. Hind wing length of both sexes: c. 21.5 mm.

.....*Heteragrion bariai* De Marmels, 1989 (Ecuador, Peru, Venezuela, Rondônia).

- The compound eyes of the male are yellow with a narrow blackish band appearing to be an extension of the anterior margin of the black area posterior to the median ocellus (**Fig. 3.1.324**). The ovipositor reaches beyond the apex of the tenth abdominal segment of the female and almost reaches the apex of the superior anal appendage. Total length of male including anal appendages: 42 to 47 mm; female: 41.5 to 42 mm. Length of male abdomen: c. 35 to 39 mm; female abdomen: 33 to 35 mm. Hind wing length of male: 22 to 24 mm; female: 24 to 26 mm. The similarity of the two nominal species in this couplet, especially the common features of the male anal appendages, and the fact that they occupy some of the same general geographical areas suggests that more study is required to confirm that they are really distinct species.

.....*Heteragrion bickorum* Daigle, 2003 (Ecuador).

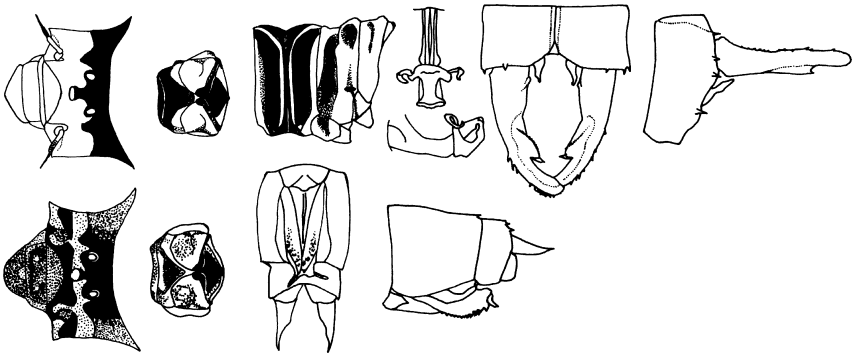


Fig. 3.1.323 *Heteragrion bariai* (above, left to right), color pattern on the surface of the head between the eyes, on dorsal surface of the prothorax, and diagrammatically shown on the synthorax of a male; penis in ventral (above) and lateral view (below); apex of a male abdomen in dorsal and lateral view; and (below, left to right): color pattern on the head and dorsal surface of the prothorax of a female; apex of the female abdomen in ventral and lateral view. Based on De Marmels (1989a).

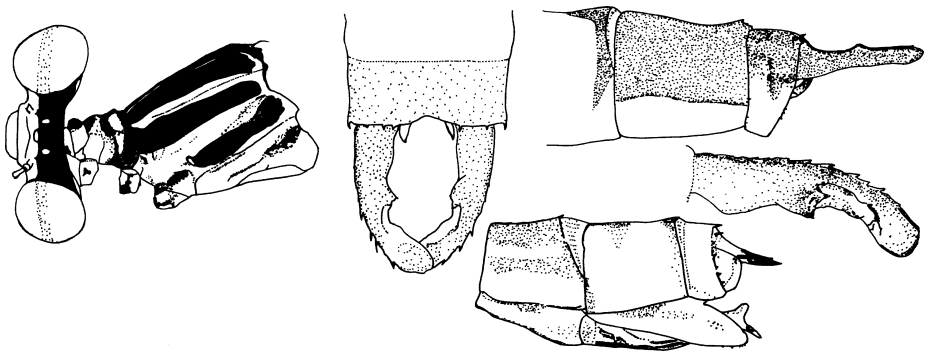


Fig. 3.1.324 *Heteragrion bickorum* (above, left to right): color pattern on the dorsal surface of the head and lateral surface of the thorax, apex of the male abdomen in dorsal and lateral view, oblique view of the inner surface of the male superior anal appendage (middle right), and apex of the female abdomen in lateral view (lower right). Based on Daigle (2003).

36. The dorsal surface of the thorax is entirely black in mature males but with small light markings in newly transformed ones. There are broad dark bands on the mesepimeron and metepisternum. The third through sixth abdominal segments of the male have a pale subapical area equal in size or larger than the dark subbasal area. The head of the male has a blackish posterior band crossing just at the posterior margin of the median ocellus, while the head of the female has a posterior band and extensive dark mid-dorsal markings (**Fig. 3.1.322**). Length of the abdomen of the male: 36 to 40 mm; female: 29 to 30.5 mm. Hind wing length of male: 21.5 to 24 mm; female: 23 to 24.5 mm.
.....*Heteragrion mitratum* Williamson, 1919 (Colombia). Two subspecies have been described: *Heteragrion mitratum mitratum* Williamson, 1919; and *Heteragrion mitratum atroterminatum* Donnally, 1992.

- The dorsal surface of the thorax is yellow with a black middorsal stripe and a lateral stripe on each side. The mesepimeron has a large obscure area, and the metepisternum has a very narrow obscure line. The third through sixth abdominal segments of the male have a pale subapical area less extensive than the dark subbasal area (**Fig. 3.1.325**). Length of male abdomen: c. 34 mm; female: c. 29 mm. Hind wing length of male: c. 21.5 mm; female: c. 22.5 mm.
…….....*Heteragrion simulatum* Williamson, 1919 (Guyana, Venezuela).

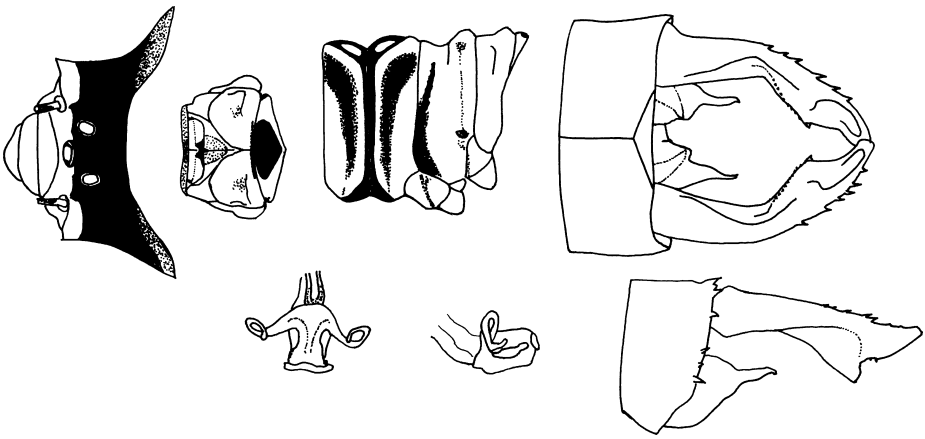


Fig. 3.1.325 *Heteragrion simulatum* male (above, left to right): color pattern on the head and dorsal surface of the pronotum, diagram of the color pattern on the synthorax, apex of the abdomen in dorsal view, and (below, left to right): penis in ventral and lateral view, and apex of the abdomen in lateral view. Based on De Marmels (1989a).

Key to the species of known *Heteragrion* larvae in South America

Information for the key was provided by Costa and Santos (2000b), De Marmels (2004), and Lencioni (2005).

1. The apex of each lateral caudal gill lamella ends in a simple acute point, but the median lamella may be drawn out into a narrow filament (**Fig. 3.1.326**). 2
 - The apices of all three caudal gill lamellae are drawn out into narrow filaments (**Fig. 3.1.236**). 3
2. The apex of each caudal gill lamella is lined with long, narrow spines (**Fig. 3.1.326**).
.....*Heteragrion consors* Hagen in Selys, 1862 (Rio de Janeiro).
 - The apex of each gill lamella is lined with only a few short hook-like spines. The second segment of the antenna is slightly longer than the third, which is subequal to the fourth (**Fig. 3.1.327**).
..... *Heteragrion chlorotaeniatum* De Marmels, 1989 (Venezuela).

3. The fourth segment of the antenna is longer than the third, and the third is longer than the second. The lateral gill lamellae are widest at or beyond the mid-length (**Fig. 3.1.328**).
..... *Heteragrion mitratum* Williamson, 1919 (Colombia). Two subspecies have been described: *Heteragrion mitratum mitratum* Williamson, 1919; and *Heteragrion mitratum atroterminatum* Donnally, 1992.
- The third and fourth segments of the antenna are subequal in length (**Fig. 3.1.329**). 4

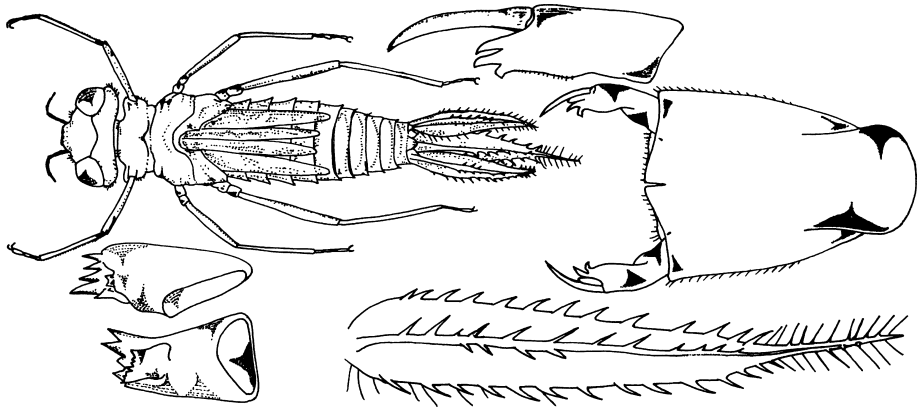


Fig. 3.1.326 *Heteragrion consors* larva: habitus (upper left), labial palp (upper center), labium (upper right), mandibles (lower left), and the median gill lamella (lower right). Based on Costa and Santos (2000b) and Lencioni (2005).

Fig. 3.1.327 *Heteragrion chlorotaeniatum* larva: antenna (left) and lateral gill lamella (right). Based on De Marmels (2004).

4. The widest part of each lateral gill lamella is at or beyond the mid-length, and the broad part of the lamella is about seven times longer than the apical filament. The second, third, and fourth segments of the antenna are subequal in length (**Fig. 3.1.329**).
..... *Heteragrion breweri* De Marmels, 1989 Venezuela).

- The widest part of each lateral gill lamella is near the base, and the broad part of the lamella is less than seven times as long as the terminal filament (**Fig. 3.1.330**). 5

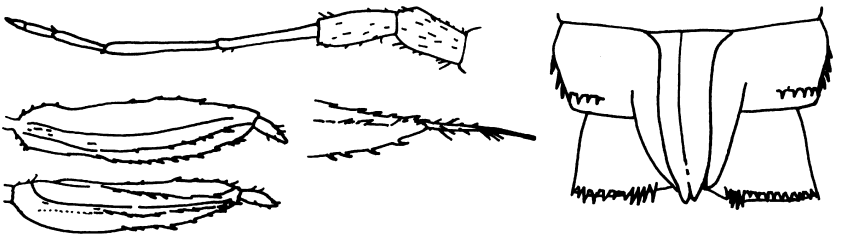


Fig. 3.1.328 *Heteragrion mitratum* larva: antenna (upper left), lateral (middle left) and middle gill lamella (lower left), apex of the lateral gill lamella of a different specimen (lower center), and apical segments of the abdomen of a male larva in ventral view (right). Based on De Marmels (2004).

5. The length of each lateral gill lamella, including the filament, is no more than three times its greatest width, and spines on the edges of the gill lamellae, if present, are small and inconspicuous (**Fig. 3.1.236**)
.....*Heteragrion aurantiacum* Selys, 1862 (Argentina, Paraguay, Bahia, Espirito Santo, São Paulo, Rio de Janeiro). Syn: *Heteragrion amazonicum* Selys, 1886.

- The length of each gill lamella, including the filament, is more than six times its greatest width, and the edges of each gill lamella are lined with robust, hook-like spines (**Fig. 3.1.330**).
.....*Heteragrion bariai* De Marmels, 1989 (Ecuador, Peru, Venezuela, Rondônia).

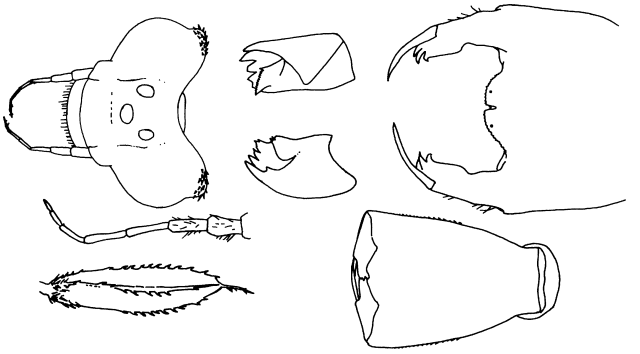


Fig. 3.1.329 *Heteragrion breweri* larva: head in dorsal view (upper left), antenna (middle left), mandibles (upper center), labium in ventral view (lower right) and its distal portion in dorsal view (upper right), and a lateral gill lamella (lower left). Based on De Marmels (2004).

Fig. 3.1.330 *Heteragrion bariai* larva: antenna (left) and middle (upper right) and lateral gill lamella (lower right). Based on De Marmels (2004).

Key to the species of adult *Oxystigma* in South America

Information for the key was taken from Williamson (1919), Geijskes (1976), and De Marmels (1987a).

1. The quadrangle is short and does not reach as far apicad as the nodus (**Fig. 3.1.331**). Veins IR_3 and Cu_1 are separated widely at their terminations. Vein IR_3 turns toward R_3. The thorax of the male is black or drab with the lighter lateral markings obscure. The face of the male is largely blue. The female has pale humeral and dorsal stripes. Length of male abdomen including appendages: 33 to 36 mm; female: 26 to 28 mm. Hind wing length: 22 to 24 mm. Length of pterostigma: c. 2 mm.
.....*Oxystigma cyanofrons* Williamson, 1919 (Venezuela, Guyana, Surinam).
- The quadrangle is long and reaches as far apicad as the nodus. The thorax of the male has pale dorsal and humeral stripes and bright lighter lateral markings (**Fig. 3.1.332**). 2
2. The face of the male is light blue, while the frons of the female is light brown, and the clypeus and labrum are darker brown (**Fig. 3.1.232**). Length of male abdomen including appendages: c. 30 mm; female: c. 32 mm. Hind wing length: 20 to 21 mm. Length of pterostigma: c. 2 mm in the male and slightly longer in the female. The general color of the abdomen is dark brown to black in the male and dark brown in the female. The third through sixth abdominal segments of the male have pale lines running about ¾ of the length of the segment, while the third through seventh segments of the female have paler basal rings and darker apical ones.
.....*Oxystigma petiolatum* (Selys, 1862) (Venezuela?, French Guiana, Guyana, Surinam?, Pará, Rondônia). Syn: *Heterargion petiolatum* Selys, 1862.
- The frons, clypeus, and labrum of the male are shiny dark brown or black, and the entire face of the female is dark brown. The superior anal appendage of the male is long and curves toward the midline at the apex (**Fig. 3.1.332**). 3

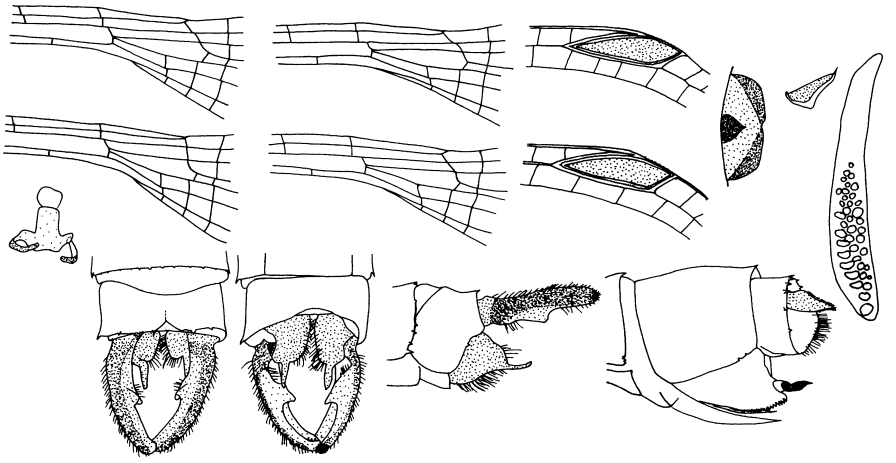


Fig. 3.1.331 *Oxystigma cyanofrons* (upper row, left to right): the basal portion of the fore and hind wings of a male, those of a female, pterostigmata on the fore and hind wings, markings on the posterior lobe of the prothorax of a female in dorsal view, left mesostigmal lamina of a female, right genital valve of a female in ventral view, and (lower row, left to right): penis after maceration, apex of the abdomen of a male in dorsal, ventral, and lateral view, and the apex of the abdomen of a female in lateral view. Based on Geijskes (1976).

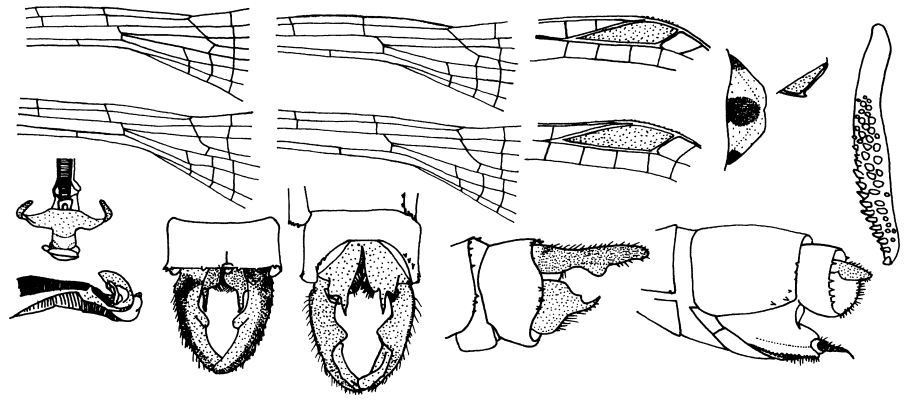


Fig. 3.1.332 *Oxystigma williamsoni* (upper row, left to right): the basal portion of the fore and hind wings of a male, those of a female, the pterostigmata on the fore and hind wings, the markings on the posterior lobe of the prothorax of a female in dorsal view, left mesostigmal lamina of a female, the right genital valve of a female in ventral view, and (lower row, left to right): penis after maceration in ventral (above) and lateral view (below), apex of the abdomen of a male in dorsal, ventral, and lateral view, and the apex of the abdomen of a female in lateral view. Based on Geijskes (1976).

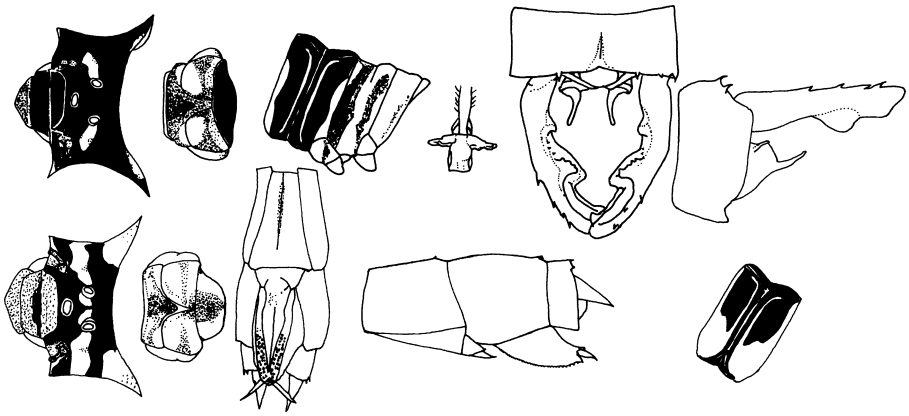


Fig. 3.1.333 *Oxystigma caerulans* (upper row, left to right): color pattern on the dorsal surface of the head and the prothorax of a male, diagram of the color pattern on the synthorax of a male, the penis is ventral view, and the apex of the male abdomen in dorsal and lateral view, and (lower row, left to right): color pattern on the dorsal surface of the head and the prothorax of a female, the apex of the female abdomen in ventral and lateral view, and an alternate color pattern on the mesepisterna of a male. Based on De Marmels (1987a).

3. The narrow apical processes on the male inferior anal appendages appear approximately parallel in dorsal view and are acutely pointed at the apex. The female superior anal appendage is conical and somewhat rounded at the apex (**Fig. 3.1.332**). Length of male abdomen, including appendages: c. 32.5 mm; female: c. 28 mm. Hind wing length: 21 to 22 mm. Pterostigma length: c. 2 mm. .....*Oxystigma williamsoni* Geijskes, 1976 (Venezuela, French Guiana, Guyana, Surinam, Roraima).

- The narrow apical processes on the inferior anal appendages of the male diverge toward the apex in dorsal view and are narrowly rounded at the apex. The superior anal appendage of the female is trangular and acutely pointed at the apex (**Fig. 3.1.333**). Total length of the female: 40.5 to 41 mm. Length of male abdomen without appendages: 37.5 to 40 mm; female: 33 to 33.5. Hind wing length of both sexes: 25 to 26.5 mm. The species in this couplet appear similar enough to be conspecific.

.....*Oxystigma caerulans* De Marmels, 1987 (Venezuela).

Coenagrionidae

Key to the genera of adult Coenagrionidae in South America

Information for the key was provided by Williamson (1917a), Ris (1918); Munz (1919), Williamson and Williamson (1924b), Kennedy (1920b, 1939a), St. Quentin (1960), Santos (1961a,b, 1962a,b,c, 1965a,b,c,d), Rácenis (1953a, 1959b, 1968a), Bulla (1972a, 1973a), Machado (1980), De Marmels (1988b, 2003, 2007b), De Marmels and Garrison (2005), Lencioni (2006), and von Ellenrieder and Muzón (2006). The characteristics of many individual genera are poorly defined, resulting in much recent reassignment of the species. Only males can be distinguished with a reasonable degree of certainty, but some specimens may not fit descriptions exactly, especially with regard to the arrangement of wing veins. The family is in need of a general revision.

1. There is a large ventral tubercle on the first abdominal segment, which is smaller in the female than in the male (**Fig. 3.1.334**).
.....*Minagrion* Santos, 1965..p. 335
- There is no ventral tubercle on the first abdominal segment (**Fig. 3.1.335**). 2
2. The petioles of the wings are very short, about half of the distance from the wing base to the cubito-anal cross-vein. The wing bases are strongly pigmented with black or dark brown to a point distal to the nodus (**Fig. 3.1.336**). Postocular spots are present.
.....*Acanthallagma* Williamson and Williamson, 1924..p. 339
- The petioles of the wings are considerably longer than half the distance from the wing base to the cubito-anal cross-vein. If in doubt, the wing membranes are hyaline or only faintly clouded (**Fig. 3.1.337**). 3

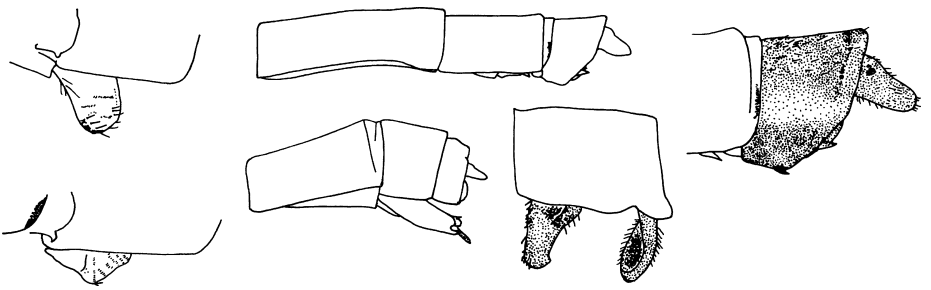


Fig. 3.1.334 *Minagrion mecistogastrum:* ventral tubercle on the first abdominal segment of the male (upper left) and the female (lower left) in lateral view, apical segments of the male abdomen in lateral view (upper center), apex of the male abdomen in dorsomedial (lower right center) and lateral view (right), and apex of the female abdomen in lateral view (lower left center). Based on Lencioni (2006).

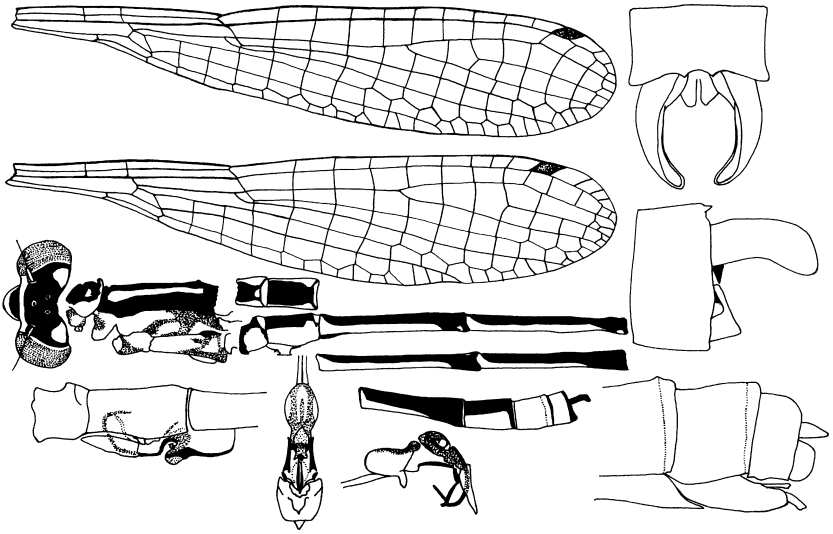


Fig. 3.1.335 *Homeoura chelifera:* fore and hind wing (upper left); head of a male in dorsal view and thorax of a male in lateral view (lower middle left); genitalia on the second and third abdominal segments in lateral view (lower left); penis in ventral (lower left center) and lateral view (lower center); pattern on the dorsal surface of the first two abdominal segments and on the lateral surfaces of the first through fourth, fifth and sixth, and seventh through tenth abdominal segments of a male (center, top to bottom); apex of a male abdomen in dorsal (upper right) and lateral view (middle right); the apex of the female abdomen in lateral view (lower right). Based on Santos (1956a).

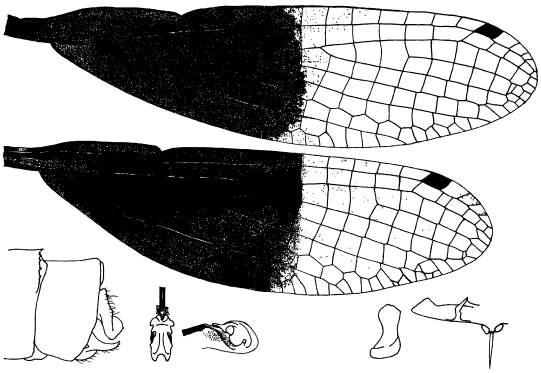


Fig. 3.1.336 *Acanthallagma luteum:* fore and hind wing (above) and (below, left to right): apex of the male abdomen in lateral view, penis in ventral and lateral view, inner posterior view of the male superior appendage to show its broadest profile, and the mesostigmal lamina of a female in dorsolateral view. Based on Williamson and Williamson (1924b).

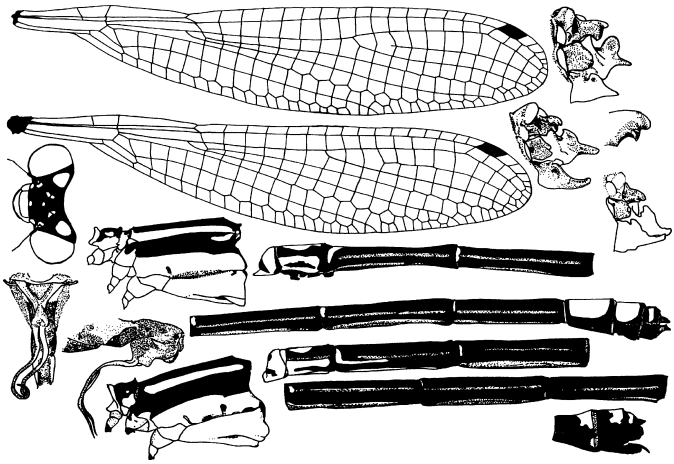


Fig. 3.1.337 *Argia yungensis* fore and hind wing (upper left); anal appendages of a male in oblique dorsal, oblique lateral, and lateral view with an enlargement of the apex of a superior anal appendage to the right (upper right); head in dorsal view and the synthorax and four anterior abdominal segments of a male in lateral view (middle row, left to right); penis in ventral and lateral view (lower left), six apical segments of the male abdomen in lateral view (right of penis); female synthorax (lower left center) and female abdomen in lateral view (lower right, with the first four segments above the fifth through seventh segments and the eighth through tenth segments at lower right). Based on von Ellenrieder and Garrison (2007).

3. The mid-dorsal part of the tenth abdominal segment of the male is produced to form a forked plate that extends ventrad between the superior anal appendages. The genital valves of the female reach far beyond the level of the apices of the abdominal appendages (**Fig. 3.1.20**).
.....*Inpabasis* Santos, 1961..p. 340
- There is no forked plate extending from the posterodorsal margin of the male tenth abdominal segment, or the forks do not extend ventrad between the superior anal appendages (**Fig. 3.1.337**). 4
4. The posterior margin of the tenth segment of the male abdomen has a mid-dorsal incision flanked on each side by a torus, a pad-like thickening. There are usually at least 10 cells between vein Cu_2 and the posterior margin of the wing. The tibial spines are much longer than the spaces between them. The females may or may not have a mesostigmal tubercle, which is a laminar lobe along the posterior margin of the mesostigmal plate, and the ovipositor always lacks a vulvar spine (**Fig. 3.1.337**).
.....*Argia* Rambur, 1842..p. 342

- The male does not have tori along the posterior margin of the tenth abdominal segment (**Fig. 3.1.338**). Females almost always lack structures resembling mesostigmal tubercles. 5

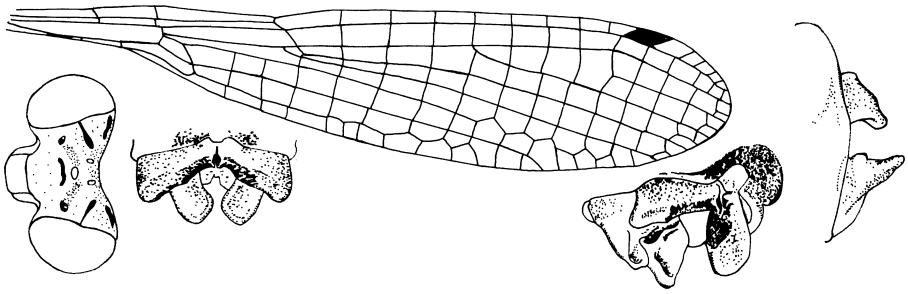


Fig. 3.1.338 *Helveciagrion simulacrum* male: hind wing (upper left), head in dorsal view (lower left), and anal appendages in dorsal (lower left center), dorsomedial (lower right center), and lateral view (right). Based on Munz (1919) and Lencioni (2006).

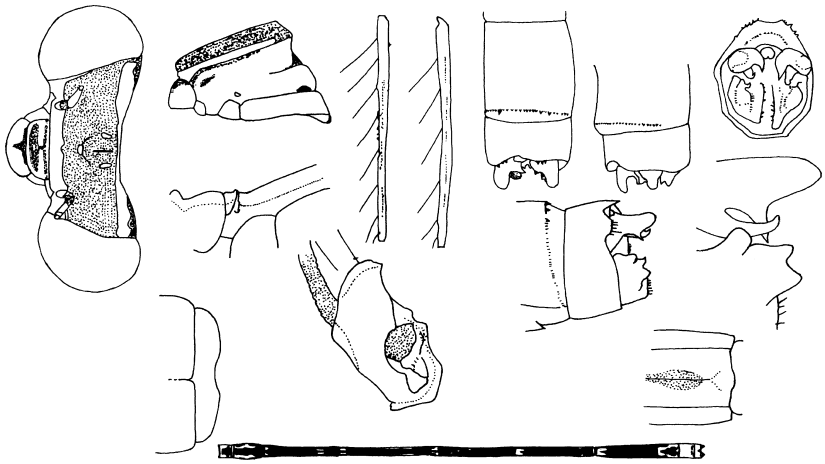


Fig. 3.1.339 *Nehalennia minuta minuta* (upper row, left to right): head of a male in dorsal view; color pattern of the male thorax in lateral view (above) and the hind margin of the prothorax (below); hind tibia of a specimen from Cuba and one from Amazonas; the apex of the male abdomen in dorsal, laterodorsal, and posterior views; and the apex of the female prothorax in dorsal view (lower left), penis in lateral view (lower left center), apex of the male abdomen in lateral view with an enlargement of the anal appendages (middle right, left and right, respectively), vulvar prolongation on the eighth sternite of a female (lower middle right), and the color pattern on the dorsal surface of the abdomen (lower center to right). Based on De Marmels (1984).

5. The superior anal appendages of the male are wider than long, shorter than the tenth abdominal segment, and broadly in contact along their inner margins. The inferior anal appendages are usually slightly longer than the superior appendages (**Fig. 3.1.338**). The anterior margin of the head, in dorsal view, appears angled rather then evenly rounded. The females are characterized by a mesepisternal fossa and the lack of a vulvar spine on the ovipositor. The color patter includes a considerable amount of blue.
.....*Helveciagrion* Machado, 1980..p. 392
- The inner margins of the superior anal appendages of the male are either well-separated along their inner margins or in contact for only a short distance at their bases (**Fig. 3.1.339**). 6

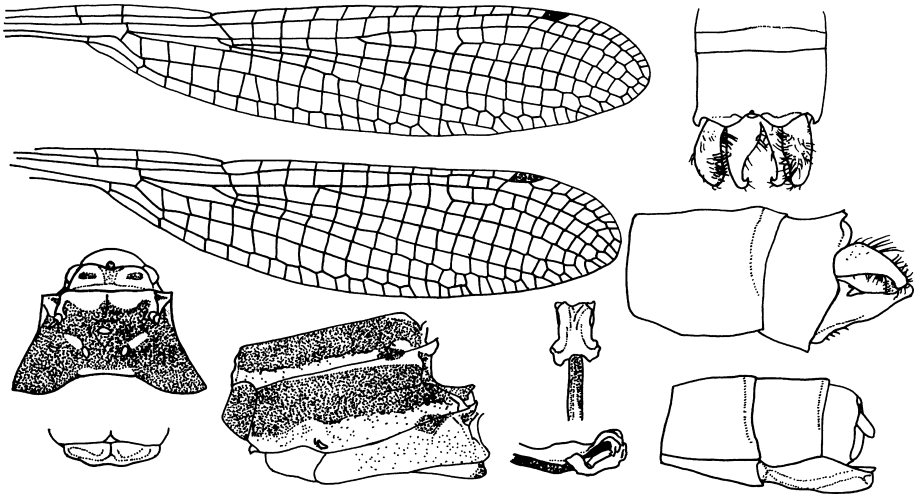


Fig. 3.1.340 *Tepuibasis chimantai:* fore and hind wing (upper left), dorsal view of head (middle left), posterior margin of the prothorax in dorsal view (lower left), lateral view of synthorax (lower left center), apex of the male abdomen in dorsal (upper right) and lateral view (middle right), penis in ventral and lateral view (lower right center, above and below, respectively), apex of a female abdomen in lateral view (lower right). Based on De Marmels (1988b).

6. On the head of the male, there is a pale blue stripe running across the occiput from the edge of one compound eye to the other. The inferior anal appendage is about as long as the superior appendage, and it ends in three lobes of nearly equal size, visible in lateral view. The superior anal appendages bear a basal apophysis, a narrow process extending ventrad from the base. The habitus is very slender, especially the abdomen. The color is brilliant metallic and similar

in both sexes (**Fig. 3.1.339**). The abdomen of the only known South American species is c. 25 mm.
.....*Nehalennia* Selys, 1850

Only a single South American species is known in this predominantly Holarctic genus: *Nehalennia minuta* (Selys in Sagra, 1857), which occurs in Mexico, Central American, the West Indies, Surinam, and the Brazilian states of Bahia, Maranhão, Minas Gerais, and São Paulo. Syn: *Trichocnemys minutum* Selys in Sagra, 1857; *Argiallagma minutum* (Selys, 1857), *Enallagma minutum* (Selys, 1857). Two subspecies have been described: *Nehalennia minuta minuta* (Selys in Sagra, 1857), from Mexico, Central America, and Surinam, also found under its synonym, *Agrion adunca* Hagen, 1861; and *Nehalennia minuta selysi* Kirby, 1890, from Brazil, also found under its synonym, *Nehalennia sophia* Selys, 1876 (nec Selys, 1840).

- The occipital region either has postocular spots that are not connected by a stripe or it is uniform in color. The inferior anal appendage is not approximately as long as the superior appendage, or it does not end in three lobes of nearly equal size (**Fig. 3.1.340**). 7

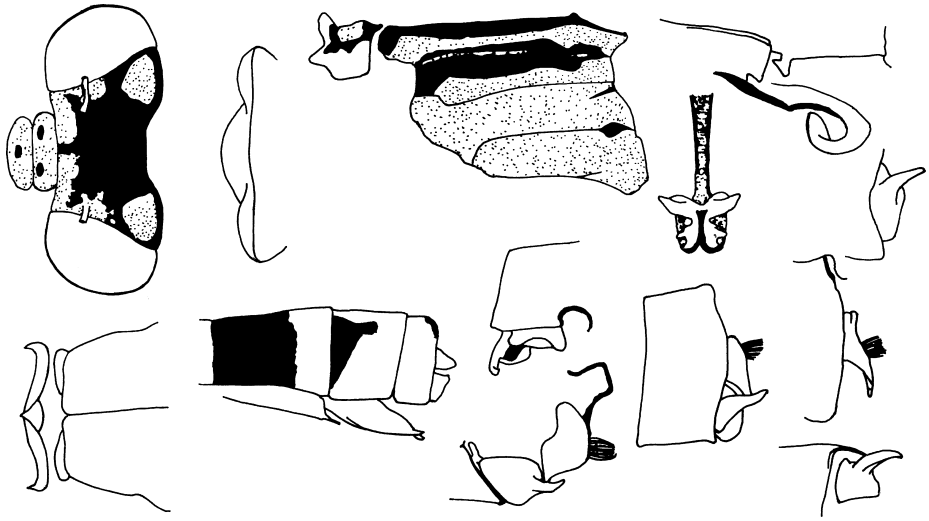


Fig. 3.1.341 *Acanthagrion taxaense* (above, left to right): head of a male in dorsal view, posterior lobe of the male prothorax in dorsal view, lateral view of the thorax, and penis in ventral and lateral view, and (below, left to right): prothorax of a female in dorsal view, apex of the female abdomen in lateral view, male anal appendages on one side in dorsal view (above) and anal appendages in ventrolateral view (below), apex of the male abdomen in lateral view, and (middle to lower right): inferior anal appendage in ventrolateral view, superior anal appendage in dorsal view, and inferior anal appendage in ventral view. Based on Santos (1965a), Leonard (1977), and Lencioni (2006).

7. There are no pale postocular spots on a dark occipital surface of the head (**Fig. 3.1.340**). Caution, specimens of some *Leptobasis* species have small spots or spots that fade with age. Also check this genus at Couplet 31. 8
- There are pale postocular spots on a dark occipital region of the head (**Fig. 3.1.341**). Caution, the spots may fade in some specimens, and in others they may be joined with other pale areas. 25

8. The posterior part of the head of the only South American species is mainly black, while the face of the male is bright yellow or orange-yellow. The thorax and abdomen are blue and black. There is a U-shaped black marking on the blue second abdominal segment, and there are narrow blue makings on the third through fifth or third through seventh abdominal segments. The eighth segment is blue with a black band; and the ninth is mainly or entirely blue. The tenth is black, and the apex of the superior anal appendage is blue (**Fig. 3.1.342**). Length of abdomen: 21.5 to 25 mm. Hind wing length: 13.5 to 16.5.
.....*Neoerythromma* Kennedy, 1920

Only one species in this genus is found in South America: *Neoerythromma cultellatum* (Selys, 1876) from North and Central America, the West Indies, and Venezuela.
- The face of the male is not uniformly bright yellow or orange yellow (**Fig. 3.1.343**). 9

9. Vein Cu_2 is short; there are no more than nine cells formed by the cross veins connecting it with the posterior margin of the wing. The arculus is located about halfway between the first and second antenodal cross veins or closer to the first. The posterior lobe of the prothorax has lateral projections. The tarsal claws do not each have a subapical tooth. The superior anal appendage of the male is short and wide, while the inferior appendages are much longer, narrow, and curved toward each other (**Fig. 3.1.344**). The female lacks a vulvar spine.
.....*Mesoleptobasis* Sjoestedt, 1918..p. 393
- There are at least ten cells formed between vein Cu_2 and the posterior margin of the wing, at least in the fore-wing and usually in both (**Fig. 3.1.335**). 10

Fig. 3.1.342 *Neoerythromma cultellatum* male: the head in oblique anterior view and the thorax and abdomen in lateral view. The pale area on the anterior surface of the head is a striking yellow or yellow orange color, while the pale markings on the thorax and abdomen are bright blue.

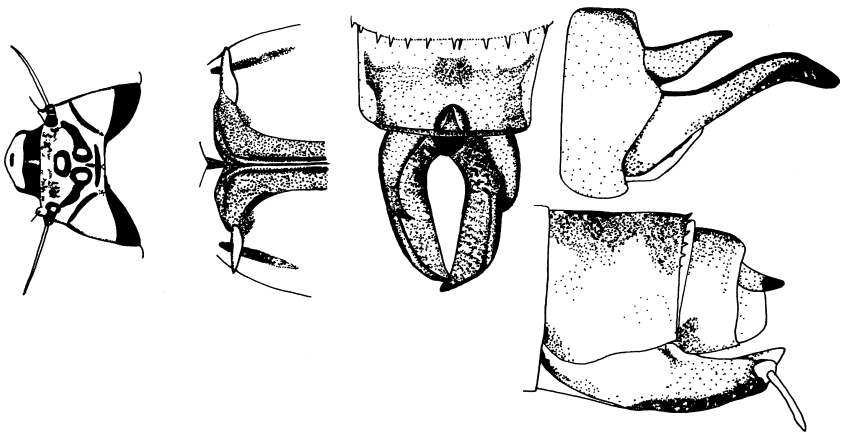


Fig. 3.1.343 *Metaleptobasis minteri* (left to right): head in dorsal view, mesothoracic horn in dorsal view, apex of the male abdomen in dorsal and lateral view (above), and apex of the female abdomen in lateral view (below). Based on Daigle (2004a).

10. There are conical or horn-like projections from the anterior part of the mesepisterna. The superior anal appendage of the male is shorter or barely equal in length to the inferior appendage, and the inferior appendage is always directed dorsad. The genital valves of the female do not reach far beyond the level of the apices of the abdominal appendages (**Fig. 3.1.343**).
.....*Metaleptobasis* Calvert, 1907..p. 395
- There are no prominent projections on the anterior part of the mesepisterna, and, if any projections are present on the synthorax, they are not prominent or horn-like, and the apices of the fore and hind wings are obviously dissimilar (**Fig. 3.1.345**). 11

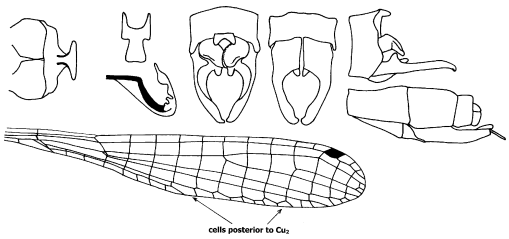


Fig. 3.1.344 *Mesoleptobasis centralli* (left to right): male prothorax in dorsal view, penis in posterior (above) and lateral view (below), apex of the male abdomen in dorsal and ventral view, and lateral views of the apices of a male (above) and female abdomen (below), and a wing (below left). Based on Santos (1961a) and Lencioni (2006).

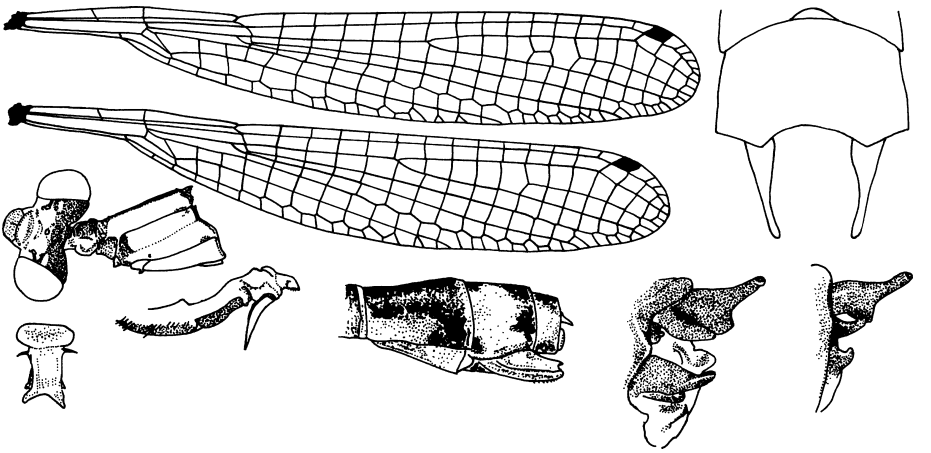


Fig. 3.1.345 *Bromeliagrion fernandezianum:* fore and hind wing (upper left); apex of the male abdomen in dorsal (upper right), dorsomedial (lower right center), and lateral view (lower right); head and thorax of a male (middle left), apical part of penis in ventral (lower left) and lateral view (lower left center); apex of the female abdomen in lateral view (lower center). Based on Rácenis (1958) and De Marmels and Garrison (2005).

11. The length of the abdomen is greater than 34 mm. The larvae develop in the water trapped in bromelias and also probably holes in trees. 12
- The length of the abdomen is less than 34 mm, or, if less than 1 mm longer, the head is brassy black, and the male abdomen is red or black without markings on the apical half, and the superior anal appendage has an articulated ventral process (**Fig. 3.1.346**). 13

12. The inferior anal appendage is well developed but shorter than the superior appendage, which is divided into two parallel branches, which are articulated. The frons is rounded. The pterostigma is slightly shorter than the cell just posterior to it. The penis appears to lack an internal fold (**Fig. 3.1.345**). The abdomen is usually longer than 45 mm.
.....*Bromeliagrion* De Marmels and Garrison, 2005..p. 408
- The inferior anal appendage is vestigial or absent, and the apex of the superior anal appendage is simple and undivided. The frons is not evenly rounded. The pterostigma is usually longer than the cell just posterior to it. The penis has a well-developed internal fold (**Fig. 3.1.347**).
.....*Leptagrion* Selys, 1876..p. 407

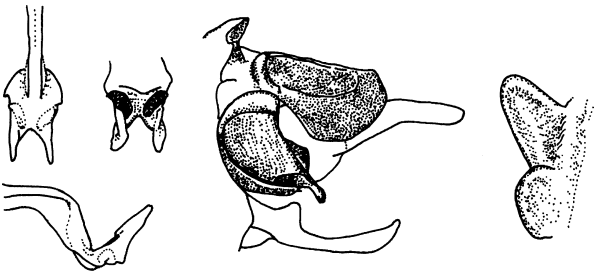


Fig. 3.1.346 *Anisagrion inornatum:* penis in dorsal (upper left) and lateral view (lower left), apex of a penis slightly enlarged in dorsal view (upper left center), anal appendages of a male in mediodorsal view (right center), and left mesostigmal plate on the thorax of a female in dorsolateral view (right). Based on De Marmels and Garrison (2005).

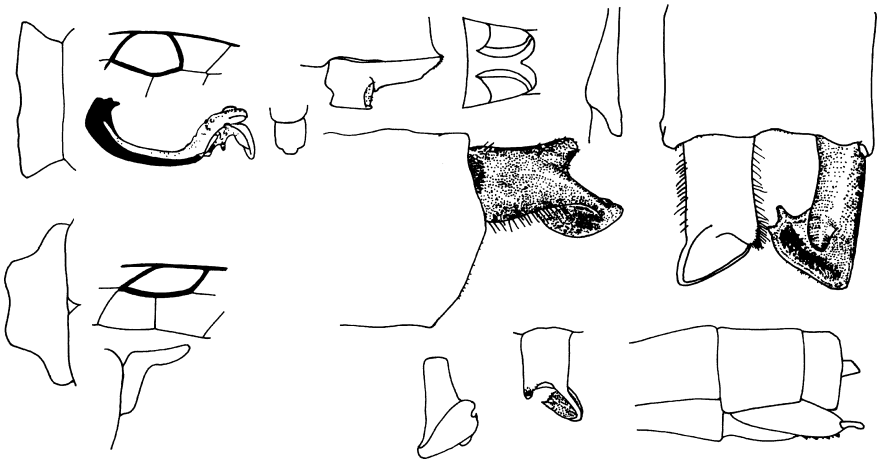


Fig. 3.1.347 *Leptagrion bocainense:* dorsal view of the posterior lobe of the male prothorax (upper left), posterior lobe of the female prothorax in dorsal and lateral view (lower left, left and lower right, respectively), pterostigma of the fore-wing of a male (upper left center) and a female (right and above female prothorax), penis in lateral and posterior view (between pterostigmas, left and right, respectively), anterior lamina on the second abdominal segment of a male in lateral view and the male genital valve in ventral view (upper center, left and right, respectively), venter of male thorax in lateral view (upper right center), apex of the male abdomen in dorsomedial (upper right) and lateral view (center), apex of the male superior anal appendage in ventral view (lower center), male anal appendages in dorsolateral view (lower right center), and apex of a female abdomen in lateral view (lower right). Based on Santos (1979) and Lencioni (2006).

13. The apices of the fore and hind wings of the male are dissimilar because the apices of veins R_1 and R_2 in the hind wing converge and almost meet near the apex. Small, conical projections are present on the mesepisterna, at least of the female of the only species in the genus found in South America. The color is reddish, bluish, or brownish. There is a small protuberance on the mesostigmal plate on the thorax of a female. The tenth abdominal segment of the male has a mid-dorsal projection and ends in two short, thick spines. The superior anal appendage is greatly expanded at its apex (**Fig. 3.1.246**).
.....*Anisagrion* Selys, 1876

Of the four species in this genus, only one is known from South America: *Anisagrion inornatum* (Selys, 1876), from Venezuela, sometimes referred to by its synonyms: *Leptagrion inornatum* Selys, 1876; *Leptagrion rufum* Selys, 1876; *Anisagrion meridionale* Rácinis, 1953. Better illustrations of the South American species would be helpful.

- The apices of the fore and hind wings appear similar and have a generally similar arrangement of the veins at the apex. The male superior anal appendage is undivided or forms two rounded branches at its apex (**Fig. 3.1.340**). 14

14. Each superior anal appendage of the male is divided into two apical or subapical branches visible in lateral view. The branches appear broadly rounded at their apices, mitten-shaped with an acutely pointed thumb on the ventral side, or sharply bent ventrad with a short wide posterior lobe and a longer ventral branch. The subnodus in the hind wing is contiguous with a cross vein that usually runs uninterrupted to the posterior margin, where the marginal cells bordering it are in the shape of narrow rectangles. The shape of the wings is spatulate, with the anterior and posterior margins nowhere parallel. The inferior anal appendage of the male is well developed (**Fig. 3.1.340**). 15

- The superior anal appendage of the male is simple and undivided at the apex (**Fig. 3.1.348**). 18

15. The superior anal appendage of the male is mitten-shaped with the thumb located on the ventral side and curving to point posteriad with its apex appearing acutely pointed in lateral view (**Fig. 3.1.349**). The tenth abdominal segment of the male has a wedge-shaped apical emargination but is not elevated. The female bears a vulvar spine. The head, thorax, and anterior abdominal segments appear densely hairy. The first six abdominal segments of the male and some females are coral red with narrow black markings on the articulations and usually some black stripes; the seventh through tenth are blue with black lateral stripes on some of the segments. Some females have more extensive black markings. The length of the abdomen of the only known species is 18 to 20.5 mm, and the hind wing length is about 14.5 to 17 mm.
.....*Protallagma* Kennedy, 1920

The only South American species left in this genus after recent revisions is *Protallagma titicacae* (Calvert, 1909) from Argentina, Chile, Bolivia, and Peru. It is also known by the synonyms *Amphiagrion titicacae* Calvert, 1909, and *Amphiagrion andinum* Förster, 1909.

- The superior anal appendage of the male forms two broadly rounded branches at the apex (**Fig. 3.1.340**). 16

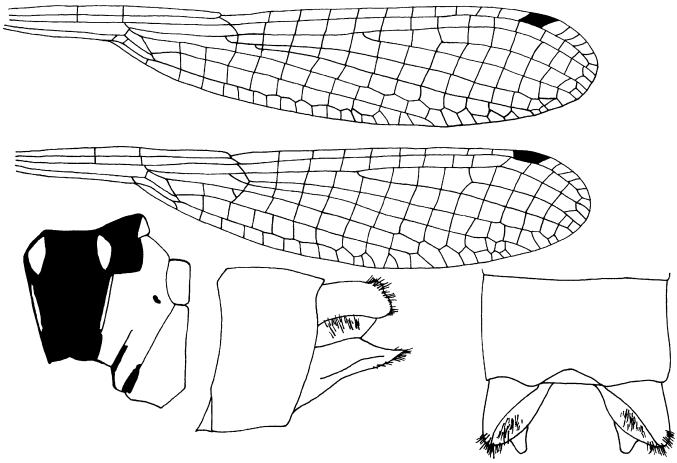


Fig. 3.1.348 *Antiagrion antigone* male: fore and hind wing (above), and (below, left to right): diagram of the color pattern on the synthorax and the apex of the abdomen in lateral and dorsal view. Based on Ris (1928a).

16. The ventral process on the superior anal appendage of the male is in the form of an articulated spur at the base. The apex of the apical segment of the penis is cleft, and at the base of each of the apical lobes, there is one spiny, auricle-like process (**Fig. 3.1.340**). The head is brassy black, and the abdomen is either red or black with no markings on its apical half. The abdomen of one species exceeds 34 mm and reaches a maximum of 35 mm.
.....*Tepuibasis* De Marmels, 2007..p. 419
- The ventral process of the superior anal appendage is not in the form of a basal spur that articulates with the rest of the process. There are no spiny, auricle-like processes at the bases of the apical lobes of the penis, or there are two such processes on each side of the apical segment, one at the base of each lobe and the other more proximal (**Fig. 3.1.350**). 17
17. The inferior anal appendage is bulbous with a short, narrow dorsal process. The ovipositor of the female has a vulvar spine on the eighth abdominal segment. The coloration is mainly red and black, but there may also be blue markings; at least the first three abdominal segments are mainly red. Vein A_1 in the fore-wing originates a distance proximal to the base of Cu_2 almost equal to the length of that cross vein, but in the hind wing, vein A_1 originates somewhat closer to the cross vein (**Fig. 3.1.351**). The fore-wing of all species usually ranges from 14 to 18 mm long.
.....*Andinagrion* Bulla, 1973..p. 425

- The inferior anal appendage usually tapers to a narrow posterior part and lacks a short, narrow dorsal process. The female lacks a vulvar spine at the base of the ovipositor (**Fig. 3.1.350**). The tooth on the tarsal claw is prominent but smaller than the apical point of the claw.
.....*Aeolagrion* Williamson, 1917..p. 427

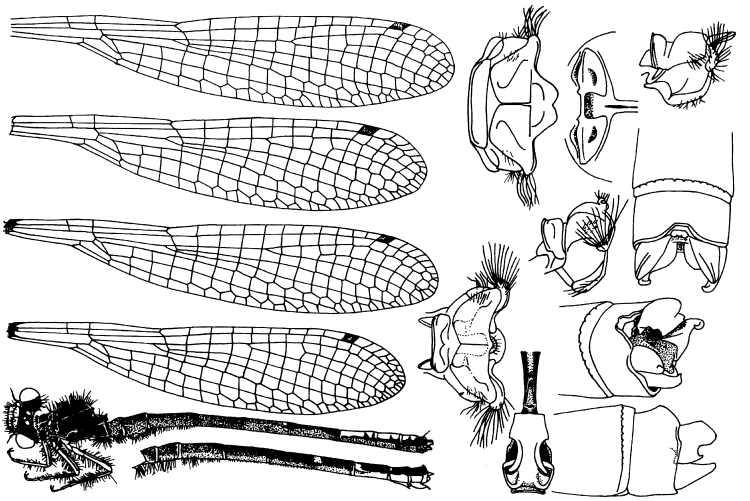


Fig. 3.1.349 *Protallagma titicacae:* fore and hind wings of a male (upper left) and female (lower left); red, blue, and yellowish coloration on the dorsal surface of the head and lateral surfaces of the thorax and abdomen of a male (lower left), lateral view of the abdomen of a female (lower left center); male prothorax in dorsal (above, right of center) and lateral view (upper right); male mesostigmal lamina, which is similar to the female's (upper right center); female prothorax in dorsal (below. right of center) and lateral view (right center); penis in ventral view (lower right center); apex of the male abdomen in dorsal (upper middle right), dorsolateral (lower middle right), and lateral view (lower right). Based on Kennedy (1939a).

18. The tibial spines are long and well-spaced, but some are considerably longer than the spaces between them, and the anterior side of the quadrangle is at least twice as long as the proximal side and usually longer. The male inferior anal appendages are longer than the superior appendages, and their apices are acute, at least in lateral view (**Fig. 3.1.348**). The apices of the fore and hind wing of the male are similar. There are two antenodal cross veins, which are parallel to each other and perpendicular to the long axis of the wing. Chilean species.
.....*Antiagrion* Ris, 1904..p. 430

- The tibial spines are shorter or not much longer than the spaces between them (**Fig. 3.1.352**), or, if they are longer, then the anterior side of the quadrangle is much less than twice as long as the proximal side. 19

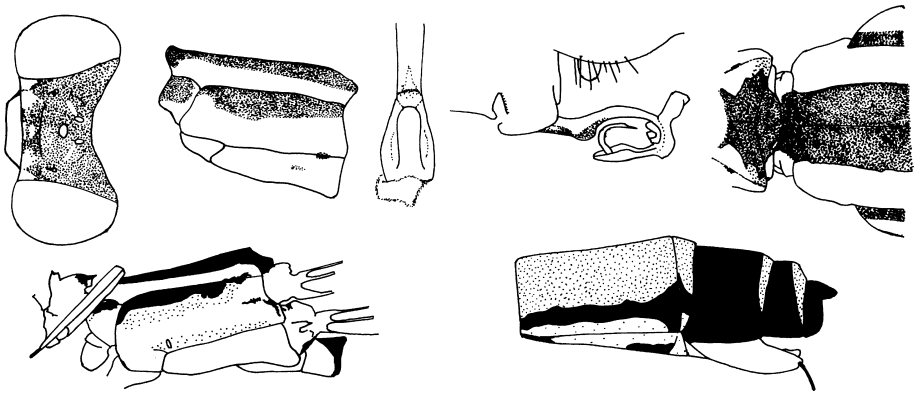


Fig. 3.1.350 *Aeolagrion inca* (above, left to right): head of a male in dorsal view, synthorax of a male in lateral view, penis in ventral and lateral view, and posterior part of the prothorax and anterior part of the synthorax of a female in dorsal view, on which the darkened areas are black, the pale areas are blue, and the thinly dotted areas are brown, and (below, left and right): the thorax and fore-leg of a female in lateral view, on which the black areas are black, the unmarked areas, blue, and the dotted areas, light brown; the apical segments of a female abdomen in lateral view, on which the black area is black; the white area is nearly white, the thinly dotted area, yellow; and the more densely dotted areas, blue. Based on Lencioni (2006).

19. The tibial spines are usually about twice as long as the spaces between them. The inner end of the quadrangle in the front wing is about as long as its anterior side and longer than the anterior part of the arculus. The antenodal cross veins are almost parallel. The discoidal cell is somewhat elongated and oriented nearly parallel to the posterior margin of the wing (**Fig. 3.1.353**). The male and female abdomens are about 26 to 28 mm long, and the hind wings of both are 15 to 16.5 mm long. The coloration of the male and female is similar: mainly yellow and black with metallic black, dark reddish, and a few bluish markings.
..... *Hylaeonympha* Rácenis, 1968

The only South American species in this genus is *Hylaeonympha magoi* Rácenis, 1968, from Venezuela.

- The tibial spines are shorter or scarcely longer than the spaces between them, or, if they are longer, then the wing is petiolate to or beyond Ac. The inner end of the quadrangle is usually no longer than its anterior side or the anterior side of the arculus (**Fig. 3.1.354**). 20

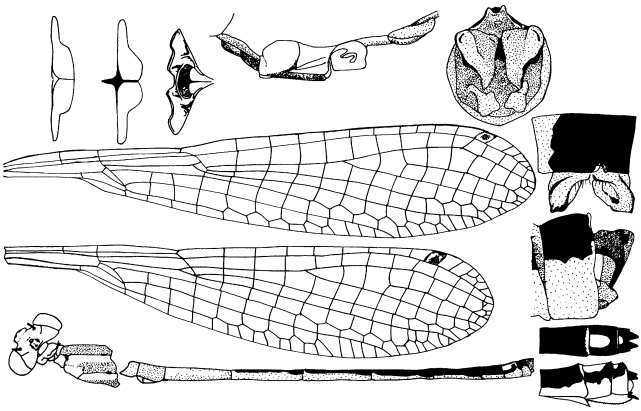


Fig. 3.1.351 *Andinagrion peterseni* (above, left to right): dorsal views of the posterior lobe of the prothorax of two individuals and the mesostigmal lamina, penis in lateral view, apex of the male abdomen in posterior view, and fore and hind wing of a male (center), head in dorsal view and thorax and abdomen of a male in lateral view (lower left), apex of the male abdomen in oblique dorsal (upper middle right) and lateral view (lower middle right), and apex of a female abdomen in dorsal and lateral view (lower right, above and below, respectively). Based on Bulla (1975) and von Ellenrieder and Muzón (2006)..

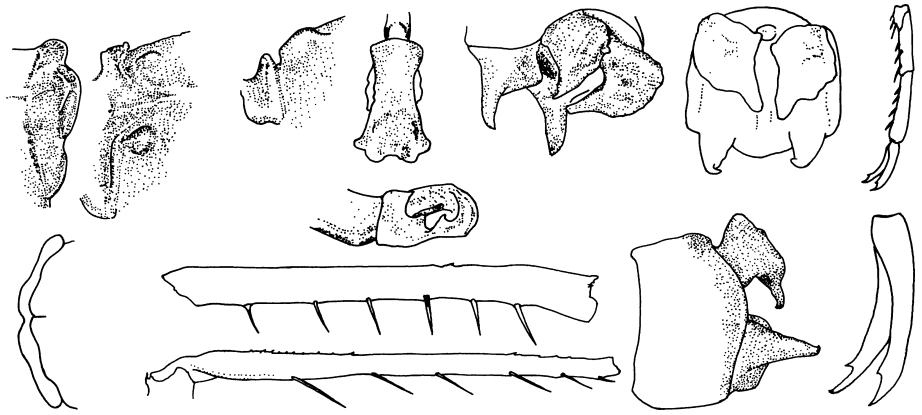


Fig. 3.1.352 *Leptobasis mammilaris* (above, left to right): posterior lobe of the prothorax and anterior part of the synthorax of a male in dorsomedial and lateral view, penis in ventral (above) and lateral view (below), apex of the male abdomen in dorsomedial and posterior view, and the hind tarsus of a male, and (below, left to right): posterior lobe of the prothorax and anterior part of the synthorax of a female in dorsal view, hind femur (above) and hind tibia of a male (below), apex of the male abdomen in lateral view, and tarsal claws of a male. Based on Calvert (1909) and Lencioni (2006).

20. In lateral view, three lobes of the inferior anal appendage are visible. In lateral view, the superior anal appendage is roughly in the shape of a parallelogram with a slightly excised apex and a small ventral fold. They are much longer than the inferior appendages (**Fig. 3.1.354**). Only the male has been described.
.....*Skiallagma* Förster, 1906

Only one species has been described in this genus, *Skiallagma baueri* Foerster, 1906, from São Paulo. The other South American species formerly assigned to this genus has been transferred to *Helveciagrion* by Machado (1980).

- The apex of the inferior anal appendage of the male is not divided into three lobes, and the superior anal appendage does not appear to have the outline of a parallelogram in lateral view (**Fig. 3.1.355**). 21

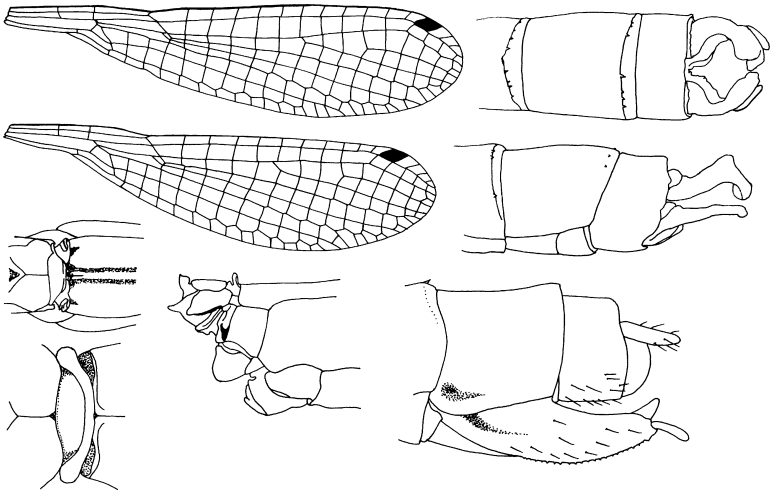


Fig. 3.1.353 *Hylaeonympha magoi:* fore and hind wing of a male (upper left), dorsal view of the prothorax of a male (middle left) and a female (lower left), prothorax of a male in lateral view (lower center), apex of the male abdomen in dorsal (upper right) and lateral view (middle right), and the apex of a female abdomen in lateral view (lower right). Based on Rácenis (1968a).

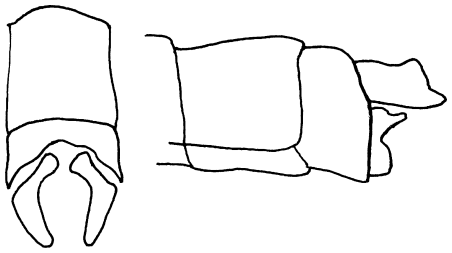


Fig. 3.1.354 *Skiallagma baueri* male: the apex of the abdomen in dorsal (left) and lateral view (right). Based on Machado (1980).

21. The superior anal appendage of the male bears a basal apophysis, a finger-like process extending ventrad from the base (**Fig. 3.1.356**). The spine-like inferior anal appendage of the male is unbranched, usually longer than its width, and much shorter than the superior appendage. The female lacks a vulvar spine. The abdomen is longer than 25 mm. The apices of the fore and hind wings of the male are similar. The color is greenish or yellowish, often with black markings but sometimes with red on the abdomen, which is very long and slender. The tenth abdominal segment of the male is not produced and forked along the posterior margin at the dorsal midline. The base of vein IR_2 in the hind wing is located one to three cells proximal to the pterostigma. The wing is not petiolate as far as the level of Ac.

.....*Telagrion* Selys, 1876..p. 432

- The superior anal appendage of the male lacks a basal apophysis (**Fig. 3.1.355**). The coloration of most species includes much reddish or orange. 22

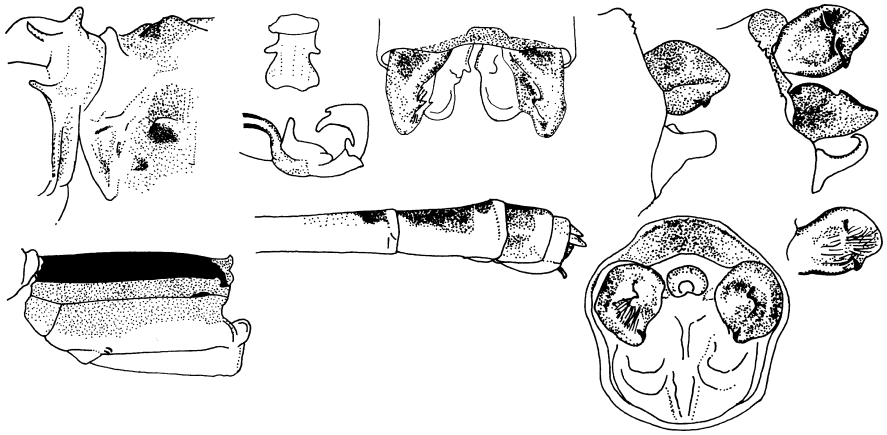


Fig. 3.1.355 *Telebasis milleri* male (above, left to right): posterior lobe of the prothorax and the mesostigmal plate; apex of the penis in dorsal (above) and lateral view (below); apex of the abdomen in dorsal, lateral, and oblique dorsal view with the setae on the superior anal appendage removed; and (below, left to right): the synthorax in lateral view; seventh through tenth abdominal segments in lateral view; apex of the abdomen in posterior view; superior anal appendage in oblique dorsal view with the setae still in place. Based on Garrison (1997).

22. The color pattern is orange with a pattern of black spots. The superior anal appendages of the male are shorter than the tenth abdominal segment but longer than the inferior appendages. The arculus is very near or at the second antenodal cross vein. Vein M_2 on the hind wing arises near the fourth postnodal vein. The costal edge of the pterostigma in the hind wing is shorter than its proximal or distal edges. Cu_1 and Cu_2 do not reach as far distad as the origins of IR_2 and R_3. Vein A leaves the hind wing margin at a level nearest the first and not the

second antenodal cross vein. The venation at the apices of the fore and hind wings is similar. The dorsal part of the tenth tergite of the male is not elevated at the posterior margin (**Fig. 3.1.357**). The female has a vulvar spine. This genus has not been satisfactorily defined.

.....*Tigriagrion* Calvert, 1909

The only species described in this genus is *Tigriagrion aurantinigrum* Calvert, 1909, from Argentina, Paraguay, Bolivia, Mato Grosso, Minas Gerais, and São Paulo.

- The color pattern usually includes red but no orange markings, but if orange is present, it does not constitute part of a black and orange color pattern (**Fig. 3.1.354**). 23

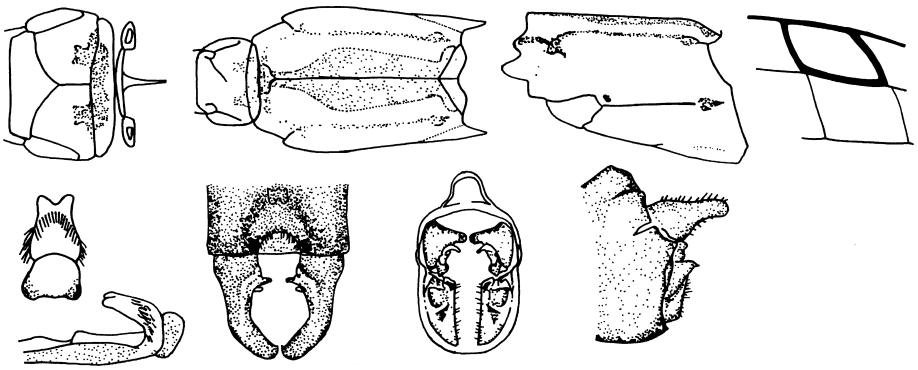


Fig. 3.1.356 *Telagrion mourei* (above, left to right): prothorax and synthorax in dorsal view, synthorax in lateral view, pterostigma in the hind wing, and (below, left to right): penis in ventral (above) and lateral view (below) and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Santos (1970d) and Lencioni (2004).

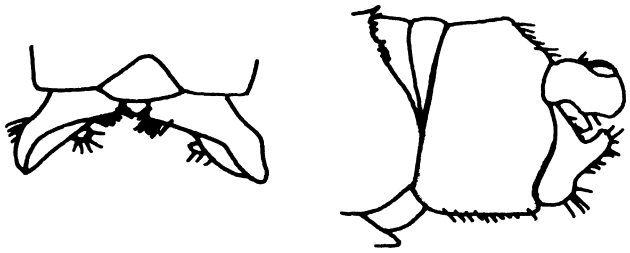


Fig. 3.1.357 The apex of the abdomen of *Tigriagrion aurantinigrum* in dorsal (left) and lateral view (right). Based on Calvert (1909).

23. There is at least one tooth along the inner margin of the superior anal appendage. There is a well-defined stripe along the dorsal carina (**Fig. 3.1.355**). The frons has a transverse carina, making it appear angulate in lateral view. The ovipositor has a vulvar spine.
.....*Telebasis* Selys, 1865..p. 437
- The superior anal appendage of the male lacks teeth along the inner margin. The male is mainly red but usually has black and blue markings. Vein A_1 in the fore-wing originates at the base of Cu_2 or a very short distance proximal to it (**Fig. 3.1.358**). 24

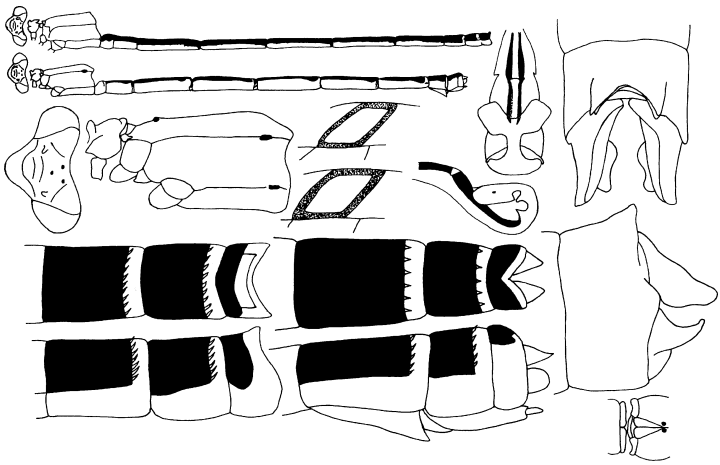


Fig. 3.1.358 *Oxyagrion sulinum:* head in dorsal view and body in lateral view (upper left) of a male (above) and female (below); head in dorsal view and thorax in lateral view (upper middle left) of a female, penis in ventral and lateral view (upper right center, above and below); pterostigma of a male fore and hind wing (center, above and below); color pattern on the eighth through tenth abdominal segments of the male (lower left) and female (lower center) in dorsal and lateral view (above and below, respectively), without appendages on the male; apex of the male abdomen with appendages in dorsal (upper right) and lateral view (middle right); dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (lower right). Based on Costa (1978).

24. The inferior anal appendage is not mitten-shaped with the thumb pointed dorsad (**Fig. 3.1.358**). The superior anal appendage of the male usually slants ventrad, but in one case, it points dorsad. There is not distinct stripe along the dorsal carina, but there may be some vague darkening. The female bears a vulvar spine, and females of most species have mesepisternal fossae.
.....*Oxyagrion* Selys, 1876..p. 460
- The inferior anal appendage of the male is mitten-shaped with the thumb directed dorsad, and the superior appendage extends straight posteriad. The

subnodus in the hind wing is contiguous with a set of cross veins that runs uninterrupted to the posterior margin, where the marginal cells bordering it are in the shape of narrow rectangles. The wing is spatulate. Vein R_3 branches off R_2 near the sixth postnodal cross vein in the fore-wing and between the fourth or fifth in the hind wing. Any subapical tooth on the tarsal claw is minute or completely absent. The body has a hairy appearance, with long setae on the anterior part of the head, the posterolateral corners of the prothorax, the dorsal surface of the synthorax, a protuberance on the metasternite just anterior to the first abdominal segment, and the anterior surface of the abdomen (**Fig. 3.1.359**). The anterior part of the abdomen is mainly red dorsally and yellow ventrally, while the four posterior segments of the male and five posterior segments of the female are mainly blue. The length of the abdomen of the only known species is about 23 to 24 mm, and the hind wing length is about 18 to 18.5 mm.

.....*Oxyallagma* Kennedy, 1920

The only South American species in this genus is *Oxyallagma dissidens* (Selys, 1876) from Ecuador and Peru. It is also known by the synonyms *Oxyagrion dissidens* Selys, 1876, and *Protallagma runtuni* Kennedy, 1939.

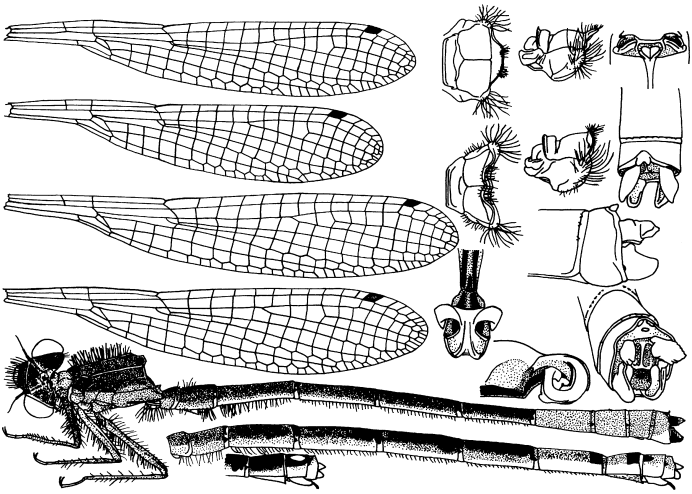


Fig. 3.1.359 *Oxyallagma dissidens:* fore and hind wing of a male (upper left) and female (middle left), habitus without the wings of a male in lateral view (lower left to lower middle right), abdomen of a female in lateral view (lower left center to lower right), and the apical segments of a female specimen with a different color pattern in lateral view (lower center), prothorax of a male in dorsal and lateral view (upper right center, left and right, respectively) and of a female (below corresponding male structures), male mesostigmal lamina (upper right), penis in ventral and lateral view (right of female wings, left and right, respectively), and apex of the male abdomen in dorsal (upper middle right), lateral (middle right) and oblique posterior view (lower middle right). Based on Kennedy (1939a), who referred to the species as *Protallagma runtuni*.

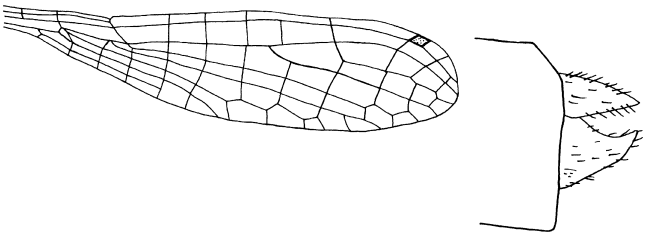


Fig. 3.1.360 *Calvertagrion minutissimum* male: fore-wing (left) and apex of the abdomen in lateral view (right). Based on St. Quentin (1960).

25. In the postquadrangular space, between the distal margin of the quadrangle and the set of cross veins appearing to run from the subnodus to the posterior margin of the wing, there are only two cells. All wings are hyaline. The posterior lobe of the male prothorax forms two elevated mid-dorsal lobes pointed dorsad. The superior and inferior anal appendages are wedge-shaped and approximately equal in length (**Fig. 3.1.360**).
.....*Calvertagrion* St, Quentin, 1960
The only species in this genus is *Calvertagrion minutissimum* (Selys, 1876) from Peru, Pará, and Amazonas, also known under its synonyms, *Agrion? minutissimum* Selys, 1876, and *Calvertagrion dicellulare* St, Quentin, 1960.
- In at least one of the wings, there are at least three cells between the distal margin of the quadrangle and the set of cross veins appearing to run from the subnodus to the posterior margin of the wing (**Fig. 3.1.361**). 26
26. The superior anal appendage of the male is bifurcated near the base to form a horizontal branch and a vertical, ventral branch, which curves to point posteriad (**Fig. 3.1.361**). 27
- The superior anal appendage of the male is not bifurcated near the base, or if it is, the ventral branch extends posteriad or posteroventrad from the fork (**Fig. 3.1.362**). 28
27. The tenth abdominal segment of the male may not be elevated dorsally, and it has a pair of apical tubercles rather than a simple emargination (**Fig. 3.1.361**). The body is not covered with long, hair-like setae. The coloration is mainly black and violet or blue, while the female is usually duller, often with dark ochraceous and shades of bluish gray.
.....*Enallagma* Charpentier, 1840..p. 490
- The body color is largely reddish. The tenth abdominal segment of the male is elevated dorsally and has a wedge-shaped apical emargination without tubercles (**Fig. 3.1.363**). The pterostigma is about half the length of a costal cell. The body is covered with long, hair-like setae.
.....*Mesamphiagrion* Kennedy, 1920
The only species in this genus is *Mesamphiagrion occultum* (Ris, 1918), from Colombia, also referred to by the synonym, *Enallagma occultum* Ris, 1918.

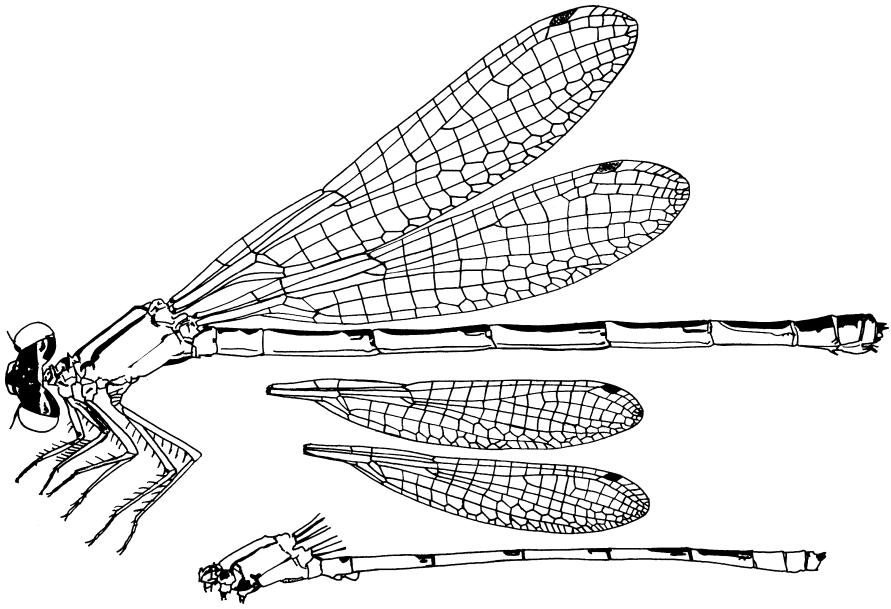


Fig. 3.1.361 *Enallagma civile:* a female showing only one set of wings (above), the fore and hind wing of a male (middle), and the color pattern on the thorax and abdomen of a male in lateral view. The pale areas on the female are mainly dark ochraceous dorsally and bluish gray laterally, and the dark areas are black, usually with a bronze iridescence. All pale areas shown on the male are brilliant blue or violet.

28. The superior anal appendage of the male is directed obliquely ventrad from the base, although in some species, it curves dorsad again toward the apex. The antehumeral stripes are always blue and not interrupted for their entire length (**Fig. 3.1.341**). The color of most species is typically blue and black, although orange and green specimens of some species are encountered.
.....*Acanthagrion* Selys, 1876..p. 491
- The superior anal appendages of the male are directed generally posteriad from the base, or, if in doubt, the humeral stripes are not blue or interrupted (**Fig. 3.1.364**). 29
29. The pale postocular spots are broadly confluent with the pale coloration on the posterior part of the head. 30
- The pale postocular spots are not broadly confluent with the pale coloration on the posterior part of the head. 32

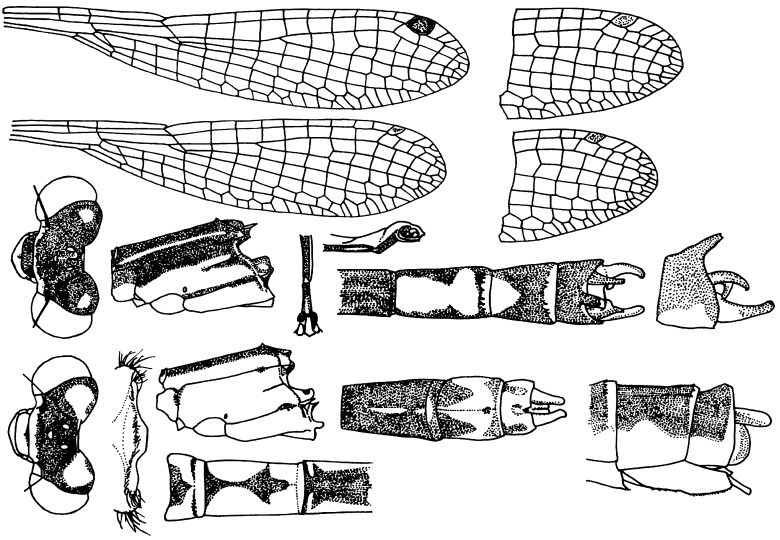


Fig. 3.1.362 *Ischnura cruzi:* fore and hind wing of a male (upper left) and apices of the wings of a female (upper right), head of a male (middle left) and a female (lower left) in dorsal view, posterior lobe of the female prothorax in dorsal view (right of female head), male (right of male head) and female synthorax (below male synthorax) in lateral view, penis in ventral and lateral view (right of male synthorax, left and right, respectively), the two anterior segments of the female abdomen and part of the third in dorsal view (lower left center), apex of the male abdomen in dorsal and lateral view (middle right, left and right, respectively), apex of the female abdomen in dorsal (lower right center) and lateral view (lower right). Based on De Marmels (1987b).

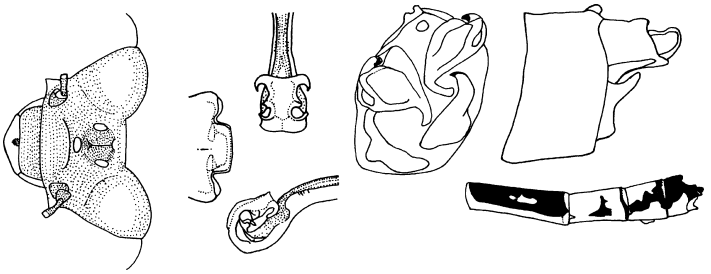


Fig. 3.1.363 *Mesamphiagrion occultum* male (left to right): pattern on the dorsal surface of the head between the compound eyes, posterior margin of the prothorax in dorsal view, penis in ventral (above) and lateral view (below), apex of the abdomen somewhat distorted in posterior view and in lateral view (above) and the pattern on the apical segments of the abdomen (below). Based on De Marmels (1989a), who referred to the species by its synonym, *Enallagma occultum*.

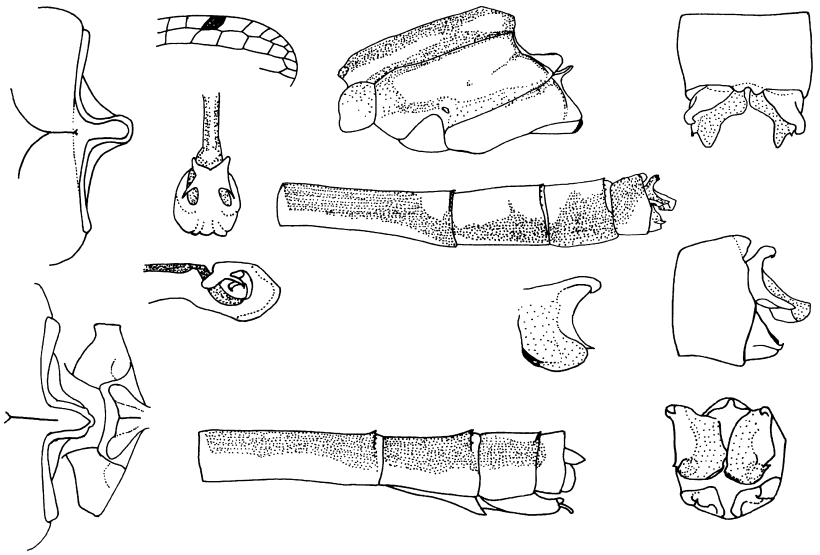


Fig. 3.1.364 *Cyanallagma demarmelsi:* hind lobe of the male (upper left) and female pronotum (lower left); area of the pterostigma of a male fore-wing (upper left center); markings on the lateral surfaces of the synthorax of a male (upper right center) and the seventh through ninth abdominal segments of a male (below synthorax) and a female (lower center); penis in ventral and lateral view (below pterostigma, above and below, respectively); apex of the male abdomen in dorsal, lateral, and posterior view (right, above to below); and an interior view of the male superior anal appendage (right center). Based on De Marmels (1997a).

30. The tarsal claws lack teeth. The superior appendages of the male are bent ventrad nearly perpendicularly in the apical half. The genital valves of the female do not extend far posterior to the apices of the anal appendages (**Fig. 3.1.365**). Vein R_3 arises at the level of the sixth postnodal vein in the fore-wing and at the fifth in the hind wing. Length of the abdomen of the only known species: 34 to 38 mm. Hind wing length: 20 to 22 mm. The head and thorax of the only known South American species are mainly brownish with yellow markings. The first through sixth abdominal segments of the male are white with tiny black dorsal specks, as are the second through sixth of the female. The rest of the abdomen is golden yellow.

.....*Leucobasis* Rácenis, 1959

The only species in this genus is *Leucobasis candicans* Rácenis, 1959, from Venezuela.

- The tarsal claws are toothed. M_2 arises nearest the fourth postnodal of the hind wing and the fifth of the fore-wing. The genital valves of the female reach far beyond the level of the tips of the anal appendages (**Fig. 3.1.366**). 31

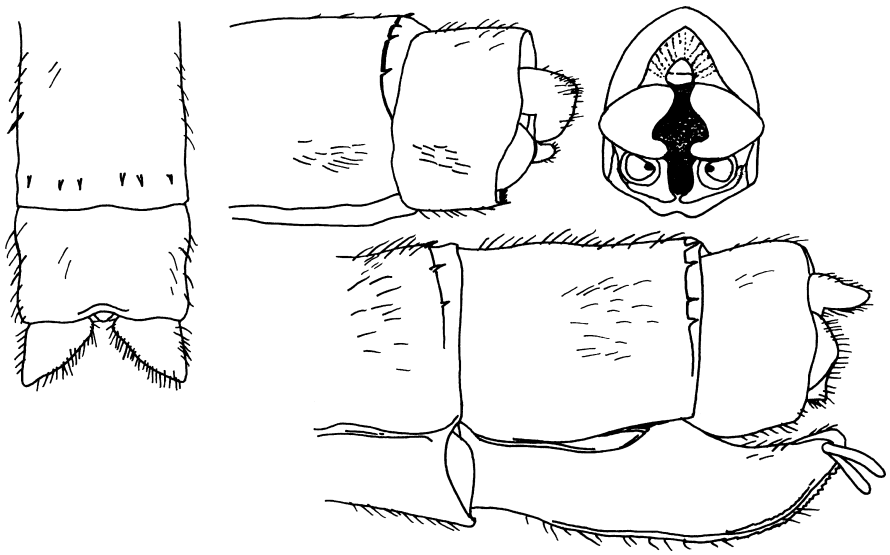


Fig. 3.1.365 *Leucobasis candicans* (above, left to right): apex of the male abdomen in dorsal, lateral, and posterior view, and (below) apex of the female abdomen in lateral view. Based on Rácenis (1959b).

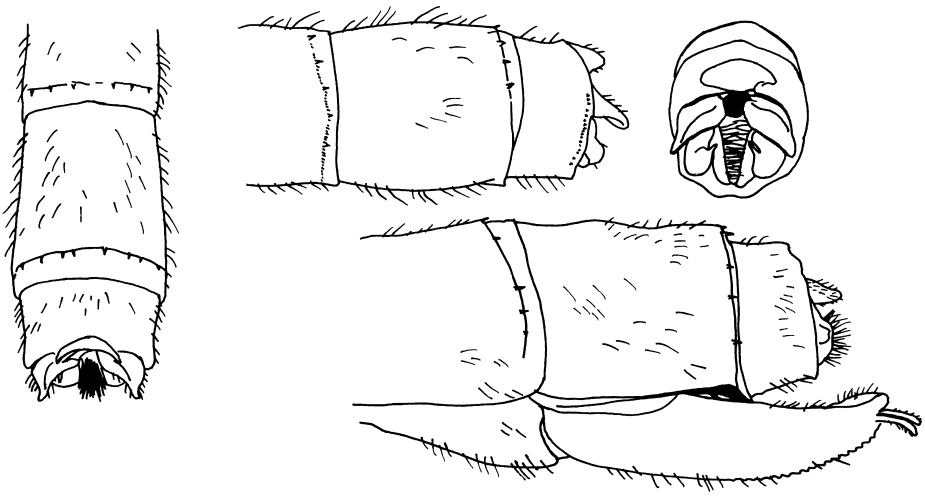


Fig. 3.1.366 *Chrysobasis buchholtzi* (above, left to right): apex of the male abdomen in dorsal, lateral, and posterior view, and (below) apex of the female abdomen in lateral view. Based on Rácenis (1959b).

31. The apex of the tenth abdominal segment of the male lacks a two-branched mid-dorsal process. Vein A_1 reaches the base of vein R_3. The superior anal appendages of the male are bent ventrad nearly perpendicularly in the apical half (**Fig. 3.1.352**).
.....*Leptobasis* Selys, 1877..p. 527
- The apex of the tenth abdominal segment of the male bears a two-branched mid-dorsal process. There are no ventral branches on the anal appendages (**Fig. 3.1.366**). Vein A_1 is short and does not reach the base of vein R_3. The head of the only male of this species that has been described is yellow and black with blue postocular spots. The predominant color of the female is yellow or yellowish brown, usually with brown or black markings. The ovipositor extends well posterior to the apices of the female anal appendages. There is no spine extending beneath the ovipositor from the eighth abdominal segment. The wings are considerably shorter than the abdomen.
.....*Chrysobasis* Rácenis, 1959..p. 532
The only South American species definitely in this genus is *Chrysobasis buchholtzi* Rácenis, 1959, from Colombia and Venezuela. See the key for a tentative placement of a second species (von Ellenrieder and Garrison, 2007a).
32. The antehumeral stripes of the males are blue and always interrupted, with the shorter segment on the posterior part of the synthorax. The superior anal appendage of the male has a prominent apical tooth (**Fig. 3.1.364**).
.....*Cyanallagma* Kennedy, 1920..p. 533
- The antehumeral stripes of the male are not blue, or, if they are, they are not interrupted (**Fig. 3.1.335**). 32
32. The inferior anal appendages are approximately as long or longer than the superior appendages, which are never forked or bent ventrad as much as 90º and are shorter than the tenth abdominal segment (**Fig. 3.1.362**). At the apex of the tenth abdominal segment, there is an elevated mid-dorsal process. In many species, the shape and color of the pterostigma in the fore-wing differs from that in the hind wing. The postocular spots are characteristically small and round. Intraspecific color varieties are commonly encountered among the females.
.....*Ischnura* Charpentier, 1840..p. 548
This genus encompasses the nominal genera, *Anomalagrion* Selys, 1857, and *Ceratura* Kennedy, 1917, which are no longer recognized as valid.
- The superior anal appendages are always longer than the inferior appendages and longer than the tenth abdominal segment. There is never an elevated mid-dorsal process at the apex of the tenth abdominal segment. The superior anal appendage is either forked at the apex, or it is bent ventrad more than 90º. The costa usually has a slight indentation at the pterostigma, which has rounded proximal and distal margins. The pterostigma of the male fore-wing touches the costa. There is a pair of erect spines on the penultimate segment of the penis and large patches of spines on the lateral surface of the second segment (**Fig. 3.1.335**). The color is black with light blue or yellow markings. Pruinescence may conceal the postocular spots of females.
.....*Homeoura* Kennedy, 1920..p. 555

Key to the genera of known Coenagrionidae larvae in South America

Information for the key was provided by Geijskes (1941, 1943), Bulla (1970, 1972a), Minter and Westfall (1984), Novelo-Gutiérrez (2005), von Ellenrieder and Muzón (2006), von Ellenrieder (2007), and De Marmels (2007a). Information is fragmentary because the larvae of many species have not yet been described. Revisions of the keys will be necessary after the intrageneric variability is better known.

1. The prementum lacks long dorsal setae. There are two pointed hooks on the distal part of each palpal lobe. Palpal setae are absent or they number one to five, most frequently three or fewer. In dorsal view, the caudal gills of some species appear thick or triangular in cross section. (**Fig. 3.1.367**).
.....*Argia* Rambur, 1842..p. 342

- The prementum bears long dorsal setae; if more than one is present on each side, they are arranged in a pair of rows. One pointed hook and a truncate, denticulate lobe are present on the distal part of each palpal lobe. Palpal setae number three to seven. The body is usually rather long and slender (**Fig. 3.1.368**). 2

2. The dorsal margins of the caudal gill lamellae are highly arched, so that the length of each lamella is 2.1 to 2.6 times its height. The corners of the head are evenly rounded (**Fig. 3.1.369**). 3

- At least one of the caudal gill lamellae is at least about three times as long as its greatest width. In case of doubt, only the apical half of each gill lamella is broadened (**Fig. 3.1.368**). 4

3. The larva is light or medium brown without markings. The labium is short and flat, with two or rarely three premental setae on each side. Each labial palp bears three or four long setae in a row proximal to the moveable hook. The wing buds of the final instar reach to between the middle of the fourth and middle of the fifth abdominal segment. The gill lamellae in lateral view appear asymmetrical, with one margin convex and the other nearly straight (**Fig. 3.1.369**). Total length of final instar: 8.5 to 13.5 mm.
.....*Protallagma* Kennedy, 1920

The only South American species left in this genus after recent revisions is *Protallagma titicacae* (Calvert, 1909) from Argentina, Chile, Bolivia, and Peru. It is also known by the synonyms *Amphiagrion titicacae* Calvert, 1909, and *Amphiagrion andinum* Förster, 1909.

- The abdomen has a distinct pattern of light and dark. The shape of the gill lamellae in lateral view is almost symmetrical (**Fig. 3.1.371**).
.....*Cyanallagma* Kennedy, 1920 pars..p. 533

4. The lateral caudal gills are only about three times as long as wide, and the average angle formed by their apical sixth is at least 70º, disregarding their terminal extensions. There are from one to three long dorsal setae on each side of the median line of the prementum (**Fig. 3.1.370**). 5

- The lateral caudal gills are at least four times longer than wide, and their terminal angle in the apical sixth is no more than 60º (**Fig. 3.1.372**). 6

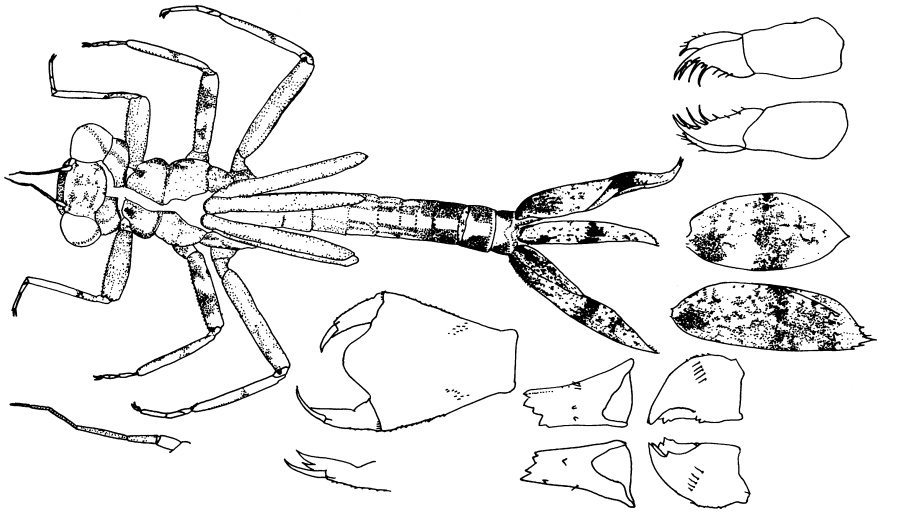


Fig. 3.1.367 *Argia joergenseni* larva: habitus from an exuvia (upper left), antenna (lower left), labium in dorsal view (center), labial palp (lower center), mandibles in inner (lower right center) and lateral view (lower right), maxillae in lateral view (upper right), and the middle and one lateral gill lamella (middle right, above and below, respectively). Based on von Ellenrieder (2007).

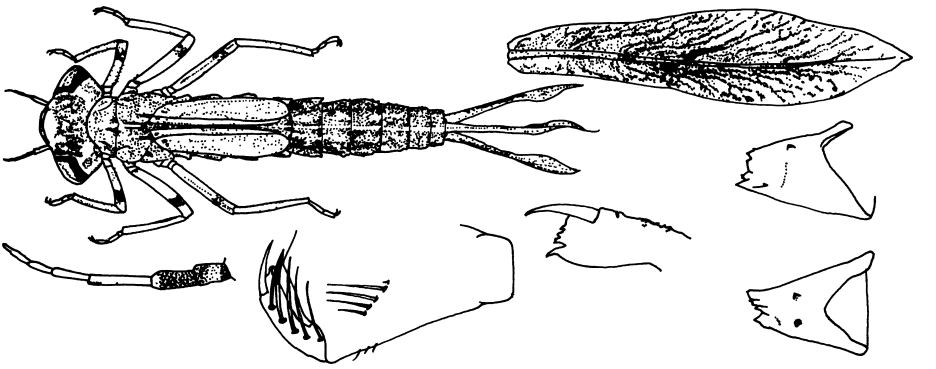


Fig. 3.1.368 *Leptobasis vacillans* larva: habitus (upper left), antenna (lower left), labium with one palp removed (lower left center), a labial palp (lower right center), mandibles (lower right), and a lateral gill lamella (upper right). Based on Geijskes (1941).

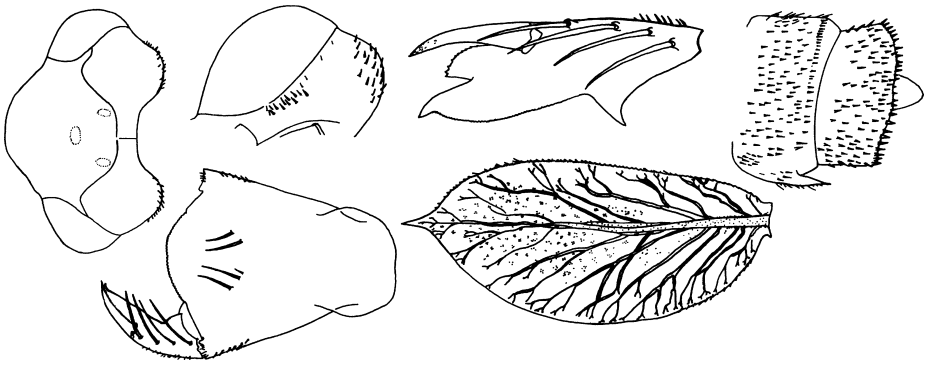


Fig. 3.1.369 *Protallagma titicacae* larva: head in dorsal view (left) and one side of the head in ventral view (upper left center), labium in dorsal view (lower left center), inner surface labial palp (upper right center), ninth and tenth abdominal segments of a male larva in lateral view (right), and a gill lamella in lateral view (lower right center). Based on Bulla (1972a).

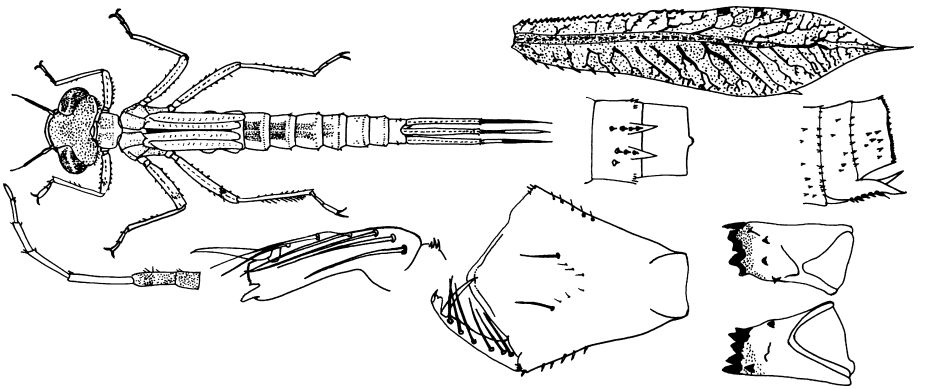


Fig. 3.1.370 *Telebasis simulata* larva: habitus (upper left), antenna (lower left), mandibles (lower right), prementum (lower right center), labial palp (lower left center), apical segments of the male abdomen in ventral view (right center), apical segments of a female abdomen in lateral view (right center), and a lateral gill lamella (upper right). Based on Geijskes (1943).

5. The gill lamellae consist of a basal part with one serrated margin and a terminal portion, which is evenly rounded on the margins and ends in an acutely pointed extension with a terminal angle less than 30º. The lateral margins of the prementum are slightly concave near the middle. In addition to the long dorsal setae on each side of the prementum, there may be short setae forming a continuous row (**Fig. 3.1.370**).

.....*Telebasis* Selys, 1865..p. 437

- The gill lamellae are serrated along the basal margin and then flared into a distinctly bulbous apical part ending in a short triangular extension forming an angle greater than 70º. The lateral margins of the prementum are uniformly convex. There is only one long seta on each side of the prementum (**Fig. 3.1.373**).

.....*Bromeliagrion* De Marmels and Garrison, 2005..p. 408

6. The lateral gills are at least 80% as long as the rest of the head and body length, and they have patches of pigmented tracheae. There are three dorsal setae on each side of the median line of the prementum and four palpal setae (**Fig. 3.1.371**).

.....*Acanthagrion* Selys, 1876..p. 491

- The lateral gills are no more than 66% as long as the rest of the head and body length, and they usually lack patches of pigmented tracheae (**Fig. 3.1.373**). 7

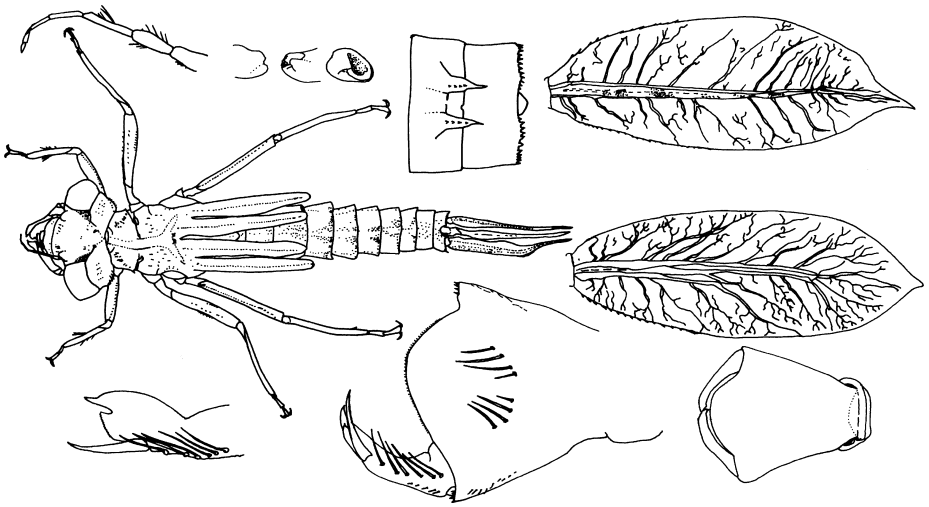


Fig. 3.1.371 *Cyanallagma gaianii* larva: habitus (middle left); antenna (upper left); labial palp (lower left); dorsal view of the anterior part of the labium with one palp removed (lower center); labium in ventral view (lower right); cercus in lateral, inner, and posterior view (upper left center, left to right); ventral view of the two apical abdominal segments showing the gonophphyses (upper right center); a middle (upper right) and lateral gill lamella (middle right). Based on De Marmels (1997).

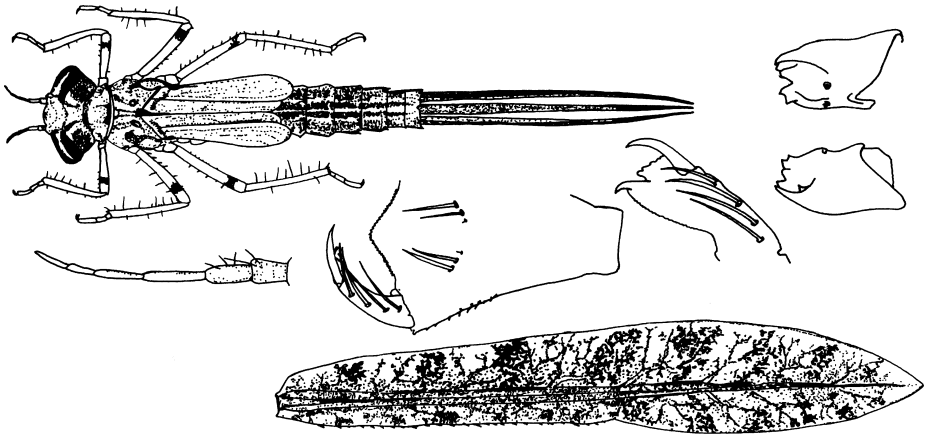


Fig. 3.1.372 *Acanthagrion ascendens* larva: habitus (upper left), antenna (lower left), labium with one palp removed (center), labial palp (right of center), mandibles (upper right), and a lateral gill lamella (lower right). Based on Geijskes (1941).

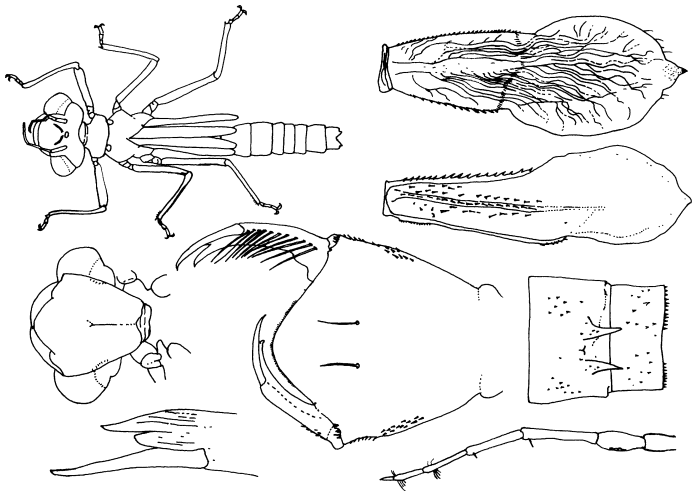


Fig. 3.1.373 *Bromeliagrion fernandezianum* larva: habitus from exuvia without gill lamellae (upper left), center (upper right) and lateral gill lamella (upper middle right) from the second to final larval instar, head with the labium folded beneath in ventral view (middle left), labium in dorsal view (lower center), frontal view of the apex of the labial palp (lower left), ninth and tenth abdominal segments without caudal appendages in ventral view (lower middle right), and the antenna of the second to last larval instar (lower right). Based on De Marmels (1985b).

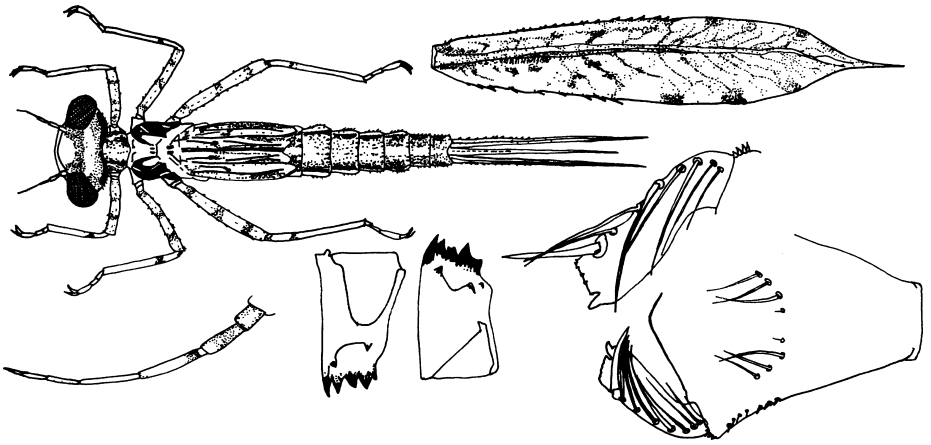


Fig. 3.1.374 *Nehalennia minuta* larva: habitus (upper left), antenna (lower left), mandibles (lower center), inner surface of the mentum (lower right), labial palp (middle right), and gill lamella (upper right). Based on Geijskes (1943).

7. There is one prominent dorsal seta on each side of the median line of the prementum, but from one to three much smaller ones may be present between each seta and the midline of the prementum. In addition, there are 5 to 6 palpal setae. Stiff setae are not present on the lateral carinae of the anterior abdominal segments, although they may be present on the posterior ones. The last instar larva is not more than 15 mm long (**Fig. 3.1.374**).
.....….....*Nehalennia* Selys, 1850

Only a single South American species is known in this predominantly Holarctic genus: *Nehalennia minuta* (Selys in Sagra, 1857), which occurs in Mexico, Central American, the West Indies, Surinam, and the Brazilian states of Bahia, Maranhão, Minas Gerais, and São Paulo. Syn: *Trichocnemys minutum* Selys in Sagra, 1857; *Argiallagma minutum* (Selys, 1857), *Enallagma minutum* (Selys, 1857). Two subspecies have been described: *Nehalennia minuta minuta* (Selys in Sagra, 1857), from Mexico, Central America, and Surinam, also found under its synonym, *Agrion adunca* Hagen, 1861; and *Nehalennia minuta selysi* Kirby, 1890, from Brazil, also found under its synonym, *Nehalennia sophia* Selys, 1876 (nec Selys, 1840).

- There are at least two prominent dorsal setae on each side of the prementum, or, if there is only one, then there are only three or four palpal setae and long, stiff setae on the lateral carinae of all abdominal segments except the first (**Fig. 3.1.375**). 8

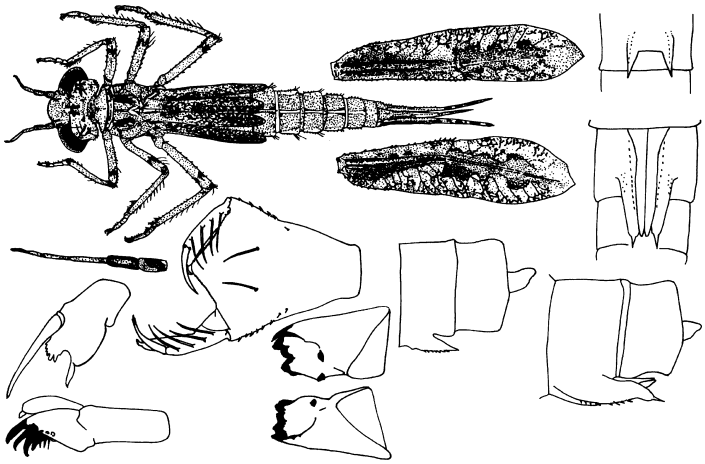


Fig. 3.1.375 *Enallagma novaehispaniae* larva: habitus (upper left), antenna (upper middle right), labial palp (lower middle right), labium (left center), maxilla (lower left), mandibles (lower center), middle (upper right center) and a lateral gill lamella (right center), apex of a male abdomen in ventral and lateral view (upper right and lower right center, respectively), and apex of a female abdomen in ventral (middle right) and lateral view (lower right). Based on Novelo-Gutiérrez (2005).

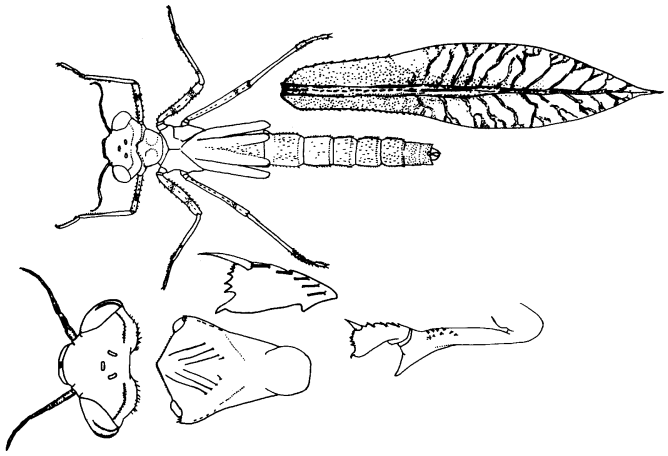
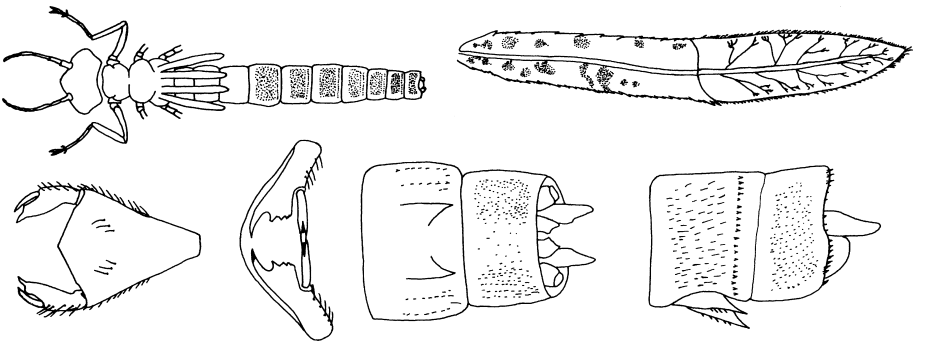


Fig. 3.1.376 *Homeoura ambigua* larva: habitus without the gill lamellae (upper left), head in dorsal view (lower left), a labial palp in interior view and the prementum in dorsal view (lower center, above and below, respectively), labium in lateral view (lower right), and an enlarged gill lamella (upper right). Based on Bulla (1970).

8. Either there is only one prominent dorsal seta on each side of the prementum, sometimes with from one to three much smaller ones between each seta and the midline of the prementum, or the lateral carinae of the second through the eighth abdominal segments are slightly concave in dorsal view and have prominent apices bearing two or more stout, curved setae (**Fig. 3.1.375**). The eyes have a dark pattern of spots or lines forming hexagonal cells. 9
- There are from two to five prominent dorsal seta on each side of the median line of the prementum. The lateral carinae of the abdominal segments are straight or slightly convex in dorsal view, without prominent apices and with setae, if present, which are no larger than the adjacent ones on the segment (**Fig. 3.1.376**). 10



Fig, 3.1.377 *Oxyagrion microstigma* larva: habitus without middle and hind legs and caudal gills (upper left), a caudal gill lamella (upper right), and (lower row, left to right): labium, anterior margin of labium with labial palps retracted, and the apex of the abdomen in ventral and lateral view. Based on Costa (1979a).

9. There is always more than one prominent dorsal seta on each side of the median line of the prementum and usually five palpal setae. The second through fourth abdominal segments lack apical, transverse groups of conspicuous stiff setae and have instead an even covering of setae of uniform size. The lateral carinae on the eighth and ninth abdominal segments are subequal, and those on the ninth each bear one stout seta apically.
.....*Neoerythromma* Kennedy, 1920

Only one species in this genus is found in South America: *Neoerythromma cultellatum* (Selys, 1876) from North and Central America, the West Indies, and Venezuela.

- There may be one prominent dorsal seta on each side of the median line of the prementum, or, if not, then the second through fourth, and sometimes the sixth abdominal segments bear apical, transverse groups of conspicuous stiff setae, or, nearly all segments are devoid of all setae ventrally, although some may be represented by brown specks. The lateral carinae on the ninth abdominal segment are much less developed than the others and bear no stout setae apically. There are usually four palpal setae (**Fig. 3.1.375**).
.....*Enallagma* Charpentier, 1840 pars..p. 490

10. Obvious transverse sutures are evident on the gill lamellae, or, if they are not evident or only suggested by the change in the armament along the margins of the lamella, there are four to six long or medium setae in each row on the prementum. If there are four, then there are long lateral rows of strong setae along the margins of the prementum that sometimes extend onto the dorsal surface or patches of such setae on the open surface (**Fig. 3.1.377**). The length of most final instars without gill lamellae exceeds 12 mm. The genus is very heterogeneous, and descriptions of more species will be necessary before definitive characters can be identified.
.....*Oxyagrion* Selys, 1876..p. 460

- If the length of the final instar is greater than 12 mm, there are no transverse sutures near the middle of the gill lamellae, although the division between the proximal and distal parts may be obvious from the changes in the shape and marginal armament. There are usually no more than four long or medium length setae in each row on the prementum, but if there are, then there are only short rows or setae that do not extend onto the dorsal surface and no patches of short setae on the surface of the prementum (**Fig. 3.1.378**). 11

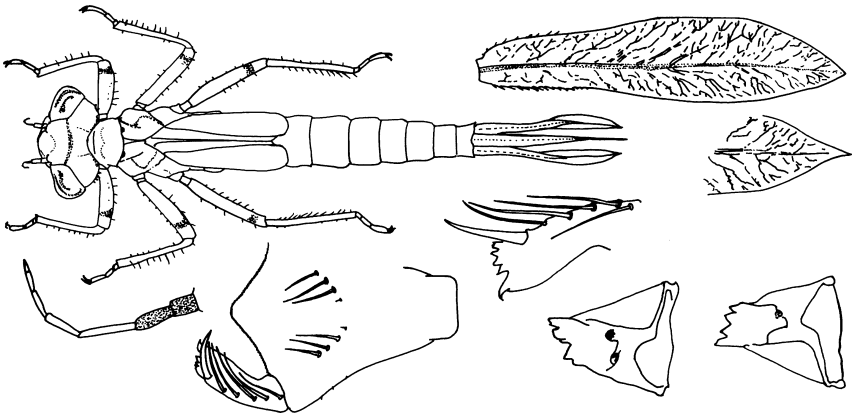


Fig. 3.1.378 *Ischnura capreola* larva: habitus (upper left), antenna (lower left), labium with one palp removed (lower left center), labial palp (lower right center), lateral gill lamella above the apex of the corresponding lamella from another specimen (upper right), and the mandibles (lower right). Based on Geijskes (1941).

11. The total length of the final instar, excluding the gill lamellae, is greater than 12 mm, or there is a distinctive pattern of light and dark on the dorsal surface of the abdomen. The antenna consists of seven segments. The lateral carinae on the second through eighth abdominal segments each bear a single row of spines slightly larger than the others scattered on the segments. There are either three or four long setae in each row on the prementum, sometimes supplemented by one or two additional short setae (**Fig. 3.1.371**). The larvae inhabit standing or slowly flowing water with submerged plants.
.....*Cyanallagma* Kennedy, 1920..pars p. 533
- Either the antenna consists of six segments, or the small setae along the lateral carina are not arranged in a single row, or the total length of the final instar without the gill lamellae is shorter than 12 mm and there is no distinctive pattern of light and dark on the abdomen (**Fig. 3.1.376**). 12
12. The wing buds diverge. The antenna consists of seven segments. About three long and one short seta are present on each side of the prementum (**Fig. 3.1.376**). 13
- The wing buds of the known South American species are usually parallel. The final instar larva is considerably longer than 6 mm without the gill lamellae (**Fig. 3.1.378**). 14

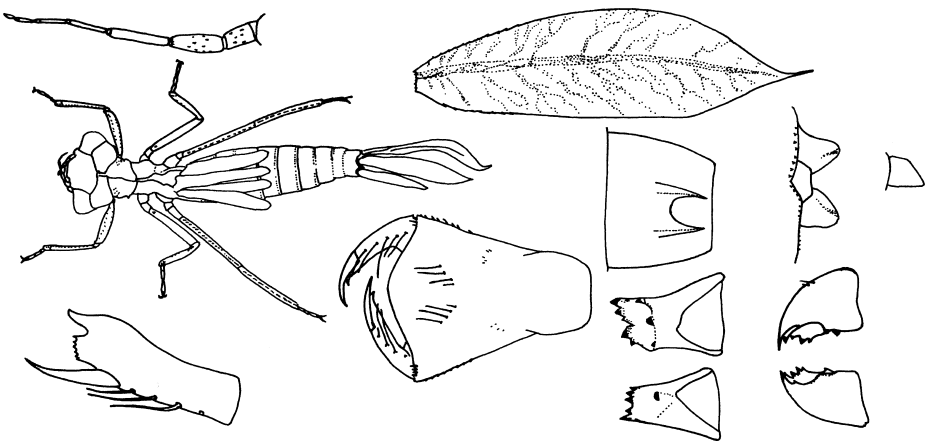


Fig. 3.1.379 *Andinagrion garrisoni* larva: habitus from the exuvia of a male (middle left), antenna (upper left), labial palp (lower left), labium (lower left center), mandibles in inner (lower right center) and lateral view (lower right), middle gill lamella (upper right), gonopophyses in ventral view (right center), and cerci in dorsal and lateral view (middle right, left and right, respectively). Based on von Ellenrieder and Muzón (2006).

13. The only final instar larva of this genus that has been described is only about 5.8 mm long without the gill lamellae. The labial palp has five short setae posterior to the moveable hook. The denticles on the distal lobe of the labial palp are robust, and the longest of them is almost as long as the inner margin of the distal hook beside the lobe (**Fig. 3.1.376**).
.....*Homeoura* Kennedy, 1920..p. 555
- The final instar larvae exceed 9 mm in length without the gill lamellae. The labial palps of the known larvae each have four or five long setae proximal to the moveable hook. The denticles on the distal lobe of the labial palp are small, and the longest of them is barely half as long as the inner margin of the distal hook beside the lobe (**Fig. 3.1.379**).
.....*Andinagrion* Bulla, 1973..p. 425
14. The eyes usually have a pattern of lateral bands alternating between light and dark. The antenna usually consists of seven distinct segments (**Fig. 3.1.378**). The lateral carinae of the second through seventh abdominal segments have numerous small setae that are not arranged in a single row.
.....*Ischnura* Charpentier, 1840..p. 548
This genus encompasses the nominal genus, *Anomalagrion* Selys, 1857.
- The eyes have no pattern of lateral bands, but they may have dark spots. The antenna usually consists of six segments, but sometimes there is a faint line that seems to divide the apical segment. The lateral carinae of the second through eighth abdominal segments have setae of variable size that are usually arranged in a single row (**Fig. 3.1.375**).
.....*Enallagma* Charpentier, 1840 pars..p. 490

Key to the species of adult *Minagrion* in South America

Information for the key provided by Santos (1962b, 1965d,e, 1967) and Lencioni (2006). There is no information about the larvae of South American species.

1. In lateral view, the tubercle on the ventral side of the first abdominal segment of the male appears cylindrical and excavated at the apex, but that of the female is not. The ventral side of the head is yellow. The thorax and legs are entirely pale yellow, except for a black dorsal stripe on the prothorax and antehumeral surface of the synthorax. There are no black markings on the seventh through ninth abdominal segments (**Fig. 3.1.380**). Length of male abdomen: c. 22 mm; female abdomen: c. 15 mm. Hind wing length of male: 14.5 mm; female: 23 to 23.5 mm.
.....*Minagrion caldense* Santos, 1965 (Minas Gerais).
- The tubercle on the ventral side of the first abdominal segment of the male and female is not excavated at the apex, although in one species, it is cuniform with a groove ending in a group of setae (**Fig. 3.1.381**). 2

2. The tubercle on the ventral side of the first abdominal segment of both the male and the female is cuniform with a groove ending in a group of setae, best visible in ventral view. The ventral side of the head is mainly black. The prothorax is black with blue markings, and the synthorax has black and bright blue markings dorsally on an orange background. The abdomen is mainly orange with blue markings (**Fig. 3.1.381**). Length of abdomen: 26 to 29 mm. Hind wing length: 15.5 to 17.5 mm.
.....*Minagrion waltheri* (Selys, 1976)
(Minas Gerais, São Paulo). Syn: *Telagrion serracipoensis* Santos, 1956; probably *Agrion waltheri* Selys, 1976.
- The tubercle on the first abdominal segment is neither excavated nor grooved, and the tubercle of the male is larger than that of the female (**Fig. 3.1.382**). 3

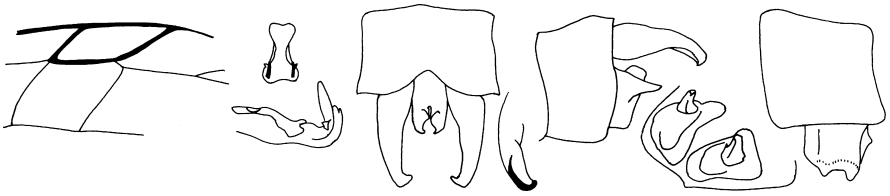


Fig. 3.1.380 *Minagrion caldense* male (left to right): pterostigma of the fore-wing; apical lobe of the penis in ventral (above) and lateral view (below); apex of the abdomen in dorsal view with the apex of the superior anal appendage in oblique dorsolateral view to its right; apex of the abdomen in lateral view; inferior anal appendages in oblique posterior view; first abdominal segment in lateral view showing the ventral tubercle. Based on Santos (1965d).

3. The inferior anal appendage of the male is vestigial and visible in lateral view only as a pad with a short, spine-like process. The tubercle on the first abdominal segment is sparcely setose, cylindroid in the male and roughly triangular with slightly convex sides in the female. The ovipositor reaches about as far posteriad as the inferior anal appendage of the female (**Fig. 3.1.334**).
.....*Minagrion mecistogastrum* (Selys, 1976)
(São Paulo, Rio de Janeiro, Paraná, Santa Catarina, Rio Grande do Sul). Syn: *Telagrion mecistogastrum* Selys, 1976.
- The inferior anal appendage is well developed and is either curved toward the superior appendage or extends posteriad for a distance more than half the length of the superior appendage (**Fig. 3.1.382**). 4

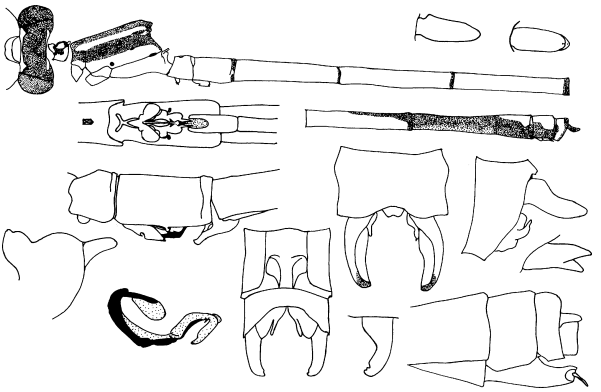


Fig. 3.1.381 *Minagrion waltheri:* head in dorsal view, thorax, and first five abdominal segments of a male in lateral view (above left); first and second abdominal segments of a male in ventral (upper middle left) and lateral view (lower middle left); fifth through tenth segments of the male abdomen in lateral view (upper middle right); outline of the prothorax in lateral view (lower left); penis in lateral view (lower left center); apex on the male abdomen in dorsal (right center), ventral (lower center), and lateral view (middle right); superior anal appendage of a male in oblique dorsolateral (lower right center), oblique ventrolateral (upper right center), and oblique dorsal view (upper right); inferior anal appendage in frontal view (lower middle right); apex of female abdomen in lateral view (lower right). Based on Santos (1956c), illustrated as *Telagrion serracipoensis*.

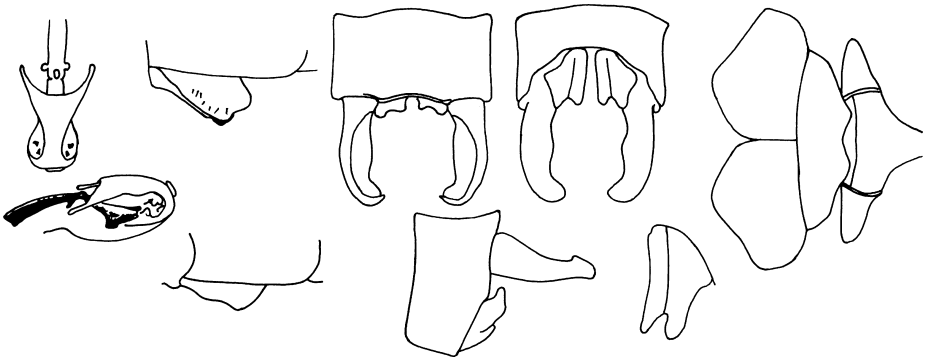


Fig. 3.1.382 *Minagrion canaanense* (above, left to right): penis in ventral view, ventral tubercle on the first abdominal segment of the male in lateral view, apex of the male abdomen in dorsal and ventral view, and the prothorax of a female in dorsal view, and (below, left to right): penis in lateral view, ventral tubercle on the first abdominal segment of the female in lateral view, apex of the male abdomen in lateral view, and inferior anal appendage of the male in posterior view. Based on Santos (1967).

4. The superior anal appendage extends posteriad much more than three times as far as the superior appendage, and there is a subapical dorsal projection that widens it subapically (**Fig. 3.1.382**). The ventral tubercle on the first abominal segment is roughly trapezoidal in the male with sparce short setae and roughly triangular in the female with one margin shallowly sigmoid in lateral view. Length of abdomen: 32 to 37 mm. Hind wing length: 19 to 21 mm. The first through eighth abdominal segments of the male are black dorsally with an isolated quadrangular marking on the first and a continuous dorsal stripe on the second through eighth. The distal third of the eighth segment of the male and the ninth and tenth segments are blue. The abdomen of the female is mainly black with yellow basal rings on some of the segments. The head and thorax of the male are blue with black markings, while those of the female are yellowish and black, with more restricted black markings.
.....*Minagrion canaanense* Santos, 1967 (Esperito Santo, Minas Gerais).

- The superior anal appendage narrows abruptly near the apex and ends in a finger-like process; it extends posteriad less than twice as far as the inferior appendage (**Fig. 3.1.383**). The ventral tubercle on the first abominal segment is cuneiform and triangular in lateral view. The first five segments of the abdomen are mainly ivory with black rings around the intersegmental articulations, while some of the dorsal surfaces of the first and sixth segments, all of the seventh and eighth, and the lateral surfaces of the ninth are black. The dorsal surfaces of the ninth and all of the tenth segment are blue, and the lateral surface of the sixth segment is yellow for ¾ of its length. Length of abdomen: 29 to 31 mm. Hind wing length: 18 to 19 mm.
.....*Minagrion ribeiroi* (Santos, 1962) (Rio de Janeiro). Syn: *Telagrion ribeiroi* Santos, 1962.

Fig. 3.1.383 *Minagrion ribeiroi* male: apex of the abdomen in dorsal (left), ventral (left center), and lateral view (upper right center) and the penis in ventral (upper right) and lateral view (lower right). Based on Santos (1962b).

Key to the species of adult *Acanthallagma* in South America

Information for the key was provided by Williamson and Williamson (1924b). There is no information about the larvae.

1. The thorax is black with obscure pale markings. The superior appendage of the male, viewed on the inner side from the posterior to observe its widest profile, is evenly convex on the other side (**Fig. 3.1.384**). Length of abdomen of male: 22 to 23 mm; of female: 20 to 21 mm. Hind wing length, male: 14 mm; female: 14 to 14.5 mm.
.....*Acanthallagma strohmi* Williamson and Williamson, 1924 (Rondônia).
- The thorax has distinct pale markings. The superior appendage of the male, viewed on the inner side from the posterior to observe its widest profile, is concave in the middle of the other side (**Fig. 3.1.385**). 2

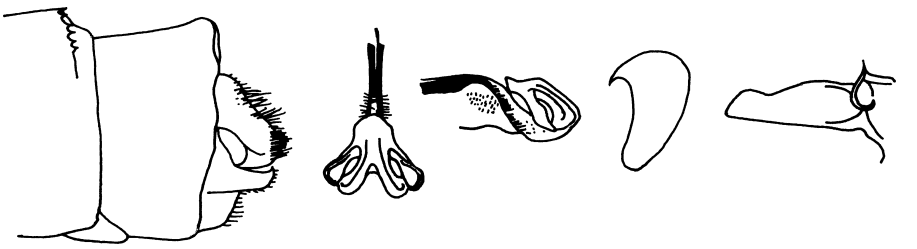


Fig. 3.1.384 *Acanthallagma strohmi* (left to right): apex of the male abdomen in lateral view, penis in ventral and lateral view, inner posterior view of the male superior appendage to show its broadest profile, and the mesostigmal lamina of a female in dorsolateral view. Based on Williamson and Williamson (1924b).

2. The thorax pattern is black and orange or yellow. The mesostigmal lamina of the female bears a long, spine-like process (**Fig. 3.1.336**). Length of abdomen of male: 20 to 21.5 mm; of female: 20 to 20.5 mm. Hind wing length, male: 13 to 14 mm; female: 14 to 14.5 mm.
.....*Acanthallagma luteum* Williamson and Williamson, 1924 (Rondônia).
- The thorax pattern is black and bright blue. The mesostigmal lamina of the female lacks a long, spine-like process (**Fig: 3.1.385**). Length of abdomen of male: 23 mm; of female: 21 to 22 mm. Hind wing length, male: 14 mm; female: 14 to 15 mm.
.....*Acanthallagma caeruleum* Williamson and Williamson, 1924 (Ecuador, Amazonas).

Fig. 3.1.385 *Acanthallagma caeruleum* (left to right): penis in ventral and lateral view, inner posterior view of the male superior appendage to show its broadest profile, and the mesostigmal lamina of a female in dorsolateral view. Based on Williamson and Williamson (1924b).

Key to the species of adult *Inpabasis* in South America

Information for the key provided by Santos (1961b) and Garrison and Costa (2002). Information about the larvae is not yet available.

1. The median part of the posterior margin of the posterior prothoracic lobe is convex. The apices of the superior and inferior anal appendages are acutely pointed. The petiole of the wings extends beyond Ac a distance double its length. The bifid plate on the tenth abdominal tergite is not visible in lateral view, and its branches are contiguous (**Fig. 3.1.386**). Length of male abdomen: c. 30 mm; female: c. 28 mm. Hind wing length of male: c. 20 mm; female: c. 21 mm.
.....*Inpabasis hubelli* Santos, 1961 (Peru).
- The median part of the posterior margin of the posterior prothoracic lobe is almost straight or concave. The apices of the superior and inferior anal appendages are not both acutely pointed. The petiole of the wings extends beyond Ac a distance less than double its length. The bifid plate on the tenth abdominal tergite is visible in lateral view, and its branches are divergent (**Fig. 3.1.387**). 2
2. The median part of the posterior margin of the posterior prothoracic lobe is almost straight. The apex of the superior anal appendage is acutely pointed. The apex of the inferior anal appendage is forked. The petiole of the wings extends beyond Ac a distance equal to or shorter than its length. The branches of the bifid plate on the tenth abdominal tergite are acutely pointed (**Fig. 3.1.387**). Length of male abdomen: 28 to 29 mm; female: c. 24 mm. Hind wing length of male: c. 19 mm; female: c. 18 mm.
.....*Inpabasis machadoi* Santos, 1961 (Amazonas, Rondônia).

- The median part of the posterior margin of the posterior prothoracic lobe is almost concave. The apex of the superior anal appendage is rounded. The apex of the inferior anal appendage is acutely pointed and not forked. The petiole of the wings extends beyond Ac a distance equal to or longer than its length. The branches of the bifid plate on the tenth abdominal tergite are rounded (**Fig. 3.1.20**). Length of male abdomen: 31 to 32 mm; female: c. 27 mm. Hind wing length of male: 21 to 22 mm; female: c. 20 mm.
.....*Inpabasis rosea* (Selys, 1877)
(Venezuela, French Guiana, Surinam, Amazonas). Syn: *Leptobasis rosea* Selys, 1877; *Metaleptobasis rosea* (Selys, 1877); *Inpabasis eliasi* Santos, 1961.

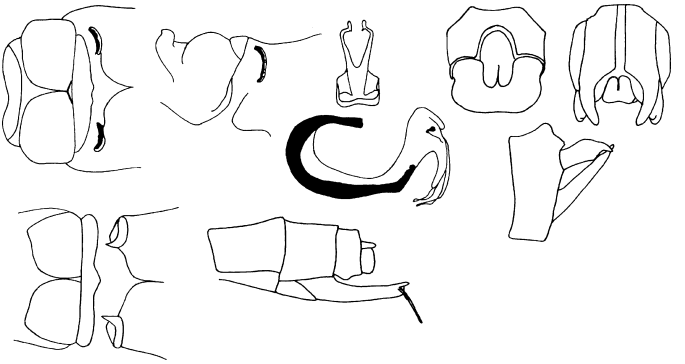


Fig. 3.1.386 *Inpabasis hubelli:* prothorax of a male (upper left) and a female in dorsal view (lower left); prothorax of a male in lateral view (upper left center); penis in ventral and lateral view (upper center, above and below, respectively); apex of a male abdomen in dorsoposterior (upper right center), ventral (upper right), and lateral view (lower right), and apex of the female abdomen with ovipositor in lateral view (lower center). Based on Santos (1961b).

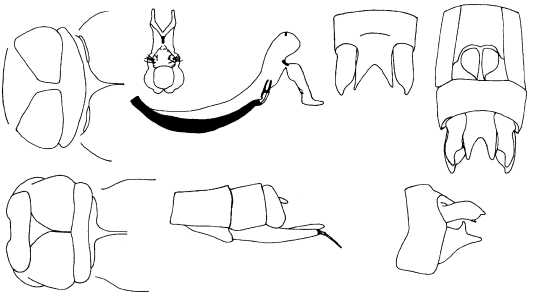


Fig. 3.1.387 *Inpabasis machadoi:* prothorax of a male (upper left) and female in dorsal view (lower left); penis in ventral and lateral view (upper left center, above and below); apex of male abdomen in dorsal (upper right center), ventral (upper right), and lateral view (lower right), and apex of the female abdomen with ovipositor in lateral view (lower center). Based on Santos (1961b).

Key to the species of adult male *Argia* in South America

Information for the key provided by Selys (1865), Eaton and Calvert (1892-1908), Calvert (1909), Hagen and Calvert (1902), Förster (1914), Ris (1913, 1918), Sjöstedt (1918), Navás (1924a, 1934b,c, 1935), Fraser (1946a, 1948b), Tennessen (2002a), Lencioni (2006), and Garrison and von Ellenrieder (2007). The males of *Argia iralai* has not been described, it appears only in the key to the females. This genus is greatly in need of a taxonomic revision, and original descriptions should be consulted to confirm any tentative identifications made by using the key.

1.The area posterior to Cu_2 is usually two cells wide, and the second antenodal is often slightly beyond the level of the arculus. M_4 runs zigzag beyond the level of the fork in M_{1+2}. Length of abdomen: 43 to 44 mm. Hind wing length of male: c. 36 mm; female: c. 39 mm. The head is brown, and the thorax is blackish with a dark red antehumeral stripe and vestiges of three dark red lateral stripes. The abdomen is black with red around the margins of the segments. The legs are blackish brown. This poorly known species urgently requires a better description.
.....*Argia funcki* (Selys, 1854)
(Mexico, Central America, Colombia? Venezuela?). Syn: *Hyponeura funcki* Selys, 1854. Reports from South America may have resulted from errors on museum labels (von Ellenrieder and Garrison, 2007a).
- The area posterior to Cu_2 is one cell wide, or another characteristic is lacking (**Fig. 3.1.337**).....2
2. The whole body is almost entirely light blue. The wings are deep yellow with light yellowish brown pterostigmata. The anal appendages are wider than long (**Fig. 3.1.388**). Length of abdomen: 28 to 33 mm. Hind wing length: 24 to 25 mm.
.....*Argia fissa* Selys, 1865
(Mexico, Central America, Colombia, Peru).
- The whole body is not almost entirely light blue, although it may be predominantly blue (**Fig. 3.1.389**).....3
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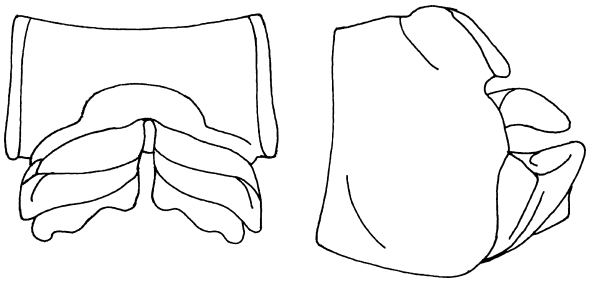


Fig. 3.1.388 *Argia fissa* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

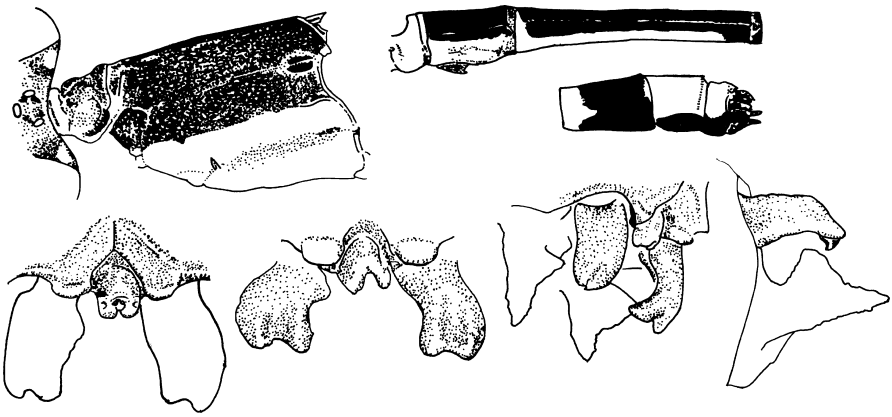


Fig. 3.1.389 *Argia dives* male (above, left to right): posterior part of head in dorsolateral view and thorax in lateral view; first three segments of the abdomen (above) and eighth, ninth, and tenth segments in lateral view (below); and (below, left to right): apex of the male abdomen in dorsal, posterior, dorsolateral, and lateral view. Based on Lencioni (2006).

3. The head and prothorax are blackish olive, and the synthorax is blackish brown dorsally and reddish ventral to the first suture. There are no antehumeral or humeral stripes, but there is a brown lateral stripe ventral to the second suture. The seventh through tenth abdominal segments are black with blue dorsal markings on the ninth and tenth segments. The rest of the abdomen is mainly red with black markings. The superior anal appendages are slightly longer than the inferior appendages, and in dorsal view, each superior appendage appears divided into long, narrow inner and outer processes separated by a deep, broad excavation with an evenly curved margin (**Fig. 3.1.390**). Length of male abdomen: c. 26 mm. Hind wing length of male: c. 18 mm.
.....*Argia infumata* Selys, 1865 (Venezuela, Bolivia, Pará, Amazonas, Rondônia).
- The abdomen is mainly violet, blue, black, yellow, or brown, or, if it is all or partially a shade of red or scarlet on the anterior part, its thorax is bronzed black dorsally bordering on a blue or chestnut brown area. 4
4. The abdomen is mainly bright scarlet, usually with blue and sometimes black markings. The dorsal surface of the thorax is bronzed black bordered by narrow blue posthumeral areas separating the black dorsum from a broad chestnut brown area. The wings are hyaline with long pterostigmata. The superior anal appendages are longer than the inferior appendages (**Fig. 3.1.391**). 5
- Both the third through sixth abdominal segments and the dorsal surface of the thorax have pale and darker markings (**Fig. 3.1.389**), and the predominant color covering most of the dorsal surface of the abdomen is not scarlet. 7

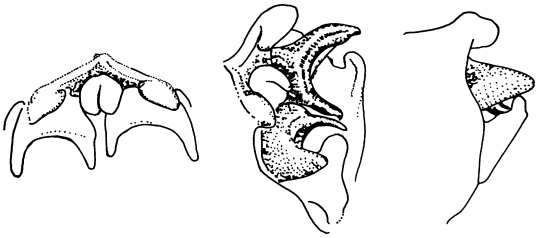


Fig. 3.1.390 *Argia infumata* male (left to right): anal appendages in dorsal, dorsomedial, and lateral view. Based on Lencioni (2006).

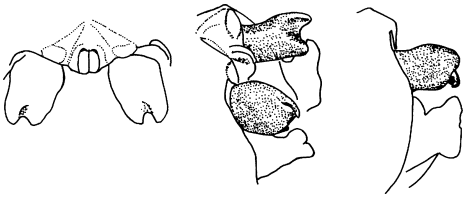


Fig. 3.1.391 *Argia cyathigera* male (left to right): anal appendages in dorsal, dorsomedial, and lateral view. Based on Lencioni (2006).

5. In dorsal view, the apex of the superior anal appendage appears divided in the middle by a small U-shaped excision, producing two subequal lobes (**Fig. 3.1.391**). The labrum is rusty red. The occiput has a blue wedge-shaped mark between the eyes. The abdomen is yellowish red with a black middorsal stripe. Length of hind wing of male: 26 mm; of female: 27.8 mm. Descriptions of the female are sketchy.
.....*Argia cyathigera* Navás, 1934
(Santa Catarina, Rio Grande do Sul). Syn: *Argia ambigua* Navás, 1934.
- In dorsal view, the apex of the superior anal appendage does not appear divided in the middle, although a process may be present along the outer margin (**Fig. 3.1.392**). 6
6. The inferior anal appendage curves evenly dorsad toward the superior appendage and has an inner branch that extends posteriad, slightly beyond the superior appendage (**Fig. 3.1.392**). The abdomen is entirely bright scarlet except for the apicalmost segments, which are blue. Length of male abdomen: 30 to 33 mm. Hind wing length of male: 24 to 25 mm.
.....*Argia croceipennis* Selys, 1865
(Paraguay, Uruguay, Argentina, Rio de Janeiro, São Paulo, Santa Catarina, Rio Grande do Sul). Syn: *Argia missionensis* Fraser, 1948.
- The inferior anal appendage extends straight posteriad well beyond the superior appendage and ends in an acute or narrowly rounded point (**Fig. 3.1.393**). The abdomen is bright scarlet with blue markings on the middle

segments and blue with black markings on the two apical segments. The legs are black with blue markings on the inner side of the femora bases and on the tibiae. Length of male abdomen: c. 32 mm. Hind wing length of male: c. 24.5 mm. .....*Argia eliptica* Selys, 1865 (Central America, Rondônia).

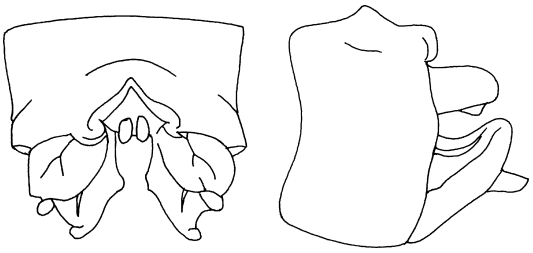


Fig. 3.1.392 *Argia croceipennis* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

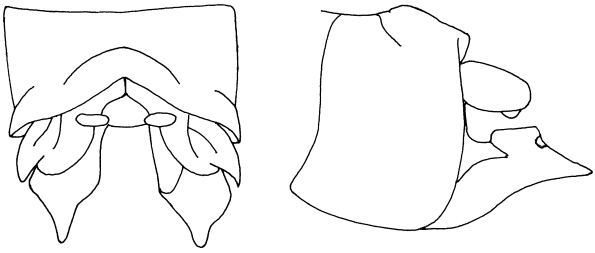


Fig. 3.1.393 *Argia eliptica* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

7. The prothorax is mainly light brown or yellowish brown with violet or black dorsolateral markings. The synthorax is black along the mid-dorsal line bordered by dark brown or light violet brown bordered laterally or posteriorly by pale or yellow brown. The third through fifth abdominal segments have a narrow bluish violet or dull violet middorsal stripe bordered by black, which is bordered laterally by dull violet or brown. The eighth through tenth abdominal segments are entirely pale, except for a narrow posterior black margin on the tenth (**Fig. 3.1.393**). 8

- The prothorax is not mainly light brown with violet dorsolateral markings, or the synthorax does not have a sequence of black, dark or light violet brown, and violet or pale brown, sometimes followed by blue on the dorsal and lateral surfaces of the synthorax. If in doubt, the third through fifth abdominal segments do not have a bluish violet middorsal stripe bordered by black, which is bordered laterally by brown or dull violet (**Fig. 3.1.389**). 9

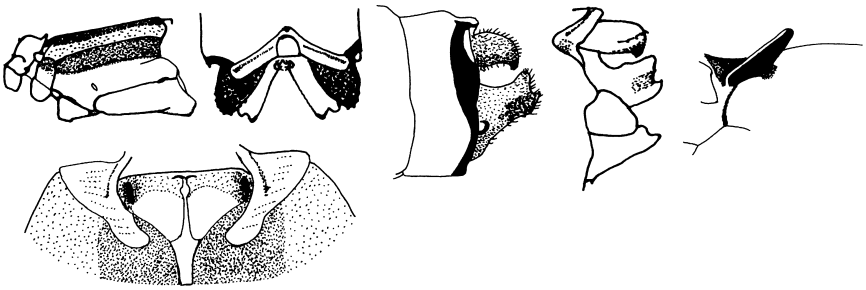


Fig. 3.1.394 *Argia rosseri* (above, left to right): the color pattern on the lateral surface of the thorax of a male with light brown, violet, and blue; the apex of the male abdomen in dorsal, lateral, and dorsolateral view; mesostigmal plate of a female in lateral view, and the anterior part of the synthorax of a female in dorsal view (lower left). Based on Tennessen (2002a).

8. The prothorax is mainly light brown with violet dorsolateral markings, while the synthorax has a black middorsal carina, a broad dark brown middorsal stripe, a narrow violet antehumeral stripe, a pale brown stripe on the mesepimeron, and an extensive blue ventrolateral area. The first abdominal segment is brown at the base and light blue apically; the second segment is blue with black subapical crescents. The third through fifth abdominal segments have a narrow bluish violet mid-dorsal stripe bordered by black dorsolateral stripes, bordered, in turn, by a brown lateral area that extends from the second through the ninth segments. The sixth and seventh segments each have a blue basal ring, brown mid-dorsal stripe, and black dorsolateral stripes. The eighth through tenth segments are light bluish violet dorsally with a black apical margin on the tenth segment. The superior anal appendages are brown. The upper half of the inferior anal appendages are blue, and the lower half, brown (**Fig. 3.1.394**). The sterna of the third through ninth abdominal segments are black. Total length of male: 34.5 to 37.5 mm. Length of male abdomen: 27.5 to 30 mm. Hind wing length of male: 21.5 to 23 mm. The labrum is pale violet at the base and pale blue distally. The occiput is brown anterior to the dark brown postfrontal suture and light brown with violet postocular spots posterior to it.
.....*Argia rosseri* Tennessen, 2002 (Argentina).

- The prothorax is mainly light yellowish brown with two small round black flecks on the lower lobe. The synthorax has a thin black line along the mid-dorsal carina flanked by light violet brown. There is a black comma-shaped making at the dorsal end of the humeral suture. The lateral and posterior parts of the synthorax are light yellowish brown. The abdomen is mainly dull violet with a black triangular marking near the posterolateral corners of the second segments, black dorsolateral stripes on the third through seventh segments, which become wider posteriad so that the black stripes on the seventh segment

leave only a narrow pale mid-dorsal line on the segment. The wings are heavily clouded with yellow. The inferior anal appendage is slightly longer than the superior and has two lobes (**Fig. 3.1.395**). Length of male abdomen: c. 26.5 mm. Hind wing length of male: c. 20.5 mm. The female has not been described.
.....*Argia jujuya* Ris, 1913 (Argentina).

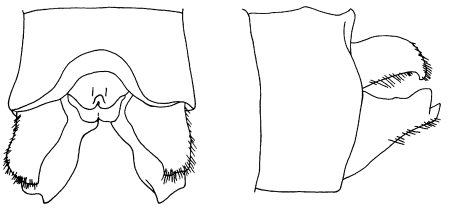


Fig. 3.1.395 *Argia jujuya* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Ris (1913).

9. The relationship between the blue or violet and the black stripes visible on the thorax in dorsal view varies; most specimens have equal or slightly more of the paler coloration. The occipital region of the head is pale, and the second through seventh abdominal segments are mainly blue or violet with a black streak beginning beyond the base of the second segment and ending with two lobes that do not reach the posterior end of the segment. There are black lateral streaks sometimes uniting with black on the posterior 1/6 to 1/4 of the third through sixth segments. On the seventh segment, the lateral streaks almost always unite with the black posterior part of the segment. The eighth and ninth abdominal segments are blue without dark markings. The inferior anal appendage is forked at the apex, forming a ventral branch that is longer than the dorsal (**Fig. 3.1.396**). There are four antenodal cells on the fore-wing. Length of the male abdomen: 25.5 to 30 mm. Hind wing length of male: 18 to 23 mm.
.....*Argia extranea* (Hagen, 1861) (North and Central America, Surinam, Colombia). Syn: *Agrion extranea* Hagen, 1861; *Argia mista* Navás, 1934.

- There is usually a recognizable prodominance of either pale and dark colors on the part of the synthorax visible in dorsal view, so that the areas do not appear nearly equal, and a dominance of either pale or dark is also evident on the third through sixth abdominal segments. The thorax and the abdomen may both be predominantly pale or dark, or one may be mainly pale and the other mainly dark. In case of doubt, the pattern of black lateral streaks and black on the apical 1/6 to 1/4 of the third through sixth segments is not evident, or there are fewer than four antenodal cross veins on the fore-wing, or the inferior anal appendage does not have a forked apex with a longer ventral branch, or the occipital part of the head is not black (**Fig. 3.1.389**). 10

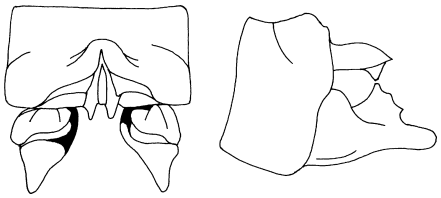


Fig. 3.1.396 *Argia extranea* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

10. If the dorsal surface of the synthorax is predominantly dark, metallic, or mainly yellow green with dark markings, the dorsal surfaces of the third through sixth abdominal segments are mainly violet or blue, or if the synthorax is predominantly blue dorsally, the third through sixth abdominal segments are mainly dark. Stated otherwise, the dorsal surface of the thorax and the third through sixth abdominal segments have color patterns markedly different in the predominance of light and dark colors.....11
- If the dorsal surface of the synthorax is predominantly dark, so are the dorsal surfaces of the third through sixth (**Fig. 3.1.389**), or, alternatively, so are all of the third through fifth abdominal segments, or if the synthorax is predominantly pale dorsally, so are the third through sixth abdominal segments (**Fig. 3.1.397**). If the predominant pale color is violet, yellow, brown, orange, or a shade of red, the specimen belongs here. 17

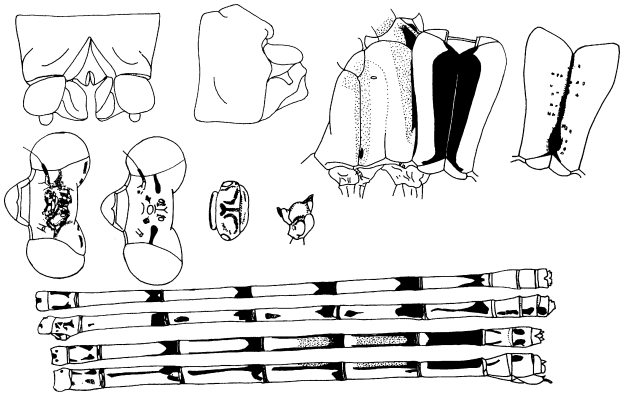


Fig. 3.1.397 *Argia inculta* (above, left to right): apex of the abdomen in dorsal and lateral view, diagram of the color pattern on the synthorax of a male and on the mesepisternum of another male specimen, and (middle, left to right): heads of female specimens in dorsal view and prothorax of a male in dorsal and lateral view, and (below, from above to below): color patterns on the abdomen of a male in dorsal and lateral view and of a female in dorsal and lateral view. Based on Hagen and Calvert (1902) and Schmidt (1942).

11. There are bright blue antehumeral stripes about as wide as the black middorsal stripe on the synthorax, or, if the blue stripes are narrower, the ventral part of the thorax is powdery white, and the fourth through seventh abdominal segments are entirely black. 12
- The thorax is usually mainly dark or metallic, but it may also be yellow green with black markings. The third through sixth abdominal segments or the entire dorsal surface of the third through fifth are blue. 14
12. The prothorax is black with a pair of large blue dorsal spots on the middle lobe. The synthorax is pale azure blue with a black middorsal stripe interrupted on each side by a blue antehumeral stripe, which widens ventrad and curls slightly inward. On the second lateral suture, there is a wide oblique black stripe. The coxae and trochanters are pale yellow, and the rest of the legs are black. The wings have a deep brown tint. The abdomen is black with a small blue triangle on the first segment; the second segment has a blue pyriform spot on the basal ¾ of the dorsal surface. The third segment has a blue basal spot that tapers posteriad. The fourth through seventh and the tenth segments are entirely black, and the eighth and ninth are broadly blue dorsally. The head is entirely black, except for a pair of azure postocular spots. There is a narrow ventral process on the inferior anal appendage of the male (**Fig. 3.1.398**). Length of male abdomen: c. 29 mm. Hind wing length: 20 mm.
.....*Argia hamulata* Fraser, 1946 (Peru).
- The prothorax is black or bright blue dorsally. If the abdomen is mainly black, it has pale markings on one or more of the fourth through seventh segments. ..13

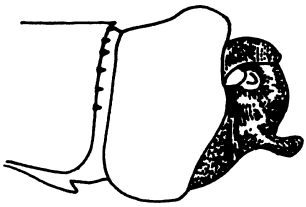


Fig. 3.1.398 Apex of the male abdomen of *Argia hamulata.* Based on Fraser (1946a).

13. The prothorax is bright blue. The underside of the thorax is whitish. The first two abdominal segments are mainly bright blue with black posterolateral and ventral markings on the second segment. The third through seventh abdominal segments are mainly black dorsally, but they have blue basal rings contiguous with narrow blue middorsal stripes and blue lateral surfaces marked with narrow black stripes. The eighth through tenth abdominal segments are blue with narrow black lateral markings. The labrum, face and apical part of the postclypeus of the male are blue; there is a black line across the base of the postclypeus. The occuput is white with a black spot on either side of the foramen. The superior and inferior anal appendages extend about an equal

distance posteriad (**Fig. 3.1.399**). Length of abdomen: c. 29 mm. Hind wing length: 22 to 31 mm.
.....*Argia talamanca* Calvert, 1907 (Central America, Colombia, Ecuador, Venezuela).
- The male prothorax is black dorsally and olivaceous laterally. The male abdomen is mainly blue, but the first abdominal segment has a large black dorsal marking, and the second has black longitudinal stripes. The eighth and ninth segments are entirely blue dorsally, and the tenth is black. The other abdominal segments are mainly blue with black on the apical part. Total length of the male: c. 30.5 mm. Length of male abdomen: c. 25 mm. Hind wing length of male: c. 18.5 mm. The female has not been described.
.....*Argia variata* Navás, 1935 (Colombia).

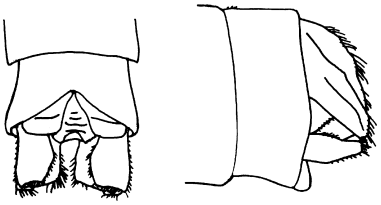


Fig. 3.1.399 *Argia talamanca* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Ris (1918).

14. The dorsal surface of the thorax is variable, either covered by a wide black stripe or yellow green with dark markings, while the first through fifth or first through sixth abdominal segments are predominantly blue with a pair of dark dorsolateral stripes on the second segment. The sixth through eighth or seventh and eighth segments are black, sometimes with a blue posterior marking on the eighth. The ninth abdominal segment is entirely blue, and the anal appendages are black. The thorax is black and blue or greenish, forming a variable pattern. The head is olive green and black. The tenth abdominal segment is broadly and deeply excavated along the dorsal midline (**Fig. 3.1.400**). Total length of male: 32 to 37.5 mm. Length of male abdomen: 29.5 to 31.5 mm. Hind wing length of male: 23 to 25 mm.
.....*Argia medullaris* Hagen in Selys, 1865 (Mexico, Central America, Colombia, Ecuador, Venezuela). Syn: *Argia rectangula* Navás, 1921; *Argia charalana* Navás, 1924; *Argia columbiana* Navás, 1924; *Argia augustana* Navás, 1934.
- The entire dorsal surface of the synthorax is metallic coppery red, coppery black or bright coppery, sometimes with green or sometimes with purple reflections. The head is black and yellow. The inferior anal appendage is divided into a dorsal and a ventral branch, each of which may be long or reduced to little more than a small rounded knob (**Fig. 3.1.401**). 15

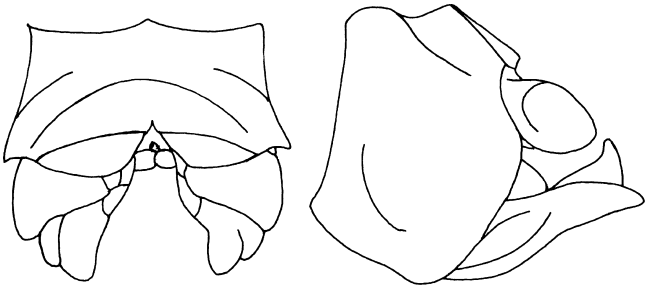


Fig. 3.1.400 *Argia medullaris* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

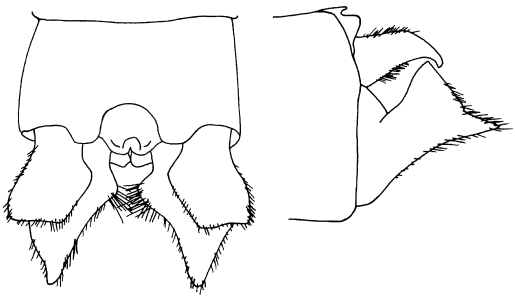


Fig. 3.1.401 *Argia joergenseni* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Ris (1913).

15. The inferior anal appendage curves dorsad and has a truncate apex divided into two low, flattened knobs by a small excision (**Fig. 3.1.402**). The thorax is metallic coppery red, sometimes with greenish or purple reflections, a color that seems to become dark metallic brown in preservative. Pale antehumeral stripes are present in some specimens and absent in others, suggesting that they disappear as the insect ages. Length of male abdomen: 28.5 to 30.5. Hind wing length of male: 20.5 to 22 mm. The second and third abdominal segments are blue or violet with black lateral stripes, and the third through sixth are blue or violet with the posterior 1/6 to 1/2 black, the extent of the black increasing progressively posteriad. The seventh is black with a pale basal ring, and the eighth through tenth are violet or blue dorsally, sometimes with black lateral stripes. The head has a variable pattern of black and pale colors.
.....*Argia oenea* Hagen in Selys, 1865 (North and Central America, Colombia).
- The inferior anal appendage has a narrow ventral process (**Fig. 3.1.401**). The seventh abdominal segment has more extensive blue dorsal markings than just a pale basal ring.....16

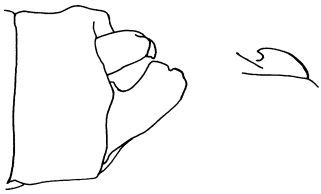


Fig. 3.1.402 *Argia oenea:* apex of the male abdomen in lateral view (left) and the mesostigmal lamina of a female in anterodorsal view (right).

16. The inferior anal appendage extends farther posteriad than the superior appendage (**Fig. 3.1.401**). The entire dorsal surface of the synthorax is bright coppery, and 3/4 to 4/5 of the third through sixth abdominal segments are bright blue. The seventh abdominal segment has narrow blue lateral stripes running for the entire length and a narrow, incomplete blue middorsal stripe. The labrum and anterior part of the face are light reddish yellow, and the occipital part of the head is yellow. The postclypeus is at least partially coppery. Length of male abdomen: c. 32 mm. Hindwing length of male: c. 24 mm.
.....*Argia joergenseni* Ris, 1913 (Argentina).
- The superior and inferior anal appendages extend posteriad an approximately equal distance (**Fig. 3.1.403**). Like the third through sixth abdominal segments, the seventh is largely blue with only a black apical ring. Total length: c. 38 mm. Length of male abdomen: c. 30 to 30.5 mm. Hind wing length of male: c. 21 to 21.5 mm. The female has not been described. The strong suspicion that the two nominal species in this couplet are actually conspecific is justified by the trivial nature of the differences that have been described.
.....*Argia limitata* Navás, 1924 (Peru).

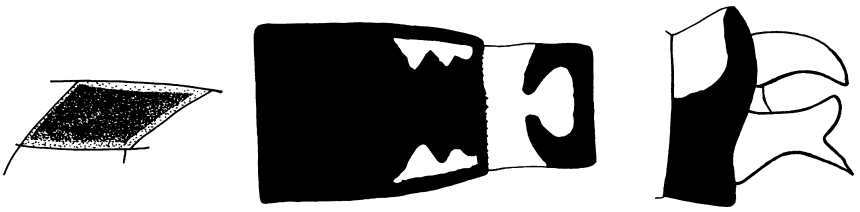


Fig. 3.1.403 *Argia limitata* male (left to right): pterostigma, first two abdominal segments in dorsal view, and apex of the abdomen in lateral view. Based on Navás (1924a).

17. Pale areas on the thorax and third through sixth abdominal segments cover more than half of the dorsal areas (**Fig. 3.1.397**). 18

- The dark areas on the thorax and third through sixth abdominal segments cover more than half of the dorsal areas (**Fig. 3.1.389**). Intraspecific variability of most species has not been well documented, so it is possible that some specimens may have more or less dark or pale coloration than indicated here. In case of doubt, check both possibilities in this couplet. 30

18. The height of the male inferior anal appendages at the apex is equal to or greater than its length (**Fig. 3.1.404**). 19

- The inferior anal appendages are longer than their height at the apex, which is slightly or deeply excised or truncate and armed with a finger-like process at its ventrolateral corner (**Fig. 3.1.405**). The thorax has a black mid-dorsal stripe that is wider than the carina. 24

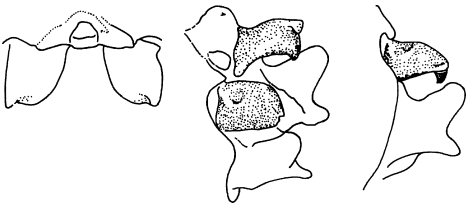


Fig. 3.1.404 *Argia subapicalis* male (left to right): anal appendages in dorsal, dorsomedial, and lateral view. Based on Lencioni (2006).

Fig. 3.1.405 *Argia botacudo* (left to right): apex of the male abdomen in lateral view, dorso-internal view of the apex of the male superior anal appendage, and mesostigmal lamina of the female. Based on Calvert (1909).

19. As seen in lateral view, the posterior margin of the inferior anal appendage is slightly and broadly excavated in the middle and is indented near the dorsal margin to produce a short, broadly rounded process that contacts or nearly contacts the superior anal appendage at its apex (**Fig. 3.1.406**). There are about two cells just posterior to the pterostigma. The superior anal appendage has a pointed process that curves posteriad along its outer margin. The male abdomen is 33 to 36 mm long, and the hind wing of the male is 25 to 28 mm. The color of the male is predominantly blue with black markings, including lateral stripes and posterior rings on the second through eighth abdominal segments. The ninth and tenth segments are blue dorsally and black laterally. The legs are black with yellow on the exterior surfaces of the tibiae.
.....*Argia claussenii* Selys, 1865
(Paraguay, Uruguay, Argentina, Minas Gerais).

- As seen in lateral view, the posterior margin of the inferior anal appendage is either deeply excavated at or ventral to the midpoint of its height, or it is sigmoid with a complex set of folded lobes (**Fig. 3.1.407**). 20

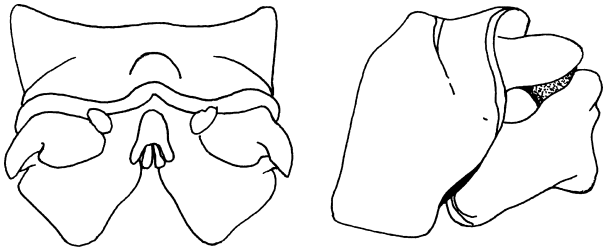


Fig. 3.1.406 *Argia claussenii* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

20. The superior anal appendage is short, and both lobes of the far larger inferior appendage extend much farther posteriad. The superior lobe is flattened in the horizontal plane, and divided into two lobes, the inner of which extends farther posteriad than the outer (**Fig. 3.1.407**). The head is blue with a black marking on the occiput and a black line on the frons and vertex. The wings are clouded, and the pterostigma is relatively short. Length of male abdomen: 30 to 31 mm. Hind wing length of male: 23 to 24 mm. There is just one cell directly posterior to the pterostigma.
.....*Argia serva* (Hagen in Selys, 1865) (Argentina, Santa Catarina).
- Both lobes of the inferior anal appendage do not extend farther posteriad than the apex of the superior appendage, or, if they do, they are only slightly longer (**Fig. 3.1.397**). 21

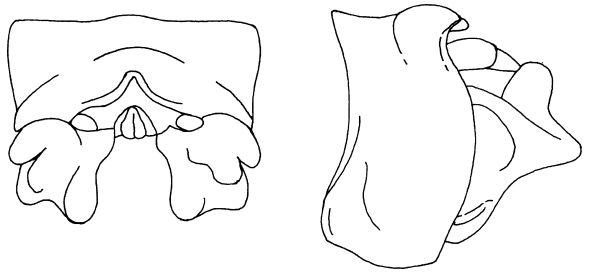


Fig. 3.1.407 *Argia serva* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

21. The occipital region of the head is mainly pale dorsally. The black mid-dorsal stripe on the thorax is hardly wider than the carina (**Fig. 3.1.397**). 22

- The occipital region of the head is black with a pale stripe bordering the compound eye. The superior anal appendage hooks ventrad at the apex (**Fig. 3.1.404**). 23

22. The mandibles and occipital region of the head are bright yellow, and the rest of the head is mainly greenish blue with a narrow line beside each lateral ocellus. Length of male abdomen: 27.5 to 30.5. Hind wing length of male: 19.5 to 22.5 mm. The thorax and abdomen are mainly blue with black markings (**Fig. 3.1.397**).
.....*Argia inculta* Hagen in Selys, 1865 (Ecuador, Peru).

- The occipital region of the head is pale dorsally and black ventrally and around the occipital foramen (**Fig. 3.1.408**). Length of abdomen: 26 to 29 mm. Hind wing length: 21 to 22.5 mm.
.....*Argia variabilis* Selys, 1865 (North and Central America, Colombia).

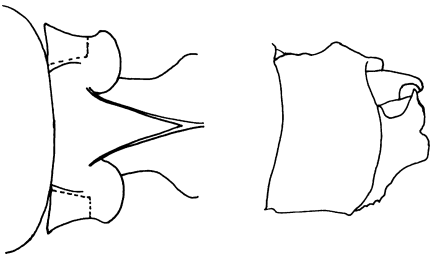


Fig. 3.1.408 *Argia variabilis:* prothorax and anterior part of the synthorax of a female in dorsal view (left) and apex of the male abdomen in lateral view. Based on Eaton and Calvert (1892-1908).

23. The black mid-dorsal stripe on the thorax is a narrow line covering only the carina. The hooked ventral subapical process at the apex of the superior anal appendage is small (**Fig. 3.1.404**). Length of abdomen: 28 to 31.5 mm. Hind wing length: 19 to 23 mm. The female has not been described.
.....*Argia subapicalis* Calvert, 1909 (Bolivia, Mato Grosso). This species requires re-examination because Calvert (1909) described the color of the third through seventh abdominal segments as black but placed it in his key in the group with a predominantly pale color on these segments.

- The black mid-dorsal stripe on the thorax is somewhat wider than the carina. The ventral subapical process on the superior anal appendage of the male is broader at the base than half the length of the appendage (**Fig. 3.1.409**). Length of abdomen: 29.5 to 33.5 mm. Hind wing length: 23 to 26 mm. The female has not been described.
.....*Argia tupi* Calvert, 1909 (Mato Grosso).

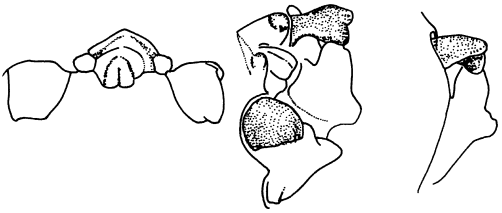


Fig. 3.1.409 *Argia tupi* male (left to right): anal appendages in dorsal, dorsomedial, and lateral view. Based on Lencioni (2006).

24. The frons, clypeus, labrum, and much of the occipital region of the head are pale blue. Black markings are limited to the region around the occipital foramen. The second abdominal segment is violet blue with two black dorsolateral stripes and greenish iridescence running the whole length of the segment. The third through seventh abdominal segments are violet blue with the apical 1/6 black, contiguous with lateral black markings running almost the whole length of each segment. The eighth through tenth are blue with black ventrolateral stripes running the whole length of the segment. Each superior anal appendage is forked at the apex, and its branches are subequal (**Fig. 3.1.410**). Length of male abdomen: 26 to 28.5 mm. Hind wing length of male: 19 to 20 mm.
.....*Argia pocomana* Calvert, 1907 (Central America, Colombia).
- The frons is at least partially black, or there are usually extensive black markings on the dorsal and occipital surfaces of the head. 25

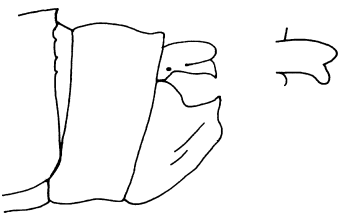


Fig. 3.1.410 *Argia pocomana* male: apex of the abdomen in lateral view (left) and oblique interior view of the superior anal appendage (right). Based on Eaton and Calvert (1892-1908).

25. The color of the pale areas includes mainly shades of violet. The superior anal appendage of the male has a small, acute subapical process (**Fig. 3.1.405**). Length of abdomen: 24 to 26.5 mm. Hind wing length: 18 to 19.5 mm. The occipital region of the head is black with narrow yellow stripes around the margins of the compound eyes. The second through fourth abdominal segments

are mainly violet dorsally with a pair of black dorsal stripes that are not contiguous on the second and black lateral stripes on the third and fourth, which begin beyond the pale area at the base of the segment and broaden posteriad until they meet on the dorsal surface at the posterior margin of the segment. The fifth is more than half black, and the sixth and seventh are black with pale basal bands. The eighth to tenth are violet dorsally and have black stripes at the ventral margins of the tergites. The ventral margins of the third through sixth and sometimes also the seventh segment are light yellow or brown.
.....*Argia botacudo* Calvert, 1909 (Mato Grosso).
- The color of the pale areas is mainly bluish. 26
26. The apex of the inferior anal appendage extends posteriad well beyond the apex of the superior appendage, and it curves dorsad enough to position its apex posterior to the apex of the superior appendage; it forms a narrow, finger-like process at the apex (**Fig. 3.1.411**). 27
- The inferior anal appendage does not extend farther posteriad than the superior appendage, or it remains well ventral to it (**Fig. 3.1.412**). 28

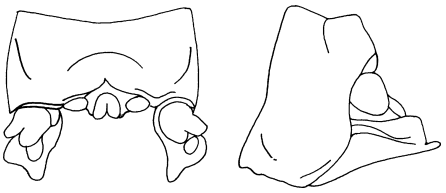


Fig. 3.1.411 *Argia insipida* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

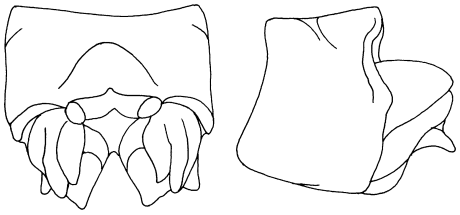


Fig. 3.1.412 *Argia tinctipennis* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

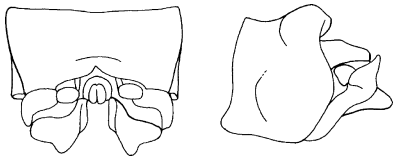


Fig. 3.1.413 *Argia modesta* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

27. The inferior anal appendage is truncate at the apex, but it has a short, finger-like process at its apex, appearing at its posteroventral corner in lateral view (**Fig. 3.1.411**). Length of male abdomen: 28 to 31 mm. Hind wing length of male: 20 to 21 mm. The head is mainly black with dark blue markings on the frons near the ocelli and base of the antennae. The prothorax is black with blue spots, and the synthorax is black as far as the first lateral suture with a broad blue stripe and blue on the lateral and ventral surfaces. The abdomen is azure blue with black markings, including one covering most of the eighth segment beyond its blue base.

.....*Argia insipida* Hagen in Selys, 1865
(Trinidad, Tobago, Colombia, Venezuela, Guyana, French Guiana, Surinam, Pará, Amazonas). Syn: *Argia ierea* Geijskes, 1932.

- The apex of the inferior anal appendage of the male narrows at the apex to a finger-like process that extends dorsoposteriad to a point beyond the apex of the superior appendage (**Fig. 3.1.413**). Length of the male abdomen: c. 27 mm. Hind wing length of male: c. 20 mm. The posterior part of the head is black, and the thorax is black dorsally as far as the first suture. This poorly known species has not been well described, and its identification depends mainly on its distinctive male anal appendages.

.....*Argia modesta* Selys, 1865
(Trinidad, Minas Gerais, Rio de Janeiro, São Paulo).

28. The black coloration on the frons extends between the antennae to the nasus but does not cover the genae. The black humeral stripe does not narrow in the middle and covers the whole mesepimeron; it is not forked, but it surrounds a pale spot at its dorsal end. The second lateral suture on the thorax is wide and complete (**Fig. 3.1.412**). Length of abdomen: 26 to 26.5 mm. Hind wing length: c. 18.5 mm.

.....*Argia tinctipennis* Selys, 1865
(Peru, Amazonas).

- The black coloration on the frons does not reach as far as the end of the first antennal segment, which is blue, at least on its anterior surface. There may be thin black lines on either side of the nasus. The dorsal branch of the inferior anal appendage curves toward the superior appendage (**Fig. 3.1.414**). 29

29. The black coloration on the frons does not reach as far as the end of the first antennal segment, which is blue on its anterior surface. There is a black line on the frontonasal suture. The black humeral stripe narrows in the middle and reaches the first lateral suture of the thorax only at its dorsal end; it is forked for least ¼ of its length at its dorsal end. The second lateral suture on the thorax is narrow and sometimes obsolete on its lower half. The dorsal surface of the inferior anal appendage bears a vertical tooth. The distal lobes of the inferior anal appendage of the male are broadly rounded (**Fig. 3.1.414**). Length of abdomen: 25.5 to 26 mm. Hind wing length: 18 to 20 mm.

.....*Argia chapadae* Calvert, 1909
(Mato Grosso).

- The black coloration does not extend at all to the basal segment of the antenna, which is entirely bluish green. The second antennal segment is bluish green on the dorsal surface, and the apical segments are black. The thorax is light blue or silvery blue with a black humeral band that forks at its dorsal end. The wings are hyaline with black veins and brown pterostigmata framed with a paler color. The inferior anal appendage is about as long as the superior, and it tapers and curves dorsad at its apical end, which touches the superior appendage (**Fig. 3.1.415**). Total length: c. 34 mm. Length of abdomen: c. 27.5 mm. Hind wing length: c. 21 mm.
.....*Argia variegata* Förster, 1914
(Colombia, Ecuador, Peru). Syn: *Argia trifoliata* Fraser, 1946.

Fig. 3.1.414 *Argia chapadae* male (left to right): anal appendages in dorsal, dorsomedial, and lateral view. Based on Lencioni (2006).

30. The entire dorsal surface of the abdomen is blackish, except for the bright blue markings on the ninth and tenth segments and fine blue lines sometimes present at the articulations of the fourth through seventh segments. The prothorax and anterior part of the synthorax are coppery gold, and the rest of the synthorax is milky blue (**Fig. 3.1.389**). The face is a bright shiny gold color with a coppery red sheen. Total length: c. 44 mm. Length of abdomen: c. 35 mm. Hind wing length: c. 25 mm.
.....*Argia dives* Förster, 1914
(Ecuador, Peru, Mato Grosso).
- Blackish is not the color on the entire dorsal surface of the first eight abdominal segments. If the eighth abdominal segment is not blue dorsally, then the color on the dorsal surface of the thorax is not coppery. 31
31. The dorsal surface of the thorax is mainly a bright metallic coppery color, and the eighth through tenth abdominal segments are at least partially blue dorsally. 32
- The dorsal surface of the thorax is not a bright metallic coppery color. 35
32. The entire labrum is orange or yellow. The inferior anal appendage has a ventral branch that is equally or more robust than the upper branch (**Fig. 3.1.416**). The third through seventh abdominal segments are black with a narrow blue basal ring dorsally. Length of abdomen: 26.5 to 30 mm. Hind wing length: 18.5 to 21 mm.
.....*Argia orichalcea* Hagen in Selys, 1865
(Panama, Trinidad, Colombia, Venezuela).

- The basal half of the labrum, or the entire labrum is metallic coppery. ...…..33

Fig. 3.1.415 *Argia variegata* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

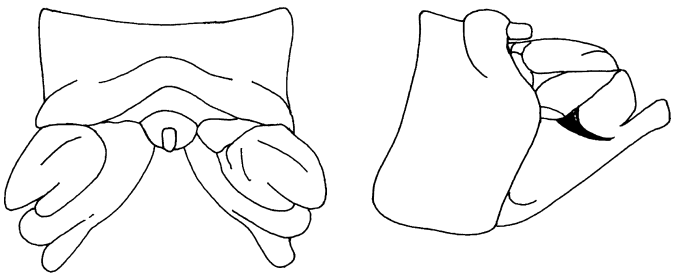


Fig. 3.1.416 *Argia orichalcea* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

33. The entire labrum is metallic coppery. The third through seventh abdominal segments are mainly black with narrow, incomplete basal rings. The eighth abdominal segment is black with a narrow blue basal ring, and the ninth and tenth segments are blue. The inferior anal appendage has a ventral process (**Fig. 3.1.417**). Length of abdomen: 27 to 31 mm. Hind wing length: 20.5 to 30 mm. .....*Argia cuprea* (Hagen, 1861)
(North and Central America). Syn: *Agrion cuprea* Hagen, 1861. A form of this species, designated Form b, was reported by Ris (1918) from Colombia and Bolivia.

- At least the basal half of the labrum is a metallic coppery color; either its apical half or a narrow line along its anterior margin is yellow. The ventral branch of the inferior anal appendage is not as robust as the dorsal branch (**Fig. 3.1.418**). At least half of the dorsal surfaces of the third through sixth abdominal segments are blue. 34

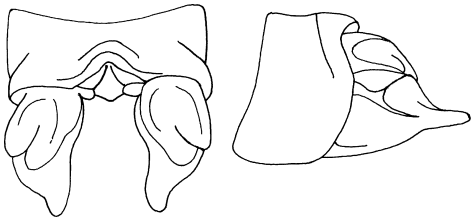


Fig. 3.1.417 *Argia cuprea* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

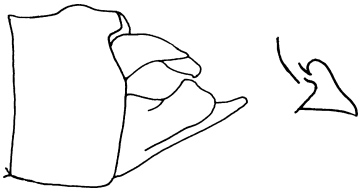


Fig. 3.1.418 *Argia cupraurea:* apex of the male abdomen in lateral view (left) and the mesostigmal lamina of a female in anterodorsal view (right). Based on Hagen and Calvert (1902).

34. Dorsally, the basal halves of the third through sixth abdominal segments are blue, and their apical halves, as well as the entire seventh segment, are black. .....*Argia jocosa* Hagen in Selys, 1865 (Ecuador, Colombia, Venezuela).

- At least 2/3 of the dorsal surfaces of the third through sixth abdominal segments are blue, while the apical parts of these segments are black. The seventh segment is black with a blue basal ring (**Fig. 3.1.418**). .....*Argia cupraurea* Calvert, 1902 (Central America, Colombia, Venezuela). Syn: *Argia fulgida* Navás, 1934.

35. The third through eighth abdominal segments are blackish brown with a violet luster. The second, ninth, and anterior half of the tenth abdominal segments are violet dorsally. The face is bluish or olive, and the nasus is golden brown. The entire frons is black, and two bright green or blue postocular spots are present. The wings are hyaline with black veins and a brown pterostigma. The inferior anal appendage is slightly forked with the upper branch extending almost as far posteriad as the superior appendage. Total length: c. 41 mm. Length of abdomen: c. 34 mm. Hind wing length: c. 24 mm. .....*Argia fraudatricula* Förster, 1914 (Ecuador, Peru).

- The third through eighth abdominal segments are not entirely dark; one or more of them have pale markings. 36

36. The third and fourth abdominal segments are mainly black with a pair of small blue basal triangles on the dorsal surface. The first abdominal segment is blue laterally and apically. The fifth through seventh segments are entirely

black, and the eighth through tenth segments are broadly blue on the dorsum. The prothorax is mainly black dorsally and blue laterally, with blue antehumeral stripes narrower than the mid-dorsal black stripe and blue triangles within the forked black humeral stripes. The legs are black with yellow on the flexor surfaces of the femora and extensor surfaces of the tibiae. The wings are hyaline without any infuscation. The superior anal appendages are only about half the length of the inferior appendages and have an apical spine on the inner margin that is not visible in lateral view (**Fig. 3.1.419**). Length of male abdomen: c. 24 mm. Hind wing length of male: c. 18 mm.

.....*Argia infrequentula* Fraser, 1946 (Colombia, Ecuador).

- There are no small pale basal triangles on the dorsal surfaces of the third and fourth abdominal segments. Pale markings on those segments, if present, are confined to basal rings and sometimes mid-dorsal lines or stripes. 37

Fig. 3.1.419 *Argia infrequentula* male: apex of the abdomen in dorsolateral view (left) and outline of the anal appendages in lateral view (right). Based on Fraser (1946a).

37. The third through seventh abdominal segments are entirely black, while the eighth through tenth segments are entirely blue dorsally, although the anal appendages are black. The first and second abdominal segments have blue lateral markings, and there is a blue oval on the mid-dorsal surface of the anterior half of the second. The prothorax and synthorax are black dorsally and blue laterally, with narrow blue antehumeral stripes on the synthorax. The legs are entirely black, and the wings are clouded with olivaceous brown. The black pterostigma is about 1½ times as long as its maximum width, and there are 1½ to 2 wing cells just posterior to it. The head is mainly black with pale postocular spots and blue on the labrum and bases of the mandibles. The inferior anal appendage of the male is deeply forked (**Fig. 3.1.419**). Length of male abdomen: c. 28 mm. Hind wing length of male: c. 18.5 mm. The female has not been described.

.....*Argia euphorbia* Fraser, 1946 (Peru, Argentina, Amazonas). Syn: *Argia extranea euphorbia* Fraser, 1946.

- The third through seventh abdominal segments are not entirely black, or if they are, then the dorsum of the eighth segment is not entirely blue. 38

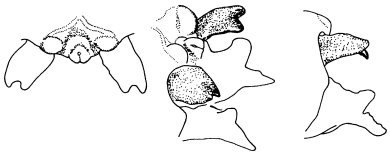


Fig. 3.1.420 *Argia euphorbia* male (left to right): anal appendages in dorsal, dorsomedial, and lateral view. Based on Lencioni (2006).

Fig. 3.1.421 *Argia thespis* male (left to right): superior anal appendages in dorsal view and apex of the abdomen in dorsolateral and lateral view. Based on von Ellenrieder and Garrison (2007a).

38. The fourth though seventh abdominal segments are entirely black, and on many specimens, the third segment is black, as well; however, some specimens may have blue markings only on a the basal ring on the third segment or a marking occupying as much as 2/3 of the third segment; the eighth through tenth are blue or black with blue markings on at least one of the segments. The wings are deeply clouded with olive brown. 39
- The fourth through seventh abdominal segments are not entirely black. 41

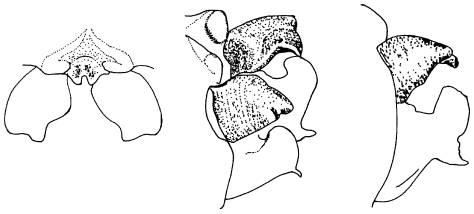


Fig. 3.1.422 *Argia collata* male (left to right): superior anal appendages in dorsal view and apex of the abdomen in dorsolateral and lateral view. Based on von Ellenrieder and Garrison (2007a).

39. The eighth abdominal segment is entirely black, while the ninth and tenth are entirely blue dorsally. There is also an oval blue mark on the second abdominal segment. The head and prothorax are black with pale coloration only on round postocular spots. The synthorax is black dorsally as far as the blue stripe along the first suture and light blue laterally crossed by a black stripe along the second lateral suture. There is a small tooth at about the mid-length of the ventral margin of the inferior anal appendage, best seen in lateral view (**Fig.**

3.1.421). Length of abdomen: c. 25 mm. Hind wing length: c. 18.5 mm. The original publication by Hagen (1865) includes the description of a female, which belongs to a different species (von Ellenrieder and Garrison, 2007a).
.....*Argia thespis* Hagen in Selys, 1865
- The eighth abdominal segment is not entirely black; it is blue dorsally or at least has small blue apical markings. 40
40. The eighth through tenth abdominal segments are blue dorsally or have narrow blue ventrolateral stripes and a broad azure-blue mid-dorsal stripe on each, which narrow from the base to the apex of the eighth segment or are sometimes present only on the apical third of that segment. The anal appendages are black and shorter than the tenth segment. The superior anal appendage of the male is wide in the horizontal plane and has a long process only at its outer corner. The inferior anal appendage curves strongly dorsad to contact or almost contact the superior appendage at its apex, and it has a small tooth inserted along the apical half of the ventral margin of the inferior anal appendage, best seen in lateral view (**Fig. 3.1.422**). The pterostigma is not quite as long as one cell in the row posterior to it.. Length of the abdomen: 16 to 18 mm. Hind wing length: 24 to 28 mm. The head is black with cinereous markings at the base of the labium and blue markings on the labrum, bases of the mandibles, large postocular spots, ventral borders of the eyes, and, often, quadrangular spots between the compound eyes and antennae. The thorax is broadly black dorsally bordered laterally by blue striped with black.
.....*Argia collata* Selys, 1865
(Ecuador, French Guiana, Surinam, Amazonas, Pará, Bahía). Syn: *Argia mollusca* Fraser, 1946; *Argia thespis* nec Hagen in Selys, 1865.
- The eight segment is mainly black but has small blue apical markings. The pterostigma is as long as 2 to 2½ cells in the row posterior to it. The superior anal appendage of the male is wide in the horizontal plane and appears truncate at the apex with a small median incision in dorsal view. The inferior anal appendage extends posteriad and forks just proximal to the apex (**Fig. 3.1.423**). Judging from the reported size of the female type specimen, males are probably only slightly smaller than male *A. thespis*.
.....*Argia fumigata* Hagen in Selys, 1865
(Venezuela, French Guiana, Guyana, Surinam, Amazonas, Rondônia, Mato Grosso).

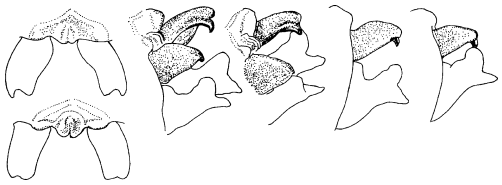


Fig. 3.1.423 *Argia fumigata* male (left to right): anal appendages of two specimens in dorsal (above and below), dorsomedial, and lateral view. Based on Lencioni (2006).

41. The pale coloration on the dorsal surfaces of the third through sixth abdominal segments is limited to a basal transverse ring and sometimes a fine middorsal line. The posterior part of the head is mainly black. 42
- The pale coloration on the dorsal surfaces of some or all of the third through sixth abdominal segments includes a basal transverse ring and middorsal stripe that is thicker than a fine line on the anterior half and narrows posteriad (**Fig. 3.1.424**). 49
42. The ninth abdominal segment is entirely bright blue, while the fourth through eighth, the tenth, and the appendices are entirely black. The anterior part of the thorax is black dorsally with two olive markings on the prothorax and an olive antehumeral stripe. The first abdominal segment is pale dorsally, and the second is black with an oval violet marking. The third abdominal segment has a violet coloration on the anterior half. The dorsal surface of the inferior anal appendage bears a vertical tooth (**Fig. 3.1.424**). Total length: c. 28 mm. Length of abdomen: c. 22 mm. Hind wing length: c. 17 mm. The head is mainly olive and black.
.....*Argia indicatrix* Calvert, 1902
(Mexico, Central America, Colombia, Ecuador, Peru, Venezuela, Amazonas). Syn: *Argia dagnina* Förster, 1914; *Argia stigmatica* Navás, 1934; *Argia umbriaca* Fraser, 1946.
- Either the ninth segment of the abdomen is partly to entirely black, or, if the ninth segment is entirely pale, then the eighth, tenth, or both are also partially pale.....43

Fig. 3.1.424 Dorsomedial view of the anal appendages of a male *Argia indicatrix*. Based on Lencioni (2006).

43. There is a pale oval marking covering about 2/3 of the length of the segment, and the second through fourth segments have pale basal rings, sometimes obscure. Otherwise the head and dorsal surfaces of the thorax and abdomen are all black. There is a reddish yellow antehumeral stripe and lateral areas on the thorax of the same color. The wings are uniformly clouded with yellowish brown, and the pterostigma is black. The superior anal appendage is conical and shorter than the tenth segment (**Fig. 3.1.425**). Total length of male: c. 27 mm. Length of male abdomen: c. 22 mm. Hind wing length: c. 16 mm.
.....*Argia impura* Rambur, 1842
(Guyana, Amazonas).

- At least part of the eighth or ninth segment is blue. In case both are mainly or entirely dark, then the abdomen is at least about 28 mm long, and the hind wing is at least about 18 mm. 44

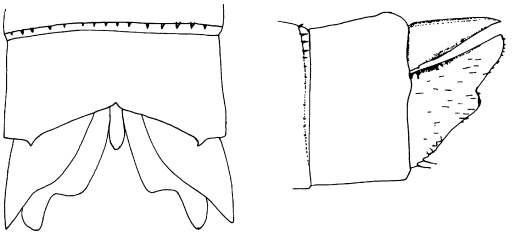


Fig. 3.1.425 *Argia impura* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Sjöstedt (1918).

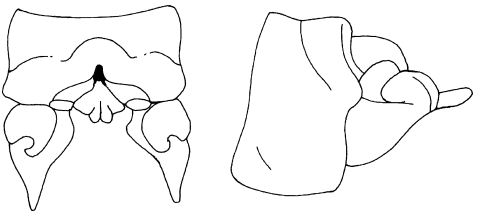


Fig. 3.1.426 *Argia translata* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

44. The eighth and ninth abdominal segments are mainly black dorsally with no more than the basal half of the ninth segment blue (**Fig. 3.1.426**). Length of abdomen: 28 to 33.5 mm. Hind wing length: 18.5 to 22.5 mm.
.....*Argia translata* Hagen in Selys, 1865
(North and Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, French Guiana, Argentina). Syn: *Argia espinalensis* Navás, 1935.
- The eighth and ninth segments are mainly pale or deep indigo dorsally, but they may have black lateroventral stripes or black posterior margins 45
45. The eighth through tenth abdominal segments are deep indigo with a black posterior margin on the eighth segment. The head is olive on the anterior surface with a black band across the ocellar area from the margin of one compound eye to the other. The postocellar spots are violet. The thorax is black dorsally with violet markings and silvery white ventrally. The fourth through seventh abdominal segments are metallic black dorsally with narrow ochre yellow basal bands. The inferior anal appendage is considerably longer than the superior appendage (**Fig. 3.1.427**). Total length: c. 33 mm. Length of abdomen: c. 28.5 mm. Hind wing length: c. 20.5 mm.
.....*Argia huanacina* Förster, 1914
(Ecuador, Peru, Bolivia). Syn: *Argia lateralis* Selys, MS *nomen nudum*.

- The eighth and ninth abdominal segments are pale rather than deep indigo on the dorsal surface (**Fig. 3.1.337**). 46

Fig. 3.1.427 *Argia huanacina* male (left to right): superior anal appendages in dorsal view and apex of the abdomen in dorsolateral and lateral view. Based on von Ellenrieder and Garrison (2007a).

46. The eighth, ninth, and tenth segments are narrowly black along the anterior margin, broadly black laterally, and black along the posterior margin, leaving a nearly quadrilateral spot of pale blue covering the middle of the dorsal surface of each of these segments. The third through seventh segments are black with narrow pale blue basal rings and a very narrow pale lateral stripe (**Fig. 3.1.337**). Total length of male: 37 to 42 mm. Length of male abdomen: 29.5 to 33.5 mm. Hind wing length of male: 23 to 26 mm. The habitat is dense foothill forests.
.....*Argia yungensis* Garrison and von Ellenrieder, 2007 (Peru, Bolivia, Argentina).

- The large pale blue areas on the eighth, ninth, and tenth segments do not have black surrounding them on their anterior, lateral, and posterior sides. In case of doubt, the inferior anal appendage appears to have two or three apical lobes (**Fig. 3.1.428**). 47

47. The seventh through tenth abdominal segments are blue with black only on the strenites and the posterior margin of the tenth segment. The head is greenish yellow on much of the face and the first segment of the abdomen, black on the vertex, and green on the postocular spots. The first abdominal segment is blue, and the second is black with a large blue basal marking. The superior anal appendage has a ventral subapical process, and the inferior appendage has a prominent median process, making it appear to form three apical lobes (**Fig. 3.1.428**). Length of abdomen: c. 24 mm. Fore-wing length: c. 18 mm. Hind wing length: c. 17 mm.
.....*Argia pulla* Selys, 1865 (North and Central America, Trinidad, Tobago, Colombia, Ecuador, Peru, Venezuela, Argentina, Roraima). Syn: *Argia lobata* Navás, 1924.

- The predominantly pale eighth and ninth abdominal segments have black lateroventral stripes. No more than the basal 1/6 of the third abdominal segment is blue. The inferior anal appendage is forked to form two apical lobes (**Fig. 3.1.429**). 48

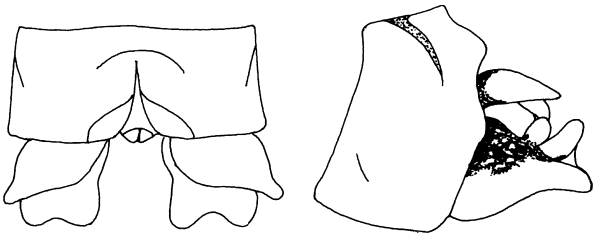


Fig. 3.1.428 *Argia pulla* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

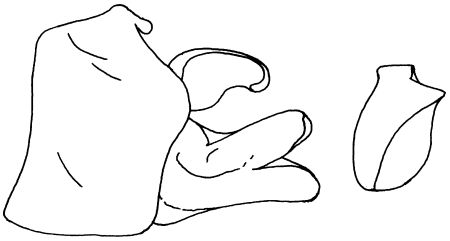


Fig. 3.1.429 *Argia reclusa* male: apex of abdomen in lateral view (left), superior anal appendage in dorsal view (right). Based on Hagen and Calvert (1902).

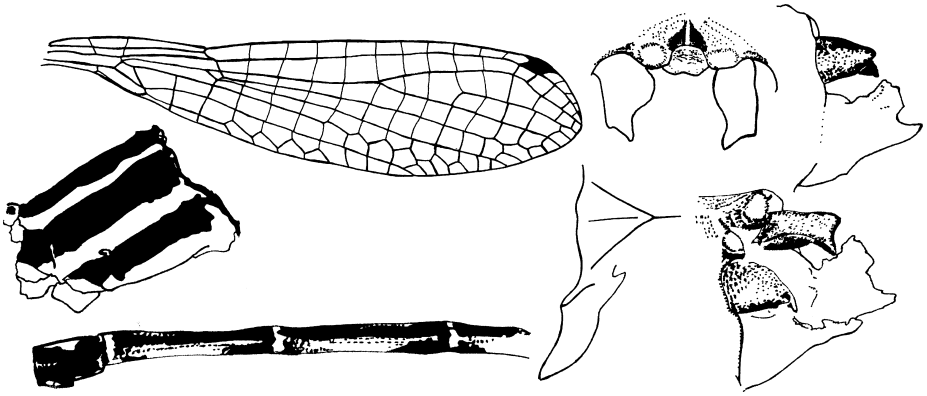


Fig. 3.1.430 *Argia bicellulata:* fore-wing (upper left), synthorax of a male in lateral view (middle left), proximal abdominal segments of a male in lateral view (lower left), anal appendages of a male in dorsal (upper right center), lateral (upper right), and dorsolateral view (lower right), and the female mesostigmal lamina (lower right center). Based on Munz (1919) and Lencioni (2006).

48. As much as the basal 1/6 of the third abdominal segment is blue, and the fourth through sixth segments are entirely black. There are three antenodal cells in the hind wing. Both lobes of the inferior anal appendage extend farther posteriad than the superior appendage (**Fig. 3.1.429**).
.....*Argia reclusa* Selys, 1865 (Argentina, Bolivia, Paraguay, Pará, Amazonas, Minas Gerais, São Paulo, Rio Grande do Sul, Mato Grosso).
- Only a narrow basal ring on the third abdominal segment is blue or yellow and confluent with a narrow mid-dorsal line. There are similar blue or yellow markings on the third through sixth and sometimes the seventh abdominal segments. There are two or three antenodal cells in both the fore and hind wings (**Fig. 3.1.430**).
.....*Argia bicellulata* (Calvert, 1909) (Mato Grosso). Syn: *Diargia bicellulata* Calvert, 1909.

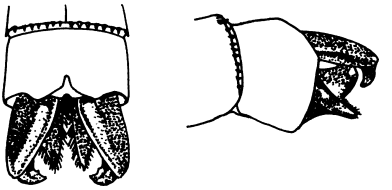


Fig. 3.1.431 *Argia mishuyaca* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Fraser (1946a).

49. The black superior anal appendages are as long as the tenth abdominal segment, longer than the inferior appendages, and end in an apical spine resembling a claw (**Fig. 3.1.431**). The head is almost entirely black with azure blue only on the postocular spots and tiny squares along the margin of the compound eyes at the level of the antennal insertions and with a narrow blue or yellow rim of the compound eyes. The prothorax is black dorsally and bluish ventrolaterally. The synthorax is black dorsally with narrow blue antehumeral stripes and blue ventral from the first lateral suture except for a black stripe along the posterolateral suture. The legs are entirely black. The abdomen is mostly black with blue on most of the first and all of the ninth segment, as well as on a dorsal spot and an irregular ventrolateral stripe on each side of the second, basal rings on the third and fourth and occasionally on other segments, and a mid-dorsal stripe on the third, which narrows posteriad from the anterior margin. There are also sometimes small blue spots on the tenth segment. The wings are smoky with an olivaceous brown color and pterostigmata that are dark yellow with black centers and framed by black veins. Length of male abdomen: c. 26 mm. Hind wing length of male: 17 to 18 mm.
.....*Argia mishuyaca* Fraser, 1946 (Peru).

- The superior anal appendages are shorter than the inferior appendages, or, if not, the superior appendages do not end in an apical spine resembling a claw (**Fig. 3.1.432**). The head is not almost entirely black with azure blue only on the postocular spots and tiny squares along the margin of the compound eyes at the level of the antennal insertions and with a narrow blue or yellow rim of the compound eyes. 50

50. The superior anal appendages are deeply forked; the outer branch is much shorter than the inner (**Fig. 3.1.432**). 51

- The superior anal appendage is not deeply forked, or, if it is, the outer branch is about as long or longer than the inner (**Fig. 3.1.433**). 53

Fig. 3.1.432 *Argia sordida* male (left to right): apex of the abdomen in dorsal view and lateral views of two specimens, one (right) of which was probably cataloged earlier as *Argia dimissa*. Based on Hagen and Calvert (1902).

Fig. 3.1.433 *Argia smithiana* (left to right): apex of the male abdomen in lateral view, dorso-internal view of the apex of the male superior anal appendage, and mesostigmal lamina of a female. Based on Calvert (1909).

51. The posterior margin on the tenth abdominal segment is not produced along the midline to form a thick, blunt process; in lateral view, it appears simply rounded. There is a black marking on the frons. The eighth through tenth abdominal segments are blue dorsally and black laterally (**Fig. 3.1.434**). Length of male abdomen: c. 21 mm. Hind wing length of male: 17 to 28 mm.
.....*Argia adamsi* Calvert, 1901
(Mexico, Central America, Colombia, Ecuador, Peru, Venezuela). Syn: *Argia huallaga* Fraser, 1946.

- The posterior margin on the tenth abdominal segment is produced along the midline to form a thick, blunt process elevated above the plane of the dorsal surface of the segment, as best seen in lateral view (**Fig. 3.1.432**). 52

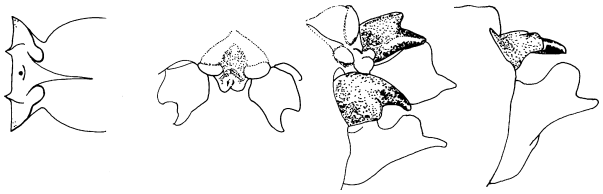


Fig. 3.1.434 *Argia adamsi* (left to right): prothorax and anterior part of the synthorax of a female in dorsal view and anal appendages of a male in dorsal, dorsolateral, and lateral view. Based on Eaton and Calvert (1892-1908) and Lencioni (2006).

52. The posterior part of the head is black. The black humeral stripe is unforked (**Fig. 3.1.432**). Length of male abdomen: 29 to 32 mm. Hind wing length of male: 22.5 to 26 mm. The posterior and ventral parts of the head are black. .....*Argia sordida* Hagen in Selys, 1865 (Minas, Gerais, Rio de Janeiro, São Paulo). Syn: *Argia dimissa* Selys, 1865.

- The posterior part of the head is mainly pale. The dorsal 1/3 to 1/2 of the black humeral stripe is forked. The superior and inferior anal appendages have complex folds and reach approximately equally far posteriad (**Fig. 3.1.435**). Length of male abdomen: 28.5 to 30 mm. Hind wing length of male: 22 to 23.5 mm.

.....*Argia albistigma* Hagen in Selys, 1865 (Paraguay, Uruguay, Argentina, Rio Grande do Sul, Santa Catarina). Syn: *Argia fosteri* Calvert, 1909.

53. The inferior anal appendage has a tapering, finger-shaped lower branch that extends well beyond the upper branch and curves dorsad at the apex to point dorsoposteriad, as best seen in lateral view (**Fig. 3.1.436**). The hind wing has three antenodal cells. 54

- The lower branch of the inferior anal appendage is not tapering and finger-shaped, or, if it is, it points caudad and does not curve dorsad near the apex (**Fig. 3.1.437**). 56

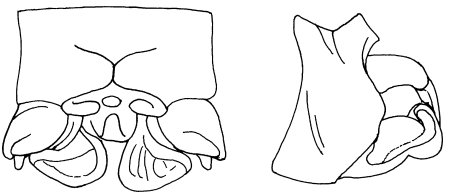


Fig. 3.1.435 *Argia albistigma* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

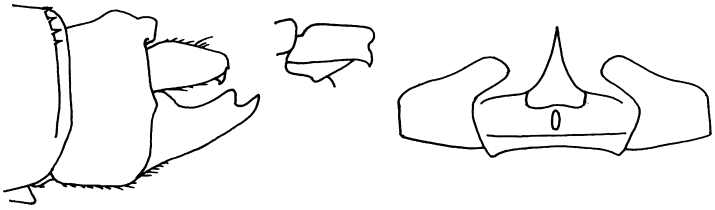


Fig. 3.1.436 *Argia gerhardi* (left to right): apex of the male abdomen in lateral view, dorso-internal view of the apex of the male superior anal appendage, and mesostigmal lamina of the female. Based on Calvert (1909).

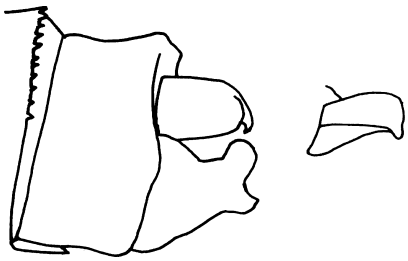


Fig. 3.1.437 *Argia tamoyo* male: apex of the male abdomen in lateral view (left) and a dorso-internal view of the apex of the male superior anal appendage (right). Based on Calvert (1909).

54. Hind wing length: c. 16.5 mm. Length of abdomen: c. 23.5 mm. The black antehumeral stripe is not forked, is nearly of uniform width, and covers almost all of the mesepimeron. There is a dorso-internal indentation on the superior anal appendage (**Fig. 3.1.438**).
.....*Argia kokama* Calvert, 1909 (Peru). Syn: *Argia makoka* Fraser, 1946.
- The hind wing is at least about 20 mm long, and the length of the abdomen is at least 20 mm. The mesepimeron is mainly pale brown (**Fig. 3.1.436**). 55

Fig. 3.1.438 *Argia kokama* male: apex of the male abdomen in lateral view (left) and a dorso-internal view of the apex of the male superior anal appendage (right). Based on Calvert (1909).

55. There is no black spot on the ventral ¼ of the mesepimeron, which has a pale brownish stripe with greenish bronze iridescence running from the lower margin of the humeral stripe almost to the dorsal margin of the sclerite (**Fig. 3.1.436**). Length of abdomen: 25 to 28 mm. Hind wing length: 19.5 to 22 mm. .....*Argia gerhardi* Calvert, 1909 (Colombia, Ecuador, Peru, Bolivia). Syn: *Argia medinensis* Navás, 1935.
- There is a black spot on the ventral ¼ of the mesepimeron, which is as broad as the pale antehumeral stripe crossing an otherwise pale brown sclerite. .....*Argia nigrior* Calvert, 1909 (Ecuador, Peru). Syn: *Argia gerhardi nigrior* Calvert, 1909, and probably *Argia mariensis* Calvert, 1961.

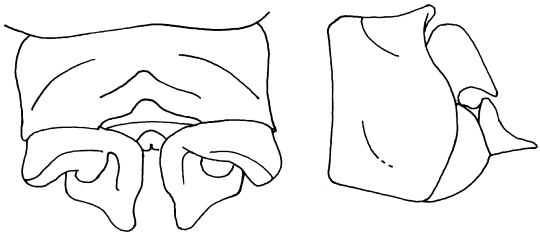


Fig. 3.1.439 *Argia mollis* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

56. In lateral view, the inferior anal appendage of the male remains broad to the apex, which has a median excavation dividing it into a dorsal and ventral branch, each of which is broad and extends approximately the same distance posteriad. The superior anal appendage is slightly shorter than the inferior and has a short apical or subapical process hooking ventrad (**Fig. 3.1.437**). There are usually more than three antenodal cells in the fore-wing. 57
- If the inferior anal appendage is divided into branches at its apex, one of them extends considerably farther posteriad than the other or both are long and taper gradually (**Fig. 3.1.438**). 59

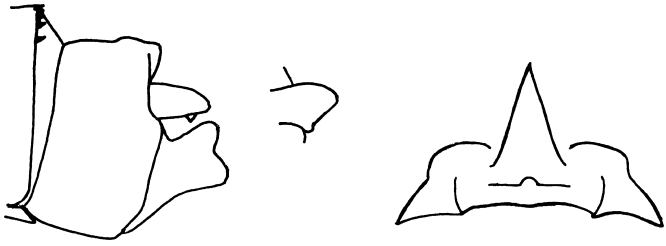


Fig. 3.1.440 *Argia hasemani* (left to right): apex of the male abdomen in lateral view, dorso-internal view of the apex of the male superior anal appendage, and mesostigmal lamina of the female. Based on Calvert (1909).

57. A hook curves ventrad from the apex of the superior anal appendage. The apex of the inferior anal appendage has an excavation separating blunt dorsal and ventral lobes (**Fig. 3.1.437**). The branch of the forked humeral stripe extending onto the mesepimeron reaches the dorsal margin of that sclerite. The second lateral suture has a black line along its entire length. There are usually more than three antenodal cells in the fore-wing and four in the hind wing. Length of male abdomen: c. 29 mm. Hind wing length of male: c. 21.5 mm. The female has not been described.
.....*Argia tamoyo* Calvert, 1909
(Bolivia, Mato Grosso, Minas Gerais, Rio de Janeiro).
- The hook on the superior anal appendage is obviously inserted subapically (**Fig. 3.1.440**). 58

Fig. 3.1.441 *Argia indocilis* male (left to right): anal appendages in dorsal, dorsomedial, and lateral view. Based on Lencioni (2006).

58. The eighth through tenth abdominal segments are blue with black lateral stripes running the length of each segment. The second abdominal segment and the longitudinal stripe on the third are violet. The branch of the forked humeral stripe extending onto the mesepimeron does not reach the dorsal margin of that sclerite. The second lateral suture has a short black line only on its dorsal end. The ventral lobe on the inferior anal appendage is slightly thicker than the dorsal lobe (**Fig. 3.1.440**). The hind wing has three antenodal cells, and the fore-wing has either three or four. Length of male abdomen: 26.5 to 28 mm. Hind wing length of male: 19.5 to 20.5 mm.
.....*Argia hasemani* Calvert, 1909
(Argentina, Bahia, Amazonas, Mato Grosso).
- The basal ring on the eighth and the entire ninth and tenth abdominal segments are blue. The anal appendages of the male are black. The pale markings on the second through seventh abdominal segments are blue, and the first segment is blue with a rectangular black mark in the middle. The antehumeral stripe is blue; the humeral stripe and carina are yellow. The labrum is yellow with black setae. The occiput is pale. The dorsal lobe on the inferior anal appendage is slightly thicker than the ventral lobe (**Fig. 3.1.441**). Length of male abdomen: c. 27 mm. Hind wing length of male: c. 22 to 22.5 mm.
.....*Argia indocilis* Navás, 1934
(Rio Grande do Sul). The great resemblance of the male anal appendages suggests that the forms in the couplet may be conspecific.

59. In lateral view, the superior anal appendage appears about twice as high at the apex as long, and its posteroventral corner is elongated to extend beyond the short dorsal branch of the inferior appendage (**Fig. 3.1.439**). There are sometimes three and sometimes four or more antenodal cells in the fore-wing and three in the hind wing. Hind wing length: 20 to 22.5 mm. Length of abdomen: 25 to 29 mm. The color is variable, and the coloration may resemble that of a number of other species.
.....*Argia mollis* Selys, 1865 pars (Bolivia, Paraguay, Argentina, Amazonas, Rondônia, Mato Grosso, Minas Gerais, São Paulo).
- In lateral view, the superior anal appendage is as long or longer than high. The ventral branch of the inferior appendage is long, narrow, and projects posteriad (**Fig. 3.1.433**). 60
60. The inferior anal appendage is truncate except for a relatively long ventral appendage, which tapers to an almost acute apex (**Fig. 3.1.433**). 61
- The inferior anal appendage branches more in the horizontal than in the vertical plane, so it does not appear truncate in lateral view (**Fig. 3.1.442**). 62
61. The superior anal appendage just reaches the apex of the dorsal branch of the inferior anal appendage, which appears excavated along its dorsal margin in lateral view (**Fig. 3.1.433**). The posterior part of the head is mainly black, and pale markings on the fourth through sixth abdominal segments are more extensive than a narrow line. There are usually no more than three antenodal cells in the fore-wing. Length of abdomen: 25 to 28 mm. Hind wing length: 18.5 to 20 mm.
.....*Argia smithiana* Calvert, 1909 (Bolivia, Mato Grosso, Goiás, Minas Gerais).
- The superior anal appendages are, at most, only slightly curved ventrad and do not extend as far posteriad as the inferior appendages (**Fig. 3.1.443**). There are usually more than three antenodal cells in the fore-wing. Total length: c. 36 mm. Length of abdomen: 27 to 28 mm. Hind wing length: 19 to 32 mm. The body has a metallic sheen.
.....*Argia difficilis* Selys, 1865 (Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela?, Mato Grosso). Syn: *Argia machadina* Förster, 1914; *Argia extranea forficula* Fraser, 1946.

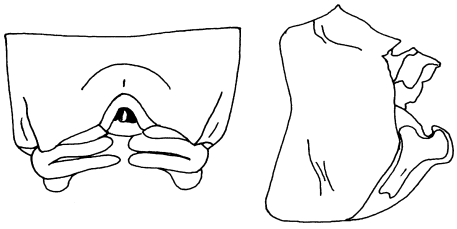


Fig. 3.1.442 *Argia lilacina* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

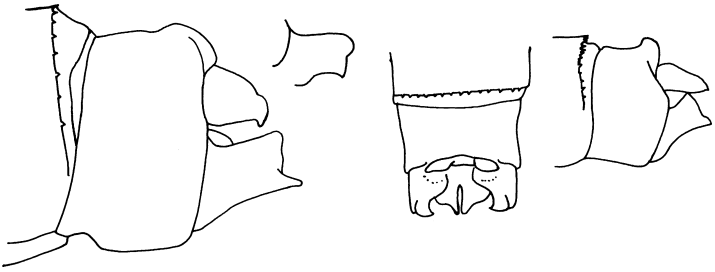


Fig. 3.1.443 *Argia difficilis* male (left to right): apex of the abdomen in lateral view, apex of the superior anal appendage in dorsal view and the apex of the abdomen of a different specimen in dorsal and lateral view. Based on Calvert (1902) and Schmidt (1942).

62. The inferior anal appendage appears hooked dorsad in lateral view and appears to extend only slightly farther posteriad than the superior appendage (**Fig. 3.1.442**). There are usually no more than three antenodal cells in the forewing. Length of abdomen: 22.5 to 26 mm. Hind wing length: 14 to 20 mm. The color pattern is somewhat variable.
.....*Argia lilacina* Selys, 1865
(Paraguay, Argentina, Uruguay, Minas Gerais, São Paulo, Mato Grosso). Syn: *Argia thisma* Calvert, 1909.

- The inferior anal appendage has long lobes that extend considerably farther posteriad than the superior appendage. In dorsal view, each superior anal appendage is indented at the apex to form a narrow outer lobe and a broad inner lobe (**Fig. 3.1.444**). The third through sixth abdominal segments have a blue middorsal stripe. There are usually more than three antenodal cells in the forewing and three antenodal cells in the hind wing. Length of male abdomen: 27 to 31 mm. Hind wing length of male: 18 to 24 mm.
.....*Argia oculata* Hagen in Selys, 1865
(Mexico, Central America, Trinidad, Tobago, Colombia, Peru. Ecuador, Venezuela, Amazonas, Mato Grosso). Syn: probably *Argia icterica* Navás, 1934.

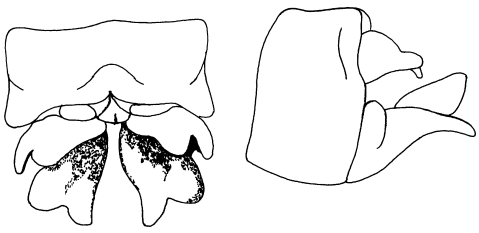


Fig. 3.1.444 *Argia oculata* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Hagen and Calvert (1902).

Key to the species of adult female *Argia* in South America

Information for the key provided by Selys (1865), Calvert (1909), Förster (1914), Ris (1916), Sjöstedt (1918), Navás (1934b.c, 1935), Fraser (1946a, 1948b), and Garrison and von Ellenrieder (2007). The females of the following species have not been described: *Argia dives, A. euphorbia*, *A. jujuya, A. hamulata, A. huanacina, A, jocaste, A. kokama, A. limitata, A. subapicalis, A. tamoyo, A. thespis, A. tupi,* and *A. variata.* In addition, the desciptions of *A. cyathigera* and *A. modesta* are too sketchy and those of *A. insipida* and *A. indocilis* are too doubtful to include the species in the key.

1. The area posterior to Cu_2 is usually two cells wide, and the second antenodal is often slightly beyond the level of the arculus. M_4 runs zigzag beyond the level of the fork in M_{1+2}. Length of abdomen: 43 to 44 mm. Hind wing length of male: c. 36 mm; female: c. 39 mm. The head is brown, and the thorax is blackish with a dark red antehumeral stripe and vestiges of three dark red lateral stripes. The abdomen is black with red around the margins of the segments. The legs are blackish brown. This poorly known species urgently requires a better description.
.....*Argia funcki* (Selys, 1854) (Mexico, Central America, Colombia? Venezuela?). Syn: *Hyponeura funcki* Selys, 1854. Reports from South America may have resulted from errors on museum labels (von Ellenrieder and Garrison, 2007a).
- The area posterior to Cu_2 is one cell wide, or another characteristic is lacking (**Fig. 3.1.337**). 2
2. The color pattern on the thorax and abdomen is complex so that there is no clear dominance of either black or one other color. 3
- The dorsal surface of the third through sixth abdominal segments is predominantly either black or a pale color. 4
3. The dark and pale color pattern is variable, but generally, the dorsal surfaces of the thorax and abdomen are black and violet or blue without notable dominance of one color. The thorax is violet or blue with variable black middorsal and humeral stripes and a narrow black line along the second lateral suture. The abdomen is black on the first seven abdominal segments marked with violet or blue on the posterior part of the first segment, dorsolateral stripes on the second, large basal and dorsal areas on the third and fourth, a small basal markings on the fifth through seventh, the entire dorsal and lateral surfaces of the eighth and ninth, and the anterior margin and spots on the tenth. Hind wing length: 19 to 32 mm. Length of abdomen: c. 27 mm.
.....*Argia difficilis* Selys, 1865 (Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela?, Mato Grosso). Syn: probably *Argia machadina* Förster, 1914; *Argia extranea forficula* Fraser, 1946.
- The mid-dorsal stripe from the third through fifth abdominal segments is brown or grayish brown bordered by a pair of black dorsolateral stripes. The

sixth and seventh segments have brownish proximal rings confluent with mid-dorsal stripes of the same color. The ninth segment is brown with a pair of black spots on the dorsum. The lateral surfaces of the second through ninth abdominal segments are brown. The mesostigmal plates have long, lobular posterior flanges directed posterodorsally (**Fig. 3.1.393**). The labrum and postclypeus are mainly pale brown. Total length of female: c. 33.5 to 34 mm. Length of female abdomen with appendages: c. 26.5 to 27 mm. Hind wing length of female: c. 23.5 mm.
.....*Argia rosseri* Tennessen, 2002 (Argentina).

4. The dorsal surface of the third through sixth abdominal segments is not mainly black (**Fig. 3.1.396**). 5
- The dorsal surface of the third through sixth abdominal segments is mainly black (**Fig. 3.1.337**). 13

5. The middle segments of the abdomen are mainly reddish. The labrum, anteclypeus, and two postocular spots are bright azure blue, while most of the rest of the head is black. The thorax is velvety black dorsally with blue antehumeral stripes. 6
- The middle segments of the abdomen are not mainly reddish. The labrum and face are light reddish yellow, yellow, blue, or violet, sometimes with other markings. 8

6. The abdomen of the female is c. 24 mm, and its hind wing length is c. 19 mm. The wings are entirely clouded with brown or reddish brown, somewhat lighter in the female than in the male, with a brown, elongate, elliptical pterostigma that is paler in the middle. The head and thorax are blackish olive, and the first six abdominal segments are dark red; the seventh through tenth are blackish with bluish markings on the ninth.
.....*Argia infumata* Selys, 1865 (Venezuela, Bolivia, Pará, Amazonas, Rondônia).

- The female abdomen is longer than 28 mm, and its hind wing length is more than 24 mm. 7

7. The ventral surface of the abdomen is blue; its dorsal surface is bright scarlet with a black marking covering the dorsal surfaces of the posterior half of the seventh and the entire eighth and ninth segments. Length of female abdomen: c. 30 mm. Hind wing length of female: 26 to 27 mm.
.....*Argia croceipennis* Selys, 1865 (Paraguay, Uruguay, Argentina, Rio de Janeiro, São Paulo, Santa Catarina, Rio Grande do Sul). Syn: *Argia missionensis* Fraser, 1948.
- The ventral surface of the abdomen is black. The pale, round postocular spots are joined by a pale line. The description of the female is poor because the type specimen was damaged.
.....*Argia eliptica* Selys, 1865 (Central America, Rondônia).

8. The hind wing length of the female is 26 to 29 mm. The abdomen of the female is 30 to 34 mm. 9

- The hind wing of the female is not longer than c. 25 mm. In case of doubt, the eighth abdominal segment has dark markings apically and laterally, while the ninth and tenth have such markings laterally or ventrolaterally, or, alternatively, there is only one cell directly posterior to the pterostigma. 10

9. The thorax and abdomen are mainly yellowish or olive and black without a metallic coppery shine, and the legs are vivid red with black on the inside surfaces of the tibiae. There are about two cells directly posterior to the pterostigma.
.....*Argia claussenii* Selys, 1865
(Paraguay, Uruguay, Argentina, Minas Gerais).

- The thorax is black with a strong metallic coppery shine on the dorsal surface, and the lateral markings are mainly light yellowish brown. The legs are whitish with black lines on the femora, tibiae, and tarsi and black spines. Length of female abdomen: c. 32 mm. Hind wing length of female: c. 27 mm.
.....*Argia joergenseni* Ris, 1913
(Argentina).

10. The eighth through tenth abdominal segments are mainly blue with black markings on the eighth and ninth and sometimes also on the tenth segment (**Fig. 3.1.396**). 11

- The eighth and ninth abdominal segments are entirely pale, or pale with black markings only on the ninth. The postclypeus is partly or entirely coppery or blue and violet. The occiput is white or yellow. 12

11. The head is mainly bluish gray, and the thorax, mainly grayish blue or bright gray with black markings, which are reduced to reddish brown traces in some specimens (**Fig. 3.1.396**). Length of female abdomen: 23 to 28.5 mm. Hind wing length of female: 19 to 23 mm.
.....*Argia inculta* Hagen in Selys, 1865
(Ecuador, Peru).

- The head and thorax are mainly black and blue. The eighth abdominal segment is blue dorsally and black laterally, while the ninth and tenth are mainly blue with black markings. Length of the female abdomen: c. 27 mm. Hind wing length of female: c. 22 mm. There is just one cell directly posterior to the pterostigma.
.....*Argia serva* (Hagen in Selys, 1865)
(Argentina, Santa Catarina).

12. There are no black streaks on the third through sixth abdominal segments, and black markings are limited to an apical spot on each side. The eighth through tenth abdominal segments are entirely pale. Length of abdomen: 28 to 33 mm. Hind wing length: 24 to 25 mm.
.....*Argia fissa* Selys, 1865
(Mexico, Central America, Colombia, Peru).

- There are black streaks on the third through sixth abdominal segments, which begin beyond the base of the segment and are not continuous with a black apical ring. The eighth and ninth abdominal segments are pale dorsally, except

sometimes for black markings on the ninth. Length of female abdomen: 23 to 28.5 mm. Hind wing length of female: 19 to 23.5 mm.
.....*Argia extranea* (Hagen, 1861)
(North and Central America, Surinam, Colombia). Syn: *Agrion extranea* Hagen, 1861; *Argia mista* Navás, 1934.
13. Mesepisternal tubercles, one of which located near the ventral end of the mesepisternum and the other on the outer side of the mesostigmal lamina, are prominent and well developed. The tenth abdominal segment is pale with a pair of black or dark brown spots on the dorsum. There is a pair of black stripes running the length of the eighth and most of the length of the ninth abdominal segment. These stripes are sometimes more extensive than the pale color on the eighth segment. There is no coppery metallic shine on the head and thorax. Length of abdomen: 28 to 33.5 mm. Hind wing length: 18.5 to 22.5 mm.
.....*Argia translata* Hagen in Selys, 1865
(North and Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, French Guiana, Argentina). Syn: *Argia espinalensis* Navás, 1935.
- Mesepisternal tubercles are absent, or they are small and not well developed. In case of doubt, the tenth abdominal segment is entirely pale dorsally, or there is no pair of black lines running the length of an otherwise pale eighth and most of the length of the ninth abdominal segment. 14
14. The ninth abdominal segment is black with a dull greenish band covering the posterior half of the segment and extending as a mid-dorsal stripe to the anterior margin of the segment. The eighth abdominal segment is dull ocher with a greenish tinge and a wide black posterior margin. The tenth segment is black with round pale markings. The prothorax is ocher. The underside of the thorax is whitish. The first two abdominal segments are mainly ocher with black posterolateral and ventral markings on the second segment. The third through seventh segments are mainly black dorsally, but they have ocher basal rings contiguous with narrow middorsal stripes and lateral surfaces divided by narrow black stripes. The labrum, face and apical part of the postclypeus of the female are pale greenish yellow; there is a black line across the base of the postclypeus. Length of abdomen: c. 29 mm. Hind wing length: 23 to 30 mm.
.....*Argia talamanca* Calvert, 1907
(Central America, Colombia, Ecuador, Venezuela).
- Pale markings are not mainly ocher or dull greenish, or the posterior half of the ninth abdominal segment is not pale, or it lacks a pale mid-dorsal stripe from the pale band to the anterior margin. Otherwise, another feature is absent. 15
15. Small but distinct mesepimeral tubercles are present, and the mesostigmal lamina forms lobes directed mesad (**Fig. 3.1.434**). The eighth and ninth abdominal segments are pale with four black stripes, the ventrolateral stripes extending for the length of each segment and the dorsolateral stripes extending from the base to the posterior 2/3 of the eighth segment and from the base to the midlength of the ninth. The tenth abdominal segment is broadly pale dorsally, and the anal appendages are black. The second abdominal segment is black with an elongated mid-dorsal marking along the mid-length; the third through sixth

segments have pale markings running to the posterior margin of the segment and occupying 2/3 of the length of the third, half of the fourth, 2/5 of the fifth, and 1/5 of the sixth segments. The labrum is black. There are three to four antenodal cells in the fore-wing and three to four in the hind wing. Length of female abdomen: 24 to 28 mm. Hind wing length of female: 19 to 22 mm.
.....*Argia adamsi* Calvert, 1901
(Mexico, Central America, Colombia, Ecuador, Peru, Venezuela). Syn: *Argia huallaga* Fraser, 1946.

- Mesepimeral tubercles are lacking or vestigial, or the eighth and ninth abdominal segments have a pattern other than four black stripes on a pale background, so that either black or pale is clearly dominant on at least one of the two segments, or the labrum is not entirely black. 16

16. The eighth or ninth abdominal segment or both are at least half black dorsally; small pale lines or other markings may be present (**Fig. 3.1.337**).
….....17

- The dorsal surfaces of both the eighth and ninth abdominal segments are mainly pale, usually with black markings. 29

17. The eighth, ninth, and tenth abdominal segments are all mainly black with blue dorsal markings on posterior half (**Fig. 3.1.337**). Low, poorly developed foliate lobes are present on the mesostigmal plates. Total length of female: 36 to 42.5 mm. Length of female abdomen: 27 to 33.5 mm. Hind wing length of female: 22 to 27 mm. The habitat is dense foothill forests.
.....*Argia yungensis* Garrison and von Ellenrieder, 2007
(Peru, Bolivia, Argentina).

- At least one of the eighth through tenth abdominal segments is different from the others in the extent or position of the black and pale markings. 18

18. The abdomen is black with a pale first segment, pale lateral markings of the second and third segments, elongated yellowish brown spots on the eighth segment, a lateral triangular marking on the ninth segment. The tenth segment is deeply excavated almost to its base in the middle. Hind wing length: c. 16 mm. The head is entirely black except for a slightly lightened labrum in some specimens. The wings are clouded with yellowish brown, and the pterostigma of the female is light brown. The thorax is black dorsally with wide yellowish red humeral stripes and large yellowish red lateral areas. Total length of female: c. 25 mm. Length of female abdomen: c. 20 mm.
….....*Argia impura* Rambur, 1842
(Guyana, Amazonas).

- The eighth and ninth abdominal segments are not black with elongated yellowish brown spots on the eighth segment and a lateral triangular marking on the ninth segment. In case of doubt, the humeral stripes and lateral areas on the thorax are not yellowish red.….....19

19. The eighth segment is blue with black markings, while the ninth segment is entirely black. 20

- The eighth segment is not blue with black markings, or if it is, the ninth segment is not entirely black. 21

20. The eighth abdominal segment is pale dorsally with a black marking occupying the middle 2/5 to 3/5 of the length. On more than 90% of the specimens described, there were four antenodal cells in the fore-wing and three in the hind wing. Length of abdomen: c. 27 mm. Hind wing length: c. 21.5 mm.
.....*Argia nigrior* Calvert, 1909 (Ecuador, Peru). Syn: *Argia gerhardi nigrior* Calvert, 1909, and probably *Argia mariensis* Calvert, 1961.
- The eighth abdominal segment is pale dorsally with only the proximal 1/10 of the segment black. There are yellowish green lateral stripes on the third through seventh abdominal segments running for about 1/3 the length and pale dorsal markings on the third and fourth segments. The fifth through seventh segments are entirely black dorsally. The labrum is light brownish yellow. The face is light blue-green. The occiput is waxy yellow with a pair of black bands on each side. There is a curved black band anterior to the middle ocellus and other black markings.
.....*Argia variegata* Förster, 1914 (Colombia, Ecuador, Peru). Syn: *Argia trifoliata* Fraser, 1946.
21. The eighth abdominal segment is black proximally with small blue areas on the apical 1/4 to 1/2. The basal part of the ninth abdominal segment has black dorsal markings, while the apical part is blue.....22
- The eighth abdominal segment is mainly blue or violet, or, if it is mainly black or blackish brown, then the ninth segment is pale with no more than only a pair of black stripes. 26
22. The anal appendages are very small and yellow. The eighth and ninth abdominal appendages are mainly black dorsally with a yellow dorsal marking on the eighth that usually joins with a yellow apical ring around the segment and a yellow marking along the posterior margin of the ninth segment that forms three branches directed anteriad. Length of female abdomen: 24 to 27 mm. Hind wing length: 19 to 20 mm.
.....*Argia lilacina* Selys, 1865 (Paraguay, Argentina, Uruguay, Minas Gerais, São Paulo, Mato Grosso). Syn: *Argia thisma* Calvert, 1909.
- The entire dorsum of the tenth abdominal segment and the anal appendages are usually black. 23
23. The eighth abdominal segment is black on the anterior 1/3 with a pair of black dorsolateral stripes extending posteriad to 2/3 of the segment length and a pair of black lateral stripes extending to the mid-length of the segment. The ninth segment is black with one pale mid-basal spot and a pair of pale dots at 3/4 of the segment length. The tenth segment is black with a narrow pale posterior margin. Length of female abdomen: c. 18.5 mm. Hind wing length of female: c. 14.5 mm.
….....*Argia bicellulata* (Calvert, 1909) (Mato Grosso). Syn: *Diargia bicellulata* Calvert, 1909.

- The eighth abdominal segment is black on the entire proximal half, or, if not, there are small pale markings only on the proximal half, or the tenth segment has a pattern other than black with a narrow pale posterior margin. 24

24. The basal half of the eighth abdominal segment is black, while the apical half is blue dorsally and black laterally. The ninth segment is blue dorsally with continuous black stripes on the lower part of the lateral surfaces and a black mid-dorsal marking on the apical 1/5. The third through fifth abdominal segments lack blue mid-dorsal stripes, except sometimes on the third segment. The wings are clouded yellow or smoky. Length of female abdomen: c. 23 mm. Hind wing length: c. 18 mm.
.....*Argia indicatrix* Calvert, 1902
(Mexico, Central America, Colombia, Ecuador, Peru, Venezuela, Amazonas). Syn: *Argia dagnina* Förster, 1914; *Argia stigmatica* Navás, 1934; *Argia umbriaca* Fraser, 1946.

- More than half of the dorsal surface of the eighth abdominal segment is black. Black markings on the dorsal surface of the ninth abdominal segment are confined to the proximal half. 25

25. The eighth abdominal segment is black proximally and blue on the distal 1/4 to 1/3, while the ninth segment is black on the proximal half, but the blue encroaches into the black half along a mid-dorsal stripe. Length of female abdomen: c. 24 mm. Hind wing length of female: c. 18 mm.
….....*Argia mishuyaca* Fraser, 1946
(Peru).

- The eighth abdominal segment is mainly black but has a small blue marking at the apical margin. The ninth segment is blue with a pair of black basal triangles separated by blue along the midline and extending for about half the length of the segment. Length of female abdomen: c. 25 mm. Hind wing length of female: c. 20.5 mm.
.....*Argia fumigata* Hagen in Selys, 1865
(Venezuela, French Guiana, Guyana, Surinam, Amazonas, Rondônia, Mato Grosso).

26. The eighth abdominal segment is mainly black or blackish brown, while the ninth is pale with a pair of black stripes. 27

- The eighth abdominal segment is mainly blue. 28

27. There are no mesepisternal tubercles. There is a narrow, pale mid-dorsal stripe on the third through sixth abdominal segments.
….....*Argia reclusa* Selys, 1865 pars
(Argentina, Bolivia, Paraguay, Pará, Amazonas, Minas Gerais, São Paulo, Rio Grande do Sul, Mato Grosso).

- Mesepisternal tubercles are present. The third through eighth abdominal segments are blackish brown, sometimes with violet reflections. The ninth abdominal segment is violet dorsally. There are no pale median flecks on the dorsal surface of the head. The pterostigma is almost twice as long as wide.
.....*Argia fraudatricula* Förster, 1914
(Ecuador, Peru).

28. The occipital region of the head is mainly pale dorsally with black only on the posterior surface and around the foramen. The eighth abdominal segment is blue dorsally, and the ninth is at least half black with a pair of apical blue spots that may merge to cover the posterior half of the segment. Mesepisternal tubercles are present. The posterior lobe of the prothorax has an evenly curved margin (**Fig. 3.1.407**). There are always three antenodal cells on both fore and hind wings. Abdomen length: 26 to 29 mm. Hind wing length: 21 to 22.5 mm.
.....*Argia variabilis* Selys, 1865 (North and Central America, Colombia).

- The occipital region of the head is mainly black, and a pair of pale dorsal spots is present on the dorsal surface of the head. The thorax and abdomen are mainly black and blue, with the blue replaced by yellow in preserved specimens. The abdomen has a wide black mid-dorsal stripe. The eighth tergite is blue in life. The pterostigma is dark becoming somewhat paler along the posterior margin, and its width is about 80% of its length. The posterolateral corners of the tenth abdominal segment are somewhat produced. The general description is poor. Length of female abdomen: 31 mm. Hind wing length of female: 23 mm.
.....*Argia medullaris* Hagen in Selys, 1865 (Mexico, Central America, Colombia, Ecuador, Venezuela). Syn: *Argia rectangula* Navás, 1921; *Argia charalana* Navás, 1924; *Argia columbiana* Navás, 1924; *Argia augustana* Navás, 1934.

29. The dorsal surface of the thorax and parts of the head are dark metallic with coppery reflections. 30

- Coppery reflections are not evident on either the dorsal surface of the thorax or large parts of the head, although such reflections may be present only on small areas of the head. 33

30. The labrum is entirely yellow and lacks any metallic reflections. 31

- At least the basal half of the labrum and the postclypeus are a metallic coppery color. Well-developed mesepisternal tubercles are present. There are five antenodal cells on the fore-wings and four on the hind wings. There is a pair of black lines running the length of the eighth and most of the length of the ninth abdominal segment. 32

31. There is no pale antehumeral stripe, or it is present only dorsally. Mesosternal tubercles are lacking (**Fig. 3.1.401**). The differences in the coloration of the thorax are not sufficient to separate the females of the two species in this couplet with certainty, and more complete descriptions will be required after the intraspecific variability is better defined. Length of abdomen: c. 26 mm. Hind wing length: 21.5 to 23 mm.
.....*Argia oenea* Hagen in Selys, 1865 (North and Central America, Colombia).

- There are yellow humeral and posthumeral stripes. Length of abdomen: c. 26 mm. Hind wing length: c. 21 mm.
.....*Argia orichalcea* Hagen in Selys, 1865 (Panama, Trinidad, Colombia, Venezuela).

32. Coppery reflections are evident on the thorax and usually the vertex, nasus, and labrum. Length of abdomen: 27 to 31 mm. Hind wing length: 20.5 to 30 mm. The females of these two nominal species can apparently not be distinguished with certainty. Calvert in Eaton and Calvert (1892-1907) initially reported that *A. cuprea* has mesepisternal tubercles, while *A. cupraurea* does not, but he later discovered that these tubercles are present on the females of both species. Only the slightly shorter wings in relation to the length of the abdomen seem to be distinctive, but intraspecific variability would explain this.
.....*Argia cuprea* (Hagen, 1861)
(North and Central America). Syn: *Agrion cuprea* Hagen, 1861. A form of this species, designated Form b, was reported by Ris (1918) from Colombia and Bolivia.

- Coppery reflections are evident of the thorax, vertex, only the basal half of the labrum, and postclypeus. Mesepisternal tubercles are present but not well developed (**Fig. 3.1.418**). Length of abdomen: c. 27.5 mm. Hind wing length: c. 22 mm. The occiput is black with a narrow pale border to the eye. The abdomen is marked with much blue.
.....*Argia cupraurea* Calvert, 1902
(Central America, Colombia, Venezuela). Syn: *Argia fulgida* Navás, 1934.

33. The eighth and ninth abdominal segments are broadly pale dorsally, although they may be black on their lateral surfaces. …….....34

- The eighth and ninth abdominal segments have black dorsal or dorsolateral markings, usually in the form of stripes.....35

34. Both the eighth and ninth abdominal segments are entirely pale without any black markings.
.....*Argia pulla* Selys, 1865
(North and Central America, Trinidad, Tobago, Colombia, Ecuador, Peru, Venezuela, Argentina, Roraima). Syn: *Argia lobata* Navás, 1924.

- The eighth through tenth abdominal segments are broadly blue dorsally, and although the rest of the pattern on the abdomen becomes darker with age, these blue markings remain. The third through seventh abdominal segments are black with a pair of small blue basal triangles, which tend to fade out posterior to the fourth segment and may not be discernible. Length of female abdomen: c. 22 mm. Hind wing length of female: c. 19 mm.
.....*Argia infrequentula* Fraser, 1946
(Colombia, Ecuador).

35. There are three antenodal cells on both the fore and hind wing. 36

- There are usually at least four antenodal cells on one of the wings. Caution, some specimens may have fewer than the normal number on one wing. 42

36. The eighth and ninth abdominal segments are pale dorsally and laterally but with black ventrolateral stripes running the entire length of the segment and a pair of black dorsal markings at the base of the ninth segment occupying about 1/5 the length of the segment and connected with a narrow basal band reaching the ventrolateral stripes. Length of the female abdomen: 23 to 24 mm. Hind

wing length of female: 19.5 to 20 mm. The occipital region of the head is pale, except for black spots around the foramen.
.....*Argia pocomana* Calvert, 1907
(Central America, Colombia).
- The dorsal or lateral surfaces of the eighth and ninth abdominal segments have black stripes at least about half the length of the segment. 37
37. The eighth and ninth abdominal segments are pale with black dorsal or lateral stripes for the length of the eighth and most of the ninth segment. 38
- The eighth and ninth abdominal segments are pale with black dorsal or lateral stripes only about half the length of each segment. 39
38. The black humeral stripe is not broken or forked. The third and fourth abdominal segments are mainly violet (**Fig. 3.1.404**). Length of abdomen: 24 to 26.5 mm. Hind wing length: 18 to 19.5 mm.
.....*Argia botacudo* Calvert, 1909 pars
(Mato Grosso).
- The black humeral stripe is broken, leaving its shorter part at the dorsal end of the humeral suture. The third and fourth abdominal segments are black with a narrow pale mid-dorsal line on each.
.....*Argia reclusa* Selys, 1865 pars
(Argentina, Bolivia, Paraguay, Pará, Amazonas, Minas Gerais, São Paulo, Rio Grande do Sul, Mato Grosso).
39. A black marking on the head reaches from the frons to the nasus. The third and fourth abdominal segments have only a narrow, pale mid-dorsal line. Length of abdomen: 26 to 26.5 mm. Hind wing length: c. 18.5 mm.
.....*Argia tinctipennis* Selys, 1865
(Peru, Amazonas).
- The black marking on the head reaches from the frons no farther than to abeam the first antennal segment. The third and fourth abdominal segments have only a pale mid-dorsal stripe wider than a line. 40
40. The black humeral stripe is unforked, uniform in width, and encloses a small spot. The mesostigmal lamina is relatively narrow (**Fig. 3.1.404**). Length of female abdomen: c. 23.5 mm. Hind wing length of female: 19 to 20 mm.
.....*Argia botacudo* Calvert, 1909 pars
(Mato Grosso).
- The black humeral stripe widens and forks, leaving a humeral branch that is not thicker than a pencil line. ….....41
41. The dorsal half of the black humeral stripe is considerably widened. Length of abdomen: 25 to 28 mm. The mesostigmal lamina is relatively short and wide (**Fig. 3.1.433**). Hind wing length: 18.5 to 20 mm.
.....*Argia smithiana* Calvert, 1909
(Bolivia, Mato Grosso, Goiás, Minas Gerais).
- Only the dorsal third of the black humeral stripe is considerably widened. Length of abdomen: 25.5 to 26 mm. Hind wing length: 18 to 20 mm.
.....*Argia chapadae* Calvert, 1909
(Mato Grosso).

42. Antenodal cells number four in the fore and three in the hind wing. 43
- Four or five antenodal cells are usually present on both wings. Caution, exceptional specimens may have three in one wing. 46
43. The mesepimeral part of the humeral stripe is pale brown, and there is a pale mid-dorsal stripe on the third through fifth abdominal segments that is distinctly wider than a pencil line. The tenth abdominal may be either blue or black. The mesostigmal lamina is large (**Fig. 3.1.436**). Length of abdomen: 25 to 29.5 mm. Hind wing length of female: 21 to 24 mm.
.....*Argia gerhardi* Calvert, 1909
(Colombia, Ecuador, Peru, Bolivia). Syn: *Argia medinensis* Navás, 1935.
- The mesepimeral part of the humeral stripe is black, or, if not, any pale mid-dorsal stripe on the third through fifth abdominal segments is no wider than a pencil line. 44
44. The dorsal surface of the tenth abdominal segment is black with a pair of pale spots. The black humeral stripe has a branch that reaches the dorsal margin of the mesepimeron. Length of male abdomen: c. 31 mm. Hind wing length of female: 19.5 to 23 mm.
.....*Argia oculata* Hagen in Selys, 1865
(Mexico, Central America, Trinidad, Tobago, Colombia, Peru. Ecuador, Venezuela, Amazonas, Mato Grosso). Syn: probably *Argia icterica* Navás, 1934.
- The tenth abdominal segment and the labrum are blue or pale dorsally. 45
45. There is a pale mid-dorsal stripe on the third through fifth abdominal segments that is distinctly wider than a pencil line. The black humeral stripe has a branch on the mesepimeron that does not reach its dorsal margin. The tenth abdominal segment is blue dorsally. The mesostigmal lamina is relatively wide (**Fig. 3.1.440**). Length of female abdomen: 25 to 27 mm. Hind wing length of female: 20 to 22 mm.
.....*Argia hasemani* Calvert, 1909
(Argentina, Bahia, Amazonas, Mato Grosso).
- Any pale dorsal stripe on the third through fifth abdominal segments is no wider than a pencil line. The tenth abdominal segment is pale dorsally. The mesostigmal lamina is a carina that forms the anterior margin of a fossa. Length of abdomen: 25 to 29 mm. Hind wing length: 21 to 22.5 mm. It is not altogether certain that the females originally described by Calvert (1909) actually belong to this species.
.....*Argia mollis* Selys, 1865
(Bolivia, Paraguay, Argentina, Amazonas, Rondônia, Mato Grosso, Minas Gerais, São Paulo).
46. The eighth and ninth abdominal segments are pale with black stripes contiguous only at the base of the eighth and running the entire length of the eighth and most of the ninth. The female abdomen is 27 to 29 mm long. The hind wing length of the female is 23 to 24 mm. The tenth abdominal segment is pale with a black basal lateral spot on each side. The occipital region of the head

is mainly pale. The inner margin of the mesostigmal lamina continues posteriad as a flattened ridge (**Fig. 3.1.445**). The male has not been described.
.....*Argia iralai* Calvert, 1909 (Paraguay).
- The eighth and ninth abdominal segments are pale with black stripes or spots only about half the length of each segment. Mesepisternal tubercles are always absent.....47

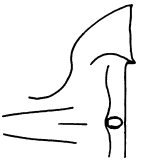


Fig. 3.1.445 Left mesostigmal lamina of a female *Argia iralai.* Based on Calvert (1909).

47. The black middorsal stripe on the synthorax is not divided by a pale stripe, and it is at least twice as wide as the pale antehumeral stripe. The occipital region of the head is mainly black. Length of abdomen of female: 28 to 30 mm. Hind wing length of female: 23 to 28 mm.
.....*Argia sordida* Hagen in Selys, 1865 (Minas, Gerais, Rio de Janeiro, São Paulo). Syn: *Argia dimissa* Selys, 1865.
- The black middorsal stripe on the synthorax is divided along the dorsal midline for most of its length by a blue stripe, and the pale antehumeral stripe is at least ¾ as wide as the mid-dorsal stripe. Length of female abdomen: 23 to 26 mm. Hind wing length of female: 19 to 23.5 mm.
.....*Argia albistigma* Hagen in Selys, 1865 (Paraguay, Uruguay, Argentina, Rio Grande do Sul, Santa Catarina). Syn: *Argia fosteri* Calvert, 1909.

Information on the known larvae of *Argia* species in South America

Descriptions for this section were provided by Geijskes (1943), Santos (1968b), Novelo-Gutiérrez (1992), De Marmels (2007a), von Ellenrieder (2007), and von Ellenrieder and Garrison (2007a). It is premature to provide a key to the species because information about the larvae is still fragmentary. It is hoped that this account will call increased attention to the larval stages.

1. The apices of the lateral gill lamellae are drawn out into tapering points lined with long setae; they are much longer than 1.5 times the length of the middle gill lamella (**Fig. 3.1.446**).
.....*Argia sordida* Hagen in Selys, 1865 (Minas, Gerais, Rio de Janeiro, São Paulo). Syn: *Argia dimissa* Selys, 1865.
- The gill lamellae end bluntly or with only a short extension (**Fig. 3.1.447**). ...2

2. The anterior margin of the prementum is rounded but protrudes only slightly beyond the level of its anterolateral corners. There are two long setae proximal to the moveable hook on the labial palp (**Fig. 3.1.448**). The caudal gill lamellae are extended to form short apical filaments.
.....*Argia pulla* Selys, 1865 (North and Central America, Trinidad, Tobago, Colombia, Ecuador, Peru, Venezuela, Argentina, Roraima). Syn: *Argia lobata* Navás, 1924.
- The anterior margin of the prementum protrudes well beyond the level of its posterolateral corners (**Fig. 3.1.447**).....3
3. In lateral view, no transverse row of setae is evident on the mandibles, but there is a longitudinal row running along the outer margin. The gill lamellae have three dark bands, one at the base, one at midlength, and one in the apical half. There are rosettes of short setae surrounding the joints of the five apical antenna segments (**Fig. 3.1.447**).
….....*Argia adamsi* Calvert, 1901 (Mexico, Central America, Colombia, Ecuador, Peru, Venezuela). Syn: *Argia huallaga* Fraser, 1946.
- In lateral view, a transverse row of about five to seven setae is evident on each mandible (**Fig. 3.1.449**).....4

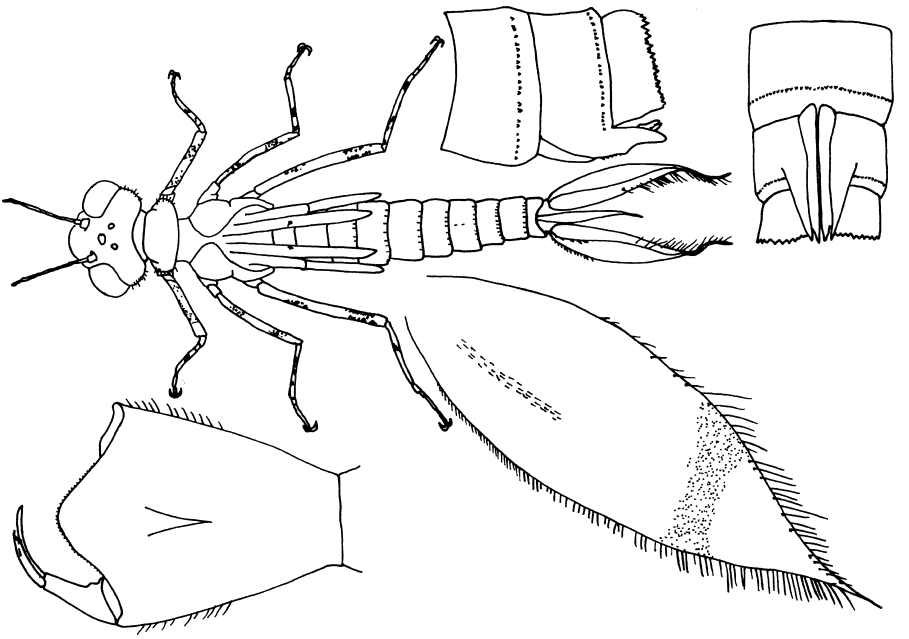


Fig. 3.1.446 *Argia sordida* larva: habitus (upper left), mentum in dorsal view (lower left), apical abdominal segments in lateral (upper center) and ventral view (upper right), and a lateral gill lamina (lower right). Based on Santos (1968b).

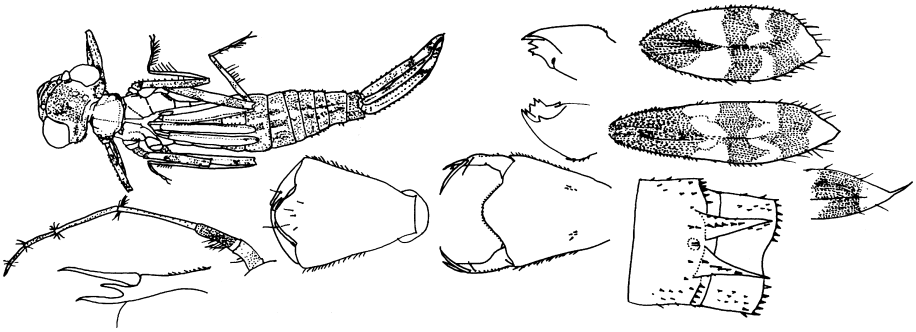


Fig. 3.1.447 *Argia adamsi* larva: habitus from an exuvia (upper left), antenna (middle left), labial palp (lower left), labium in ventral view (lower left center), anterior part of the prementum and labial palps in dorsal view (lower right center), mandibles (upper center), ninth and tenth abdominal segments of a male in ventral view showing the male gonapophyses (lower right), middle (upper right) and lateral caudal gill lamella with the apex of a lateral lamella from another specimen to the right (middle left). Based on De Marmels (2007a).

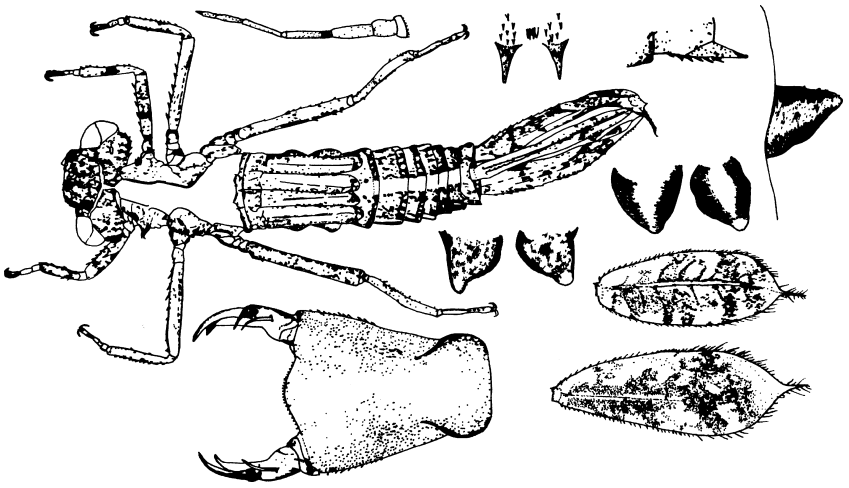


Fig. 3.1.448 *Argia pulla* larva: habitus from an exuvia (upper left), antenna (upper left center), labium (lower center), gonopophyses of a male in ventral and lateral view (upper right center, left and right, respectively), cerci in lateral (upper right), dorsolateral (middle right), and ventral view (right center), and the median (middle right) and a lateral caudal gill lamella (lower right). Based on Novelo-Gutiérrez (1992).

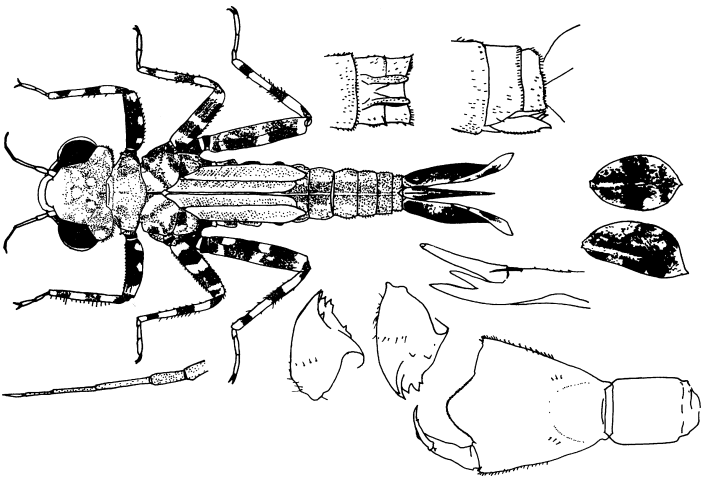


Fig. 3.1.449 *Argia insipida* larva: habitus (upper left), antenna (lower left), mandibles (lower center), inner surface of mentum (lower right), labial palp (middle right center), apex of the abdomen of a male larva in ventral view (upper center), apex of a female larval abdomen in lateral view (upper right), and two gill lamellae (middle right). Based on Geijskes (1943).

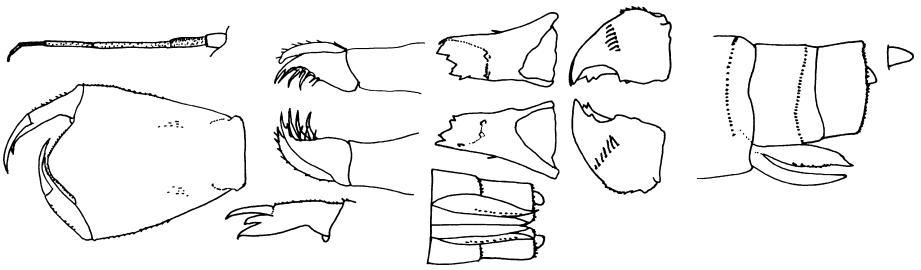


Fig. 3.1.450 *Argia translata* larva: antenna in dorsal view (upper left), labium in dorsal view (lower left), labial palp (lower left center), maxillae (upper left center), inner surface of mandibles (upper center), mandibles in lateral view (right center), ninth and tenth abdominal segments of a female larva in ventral view (lower center), and apex of the female abdomen in lateral view with a cercus in dorsal view to its right (right). Based on von Ellenrieder (2007).

4. On the proximal half of the prementum, there about three short setae in a row on each side. The legs and gill lamellae have large dark bands. The gill lamellae are short and broad with the middle lamella less than twice as long as its greatest width (**Fig. 3.1.449**).
.....*Argia insipida* Hagen in Selys, 1865 (Trinidad, Tobago, Colombia, Venezuela, Guyana, French Guiana, Surinam, Pará, Amazonas). Syn: *Argia ierea* Geijskes, 1932.
- The short setae on the proximal half of the prementum number more than three on each side and occur in patches rather than rows (**Fig. 3.1.450**). ….5
5. The male larvae has gonapophyses ending in acute points and lined with one row of spine-like setae (**Fig. 3.1.450**). There are three dark bands on each tibia.
.....*Argia translata* Hagen in Selys, 1865 (North and Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, French Guiana, Argentina). Syn: *Argia espinalensis* Navás, 1935.
- The male larva has gonaphyses with blunt apices and two or three rows of claviform setae (**Fig. 3.1.366**). There is one dark band on each tibia.
.....*Argia joergenseni* Ris, 1913 (Argentina).

Key to the species of adult male *Helveciagrion* in South America

Information for the key was provided by Machado (1980). Only the males can be distinguished with certainty. Larvae have not been described.

1. The posterior lobe of the prothorax is narrowed at the base and bears two small lateral wings. The superior anal appendage is broad with a short, acute process at the outer ventral corner (**Fig. 3.1.451**). Length of hind wing: c. 17 mm; abdomen length: 27 to 28 mm. Color of abdomen: mainly blue with black and dark red markings.
.....*Helveciagrion obsoletum* (Selys, 1876) (Ecuador, Peru, Bolivia, Pará, Amazonas, Territory of Acre, Mato Grosso, São Paulo). Syn: *Leptagrion obsoletum* Selys, 1876; *Acanthagrion chirihuanum* (Calvert, 1909); *Helveciagrion chirihuanum* (Calvert, 1909).
- The posterior lobe of the prothorax is not narrowed at the base and lacks lateral wings (**Fig. 3.1.452**). 2
2. The lateral parts of the male superior anal appendages are directed ventrad (**Fig. 3.1.338**). Length of hind wing: 16 mm; abdomen: 26 mm. Color of abdomen: the first seven segments are mainly dark red with some blue markings, while the eighth to the tenth segments are entirely blue.
.....*Helveciagrion simulacrum* (Calvert, 1909) (Mato Grosso, Rondônia). Syn: *Skiallagma simulacrum* Calvert, 1909; *Telebasis lacustris* Jurzitza and Rácenis, 1984.

- The lateral parts of the male superior anal appendages are directed posteriad (**Fig. 3.1.452**). Length of hind wing: 16 to 17.5 mm; of abdomen: 25 to 27 mm. Color of abdomen: mainly blue with black and dark red markings.
.....*Helveciagrion vulcanoae* Machado, 1980
(Ecuador, Minas Gerais).

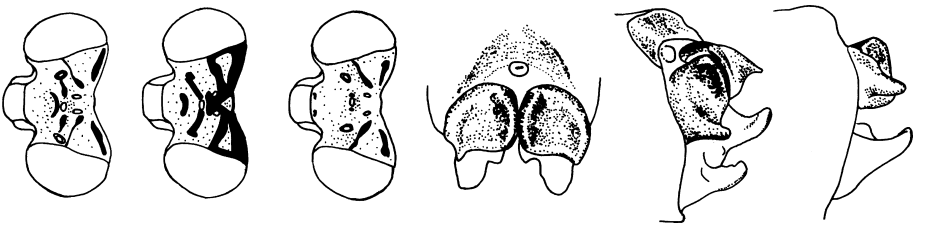


Fig. 3.1.451 *Helveciagrion obsoletum* (left to right): color patterns on the heads of two males and one female in dorsal view and the apex of the male abdomen in dorsal, dorsomedial, and lateral view. Based on Lencioni (2006).

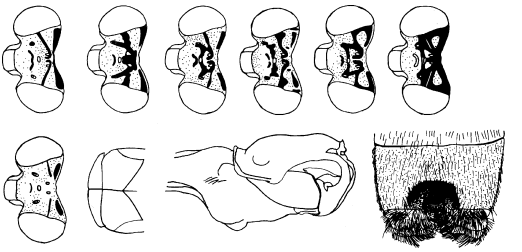


Fig. 3.1.452 *Helveciagrion vulcanoae:* pattern on the dorsal surface of the heads of six different male specimens (above), head of a female in dorsal view (below left), posterior lobe of the female pronotum (lower left center), apex of the penis in lateral view (lower right center), and apex of the male abdomen in dorsal view (lower right). Based on Machado (1980).

Key to the species of adult *Mesoleptobasis* in South America

Information for the key provided by Rácenis (1955a) and Lencioni (2006).

1. The inferior anal appendage of the male has a robust process near the base, which extends dorsad toward the apical process of the superior appendage. The ovipositor of the female extends posteriad well beyond the anal appendages (**Fig. 3.1.344**).
.....*Mesoleptobasis centralli* Santos, 1961
(Peru, Amazonas, Rondônia).

- The inferior anal appendage of the male does not have a process near the base, which extends dorsad toward the apical process of the superior appendage (**Fig. 3.1.453**).....2

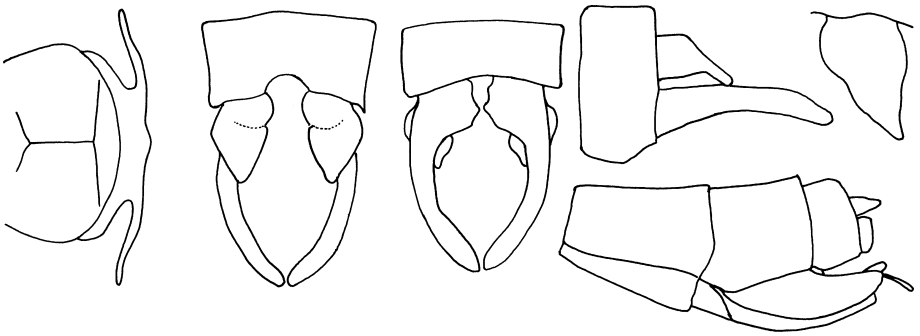


Fig. 3.1.453 *Mesoleptobasis acuminata* (above, left to right): prothorax of a male in dorsal view; apex of the male abdomen in dorsal, ventral, and lateral view; superior anal appendage of the male in anterior view; and (lower right) apex of the female abdomen in lateral view. Based on Santos (1961a).

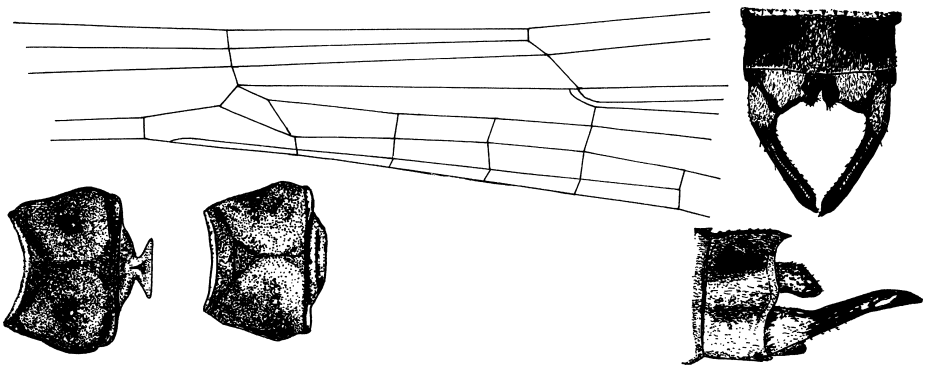


Fig. 3.1.454 Base of the fore-wing of a male *Mesoleptobasis inca* (above) and prothorax of a male (lower left) and a female in dorsal view (lower left center) and the apex of a male abdomen in dorsal (upper right) and lateral view (lower right). Based on St. Quentin (1960) and Lencioni (2006).

2. The apex of the male superior anal appendage is in the shape of a low cone and appears well separated from the inferior appendage in lateral view (**Fig. 3.1.454**). Total length of male: c. 36 mm; female: 36 to 38 mm. Length of male abdomen without appendages: c. 32 mm; female: 31 to 32 mm. Hind wing length of male: 17 to 18 mm; female: c. 20 mm.
.....*Mesoleptobasis inca* Sjöstedt, 1918 (Venezuela, Amazonas).
- The apex of the male superior anal appendage has the shape of a flattened triangle and appears to reach the inferior appendage in lateral view (**Fig. 3.1.453**). The female ovipositor is thick and curved and, without the stylus, extends only about as far posteriad as the superior anal appendage.
.....*Mesoleptobasis acuminata* Santos, 1961 (Peru, Amazonas, Rondônia).

Key to the species of adult *Metaleptobasis* in South America

Information for the key was provided by Williamson (1915), Ris (1918), Sjöstedt (1918), Calvert (1948b), Wasscher (1998), and Daigle (2000, 2004a, b). Little is known about the larvae of this genus.

1. The posterior lobe of the prothorax bears a pair of horn-like processes, which are more prominent than short extensions of the corners (**Fig. 3.1.455**). 2
- There are no horn-like processes on the posterior lobe of the prothorax longer than 0.1 mm long, although there may be such processes on the synthorax (**Fig. 3.1.456**). 5

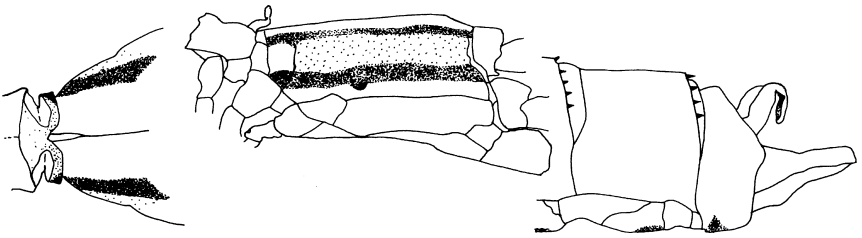


Fig. 3.1.455 *Metaleptobasis cyanolineata* (left to right): prothorax and anterior part of synthorax of a female in dorsal view, lateral view of the female thorax, and apex of the male abdomen in lateral view. Based on Wasscher (1998).

2. There is a twisted process originating near the posterolateral corners of the posterior lobe of the pronotum, but there is no prominent horn-like process on the synthorax. The synthorax is ferruginous with a light blue antehumeral stripe, which becomes grayish in preserved specimens, bordered by dark stripes (**Fig. 3.1.455**). The mesostigmal plate is brown with blue on the lateral surface. The

abdomen is generally brownish with greenish lateral spots on the eighth segment. Length of abdomen: 31 to 35 mm. Hind wing length: 19 to 21 mm. .....*Metaleptobasis cyanolineata* Wasscher, 1998 (Guyana, Surinam).

- There are processes on both the posterior lobe of the prothorax and on the mesepisternum of the synthorax (**Fig. 3.1.457**). 3

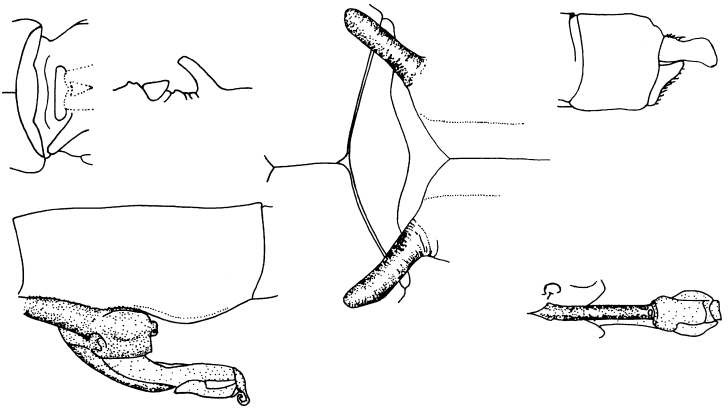


Fig. 3.1.456 *Metaleptobasis diceras* male: prothorax in dorsal (upper left) and lateral view (upper left center), anterior part of the thorax in dorsal view (right center), second abdominal segment with the penis (lower left), penis in ventral view (lower right), and apex of male abdomen in lateral view (upper right). Based on Calvert (1909) and Lencioni (2006).

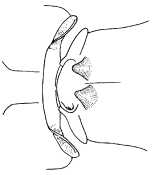


Fig. 3.1.457 The posterior part of the prothorax and anterior part of the synthorax of a female *Metaleptobasis quadricornis* in dorsal view showing the mesothoracic horns. Based on Lencioni (2006).

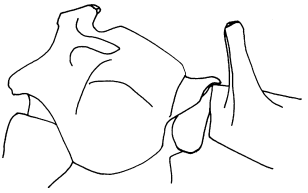


Fig. 3.1.458 Prothorax and anterior part of the synthorax of *Metaleptobasis foreli* showing the processes on both. Based on Ris (1918), who suggested that the apices of the processes might have been broken off.

3. The mesepisternal process is low and conical, ending in a bluntly acute apex (**Fig. 3.1.457**).
.....*Metaleptobasis quadricornis* (Selys, 1877) (Pará). Syn: *Leptobasis quadricornis* Selys, 1877.
- The mesepisternal process is relatively long, reaching at least 0.45 mm, and probably truncate at the apex (**Fig. 3.1.458**). However, Ris (1918) suggested that the apices might have been broken off his type specimen of *M. foreli.* 4
4. The eighth through tenth segments are dull orange (**Fig. 3.1.458**). The synthorax of the female is black with a coppery green sheen on the middle of the dorsum, orange markings, and a whitish ochre venter. The abdomen is black with a coppery green sheen on the dorsum of the second through seventh segments and light yellow on the first segment and laterally on the second through seventh segments. Length of abdomen: 31 to 38.5 mm. Hind wing length: 19 to 23.5 mm.
.....*Metaleptobasis foreli* Ris, 1918 (Central America, Colombia, Venezuela).
- The basal 2/3 of the eighth and 1/2 of the ninth abdominal segment are metallic brown, and the remaining dorsal surfaces of the eighth through tenth segments are yellow. The synthorax of the male is pale brown dorsally and yellow laterally with a metallic violet mid-dorsal stripe, at the anterior end of which the mesothoracic horns originate. Each mesothoracic horn is directed dorsad, laterad, or cephalad, and it is shorter than the prothoracic horn.
.....*Metaleptobasis tetragena* Calvert, 1948 (Guyana).

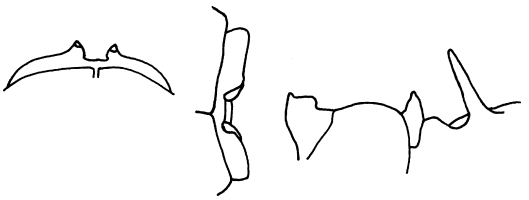


Fig. 3.1.459 *Metaleptobasis weibezahni* female (left to right): posterior margin of the female prothorax in anterior and dorsal view; prothorax and part of the mesothorax showing the horn in lateral view. Based on De Marmels (1989a).

5. The posterior margin of the posterior prothoracic lobe has a medial quadrilateral excavation flanked by two lobed processes, but the lobe is not strongly curved dorsad. The part of the posterior margin between the lobes is indented at the midline to form two broad, inner lobes. The mesothoracic horns are short and directed anterodorsad (**Fig. 3.1.456**).
.....*Metaleptobasis diceras* (Selys, 1877) (Bahia, Pará). Syn: *Leptobasis diceras* Selys, 1877; *Telagrion diceras* (Selys, 1877).

- Either the middle part of the posterior prothoracic lobe does not have a quadrilateral excavation, or, if it does, the two lobed processes flanking it are strongly curved dorsad (**Fig. 3.1.459**).....6

6. The posterior margin of the posterior prothoracic lobe is strongly curved dorsad and has a medial quadrilateral excavation flanked by lobed processes or tooth-like thickenings extending posteriad, and there are two long, narrow mesepisternal processes, which are directed dorsolaterally (**Fig. 3.1. 459**). 7

- There is no medial excavation along the posterior margin of the posterior prothoracic lobe, or, if there is one, it is triangular or curved and not flanked by prominent processes that extend posteriad (**Fig. 3.1.460**). 8

7. The lateral margins of the medial excavation along the posterior border of the prothorax converge somewhat toward the apical opening, giving it a narrow trapezoidal shape in dorsal view. There is a medial process along the posterior margin of the tenth abdominal segment, which has a deep, curved emargination in the middle (**Fig. 3.1.461**).

.....*Metaleptobasis incisula* De Marmels, 1989 (Venezuela).

- The lateral margins of the medial excavation along the posterior border of the prothorax diverge somewhat toward the apical opening, which is flanked by thickened folds of the lateral margin. There is a medial process along the posterior margin of the tenth abdominal segment, which has a deep, curved emargination in the middle (**Fig. 3.1.459**). Length of abdomen: c. 32 mm. Hind wing length: c. 21 mm. The general coloration is orange with vague dark markings and a light metallic sheen on the second through seventh abdominal segments; the ninth and tenth segments are blackish.

.....*Metaleptobasis weibezahni* Rácinis, 1955 (Venezuela).

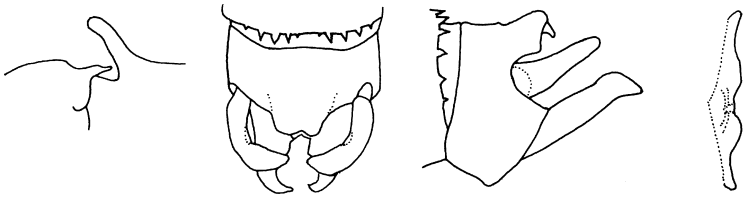


Fig. 3.1.460 *Metaleptobasis fernandezi* (left to right): left horn on the mesothorax of a male, apex of the male abdomen in dorsal and lateral view, and posterior margin of the prothorax of a female. Based on De Marmels (1992a).

8. The mesothoracic horns curve somewhat posteriad and are directed posterolaterad at their apices. There is a shallow median excavation along the posterior margin of the prothorax. The color is generally reddish, and there are no areas with a bluish tinge (**Fig. 3.1.462**). The identity of this species remains problematic. The only known male specimen is missing the apex of the

abdomen, and any specimens keying out here should be saved for examination by specialists.
.....*Metaleptobasis bicornis* (Selys, 1877) (Colombia, Mato Grosso). Syn: *Leptobasis bicornis* Selys, 1877.
- The mesothoracic horns curve somewhat anteriad and are directed laterally or anterolaterally at their apices (**Fig. 3.1.460**). 9
9. The bases of the mesothoracic horns are almost in contact, and the horns are directed laterad. The posterior margin of the posterior prothoracic lobe does not curve strongly dorsad. The excavation is shallow and flanked by wide processes. There is a medial process along the posterior margin of the tenth abdominal segment, which has a very shallow emargination in the middle forming a wide V (**Fig. 3.1.460**). Length of abdomen: 32 to 35 mm. Hind wing length: 21 to 23 mm. The head is mainly yellow and black, and the thorax is predominantly dark orange with greenish iridescence. The anterior segments of the abdomen are mainly yellow with extensive dark markings. The dorsal surfaces of the third through seventh segments are dark metallic green with pale basal rings, and the eighth through tenth segments are blackish.
.....*Metaleptobasis fernandezi* Rácinis, 1955 (Venezuela).
- The bases of the mesothoracic horns are well separated, and the horns are directed laterodorsad, anteriad, or anterodorsad (**Fig. 3.1.463**). 10

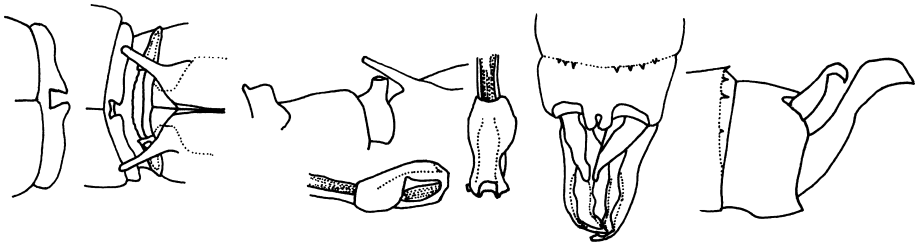


Fig. 3.1.461 *Metaleptobasis incisula* (left to right): posterior margin of the female prothorax in anterior view, prothorax and part of the mesothorax showing the horns in dorsal and lateral view (above), penis in lateral (below) and ventral view, and apex of the male abdomen in dorsal and lateral view. Based on De Marmels (1989a).

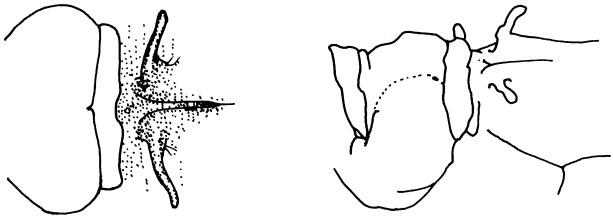


Fig. 3.1.462 *Metaleptobasis bicornis* female: prothorax and anterior part of the synthorax in dorsal (left) and lateral view (right). Based on Lencioni (2006).

10. The superior anal appendage extends posteriad less than 2/3 of the distance reached by the inferior appendage (**Fig. 3.1.463**). The appendages should be measured in dorsal view from the posterior margin of the tenth abdominal segment. 11
- The superior anal appendage extends posteriad more than 2/3 of the distance reached by the inferior appendage (**Fig. 3.1.464**), measured in dorsal view from the posterior margin of the tenth abdominal segment. 12

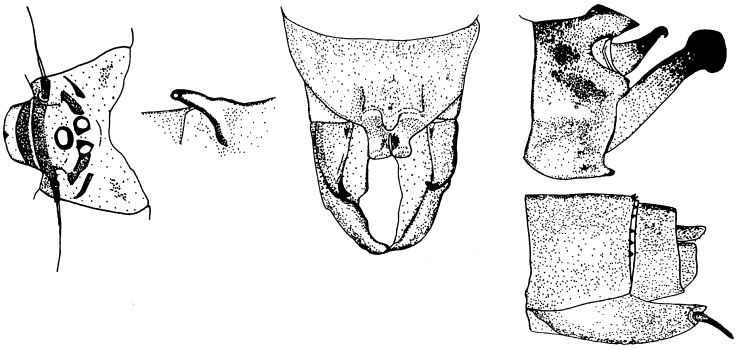


Fig. 3.1.463 *Metaleptobasis lillianae* (left to right): head in dorsal view, mesothoracic horn in lateral view, apex of the male abdomen in dorsal and lateral view (above), and apex of the female abdomen in lateral view (below). Based on Daigle (2004a).

11. The apical part of each superior anal appendage is greatly enlarged, as best seen in lateral view (**Fig. 3.1.463**). The compound eyes are green, lined with black, and with a bright red spot covering the posterior quarter. The head is patterned with dark brown and light blue, and the thorax is mainly brown with black markings, including one on the mid-dorsal carina. The abdomen is mainly black dorsally with extensive brown coloration laterally and pale basal rings on the third through sixth segments. The ovipositor extends to the apices of the superior anal appendages of the female. Total length: 44 to 48 mm. Length of abdomen including appendages: 37 to 40.5 mm. Hind wing length: 22 to 25.5 mm.
.....*Metaleptobasis lillianae* Daigle, 2004 (Venezuela).
The apical part of each superior anal appendage is conical (**Fig. 3.1.343**). The occiput and vertex are light brown with a bluish tinge. The synthorax is black, brown, and cream, with a bluish tinge toward the venter. There are also light blue tinges on the basolateral markings on the third through sixth abdominal segments. Total length: 41 to 44 mm. Length of abdomen: 34 to 37 mm. Hind wing length: 20 to 22.5 mm.
.....*Metaleptobasis minteri* Daigle, 2004 (Ecuador).

12. In dorsal view, the superior anal appendages of the male appear short and somewhat conical. The posterior lobe of the male prothorax is the same color as the rest of the prothorax and does not have an obscure marking. The posterior lobe of the female prothorax has a straight posterior margin; the lateral margins are laminar and are raised above the plane of the prothorax (**Fig. 3.1.464**). The ovipositor does not extend posteriad farther than the anal appendages. Length of abdomen: 33 to 34 mm. Hind wing length: 21 to 23 mm.
….....*Metaleptobasis brysonima* Williamson, 1915 (Trinidad, Venezuela, French Guiana, Peru).
- In dorsal view, the superior anal appendages of the male appear long and narrow, and they vary in curvature. The posterior lobe of the female prothorax has a convex posterior margin or is produced posteriad along the midline, and the lateral margins are rounded or slightly produced (**Fig. 3.1.465**). 13

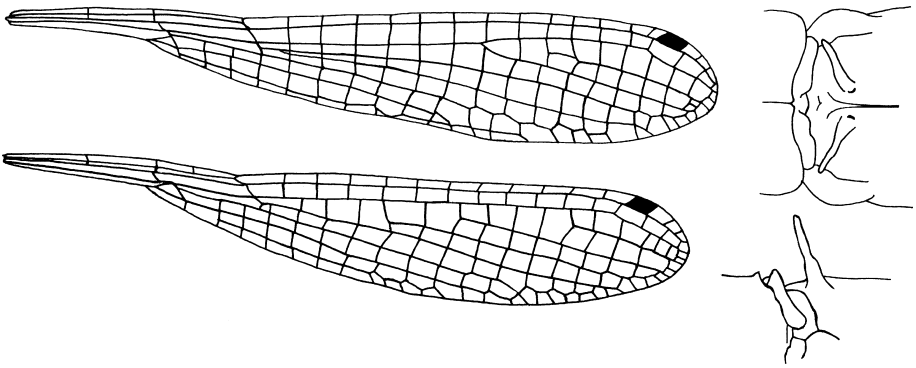


Fig. 3.1.464 *Metaleptobasis brysonima:* fore and hind wing (left) and the posterior part of the prothorax and anterior part of the synthorax in dorsal (upper right) and lateral view (lower right). Based in part on Rácinis (1955a).

13. In dorsal view, the superior anal appendages of the male curve inward only slightly, and their apices are separated much more than the apices of the inferior appendages (**Fig. 3.1.466**). Both appendages are pale at the base and darken toward the apex. The ovipositor does not reach the apex of the tenth abdominal segment of the female. Total length of male without appendages: 42 to 44 mm; female: c. 45 mm. Length of male abdomen including appendages: 36 to 37 mm; female: c. 37 mm. Hind wing length of male: c. 22 mm; female: 23 to 23.5 mm. Length of pterostigma: c. 2 mm.
.....*Metaleptobasis amazonica* Sjöstedt, 1918 (Amazonas).

- In dorsal view, both the superior and inferior anal appendages of the male curve strongly inward and almost meet at their apices (**Fig. 3.1.465**). The ovipositors of all known females reach the posterior margin of the tenth abdominal segment or beyond. 14

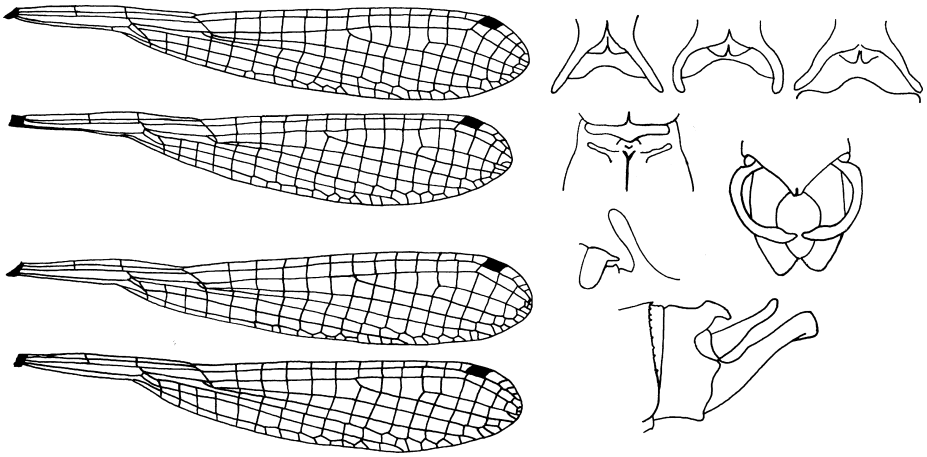


Fig. 3.1.465 *Metaleptobasis manicaria* male: fore and hind wings of two different males (left), posterior lobe of the prothorax and anterior part of the synthorax in dorsal and lateral view (center, above and below, respectively), "horns" on the mesothoraces of three different individuals in dorsal view (upper right), and apex of the abdomen in dorsal (middle right) and lateral view (lower right). Based on Williamson (1915).

Fig. 3.1.466 *Metaleptobasis amazonica:* apex of the male abdomen in dorsal (left) and lateral view (right). Based on Sjöstedt (1918).

14. The curvature of the superior and inferior anal appendages is similar, so in dorsal view, the inferior appendages appear to extend only slightly farther posteriad than the superior appendages. The apices of the mesothoracic horns of the male are prominent and directed more anteriad at their apices than dorsad or laterad; the female lacks mesothoracic horns (**Fig. 3.1.467**). The ovipositor extends only slightly farther posteriad than the anal appendages. Total length of

male, including appendages: 40 to 47 mm; female: 45 to 46 mm. Length of male abdomen including appendages: 34 to 40 mm; female: 37.5 to 39 mm. Hind wing length of male: 21 to 23 mm; female: 23.5 to 25 mm. The ventral parts of the thoraces of both males and females have a pale greenish blue color. The prothorax is uniformly brownish yellow. The abdomen is mainly black, but the apical segments are orange.
.....*Metaleptobasis mauffrayi* Daigle, 2000 (Ecuador, Peru).

- The curvature of the superior anal appendages is much greater than that of the inferior appendages, so in dorsal view, the apices of the superior appendages meet or nearly meet at the dorsal midline well anterior to the apices of the inferior appendages. The apices of the mesothoracic horns of both males and females are directed dorsolaterad (**Fig. 3.1.465**). 15

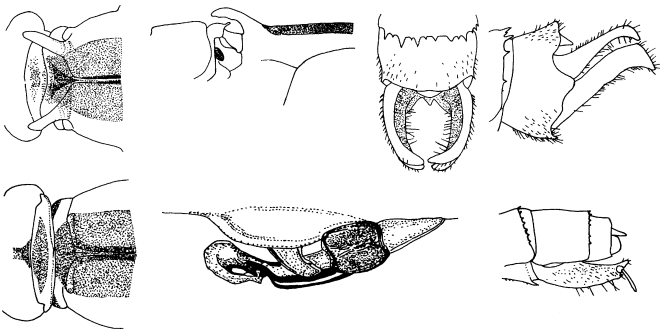


Fig. 3.1.467 *Metaleptobasis mauffrayi* (upper row, left to right): thorax of a male showing the thoracic horns in dorsal and lateral view, apex of the abdomen of a male in dorsal and lateral view, and (lower row, left to right): thorax of a female in dorsal view, male genitalia on the underside of the second abdominal segment in lateral view, and apex of the abdomen of a female in lateral view. Based on Daigle (2000).

15. The inferior anal appendages of the male are much thicker than the narrow superior appendages, and each is parallel-sided for most of its length. The inferior appendage ends in a truncate apex, the inner corners of which meet or nearly meet along the midline. The apices of the mesothoracic horns of both males and females are prominent and directed dorsolaterad at their apices (**Fig. 3.1.465**). The ovipositor extends farther posteriad than the anal appendages. Length of abdomen: 34 to 35 mm. Hind wing length: c. 22 mm. The prothorax is uniformly brownish yellow. There is no mid-dorsal stripe on the synthorax. The first abdominal segment is dark flesh colored; the second through seventh are mainly black or dark brown; the eight through tenth are dull brownish ocher.
.....*Metaleptobasis manicaria* Williamson, 1915 (Trinidad, Venezuela, Peru, Roraima).

- The inferior anal appendages of the male narrow noticeably proximal to the apex and become narrower than the superior anal appendages. Some specimens have black markings on the dorsal surface of the prothorax. There is a blackish mid-dorsal stripe on the synthorax (**Fig. 3.1.466**). 16

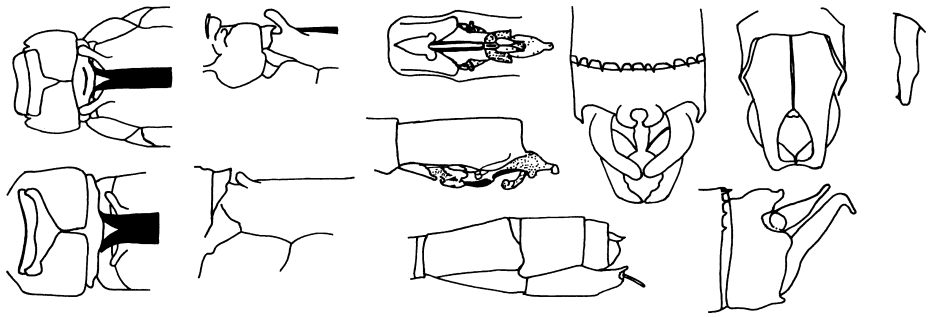


Fig. 3.1.468 *Metaleptobasis selysi:* prothorax and anterior part of the synthorax of a male in dorsal and lateral view (upper left); second abdominal segment showing the penis in ventral (upper left center) and lateral view (lower left center); apex of the male abdomen in dorsal (upper center), ventral (upper right center), and lateral view (lower right); inferior anal appendage of a male in oblique lateral view (upper right); posterior part of the female prothorax and anterior part of the synthorax in dorsal and lateral view (lower left); apex of the female abdomen in lateral view (lower center). Based on Santos (1956b) and Lencioni (2006).

16. The inferior anal appendages narrow gradually toward the apex, where they curve ventrad and meet along the midline. At the dorsal midline, two processes are formed along the posterior border of the tenth abdominal segment that curve around to enclose an oval gap between them. The apices of the mesothoracic horns of the females are much shorter than those of the male and do not reach the posterior border of the prothorax (**Fig. 3.1.468**). The ovipositor extends about as far posteriad as the anal appendages. There is a blackish mid-dorsal stripe on the synthorax.
.....*Metaleptobasis selysi* Santos, 1956 (Bahia, Espirito Santo, São Paulo, Rio de Janeiro).

- The inferior anal appendages of the male narrow to an acute point with a small subapical tubercle. The superior anal appendages end in a small, finger-like apical process. The prominence along the midline of the posterior border of the tenth abdominal segment has a broad narrow indentation and a pair of processes ventral to the overhanging apex. The apices of the mesothoracic horns of the females are about as long as those of the males (**Fig. 3.1.469**). The ovipositor

extends farther posteriad than the anal appendages. Length of abdomen: 37 to 41 mm. Hind wing length: 22 to 24 mm. The prothorax is usually pale brownish yellow, but some specimens have black posterior lobes. There is a black mid-dorsal stripe on the synthorax, about 0.5 mm wide. The first abdominal segment is dark flesh colored; the second through seventh are mainly black or dark brown; the eight through tenth are dull brownish ocher with dark markings on the ninth segment and sometimes the eighth.
.....*Metaleptobasis mauritia* Williamson, 1915 (Trinidad, Venezuela, Guyana).

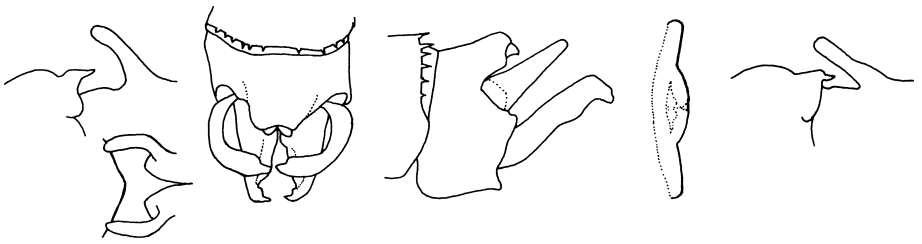


Fig. 3.1.469 *Metaleptobasis mauritia* (left to right): left horn on the mesothorax of a male (above) and the mesothoracic horns in dorsal view (below), apex of the male abdomen in dorsal and lateral view, posterior margin of the prothorax of a female, and the left horn on the mesothorax of a female. Based on Williamson (1915) and De Marmels (1992a).

Key to the species of adult *Bromeliagrion* in South America

Information for the key was provided by De Marmels and Garrison (2005). The larva of only one South American species has been described.

1. In the male, dark brown is the predominant color on the frons, clypeus, labrum, anterior part of the mesepimeron, and most of the mesepisternum, except for a short, narrow, pale basal stripe. The proximally directed process on the apical segment of the penis is leaf-like, emarginate along the midline, and has a chitinized process with subequal branches (**Fig. 3.1.470**). Total length of male: 57.5 to 59 mm. Length of male abdomen: 47.5 to 49 mm. Hind wing length of male: 31 to 32 mm. The female has not been described.
.....*Bromeliagrion beebeanum* (Calvert, 1948) (Guyana, Venezuela). Syn: *Leptagrion beebeanum* Calvert, 1948.
- The frons, clypeus, labrum, and mesepisternum are pale yellow or blue. The proximally directed process on the apical segment of the penis is forked, and the chitinized process is unbranched, or its lower branch is shorter than the upper one in dorsal view (**Fig. 3.1.471**). 2

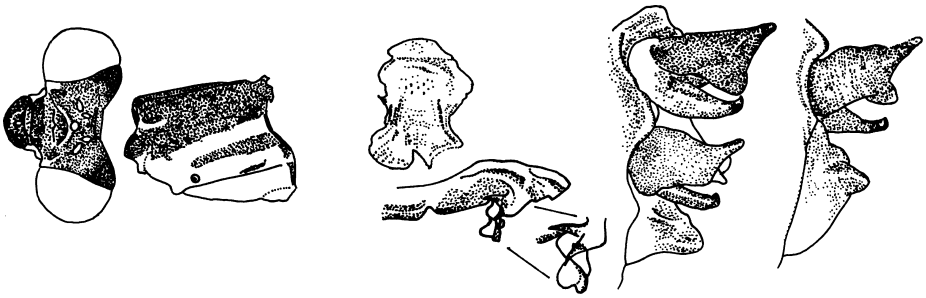


Fig. 3.1.470 *Bromeliagrion beebeanum* male (left to right): head in dorsal view, synthorax in lateral view, penis in ventral (above) and lateral view (below) with an enlargement of its chitinized process (below and right), and anal appendages in mediodorsal and lateral view. Based on De Marmels and Garrison (2005).

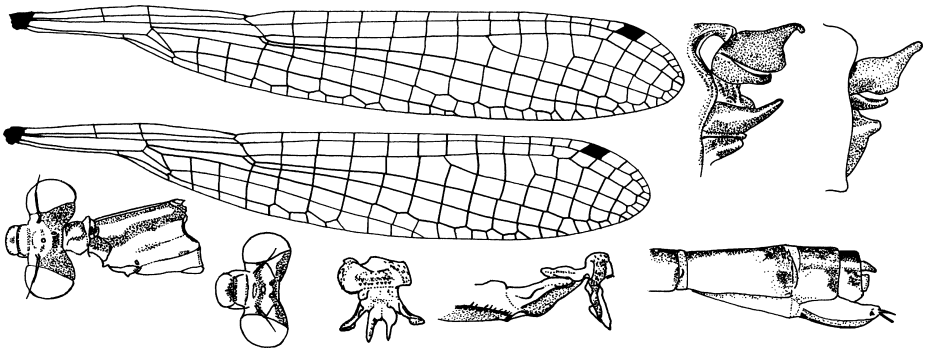


Fig. 3.1.471 *Bromeliagrion rehni:* fore and hind wing (upper left); head and thorax of a male (lower left); head of a female (lower left center); apex of the penis in ventral and lateral view (lower center, left and right, respectively); anal appendages of a male in dorsomedial (upper right center) and lateral view (upper right), and apical segments of a female abdomen in lateral view (lower right). Based on De Marmels and Garrison (2005).

2. The pale colors on the anterior part of the head and the thorax are blue. The fork on the proximally directed process on the apical segment of the penis forms an acute angle; its chitinized process lacks a lower branch, and its upper part is free from the ventral side of the flap. The female has an ovipositor that extends far beyond the apex of the tenth abdominal segment (**Fig. 3.1.471**). Total length: 52 to 53 mm. Length of abdomen: 45 to 46 mm. Hind wing length: c. 27 mm.
.....*Bromeliagrion rehni* Garrison, 2005
(Ecuador, Amazonas, Mato Grosso).

- The pale colors on the anterior part of the head and the thorax are yellow. The fork on the proximally directed process on the apical segment of the penis is broad; the lower branch of its chitinized process is free, but its longer upper branch forms a carina attached to the ventral side of the flap. The female has an ovipositor that barely extends beyond the apex of the tenth abdominal segment (**Fig. 3.1.344**). Total length: 49.5 to 56 mm. Length of abdomen: 40.5 to 46.5 mm. Hind wing length: 26 to 31.5 mm.
.....*Bromeliagrion fernandezianum* (Rácenis, 1958) (Venezuela). Syn: *Leptagrion fernandezianum* Rácenis, 1958.

Key to the species of adult male *Leptagrion* in South America

Information for the key was provided by Kimmins (1945), Santos (1962a, 1965b,c, 1968c,d, 1978), Costa and Garrison (2001), and Lencioni (2006).

1. The superior anal appendage completely lacks tooth-like structures at the apex (**Fig. 3.1.472**). 2
- The superior anal appendage is armed with at least one apical tooth; if several are present, a narrow one is usually longer than the rest (**Fig. 3.1.473**). 6
2. In lateral view, the superior anal appendage appears forked at the apex (**Fig. 3.1.472**). The abdomen is about 53 mm long.
.....*Leptagrion garbei* Santos, 1968 (Bahia).
- In lateral view, the superior anal appendage is evidently unforked at the apex (**Fig. 3.1.474**). 3

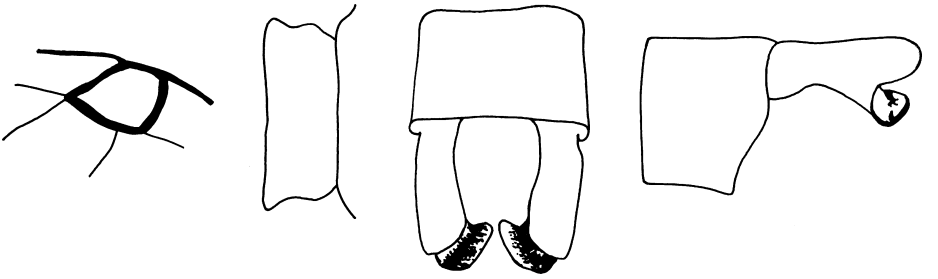


Fig. 3.1.472 *Leptagrion garbei* male (left to right): pterostigma in the hind wing, prothorax in dorsal view, and the apex of the abdomen in dorsal and lateral view. Based on Santos (1961d).

3. Each male superior anal appendage is about half as long as the tenth abdominal segment and shaped like a thick tubercle with a truncate apex. The inferior appendage is thick, curves slightly dorsad, and is somewhat pointed at the apex. The appendages are russet with the apex of the inferior appendage

darkened. Length of male abdomen: c. 26 mm. Hind wing length of male: c. 16 mm. Coloration: reddish orange with black rings on the abdomen and a yellowish underside.
.....*Leptagrion croceum* (Burmeister, 1839)
(Surinam). Syn: *Agrion croceum* Burmeister, 1839. There is doubt that this poorly known species belongs in *Leptagrion* (Costa and Garrison, 2001).
- The apex of the male superior anal appendage is foliate (**Fig. 3.1.474**). 4

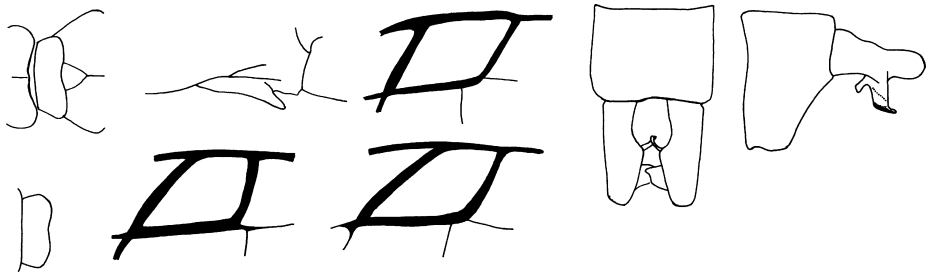


Fig. 3.1.473 *Leptagrion perlongum* male (upper row, left to right): posterior lobe of the prothorax in dorsal view, lateral view of the post-sternum, pterostigma of the fore-wing, and apex of the abdomen in dorsal and lateral view; female (lower row, left to right): posterior lobe of the prothorax and the pterostigma of the fore and hind wing. Based on Santos (1962a).

4. In dorsal view, the foliate apex of the superior anal appendage is convex. The pterostigma is tear-drop shaped. The superior caudal appendage does not bear a spine but has a curved, spatula-shaped apical process. There is a poorly delimited yellowish area between the lateral ocellus and the antenna. The posterior lobe of the prothorax is generally similar to that of the female. The eighth through tenth abdominal segments are blue dorsally. There are yellow rings on the distal thirds of the third through fifth segments. The dorsolateral surfaces of the third through tenth segments are black (**Fig. 3.1.474**). Length of abdomen: 39 mm. Hind wing length: 28 mm.
.....*Leptagrion macrurum* (Burmeister, 1839)
(Santa Catarina, Rio de Janeiro, São Paulo, Espirito Santo). Syn: *Agrion macrurum* Burmeister, 1839; *Leptagrion auriceps* St. Quentin, 1960; *Agrion briseis* Hagen, 1861 *nomen nudum*.
- In dorsal view, the foliate apex of the superior anal appendage is almost straight (**Fig. 3.1.475**). 5

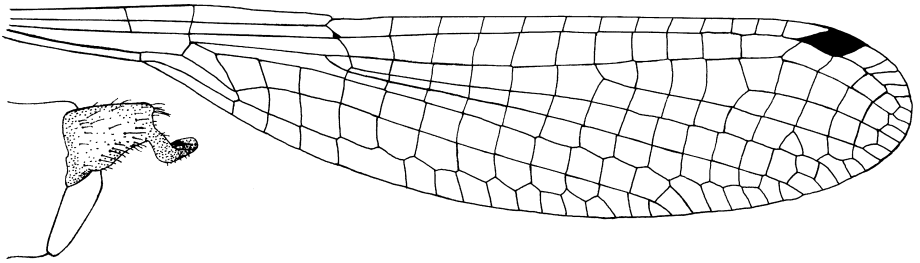


Fig. 3.1.474 *Leptagrion macrurum* male: hind wing (above) and apex of the abdomen of in lateral view (lower left). Based on Munz (1919) and St. Quentin (1960), who called the specimen *Leptagrion auriceps*.

5. In dorsal view, the foliate apex of the superior anal appendage appears about three times as long as wide, so that the outer margin of the appendage is extended posterolaterally (**Fig. 3.1.346**). The radial margin of the pterostigma is longer than the costal margin. There is a dark ring on the distal 1/3 of the third through sixth abdominal segments. Length of abdomen: c. 33.5 mm.
.....*Leptagrion bocainense* Santos, 1979 (São Paulo).

- In dorsal view, the foliate apex of the superior anal appendage appears about as long as wide, so that the outer margin of the appendage is almost straight (**Fig. 3.1.475**). The dark ochraceous color on the pterostigma does not reach the costal margin. The head is mainly bright blue with a black marking only on the dorsal part of the frons. The ventral part of the head is pale. The first abdominal segment is pale green; the second through fifth are ochraceous. The seventh abdominal segment is dark ochraceous on the anterior 1/5 and dark brown on the other 4/5. The seventh, eighth, and dorsal part of the tenth are blue. Length of abdomen: 34 to 37 mm. Hind wing length: 21 to 23 mm.
.....*Leptagrion dardanoi* Santos, 1968 (Pernambuco, Ceará).

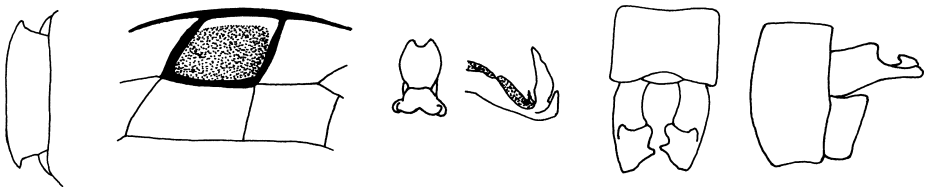


Fig. 3.1.475 *Leptagrion dardanoi* male (left to right): prothorax in dorsal view, pterostigma of the hind wing, penis in ventral and lateral view, and the apex of the male abdomen in dorsal and lateral view. Based on Santos (1968c).

6. The abdomen is at least 58 mm long. The head is black with a transverse blue band that passes through the ocelli, orange surrounding the ocelli, and brown between the antennae. The antehumeral surface and dorsal carina are yellowish. The pterostigma is quadrilateral and sometimes rhomboidal in shape. The inferior anal appendage is bifid. The posterior lobe of the prothorax is generally similar to that of the female or slightly more convex along the posterior edge (**Fig. 3.1.473**). The third through seventh segments have yellowish rings beyond their brown bases and near their apices. Hind wing length: 26 to 27 mm.
.....*Leptagrion perlongum* Calvert, 1909
(Bahia, Espírto Santo, Minas Gerais, São Paulo, Rio de Janeiro, Paraná, Santa Catarina).
- The abdomen is no more than 54 mm long. If there is an inferior caudal appendage, it is not bifid (**Fig. 3.1.476**). 7

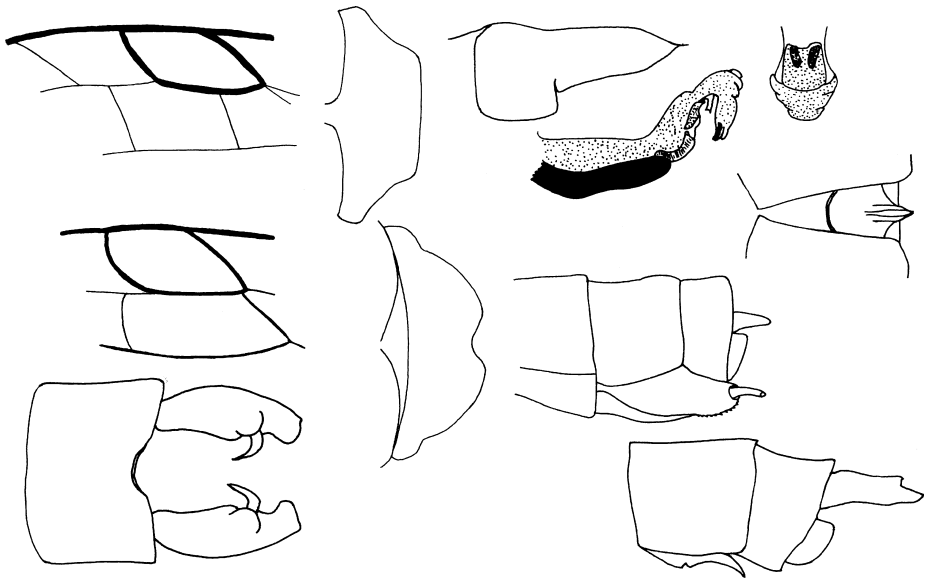


Fig. 3.1.476 *Leptagrion vriesianum*: pterostigma on the fore-wing of a male (upper left) and a female (middle left), dorsal view of the posterior prothoracic lobe of a male (upper left center) and a female (lower left center), anterior lamina on the second abdominal segment of a male in lateral view (upper right center), apex of the penis in lateral (below anterior lamina) and ventral view (upper right), male genitalia on the second abdominal segment in ventral view (upper middle right), apex of the male abdomen in dorsal view showing only the superior anal appendages (lower left) and apical segments of the male abdomen in lateral view (lower right), apical segments of the female abdomen in lateral view (lower middle right). Based on Santos (1978).

7. The superior anal appendage bears two teeth or spine-like processes (**Fig. 3.1.477**). 8
- The superior anal appendage bears only one tooth (**Fig. 3.1.476**). 10

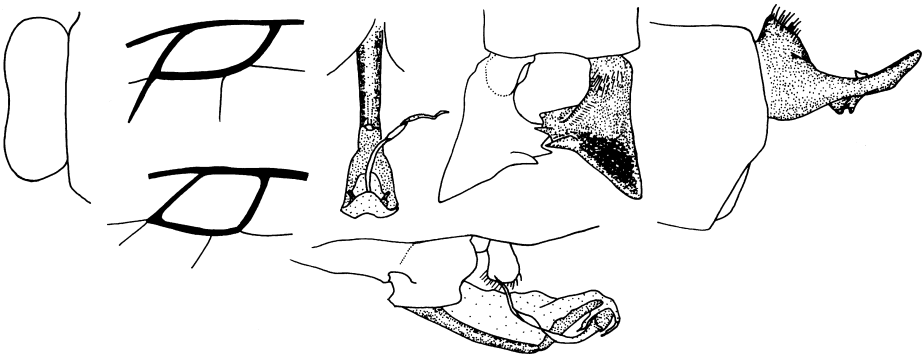


Fig. 3.1.477 *Leptagrion acutum* male: prothorax in dorsal view (left), pterostigmata of the fore and hind wing (left center), penis in ventral (upper center) and lateral view (lower center), and apex of the abdomen in dorsal (upper right center) and lateral view (right). Based on Lencioni (2006).

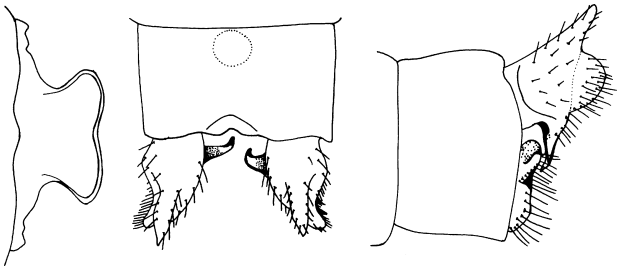


Fig. 3.1.478 *Leptagrion prothoracicum* male (left to right): posterior lobe of the prothorax in dorsal view and apex of the abdomen in dorsal and lateral view. Based on Kimmins (1945).

8. The black superior anal appendage bears a spine-like tooth directed dorsad and another directed ventrad and slightly mesad; between them is an apical lobe, which is brownish. The inferior appendage is a yellowish brown lobe appearing slightly emarginate in the middle in lateral view (**Fig. 3.1.478**). The prothorax is blue or bluish green marked with reddish brown. The first five abdominal segments are orange yellow, with black margins on the second through fifth. The sixth is somewhat blackish brown, and the seventh is black. The eighth and ninth segments are blue with black lateral stripes, and the tenth is black with a pale basal spot dorsally and blue or yellow laterally. Length of male abdomen:

c. 46 mm. Hind wing length of male: c. 25 mm. The female has not been described.
.....*Leptagrion prothoracicum* (Kimmins, 1945) (Ecuador). Syn: *Telagrion prothoracicum* Kimmins, 1945.
- If there are two teeth or processes at the apex of the superior anal appendage, they do not point in nearly opposite directions and are not separated by a broad lobe (**Fig. 3.1.477**).....9
9. The superior anal appendage appears thick at the base in lateral view; in dorsal view, one tooth is apparent along the medial margin near the base, and another is evident near the apex (**Fig. 3.1.477**). The head is black except for a pair of ochraceous lateral stripes, each running from a lateral ocellus to near the compound eye. Half of the mesepimeron is black. The pterostigma is rhomboid. The apical tooth of the tarsal claw is larger than the subapical one. The third through sixth abdominal segments have dark rings on the apical 1/3; the proximal 1/3 of the seventh segment is yellow, and the eighth through tenth segments are black. Length of abdomen: c. 47 mm.
.....*Leptagrion acutum* Santos, 1961 (Espírito Santo).
- The superior anal appendage appears uniform in width from the base to the apex in lateral view; in dorsal view, no teeth are apparent along the medial margin, but two are evident near the apex. The pterostigma is quadrangular (**Fig. 3.1.479**). Length of abdomen: c. 54 mm.
.....*Leptagrion porrectum* Selys, 1876 (Espírito Santo).

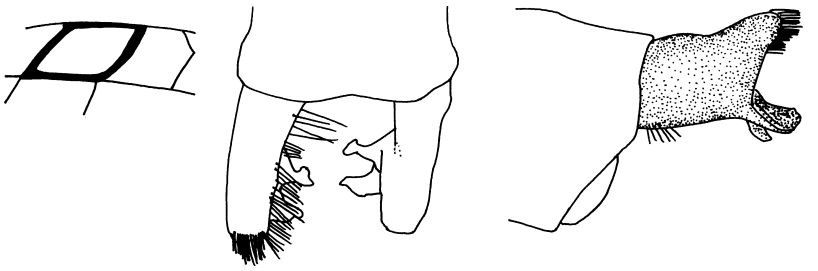


Fig. 3.1.479 *Leptagrion porrectum* male (left to right): pterostigma of the fore-wing and the apex of the abdomen in dorsal view with the setae on the right superior anal appendage removed and in lateral view. Based on Costa and Garrison (2001).

10. There is a large subterminal spine on the superior anal appendage that curves anteriad about 90º (**Fig. 3.1.476**). The pterostigma is roughly in the form of a parallelogram with two opposite angles acute and the other two rounded. The head is black with yellowish green markings in the fossa between the lateral ocellus and the antenna. The eighth through tenth abdominal segments are blue

with dark dorsolateral spots on the eighth and ninth. The apical tooth on each bifid tarsal claw is larger than the subapical claw. Length of abdomen without caudal appendages: 36 mm; hind wing length: 25 mm.
.....*Leptagrion vriesianum* Santos, 1978 (São Paulo, Rio de Janeiro).
- The superior anal appendage has only a terminal spine, or it has a subterminal spine that does not curve to point anteriad (**Fig. 3.1.480**). 11
11. The pterostigma is nearly rectangular with rounded corners. The superior anal appendage bears a spine that is directed anteriad and inward, forming an acute angle with the appendage. There is a blue crescent-shaped mark on each side of the head between the lateral ocellus and the antenna. The antehumeral surface is iridescent metallic bronze. The third through sixth segments of the abdomen have yellow rings. The second through fifth and eighth through tenth segments are black distally. The posterior lobe of the prothorax is generally similar to that of the female or slightly straighter along the posterior edge (**Fig. 3.1.480**). Length of abdomen: 38 to 40 mm. Hind wing length: 20 to 22 mm.
.....*Leptagrion andromache* Hagen in Selys, 1876 (São Paulo, Rio de Janeiro).
- The pterostigma is rhomboid (**Fig. 3.1.481**). 12

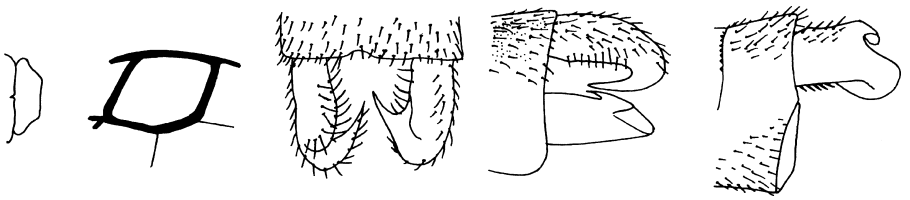


Fig. 3.1.480 *Leptagrion andromache* (left to right): posterior lobe of the female prothorax in dorsal view, pterostigma on the hind wing of a female, and apex of the male abdomen in dorsal, dorsolateral, and lateral view. Based on Santos (1962a) and Costa and Garrison (2001).

12. There is a tubercle on the distal 1/3 of the superior anal appendage (**Fig. 3.1.481**). The head is black with a metallic sheen and yellow on the fossae between the lateral ocelli and the compound eyes. The eighth through tenth abdominal segments are blue. Length of abdomen: c. 37 mm. Hind wing length: c. 24 mm,
.....*Leptagrion capixabae* Santos, 1965 (Espírito Santo).
- There is no subapical tubercle that can be seen on the superior anal appendage in dorsal view (**Fig. 3.1.482**).....13

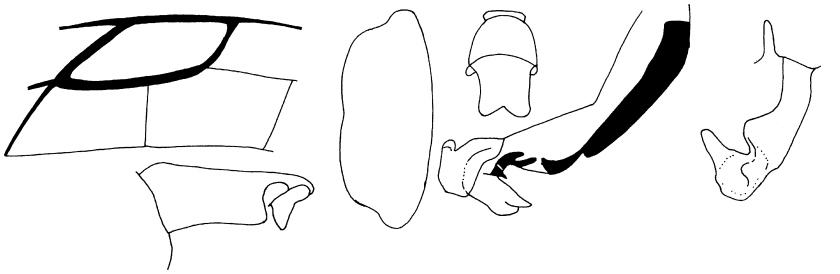


Fig. 3.1.481 *Leptagrion capixabae* male (left to right): pterostigma of the hind wing (above), superior anal appendage in lateral view (below), prothorax in dorsal view, penis in ventral and lateral view, superior anal appendage in dorsal view. Based on Santos (1965b).

13. In dorsal view, the superior anal appendage appears curved with converging apices (**Fig. 3.1.482**).....14
- In dorsal view, the superior anal appendages appear straight and parallel (**Fig. 3.1.483**).....15

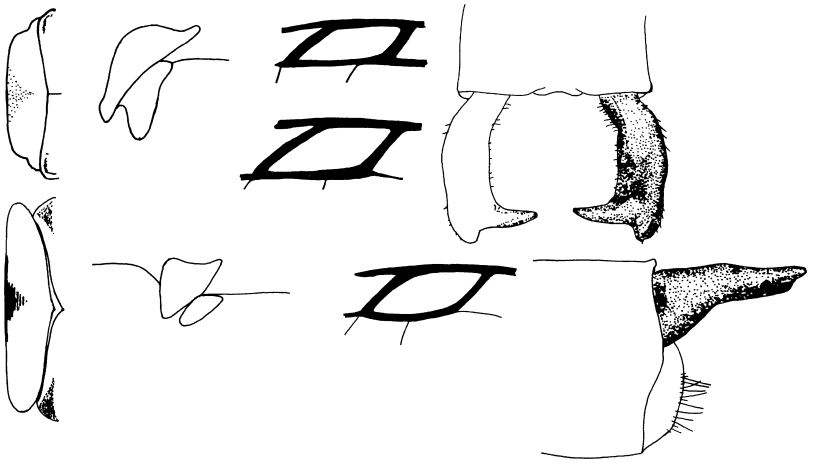


Fig. 3.1.482 *Leptagrion dispar:* posterior lobe of the male prothorax in dorsal (upper left) and lateral view (upper left center), pterostigmata of a male fore and hind wing (upper right center, above and below, respectively), apex of the male abdomen in dorsal (upper right) and lateral view (lower right), posterior lobe of the female prothorax in dorsal (lower left) and lateral view (lower left center), and pterostigma of the hind wing of a female (lower right center). Based on Lencioni (2006).

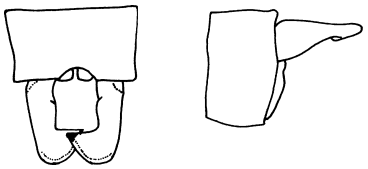


Fig. 3.1.483 Apex of the male abdomen of *Leptagrion siqueirai* in dorsal (left) and ventral view (right). Based on De Marmels and Garrison (2005).

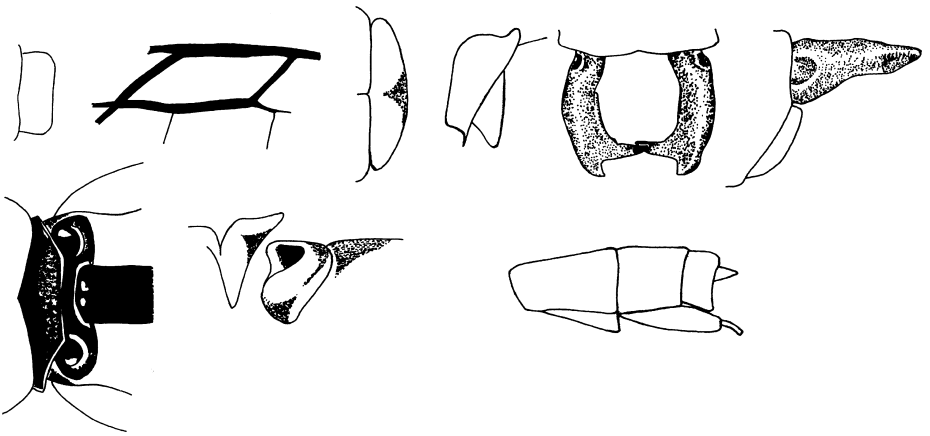


Fig. 3.1.484 *Leptagrion elongatum* (above, left to right): posterior lobe of the female prothorax in dorsal view, pterostigma on the hind wing of a female, posterior lobe of the male prothorax in dorsal and lateral view, apex of the male abdomen in dorsal and lateral view, and (below, left to right): posterior part of the female prothorax and the anterior portion of the synthorax in dorsal and lateral view, and apex of the female abdomen in lateral view. Based on Santos (1962a) and Costa and Garrison (2001).

14. The superior anal appendage bears a subapical spine that is perpendicular to the appendage. There is a crescent-shaped yellowish area between the lateral ocellus and the antenna. The posterior lobe of the prothorax is not rectangular like that of the female but rather semi-circular. The eighth through tenth abdominal segments are blue. There are yellow rings on the proximal parts of the third through seventh segments. The dorsolateral surfaces of the third through seventh segments are black (**Fig. 3.1.484**). Length of abdomen: 40 to 42 mm. Hind wing length: 24 to 28 mm.
.....*Leptagrion elongatum* Selys, 1876 (Espírito Santo, Rio de Janeiro, São Paulo).

- The superior anal appendage bears a subapical spine that is directed somewhat anteriad and forms an angle not perpendicular to the appendage (**Fig. 3.1.482**). The posterior lobe of the prothorax is elevated above the dorsal plane and appears wide in the middle in lateral view. The abdomen is black, except for the eighth through tenth segments, which are dark brown. Length of abdomen: c. 41 mm.

.....*Leptagrion dispar* Selys, 1876 (Bahia).

15. The posterior lobe of the prothorax is rectangular and occupies the median 1/3 of the lobe (**Fig. 3.1.483**). The head is black with an elliptical blue marking between the lateral ocellus and base of the antenna on each side and a comma-shaped spot beside each compound eye. The anterior part of the thorax is black with a greenish tinge. The eighth and ninth abdominal segments are black with a blue spot on the anterior part, and the tenth segment is black dorsally and laterally and blue ventrally. Length of abdomen: c. 38 mm.

.....*Leptagrion siqueirai* Santos, 1968 (Venezuela, French Guiana, Pernambuco). The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).

- The posterior lobe of the prothorax is convex and evenly curved (**Fig. 3.1.485**). The head is black with two greenish spots between the lateral ocellus and base of the antenna on each side and greenish fossae near the margin of the compound eye. The eighth through tenth abdominal segments are ochraceous or brown. Length of abdomen: 38 to 39 mm.

.....*Leptagrion aculeatum* Santos, 1965 (Venezuela, French Guiana, Surinam, Amapá, Pará).

Fig. 3.1.485 *Leptagrion aculeatum* male (left to right): head in dorsal view, pterostigma of the hind wing (above), apex of the abdomen in lateral view (below), prothorax in dorsal and lateral view (above), penis in ventral (above) and lateral view (below), apex of the abdomen in dorsal view. Based on Santos (1965c).

Information about known adult female *Leptagrion* in South America

This supplemental information was provided by Santos (1962a, 1968c,d) and Costa and Garrison (2001). The females of *Leptagrion acutum, L. capixabae, L. croceum, L. garbei, L. porrectum, L. prothoracicum,* and *L. siqueirai* have not been described.

1. The hind wing has a pterostigma that is approximately in the shape of a parallelogram or pentagram, with definite angles at each of the internal corners (**Fig. 3.1.475**).....2
- The hind wing has a nearly rhomboidal pterostigma with at least one or two of the internal corners rounded (**Fig. 3.1.476**). 3
2. The valve of the ovipositor extends a distance beyond the posterior border of the tenth abdominal segment about equal to half its own length. The rhomboid pterostigma is yellow in the middle but clear around the margin (**Fig. 3.1.475**). Hind wing length: 34 to 35 mm. Length of abdomen: 22 to 23 mm.
….....*Leptagrion dardanoi* Santos, 1968 (Pernambuco, Ceará).
- The valve of the ovipositor extends only slightly beyond the posterior border of the tenth abdominal segment. The pterostigma is generally quadratic with acute corners posteriorly and rounded corners along the costa. The posterior margin of the prothorax is straight (**Fig. 3.1.480**). The dorsal part of the head is black, except for a yellow crescent-shaped mark on the anteriomedian part of the frons and comma shaped marks between the ocelli and compound eyes. The antehumeral surface and patches of the abdomen are shiny metallic and irridescent. Length of abdomen: 35 to 38 mm. Hind wing length: 20 to 21 mm.
.....*Leptagrion andromache* Hagen in Selys, 1876 (São Paulo, Rio de Janeiro).
3. The valve of the ovipositor extends beyond the posterior border of the tenth abdominal segment (**Fig. 3.1.476**). 4
- The valve of the ovipositor does not reach the posterior border of the tenth abdominal segment (**Fig. 3.1.484**). 6
4. The apical and subapical teeth on the tarsal claws are subequal. Length of abdomen: 38 to 39 mm.
.....*Leptagrion aculeatum* Santos, 1965 (Venezuela, French Guiana, Surinam, Amapá, Pará).
- The subapical teeth on the tarsal claws are well developed but clearly smaller than the apical claws. 5
5. There are no spots on the postclypeus. The pterostigma is tear-drop shaped with one acute angle and another nearly right angle; the other corners are rounded (**Fig. 3.1.476**). The head is black with a greenish, wedge-shaped stripe between each lateral ocellus and antenna and a greenish vertical portion of the frons. The abdomen is about 40.5 mm long. Hind wing length: 24.5 mm.
.....*Leptagrion vriesianum* Santos, 1978 (São Paulo, Rio de Janeiro).

- There are round, greenish spots on the postclypeus. The pterostigma on the hind wing forms a pentagram with two somewhat rounded corners (**Fig. 3.1.346**). Length of female abdomen: c. 33.5 mm.
.....*Leptagrion bocainense* Santos, 1979 (São Paulo).

6. The epicranium and dorsal part of the head are black, except for yellow comma-shaped marks between the ocelli and compound eyes. There is a median black antehumeral stripe. The abdomen has shiny metallic black dorsolateral patches (**Fig. 3.1.484**). The pterostigma forms a parallelogram slightly longer than wide with two acute corners and the obtuse corners generally rounded. The posterior lobe of the pronotum is nearly rectangular. Length of abdomen: 42 to 44 mm. Hind wing length: 20 to 21 mm.
.....*Leptagrion elongatum* Selys, 1876 (Espírito Santo, Rio de Janeiro, São Paulo).

- The epicranium and dorsal part of the head are ocher, sometimes with blue markings (**Fig. 3.1.473**). 7

7. The proximal side of the pterostigma is oblique, while the distal side is nearly perpendicular to the costa; its external posterior corner is rounded. The posterior lobe of the pronotum is nearly rectangular (**Fig. 3.1.473**). Length of abdomen: 46 to 48 mm. Hind wing length: 26 to 27 mm. The abdomen is yellowish with blue on the dorsal surface of the eighth segment and the ninth and tenth segment darkened so that they appear almost black.
.....*Leptagrion perlongum* Calvert, 1909 (Bahia, Espírto Santo, Minas Gerais, São Paulo, Rio de Janeiro, Paraná, Santa Catarina).

- The pterostigma is tear-drop shaped with rounded distal and posterior corners (**Fig. 3.1.474**). The first seven abdominal segments are darkened dorsolaterally, and there are black distal rings on the third through sixth segments, which are blue proximally. 8

8. The eighth abdominal segment is blue, while the ninth and tenth segments are black. There are black rings surrounding the distal articulations of the third through sixth abdominal segments.The posterior lobe of the pronotum is somewhat oval with rather angular curves. The petiole of the wing extends to vein Ac (**Fig. 3.1.474**). Length of abdomen: c. 39 mm. Hind wing length: c. 27 mm.
.....*Leptagrion macrurum* (Burmeister, 1839) (Rio de Janeiro, Espirito Santo). Syn: *Agrion macrurum* Burmeister, 1839; *Agrion briseis* Hagen, 1861 *nomen nudum*.

- Both the eighth and ninth abdominal segments are blue, while the tenth segment is black. The petiole of the wing ends proximal to vein Ac. The posterior lobe of the prothorax resembles that of the male (**Fig. 3.1.482**), appearing ellipsoidal in dorsal view. Length of abdomen: c. 39 mm.
.....*Leptagrion dispar* Selys, 1876 (Bahia).

Key to the species of adult male *Tepuibasis* in South America

Information for the key was provided by De Marmels (1989a, 2007b). Information about the larvae is not yet available, but they appear to develop exclusively in ponds in open forested areas with boggy soils.

1. The posterior lobe of the pronotum has a strongly undulated margin, which curves strongly to project vertically dorsad. The abdomen is brownish black. The distal half of the inferior anal appendage is bent dorsad (**Fig. 3.1.486**). Total length of male: 34.5 to 35.5 mm. Length of male abdomen: 27 to 28 mm. Hind wing length of male: 18 to 19 mm. The female has not been described. .....*Tepuibasis garciana* De Marmels, 2007 (Venezuela).

- The margin of the posterior lobe of the pronotum is not undulated and does not curve strongly dorsad (**Fig. 3.1.487**). 2

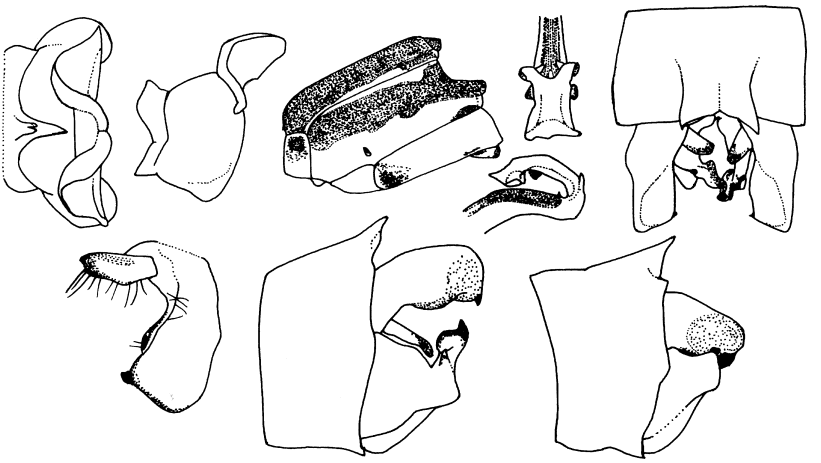


Fig. 3.1.486 *Tepuibasis garciana* male (above, left to right): prothorax in dorsal and lateral view, synthorax in lateral view, penis in ventral (above) and lateral view (below), apex of the abdomen in dorsal view, and (below, left to right): superior anal appendage in oblique internal view and apex of the abdomen in lateral view open to show the details of the appendages and closed, its natural position. Based on De Marmels (2007b).

2. A ventral process branches off the superior anal appenage beyond its midlength. The spiny process at the base of each apical lobe of the penis is vestigial (**Fig. 3.1.488**). The head is ivory white on the labium and inferior part of the genae, anterior to the compound eyes, and around the occipital foramen, and it is ferrugineous on the anteclypeus and labrum. It has a broad yellow

ventral margin on the labrum; black postclypeus in the male, and black along a band running across the ocelli and dorsal part of the genae. The postclypeus of the female is ferrugineous with two dark spots. The dorsal surface of the head is brassy black. The prothorax is orange with a brassy black median lobe and a black posterior lobe. The synthorax is pale brown or ochraceous with a straight ventral border on the mesepimeral stripe. Total length without anal appendages: 41.5 to 42 mm. Length of abdomen without anal appendages: 33.5 to 34 mm. Hind wing length: 22.5 to 23.5 mm. Length of pterostigma of male fore-wing: c. 0.9 mm. The abdomen and anal appendages of the male are red, becoming darker on the apical segments and with brown apices of the appendages. The abdomen of the female is orange brown dorsally and with black sternites and a dark distal band on the fifth through seventh segments. Vein R_3 branches from vein R_2 at or near the sixth or seventh postnodal cross vein in both the fore and hind wing.

….....*Tepuibasis neblinae* (De Marmels, 1989) (Venezuela). Syn: *Aeolagrion neblinae* De Marmels, 1989.

- No ventral process branches off the superior anal appenage beyond its midlength. An auricle-like spiny process at the base of each apical lobe of the penis is well developed and clearly evident (**Fig. 3.1.487**). 3

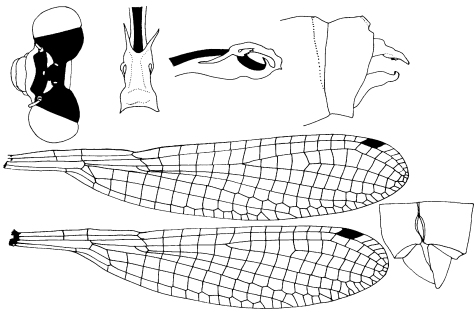


Fig. 3.1.487 *Tepuibasis fulva* (above, left to right): head of a male in dorsal view, penis in ventral and lateral view, and apex of the male abdomen in lateral view, and (below, left and right) fore and hind wing and the apex of the female abdomen in dorsal view. Based on De Marmels (1985, 2007b).

3. There are three postquadrangular cells in the discal field of the hind wing, and there are usually more than seven cells in the costal field between the pterostigma and the end of vein R_1 near the apex of the wing. Total length without anal appendages: 31 to 32.5 mm. Length of abdomen without anal appendages: c. 23.5 to 26 mm. Hind wing length: 19 to 20 mm. The anterior part of the head is brown, and the vertex is black with small orange markings. The apical fifth of the superior anal appendage arches ventrad and ends in a pointed tooth (**Fig. 3.1.340**). The thorax is black dorsally and orange with metallic green laterally. The abdomen is bright orange red becoming browner toward the apex.

There are brownish lateral markings on the first and second abdominal segments and vague darker markings on the apical 1/5 of the third through ninth abdominal segments. The pterostigma is orange.
.....*Tepuibasis chimantai* (De Marmels, 1988) (Venezuela). Syn: *Aeolagrion chimantai* De Marmels, 1988.
- There are usually two postquadrangular cells in the discal field of the hind wing, but occasionally, one of the wings will have three; there are usually fewer than seven cells in the costal field between the pterostigma and the end of vein R_1 near the apex of the wing (**Fig. 3.1.487**). 4

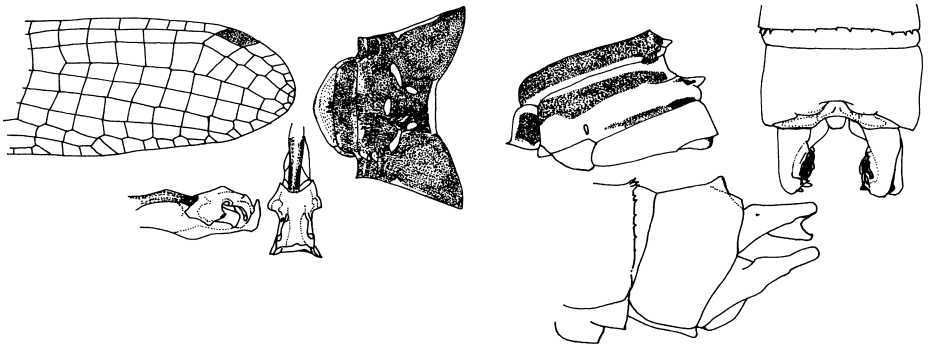


Fig. 3.1.488 *Tepuibasis neblinae* male (above, left to right): apex of a fore-wing, pattern on the dorsal surface of the head between the compound eyes, synthorax in lateral view, apex of the abdomen in dorsal view, and (below, left to right): penis in lateral and ventral view and the apex of the abdomen in lateral view. Based on De Marmels (1989a).

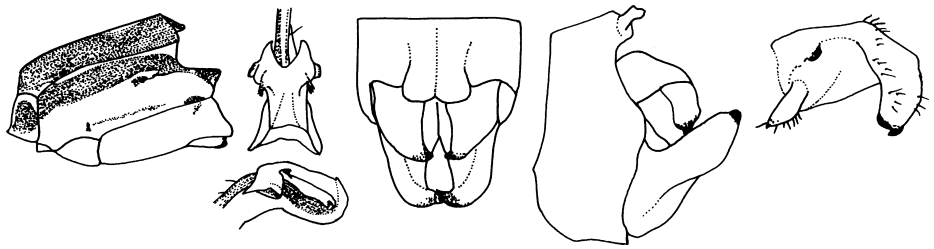


Fig. 3.1.489 *Tepuibasis thea* male (left to right): synthorax in lateral view, penis in ventral (above) and lateral view (below), apex of the abdomen in dorsal and lateral view, and interior view of the superior anal appendage. Based on DeMarmels (2007a).

4. The abdomen is red. The distal half of the superior anal appendage does not arch strongly ventrad, and it tapers evenly to its apex, as seen in lateral view (**Fig. 3.1.487**). 5
- The abdomen is mainly blackish. The distal half of the superior anal appendage arches strongly ventrad and does not taper evenly to its apex, as seen in lateral view (**Fig. 3.1.489**). 6

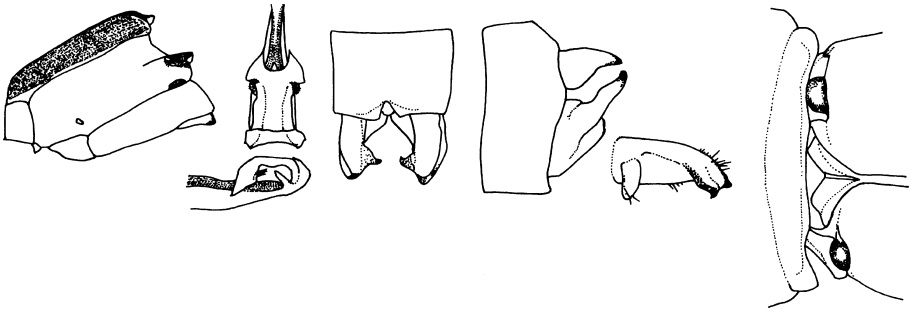


Fig. 3.1.490 *Tepuibasis rubicunda* (left to right): synthorax of a male in lateral view, penis in ventral (above) and lateral view (below), apex of the male abdomen in dorsal and lateral view, interior view of the male superior anal appendage, and the posterior part of the female prothorax and anterior portion of the synthorax in dorsal view. Based on DeMarmels (2007a).

5. There is no dark mesepimeral stripe, and a large subapical tooth is evident on the inner side of each superior anal appendage in dorsal view (**Fig. 3.1.490**). Total length of male: 38.5 to 39 mm. Length of male abdomen: 32 to 32.5 mm. Hind wing length of male: 19.5 to 20 mm. The pterostigma is light orange brown. The head is brassy black with a pale labium, yellow labrum, and white posterior surface. There are orange markings on the face, antenna, and ocellar region, and there is an orange occipital line. The prothorax is brassy black with orange markings; the synthorax is bright metallic on the mesepisternum, narrowly metallic green along the antealar carina of the metepisternum, and orange elsewhere, except for a black spot at the dorsal end of the second lateral suture. The legs are orange with black tibial spines. The narrow abdomen is orange red dorsally and yellowish orange on the lateral surfaces. There may be some darkening of the color on the dorsal and apical parts of most segments.
.....*Tepuibasis rubicunda* De Marmels, 2007 (Venezuela).
- There is a dark mesepimeral stripe, and there is no large subapical tooth on the inner side of each superior anal appendage. Total length without anal appendages: c. 42 mm. Length of abdomen without anal appendages: c. 35 mm. Hind wing length: c. 22 mm. Length of pterostigma of male fore-wing: c. 0.9 mm. The face is brownish rufescent as far as and including the antennae and black dorsally with a pair of pale, triangular markings (**Fig. 3.1.487**), which are

sometimes enlarged and meet on the middle ocellus to form a yellow W. The synthorax has a wide black mid-dorsal stripe and wide black mesepimeral stripes bordered by paler colors, becoming yellow on the ventral surface. The legs are uniform red with black tarsal claws and spines. The abdomen is uniformly reddish fulvous, somewhat darker at the proximal and distal ends but without a pattern.

.....*Tepuibasis fulva* (Needham, 1933) (Venezuela). Syn: *Aeolagrion fulvum* Needham, 1933.

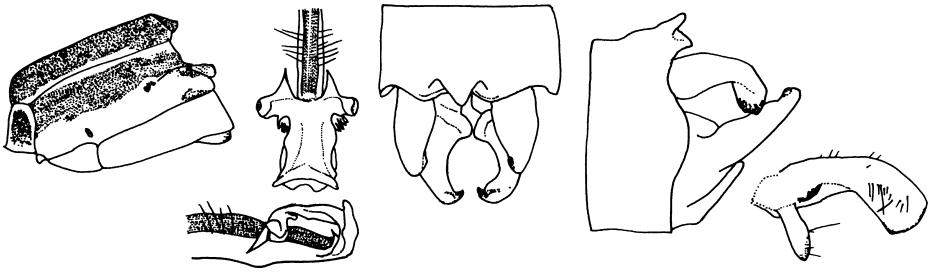


Fig. 3.1.491 *Tepuibasis nigra* male (left to right): synthorax in lateral view, penis in ventral (above) and lateral view (below), apex of the abdomen in dorsal and lateral view, and interior view of the superior anal appendage. Based on DeMarmels (2007a).

6. At midlength, the superior anal appendage arches strongly ventrad. The inferior anal appendage appears thick in lateral view. The mid-dorsal process on the tenth abdominal segment is wide and emarginate at the apex (**Fig. 3.1.489**). Total length of male: c. 45 mm. Length of male abdomen: c. 36 mm. Hind wing length of male: c. 23 mm. The head is mainly black with a pale labium, which is bluish in the middle. The labrum has pale outer margins. The mandibles are blue laterally with a black spot along the anterior margin. The genae are pale with a black mark ventral to the antenna base. The thorax is mainly black, usually with brassy reflections, and brown, pale greenish, and bluish gray laterally. The areas near the coxae are pruinose, and there is a dense patch of long setae on the posterior part of the metasternum. The legs are black with pale external lines on the tibiae. The abdomen is black dorsally, pale on the lateroventral surfaces, and has blue markings on its two proximal segments.

.....*Tepuibasis thea* De Marmels, 2007 (Venezuela).

- Beyond its midlength, the superior anal appendage arches strongly ventrad. The inferior anal appendage appears slender in lateral view. The mid-dorsal process on the tenth abdominal segment forms a blunt triangle, making the posterior margin convex (**Fig. 3.1.491**). Total length of male: c. 40 mm. Length of male abdomen: 32 to 34.5 mm. Hind wing length of male: 21 to 22.5 mm.

The head is brassy black with a pale labium and mandible, a brown labrum with a pale apical margin, a white marking on the genae, and a narrow yellow line below the occiput. The dorsal surface of the thorax is mainly brassy black with brown lateral stripes. The metepimeron and metepisternum are pale greenish gray, and the metasternum is pale. The pterostigma is dark brown with paler margins. The male abdomen is mainly black with creamy or pale blue basal rings on the third through eighth abdominal segments, cut by a black stripe along the mid-dorsal line.
.....*Tepuibasis nigra* De Marmels, 2007 (Venezuela).

Key to the species of known adult female *Tepuibasis* in South America

Information for the key was provided by De Marmels (2007b). The female of *Tepuibasis garciana* has not been described.

1. There is no dark mesepimeral stripe. The posterior lobe of the pronotum is low and has slight undulations, leaving it nearly straight across the midline. There is a mesostigmal fossa just posterior to the mesostigmal lamina (**Fig. 3.1.490**). The abdomen is pale ocher yellow. Total length: c. 37.5 mm. Length of abdomen: c. 30.5 mm. Hind wing length: c. 20 mm.
.....*Tepuibasis rubicunda* De Marmels, 2007 (Venezuela).
- There is a dark mesepimeral stripe. 2

2. There are three postquadrangular cells in the discal field of the hind wing, and there are usually more than seven cells in the costal field between the pterostigma and the end of vein R_1 near the apex of the wing (**Fig. 3.1.340**). Total length without anal appendages: 31 to 32.5 mm. Length of abdomen without anal appendages: c. 23.5 to 26 mm. Hind wing length: 19 to 20 mm.
.....*Tepuibasis chimantai* (De Marmels, 1988) (Venezuela). Syn: *Aeolagrion chimantai* De Marmels, 1988.
- There are usually two postquadrangular cells in the discal field of the hind wing, but occasionally, one of the wings will have three; there are usually fewer than seven cells in the costal field between the pterostigma and the end of vein R_1 near the apex of the wing (**Fig. 3.1.487**). 3

3. The ventral margin of the dark epimeral stripe has two or three sharp expansions. The tenth abdominal segment has a mid-dorsal cleft (**Fig. 3.1.487**). Total length without anal appendages: c. 42 mm. Length of abdomen without anal appendages: 32 to 35 mm. Hind wing length: 22 to 24 mm. Length of pterostigma of male fore-wing: c. 0.9 mm.
.....*Tepuibasis fulva* (Needham, 1933) (Venezuela). Syn: *Aeolagrion fulvum* Needham, 1933.
- The ventral margin of the dark epimeral stripe is straight or only slightly sinuous. 4

4. The posterior lobe of the prothorax is flat in the middle and elevated slightly near its lateral corners. There is a small swelling near each lateral angle of the mesostigmal lamina, behind which the mesepisternum has a shallow, glabrous depression. Total length: 41.5 to 42 mm. Length of abdomen: 33.5 to 34 mm. Hind wing length: 22.5 to 23.5 mm. Length of pterostigma of male fore-wing: c. 0.9 mm. The abdomen of the female is orange brown dorsally and with black sternites and a dark distal band on the fifth through seventh segments. Vein R_3 branches from vein R_2 at or near the sixth or seventh postnodal cross vein in both the fore and hind wing.
.....*Tepuibasis neblinae* (De Marmels, 1989) (Venezuela). Syn: *Aeolagrion neblinae* De Marmels, 1989.

- The lateral parts of the posterior lobe of the pronotum are flat. There are no swellings near the lateral angles of the mesostigmal lamina. There are no shallow depressions in the mesepisternum behind the lateral angles of the mesostigmal lamina. 5

5. There is a well-defined pale occipital line. The pterostigma is light brown. The posterior margin of the prothorax is not notably elevated along the midline. There is an area of scattered setae on the posterior part of the metasternum. Total length of female: 37 to 40 mm. Length of female abdomen: 29 to 32 mm. Hind wing length of female: 21.5 to 24 mm.
.....*Tepuibasis nigra* De Marmels, 2007 (Venezuela).

- If a pale occipital line is present, it is weak and poorly defined. The pterostigma is dark brown. The posterior margin of the prothorax is noticeably elevated along the midline. There is a patch of scattered setae on the posterior part of the metasternum. There is a dense patch of setae on the posterior part of the metasternum. Total length of female: 40 to 40.5 mm. Length of female abdomen: c. 32 mm. Hind wing length of female: c. 22 mm.
.....*Tepuibasis thea* De Marmels, 2007 (Venezuela).

Key to the species of adult *Andinagrion* in South America

Information for the key provided by Ris (1913), Bulla (1973b), and von Ellenrieder and Muzón (2006).

1. The color pattern does not include any blue markings. The abdomen is red with bronzed greenish black on the sixth through ninth segments. The tenth segment is dull red. In dorsal view, the superior appendage is strongly divergent along the lateral edge, with its tip formed into a hook directed inward; in posteriomedial view, its ventral branch appears subquadrangular. The distal lateral lobes of the apical penis segment are rounded. The posterior margin of the female prothorax has a small midline process extending posteriad, and the mesostigmal plate of the female has a posteromedial carina that projects anteriad

as far as the anterior margin (**Fig. 3.1.492**). The costal side of the pterostigma is the longest.
.....*Andinagrion saliceti* (Ris, 1904) (Argentina). Syn: *Oxyagrion saliceti* Ris, 1904.
- The color pattern includes some blue markings on the abdomen. In posteromedial view, the ventral branch of the superior anal appendage is subtriangular (**Fig. 3.1.493**). At least one of the lateral lobes of the apical penis segment is acutely pointed. The mesostigmal plate of the female does not project anteriad more than half way to the anterior margin. 2

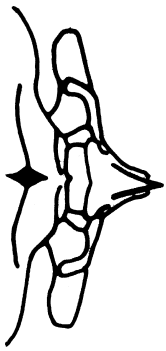


Fig. 3.1.492 *Andinagrion saliceti* female: the posterior lobe of the prothorax and mesostigmal lamina in dorsal view. Based on Bulla (1975).

2. The dorsal surface of the seventh abdominal segment of the male is black, and the lateral surfaces of the fourth through seventh segments of the female are yellow. The apical segment of the penis has an acutely pointed basal lateral lobe and a rounded distal lobe. The costal side of the pterostigma is the shortest. The first three abdominal segments are red, and the fourth through tenth are bronzed greenish black dorsally and yellowish laterally. The ninth segment is marked with blue, at least on the basal two thirds. In dorsal view, the superior appendage is not divergent along the lateral edge; its tip is bluntly triangular and not formed to a hook; in posteromedial view, its width appears to be no more than 9/10 its length. The posterior lobe of the prothorax of the female is evenly curved or indented, but it does not have a small midline process extending posteriad (**Fig. 3.1.350**). The mesostigmal plate of the female has a straight or slightly convex anterior margin
.....*Andinagrion peterseni* (Ris, 1908) (Argentina). Syn: *Oxyagrion peterseni* Ris, 1908.
- The dorsal surface of the seventh abdominal segment of the male and the lateral surfaces of the fourth through seventh segments of the female are pale blue. In posteromedial view, the superior anal appendage of the male appears to be as wide or wider than its length (**Fig. 3.1.493**). The apical segment of the penis has an acutely pointed distal lobe. The mesostigmal plate of the female has

a straight or slightly convex anterior margin, a nearly flat dorsal surface with a slight longitudinal depression parallel to the median margin, and a transverse posteromedian carina.
.....*Andinagrion garrisoni* von Ellenrieder and Muzón, 2006 (Argentina).

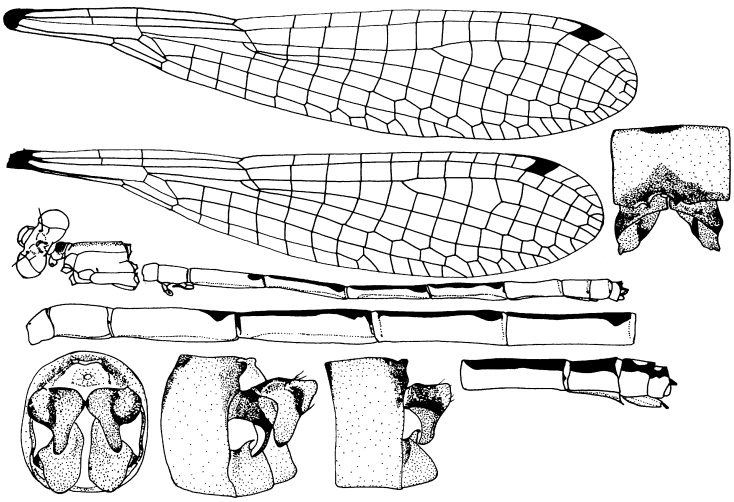


Fig. 3.1.493 *Andinagrion garrisoni:* fore and hind wing of a male (upper left), head of a male in dorsal view with its thorax and abdomen in lateral view (middle), six proximal segments of the female abdomen in lateral view (lower middle) and its four apical segments in lateral view (lower right), apex of the male abdomen in dorsal (upper right), posterior (lower left), dorsolateral (lower left center), and lateral view (lower center). Based on von Ellenrieder and Muzón (2006).

Key to the known species of *Andinagrion* larvae in South America

Information for the key provided by Ris (1913) and Bulla (1973b). The larva of *Andinagrion saliceti* has not been described.

1. The tracheae in the caudal gill lamellae are coarse and form some dark areas. The short anterolateral setae along the anterior portion of the lateral margin of the prementum are not arranged in an even row and extend onto the basal half of the ventral side; the anterior margin of the prementum is almost angled along the midline. There are two molars on the right mandible (**Fig. 3.1.494**).
.....*Andinagrion peterseni* (Ris, 1908) (Argentina). Syn: *Oxyagrion peterseni* Ris, 1908.

- The tracheae in the caudal gill lamellae are faint and barely branched. There is one regular anterolateral row of short setae along the anterior portion of the lateral margin of the prementum extending onto the basal 9/20 of the ventral side; the anterior margin of the prementum is evenly convex and smoothly curved across the midline. There is only one molar on the right mandible (**Fig. 3.1.379**).
.....*Andinagrion garrisoni* von Ellenrieder and Muzón, 2006 (Argentina).

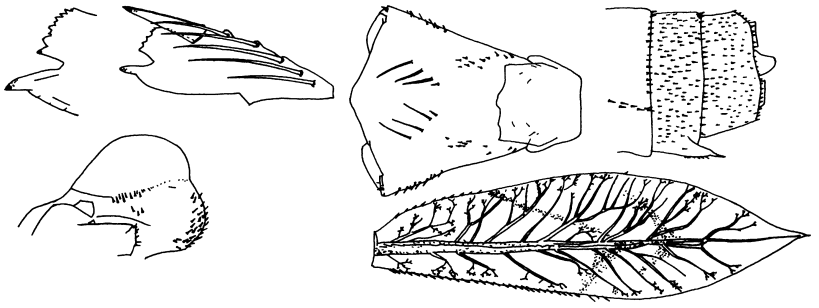


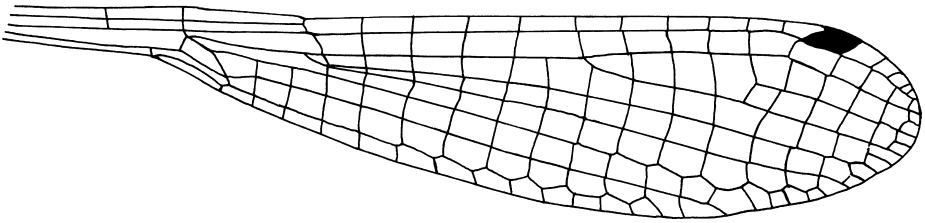
Fig. 3.1.494 *Andinagrion peterseni* larva (upper row, left to right): anterior border of the labial palp, prementum, and the apex of the abdomen of a male larva in lateral view, and (below): the left side of the head in ventral view, and a lateral gill lamella. Based on Bulla (1973b).

Key to the species of known adult male *Aeolagrion* in South America

Information for the key was provided by Williamson (1917a), Needham (1933), De Marmels (1985, 1989a), and Dunkle (1991b). Descriptions of the females are included when known.

1. Vein R_3 branches from vein R_2 at or near the seventh postnodal cross vein in the fore-wing and at or near the fifth in the hind wing (**Fig. 3.1.495**). Length of abdomen: 32 to 35 mm. Hind wing length: 21 to 22.5 mm. The head is brightly colored with shades of blue, green, yellow, orange and black. The thorax is ferrugineous, orange, yellow, and dull greenish or brownish. The abdomen is light brown at the base, becoming darker toward the apex, with the posterior segments black. The segments have yellow and bright red markings.
.....*Aeolagrion flammeum* (Selys, 1876) (Venezuela, Guyana, Peru, Bolivia, Amapá, Pará, Roraima, Amazonas, Rondônia). Syn: *Leptagrion flammeum* Selys, 1876; *Leptagrion autazensis* Sjoestedt, 1918. De Marmels (1985, 2007b) believes that the assignment of this species to *Aeolagrion* is not correct, so he left the generic name in quotation marks to suggest that it probably belongs in a new genus, yet to be described.

- Vein R_3 branches from vein R_2 at or near the fifth postnodal cross vein in the fore-wing and at or near the fourth in the hind wing (**Fig. 3.1.496**). 2



Fig, 3.1.495 Hind wing of *Aeloagrion flammeum.* Based on Munz (1919).

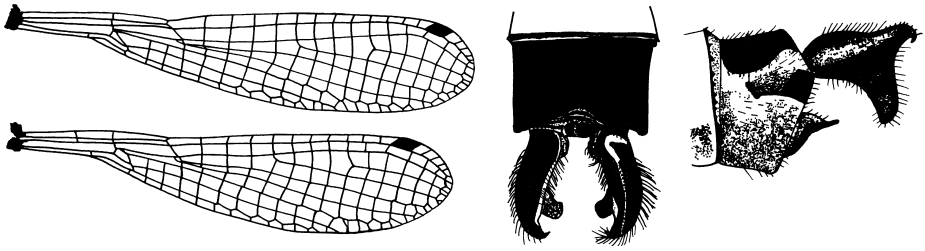


Fig. 3.1.496 *Aeolagrion dorsale* male (left to right): fore and hind wing and apex of the abdomen in dorsal and lateral view. Based on Williamson (1917a).

2. In lateral view, the cerci are shorter than the tenth abdominal segment and have a shape like the head of a hatchet (**Fig. 3.1.497**). The black coloration on the ninth abdominal segment covers the apical 2/3, while the rest is blue. Total length: 35 to 37 mm. Hind wing length: 18 to 19 mm. Length of abdomen: 28 to 30 mm.
.....*Aeolagrion axine* Dunkle, 1991 (Ecuador).
- In lateral view, the male superior anal appendages are longer than the tenth abdominal segment and have a shape like a mitten or a trapezoid. The ninth abdominal segment is entirely blue (**Fig. 3.1.496**). 3

3. In lateral view, the superior anal appendages are trapezoidal and not obviously bifid at the apex. The penis has a long, narrow subapical process (**Fig. 3.1.350**). The labrum is blue. Total length: c. 32 mm. Length of abdomen without appendages: 25 to 26 mm. Hind wing length: 16 to 16.5 mm. Length of pterostigma: c. 0.8 mm. The ovipositor barely reaches the apex of the tenth abdominal segment.
.....*Aeolagrion inca* (Selys, 1876)
(Ecuador, Peru, Bolivia, Amazonas). Syn: *Leptagrion inca* Selys, 1876; probably *Leptagrion foliaceum* Sjöstedt, 1918.
- In lateral view, the superior anal appendages are mitten-shaped, clearly bifid at the apex (**Fig. 3.1.496**). The labrum is black. Length of abdomen: 27 to 30 mm. Hind wing length: 17 to 19 mm. The head is mainly bluish green on the anterior surface and rust red or sometimes black on the dorsal surface. The prothorax is blue and black, and the synthorax is mainly metallic green or black on the dorsal surface. The abdomen is black with blue markings, with the entire eighth and ninth segments blue, and the tenth segment black.
.....*Aeolagrion dorsale* (Burmeister, 1839)
(Trinidad, Tobago, Venezuela, Surinam, Ecuador, Peru, Bolivia, Pará, Amazonas). Syn: *Agrion dorsale* Burmeister, 1839; *Hylaeagrion argenteolineatum* Förster, 1906.

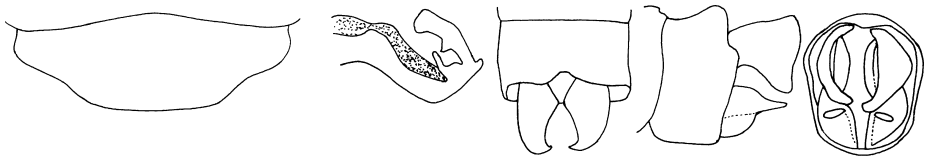


Fig. 3.1.497 *Aeolagrion axine* male (left to right): hind lobe of the pronotum in dorsal view, penis in right lateral view, and the apex of the abdomen in dorsal, lateral, and posterior view. Based on Dunkel (1991).

Key to the species of adult *Antiagrion* reported from South America

Information for the keys to this genus was provided by Jurzitza (1974, 1986). The larvae have not been described.

1. On the top of the head between the ocelli and antennae, there are two isolated blue, triangular spots that are not connected with each other or with the pale color on the callus posterior to the ocelli. The inferior anal appendages of the male appear acute at the apices, at least in lateral view (**Fig. 3.1.498**). 2

- On the top of the head between the ocelli and antennae, there are two blue markings that are connected by a bar across the middle of the head. The labrum is black on the basal 1/3 to 1/2. The inferior anal appendages of the male are broadly rounded at the apices (**Fig. 3.1.499**). The anal appendages of the female are black. 3

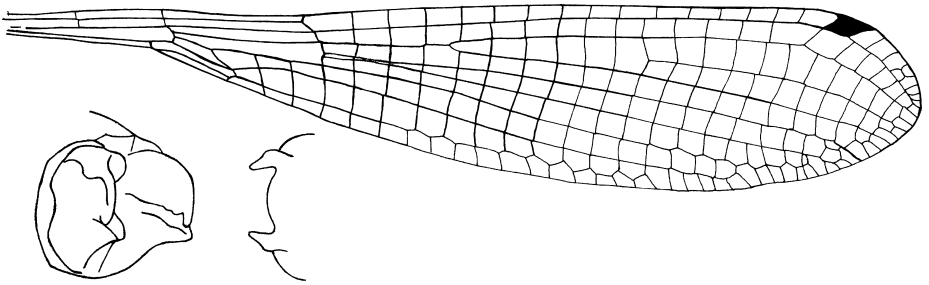


Fig. 3.1.498 *Antiagrion gayi:* hind wing of a male (above), apex of the male abdomen in posterolateral view (lower left), and posterior margin of the female prothorax in dorsal view (lower right). Based on Munz (1919) and Jurzitza (1986).

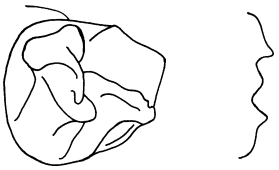


Fig. 3.1.499 *Antiagrion grinsbergsi:* apex of the male abdomen in posterolateral view (left) and the posterior margin of the female prothorax in dorsal view (right). Based on Jurzitza (1986).

2. The apex of the inferior anal appendage of the male appears acute in lateral view and truncate in dorsal or ventral view (**Fig. 3.1.498**). The labrum has a narrow black band that is widened to form a triangle in the middle. The legs are mainly blue, but there are black stripes on the outside of the femora and inside of the tibiae, and the tarsi and spines are black. Length of abdomen: 27 to 33 mm. Length of hind wing: 22 to 27 mm.
.....*Antiagrion gayi* (Selys, 1876) (Chile). Syn: *Erythromma gayi* Selys, 1876.

- The inferior anal appendages of the male appear acute at the apices, whether in dorsal or in lateral view (**Fig. 3.1.348**). The basal half of the labrum is black. The legs are black with yellow on the outer, posterior side of the femora and brownish on the inside of the tibiae. Length of abdomen: 26 to 28 mm. Length of fore-wing: 21.5 to 24 mm. Length of hind wing: 19 to 22 mm.
.....*Antiagrion antigone* Ris, 1928 (Chile).

3. Only the basal 1/3 of the labrum is black. The blue anteocellar markings between the ocelli and antennae are connected with each other across the middle of the head and with the pale callus along the posterior margin of the head (**Fig. 3.1.499**). Length of abdomen: 26 to 27 mm. Length of hind wing: 21 to 23 mm.
.....*Antiagrion grinsbergsi* Jurzitza, 1974 (Chile).

- The basal half of the labrum is black. The blue anteocellar markings between the ocelli and antennae are connected with each other across the middle of the head but not with the pale callus along the posterior margin of the head (**Fig. 3.1.500**). Length of abdomen: 24 to 31 mm. Length of hind wing: 24 to 27 mm.
.....*Antiagrion blanchardi* (Selys, 1876) (Chile). Syn: *Erythromma blanchardi* Selys, 1876.

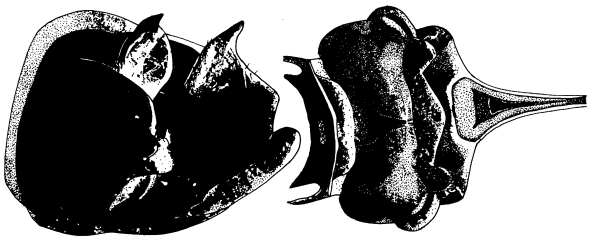


Fig. 3.1.500 *Antiagrion blanchardi:* anal appendages of a male in oblique posterior view (left) and the prothorax of a female in oblique dorsal view (right). Based on Jurzitza (1974).

Key to the species of adult *Telagrion* in South America

Information for the key provided by Ris (1918), Santos (1970d), and Lencioni (2004). Male specimens are required for identification in most cases. For the poorly known species, *Telagrion fulvellum,* see the key to *Chrysobasis,* to which this species probably belongs.

1. The eighth through tenth abdominal segments are reddish yellow or red. The wings are hyaline. 2
- The color of the eighth through tenth abdominal segments is not reddish yellow or red, at least on the dorsal surface, although it may be ocher yellow without any reddish tinge. 3

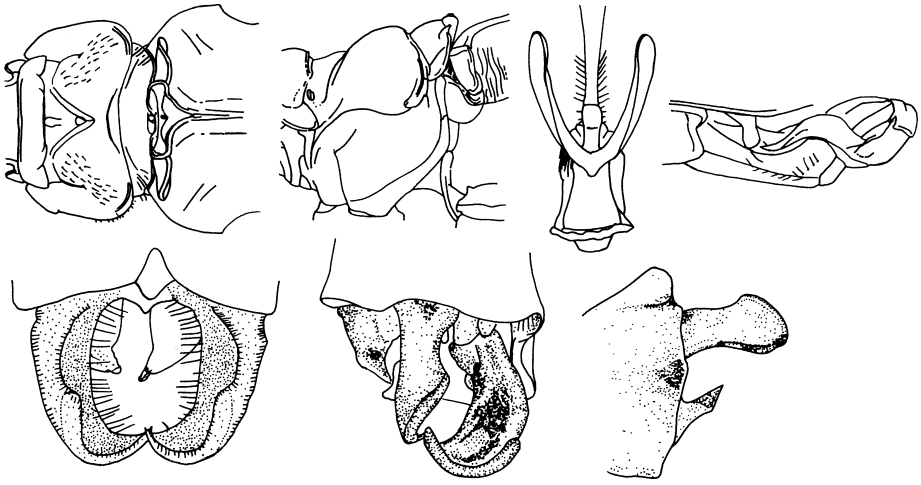


Fig. 3.1.501 *Telagrion cornicauda* (above, left to right): prothorax and anterior part of the synthorax of a male in dorsal and lateral view and penis in ventral and lateral view, and (below, left to right): apex of the male abdomen in dorsal, dorsomedial, and lateral view. Based on Lencioni (2004).

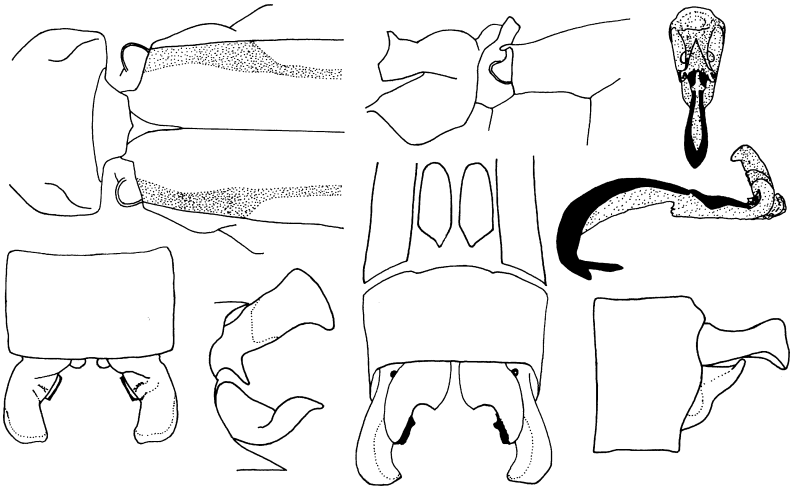


Fig. 3.1.502 *Telagrion longum* male: prothorax and synthorax of a male in dorsal (upper left) and lateral view (upper center), apex of the abdomen in dorsal (lower left), ventral (lower right center), and lateral view (lower right) with an oblique view of the anal appendages (lower left center), and the penis in ventral (upper right) and lateral view (middle right). Based on a specimen described as *Metaleptobasis sooretamae* by Santos (1957b).

2. The abdomen is about 50 mm long. In lateral view, the superior anal appendage appears to be spoon-shaped, and in dorsal view, it appears strongly curved in the apical half so that it contacts the other superior appendage at its apex. The finger-like projection near the base of the male superior anal appendage is directed toward the longitudinal midline of the abdomen (**Fig. 3.1.501**).

.....*Telagrion cornicauda* (Calvert, 1909) (Bahia). Syn: *Metaleptobasis cornicauda* Calvert, 1909.

- The abdomen is shorter then 45 mm. In lateral view, the superior anal appendage appears dilated at the apex, and the projection near its base is roughly triangular. The apex of the inferior anal appendage is bifid. The posterior lobe of the prothorax is roughly rectangular, and its posterior margin is curved dorsad (**Fig. 3.1.502**).

.....*Telagrion longum* Selys, 1876 (Espirito Santo, São Paulo, Rio de Janeiro, Rio Grande do Sul). Syn: *Metaleptobasis sooretamae* Santos, 1957; *Leptobasis tenax* St. Quentin, 1960; *Agrion longissimum* Hagen, 1861 *nomen nudum*.

3. The wings of the male are light yellow with brown veins, and those of the female are light brown. The superior anal appendage is about twice as long as the inferior appendage (**Fig. 3.1.503**). Total length including appendages: 38 to 50 mm. Length of abdomen: 31 to 40 mm. Fore-wing length: 22 to 29 mm. Hind wing length: 21 to 28 mm.

.....*Telagrion boliviensis* Daigle, 2007

- The wings are hyaline. 4

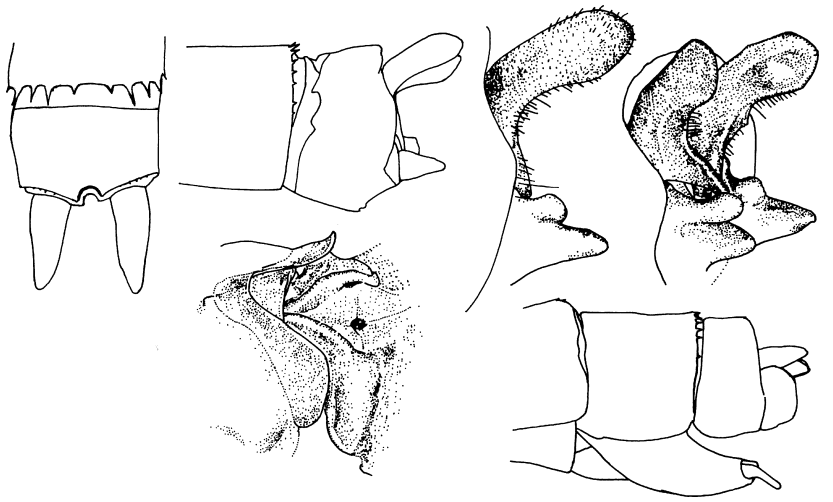


Fig. 3.1.503 *Telagrion boliviensis* (above, left to right): apex of the male abdomen in dorsal and lateral view and the anal appendages in lateral and posterolateral view, and (below, left and right): posteror lobe of the prothorax and the apex of the female abdomen in lateral view. Based on Daigle (2007).

4. The inferior anal appendage is at least ¾ as long as the superior appendage (**Fig. 3.1.504**). 5
- The inferior anal appendage is less than ¾ as long as the superior appendage (**Fig. 3.1.505**). 6

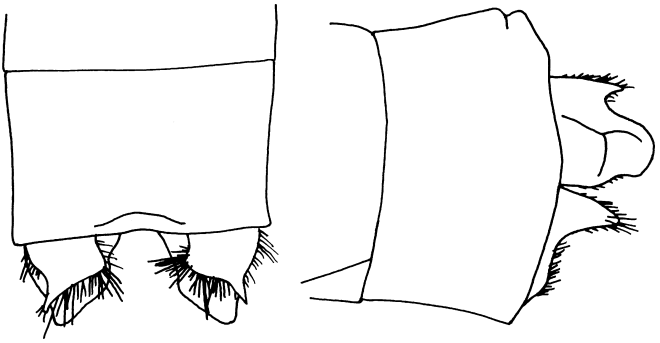


Fig. 3.1.504 *Telagrion quadricolor* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Ris (1918).

4. The abdomen is c. 30.5 mm long, and the hind wing length is c. 22 mm. The sixth abdominal segment is orange red with a diffuse black apical mark about as long as 1/6 of the segment, the same marking as that on the third through fifth segments. The seventh segment is black dorsally with dull orange on the lateral surfaces. The eighth segment is blue dorsally with black dorsolateral stripes on the anterior 2/3 of the segment, and it has dull orange lateral surfaces. The ninth segment is blue, and the tenth is black dorsally and yellow laterally. On the dorsal edge of the superior anal appendage, there is an acutely pointed process. The bright yellow inferior anal appendage is shorter than the blackish superior appendage (**Fig. 3.1.504**).
.....*Telagrion quadricolor* Ris, 1918 (Peru).
- The abdomen is c. 37 mm long, and the hind wing length is c. 25 mm. The anterior and anterolateral surfaces of the sixth abdominal segment is red, and the posterior part of the segment is black. The third through fifth segments are orange red with only the intersegmental membrane blackish. fourth and fifth segments. The seventh segment is black dorsally with a narrow red stripe on the anterior 2/3 of each lateral surface. The eighth segment is blue dorsally with black dorsolateral stripes separating the blue from red on the ventrolateral surfaces. The ninth segment is blue with black lateral markings, and the tenth is black dorsally and light yellow laterally. There is no acutely pointed process on the dorsal edge of the superior anal appendage. The superior and inferior anal appendages are both black and of about the same length (**Fig. 3.1.506**).
.....*Telagrion oreas* Ris, 1918 (Colombia).

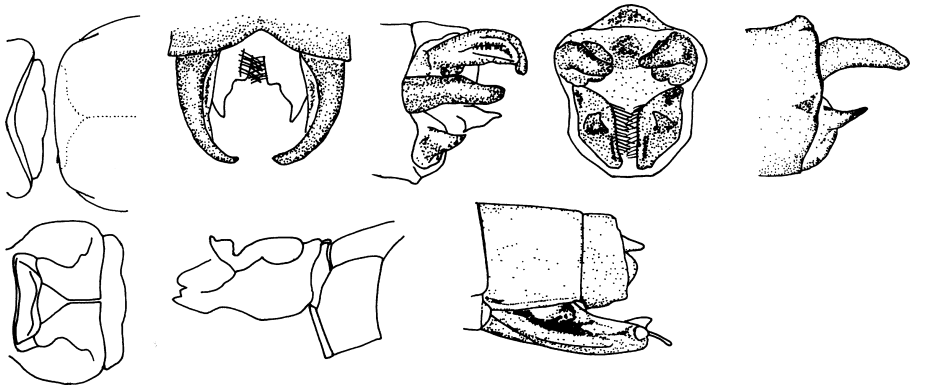


Fig. 3.1.505 *Telagrion macilentum* (above, left to right): posterior lobe of the prothorax and anterior part of the synthorax of a male in dorsal view; apex of the male abdomen in dorsal, dorsomedial, posterior, and lateral view; and (below, left to right): prothorax of a female in dorsal view and with the anterior part of the synthorax in lateral view; apex of the female abdomen in lateral view. Based on Lencioni (2004).

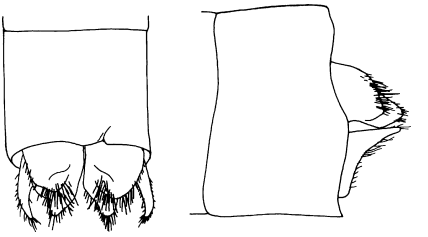


Fig. 3.1.506 *Telagrion oreas* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Ris (1918).

5. In dorsal view, a spine-like median processes can be observed on each superior anal appendage (**Fig. 3.1.356**). Length of male abdomen: c. 36 mm; female: c. 34 mm. Hind wing length of male: c. 20 mm; female: c. 21.5 mm. The dorsal surfaces of both the male and female are mainly metallic black with green reflections and a bluish pruinescence on the prothorax; markings on the face and most of the lateral and ventral surfaces of the thorax and abdomen are greenish yellow.
.....*Telagrion mourei* Santos, 1970 (Espírito Santo).
- In dorsal view, no spine-like median processes can be observed on the superior anal appendages (**Fig. 3.1.505**). 6
6. In lateral view, the superior anal appendages appear straight, and the process near its base is finger-like and points ventrad (**Figs. 3.1.10, 3.1.507**). Total length including appendages: 39 to 41 mm. Length of abdomen: 32.5 to 34 mm.

Fore-wing length: 21 to 23 mm. Hind wing length: 19.5 to 21.5 mm. The body of the male is mainly black dorsally with pale markings on the apical margin of the labrum, anteclypeus, genae, antefrons, comma-shaped markings between the ocelli and compound eyes, parts of the metepisternum and metepimeron, tibiae except for the internal surface, ventral surfaces of the first six abdominal segments, and a pale proximal ring on the seventh segment. Black areas on the thorax have metallic green iridescence. Pruinose areas on the prothorax, along V-shaped stripes on the mesepisternum, and on the eighth through tenth abdominal segment appear whitish over a black base. The head of the female is shiny black with bronze iridescence, while the female thorax is mainly pale with black dorsal and dorsolateral stripes. The female abdomen is mainly black dorsally and pale ventrally but with pale basal rings on the third through seventh segments, which are interrupted along the dorsal midline.
.....*Telagrion nathaliae* Lencioni, 2004 (São Paulo).

- In lateral view, the superior anal appendages curve sharply, and they resemble a forceps in dorsal view; the process near the base of each superior appendage is short and rounded at the apex (**Fig. 3.1.505**).
.....*Telagrion macilentum* (Rambur, 1842) (Rio de Janeiro, São Paulo). Syn: *Agrion macilentum* Rambur, 1842.

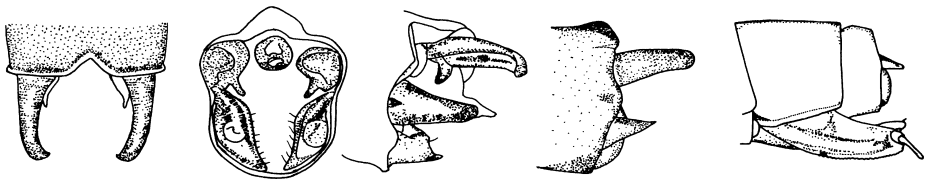


Fig. 3.1.507 *Telagrion nathaliae* (left to right): apex of the male abdomen in dorsal, posterior, dorsolateral, and lateral view; apex of the female abdomen in lateral view. Based on Lencioni (2006).

Key to the species of adult male *Telebasis* in South America

Information for the key provided by Calvert (1909), Williamson (1917a), Navás (1934b), Fraser (1946a), Jurzitza (1980c), Bick and Bick (1995, 1996), Garrison (1991b, 1997), Tennessen (2002b), Machado (2002a), and Daigle (2000, 2002a, b).

1. The superior anal appendage is either at least twice as long as the inferior, or it is notched at the apex (**Fig. 3.1.508**). 2
- The superior anal appendage is less than twice as long as the inferior and it is not notched at the apex (**Fig. 3.1.509**). 5

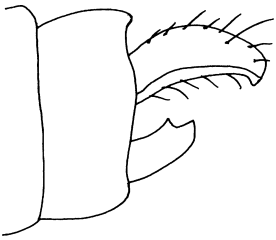


Fig. 3.1.508 Apex of the abdomen of a male *Telebasis demararum* in lateral view. Based on Bick and Bick (1995).

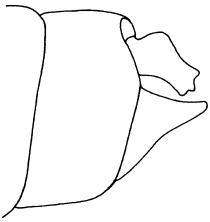


Fig. 3.1.509 Apex of the abdomen of a male *Telebasis theodori* in lateral view. Based on Bick and Bick (1995).

2. There are no reddish or orange markings on the abdomen, the first segment of which is blue with a pale-centered brown dorsal spot and a dark midline stripe. The third through sixth segments are brown basally, black apically, and greenish laterally on some specimens. The seventh segment is black with pale rings, and the eighth and ninth are bright blue. The tenth segment is black with a pair of blue or yellow dorsal spots (**Fig. 3.1.508**). Generally, however, the color is variable. Length of abdomen: 27 to 30 mm. Hind wing length: 16 to 18.5 mm. .....*Telebasis demararum* (Williamson, 1917) (Trinidad, Venezuela, Guyana, Surinam, French Guiana, Roraima). Syn: *Aeloagrion demararum* Williamson, 1917; *Telebasis fluviatilis* St. Quentin, 1960.

- The abdomen has red, reddish brown, or orange markings. 3

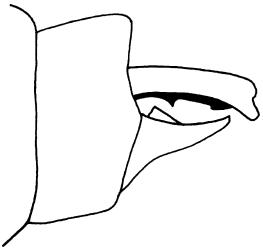


Fig. 3.1.510 Apex of the abdomen of a male *Telebasis racenisi* in lateral view. Based on Bick and Bick (1995).

3. The first three anterior and four posterior abdominal segments of the male are reddish brown, and the fourth, fifth, and sixth segments are dark brown. The superior anal appendage is slender, notched at the apex, and bears a tooth on its basal third (**Fig. 3.1.510**). Length of abdomen: 23 to 25 mm. Hind wing length: 16 to 17 mm. The head is mainly black and lined with orange on the margin of the occiput and on a marking from the ocellus to the antenna. The labrum is dark blue. A black mid-dorsal stripe runs across the anterior and median lobes of the prothorax and the synthorax. The mesepimeron is reddish brown, and the mesepisternum is black. The metepimeron and metepisternum are mainly bluish gray.
.....*Telebasis racenisi* Bick and Bick, 1995 (Venezuela, Peru, Mato Grosso).
- The abdomen of the male is either entirely reddish orange, or only the three posterior segments are red. 4

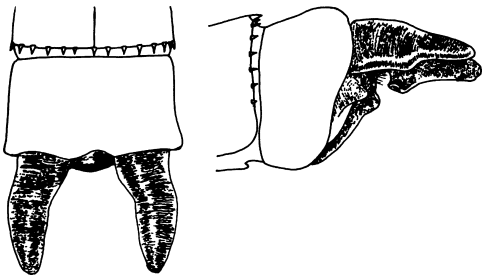


Fig. 3.1.511 *Telebasis versicolor* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Fraser (1946a).

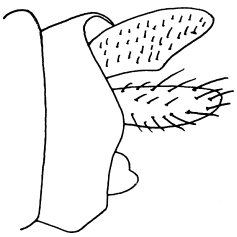


Fig. 3.1.512 Apex of the abdomen of a male *Telebasis rubricauda* in lateral view. Based on Bick and Bick (1995).

4. The abdomen of the male is entirely reddish orange. The superior anal appendage of the male is slightly longer than the tenth tergite, rather abruptly constricted just distal to the middle, and rounded at the apex, as seen in lateral view (**Fig. 3.1.511**). Length of male abdomen: 29 mm. Hind wing length: 18 mm. Wings hyaline. Legs pale yellow. Female not described.
.....*Telebasis versicolor* Fraser, 1946 (Colombia).

- Only the three apical segments of the male abdomen are red with a narrow black margin on the tenth. The inferior anal appendage is small and notched at the apex, as seen in lateral view (**Fig. 3.1.512**). Length of male abdomen: 23 to 26 mm. Hind wing length: 15 to 18 mm. The posterior part of the head is half black and half pale, and the head anterior to the antennae is entirely blue. The area between the lateral ocelli and antennae is brown.
.....*Telebasis rubricauda* Bick and Bick, 1995 (Venezuela, Ecuador, Peru, Bolivia, Rondônia, Territory of Acre).
5. The dragonfly appears golden yellow and has yellow-tinged wings. 6
- The wings are hyaline without any yellow tinge. The ground color is usually predominantly blue, black, or red. 7

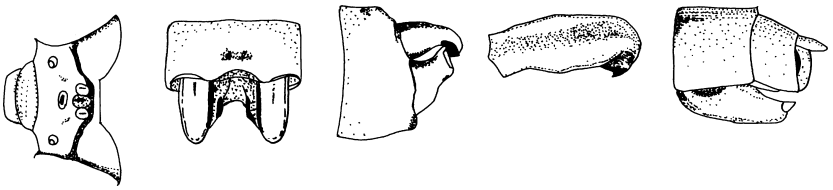


Fig. 3.1.513 *Telebasis gigantea* (left to right): pattern on the head of a male between the compound eyes, apex of the male abdomen in dorsal and lateral view, a superior anal appendage of a male, and the apex of the abdomen of a female. Based on Daigle (2002a).

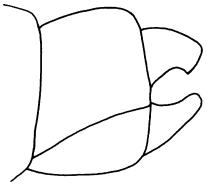


Fig. 3.1.514 Apex of the abdomen of a male *Telebasis dunklei* in lateral view. Based on Bick and Bick (1995).

6. A relatively small species, as determined only from the lengths of the female type, which presumably does not vary significantly from that of the male. Length of hind wing of female: 19.5 mm. Length of abdomen of female: 26 mm. The first antennal segment of the female is lighter than the fuscous apical segments. The labrum of the female is yellow, and the head bears yellow hairs (**Fig. 3.1.509**).
.....*Telebasis theodori* (Navás, 1934) (Argentina, Rio Grande do Sul). Syn: *Argia theodori* Navás, 1934; *Telebasis auripennis* Jurzitza, 1980. A Central American species, *Telebasis aurea* May, 1992, also has yellow-tinged wings, but it can be distinguished by the black occipital area of the head, which is pale in *T. theodori.*

- A relatively large species. Length of hind wing of male: c. 23.5 mm; female: 24.5 mm. Length of abdomen of male: c. 38 mm; female: c. 40 mm. The face is blue (**Fig. 3.1.513**).
.....*Telebasis gigantea* Daigle, 2000 (Bolivia).
7. The superior anal appendage of the male does not have a pale medial ventral process (**Fig. 3.1.514**). Length of abdomen: 21 to 25 mm. Hind wing length: 14 to 16 mm.
.....*Telebasis dunklei* Bick and Bick, 1995 (Ecuador, Peru).
- There is a pale medial process extending along the ventral surface of the superior anal appendage of the male (**Fig. 3.1.515**). 8

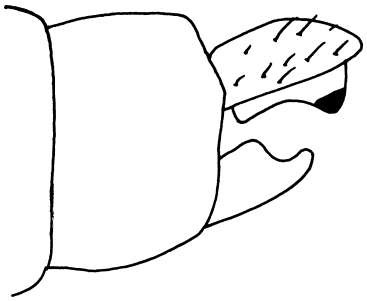


Fig. 3.1.515 Apex of the abdomen of a male *Telebasis carmesina* in lateral view. Based on Bick and Bick (1995).

8. There is a seam along the lateral side of the superior anal appendage that makes it appear to consist of two parts (**Fig. 3.1.515**). 9
- There is no seam along the lateral side of the superior anal appendage, which appears as one unit in lateral view (**Fig. 3.1.516**). 14

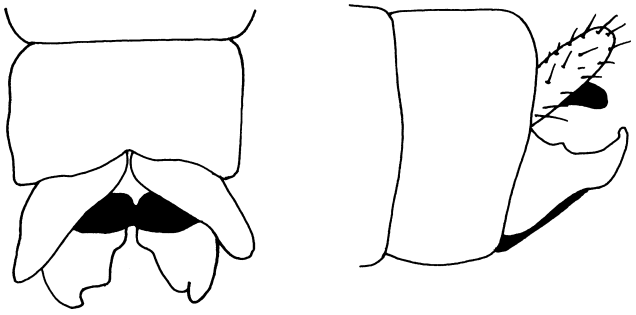


Fig. 3.1.516 Apex of the abdomen of a male *Telebasis garrisoni* in dorsal (left) and lateral view (right). Based on Bick and Bick (1995).

9. In lateral view, the superior anal appendage of the male is paddle-shaped and slightly longer than the inferior appendage (**Fig. 3.1.355**). Length of abdomen: 28 to 30 mm. Hind wing length: 18 to 19 mm.
.....*Telebasis milleri* Garrison, 1997 (Peru).
- In lateral view, the male superior anal appendage is relatively straight and parallel-sided (**Fig. 3.1.515**). 10

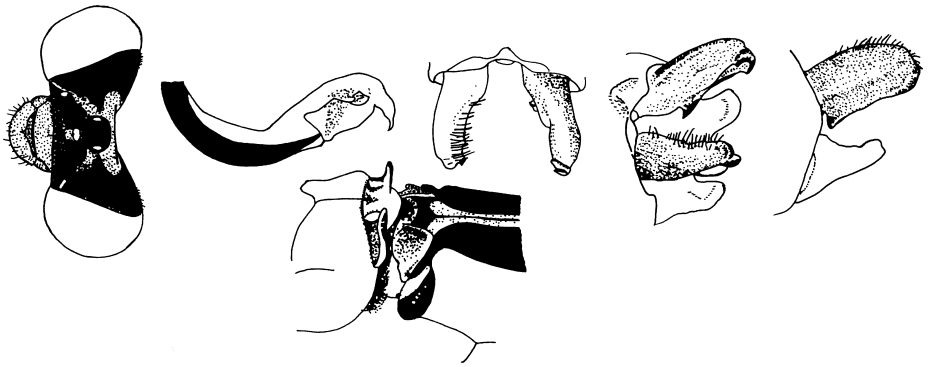


Fig. 3.1.517 *Telebasis simulata* (above, left to right): head in dorsal view, penis in lateral view, apex of the male abdomen in dorsal, dorsomedial, and lateral view, and (below): the middle and hind lobes of the female prothorax and anterior part of the synthorax in dorsolateral view. Based on Tennessen (2002b) and Lencioni (2006).

10. The head is mainly black dorsally, and there is no prominent orange-red pattern but only reddish streaks from the antenna to the ocelli and on the occiptal part of the head (**Fig. 3.1.517**). 11
- There is a prominent orange-red pattern on the dorsal side of the head, or at least the labrum is orange-red. 12
11. The superior anal appendage of the male has a prominent ventral, subapical hook, and it appears less than twice as long as wide in dorsal view. It is longer than the tenth abdominal segment and reaches well beyond the inferior appendage (**Fig. 3.1.515**). Length of male abdomen: c. 23 mm. Hind wing length of male: 16 mm.
.....*Telebasis carmesina* Calvert, 1909 (Argentina, Paraguay, Mato Grosso, Minas Gerais, São Paulo).
- The superior anal appendage of the male has only a slight ridge at the apex, visible in dorsomedial view, and it appears at least twice as long as wide in dorsal view (**Fig. 3.1.517**).
.....*Telebasis simulata* Tennessen, 2002 (Dominica, Trinidad, Venezuela, Surinam, French Guiana, Amazonas, Bahia).

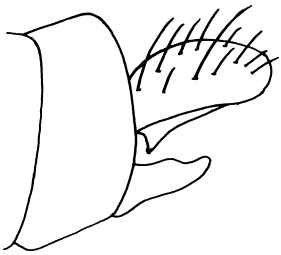


Fig. 3.1.518 Apex of the abdomen of a male *Telebasis sanguinalis* in lateral view. Based on Bick and Bick (1995).

12. The front lobe of the prothorax has a metallic green spot in the middle; on each side of the middle lobe, there is a convex green marking, or the lobe is metallic green with a reddish spot on each side. The posterior lobe is dark metallic green with yellow margins. There is a metallic green stripe on each side of the middle carina of the synthorax; the middle carina, mesepisterna and mesepimera of the synthorax are otherwise reddish, while the metapleura are pale bluish or yellowish. In lateral view, the superior anal appendage appears twice as long as wide, is longer than the tenth abdominal segment, and reaches well beyond the inferior appendage (**Fig. 3.1.518**). The color of the occipital area of the head is about half black and half pale. Length of male abdomen: 21 to 23 mm. Hind wing length of male: 14 to 15 mm.
.....*Telebasis sanguinalis* Calvert, 1909 (Bolivia, Amazonas, Mato Grosso).
- The prothorax is entirely bronzed black with lateral orange spots or entirely red. 13

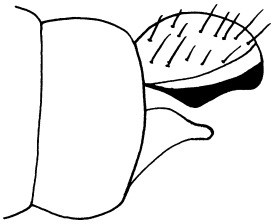


Fig. 3.1.519 Apex of the abdomen of a male *Telebasis corallina* in lateral view. Based on Bick and Bick (1995).

13. The prothorax is entirely red. There is a metallic green stripe on each side of the middle carina of the synthorax; the middle carina, mesepisterna, and mesepimera of the synthorax are otherwise reddish. The metapleura are greenish yellow. In lateral view, the superior anal appendage appears less than twice as long as wide, is longer than the tenth abdominal segment, and reaches well

beyond the inferior appendage (**Fig. 3.1.519**). The labrum is bluish green. The color of the occipital area of the head is mostly pale. Length of male abdomen: 23 to 26 mm. Hind wing length of male: 15 to 17 mm.
.....*Telebasis corallina* (Selys, 1876)
(Cuba, Costa Rica, Venezuela, Bahia, Minas Gerais, São Paulo, Rio de Janeiro, Paraná, Rio Grande do Sul). Syn: *Erythragrion corallina* Selys, 1876.

- The prothorax is bronzed black with an orange spot on each side. There is a bronzed black stripe on each side of the black middle carina of the synthorax, which covers the entire mesepisternum except for an orange line along the humeral suture. In lateral view, the superior anal appendage is about as long as the tenth abdominal segment and is subequal in length to the inferior appendage (**Fig. 3.1.520**). The labrum is orange-red. Length of male abdomen: 20 to 21 mm. Hind wing length of male: 13.5 to 14 mm. Descriptions of this species are sketchy, and it has been neglected by several authors in their revisions.
.....*Telebasis coccinea* (Selys, 1876)
(Bahia, Minas Gerais). Syn: *Erythragrion coccinea* Selys, 1876.

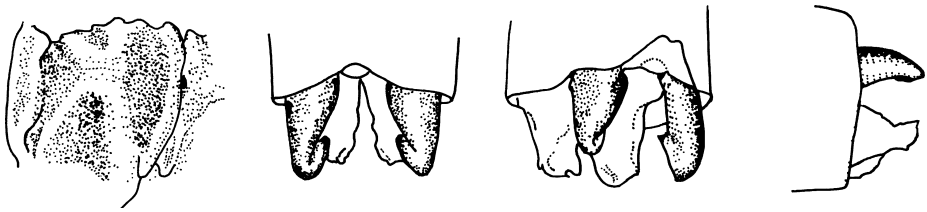


Fig. 3.1.520 *Telebasis coccinea* male (left to right): prothorax in dorsomedial view and apex of the abdomen in dorsal, dorsomedial, and lateral view. Based on Lencioni (2006).

14. There is no large, blunt medial projection at about the mid-length of the superior anal appendage (**Fig. 3.1.517**). The labrum is predominantly black or bluish. The posterior part of the head is half pale and half black. Length of abdomen: 32 mm. Hind wing length: 21 mm. The wings are hyaline with a brown pterostigma.
.....*Telebasis garrisoni* Bick and Bick, 1995
(Colombia, Venezuela).

- There is a large, blunt medial projection on the superior anal appendage (**Fig. 3.1.521**). 15

15. The superior anal appendage bends more than 90° ventrad, and its apex appears like a large tooth; it is about as long as the tenth abdominal segment and is subequal in length to the inferior appendage (**Fig. 3.1.521**). Length of female abdomen: 18 mm. Hind wing length of female: 12 mm.
.....*Telebasis carminita* Calvert, 1909
(Venezuela, French Guiana, Surinam, Bolivia, Argentina, Roraima, Mato Grosso).

- The superior anal appendage does not bend more than 90° ventrad, and its apex does not appear like a large tooth (**Fig. 3.1.522**). 16

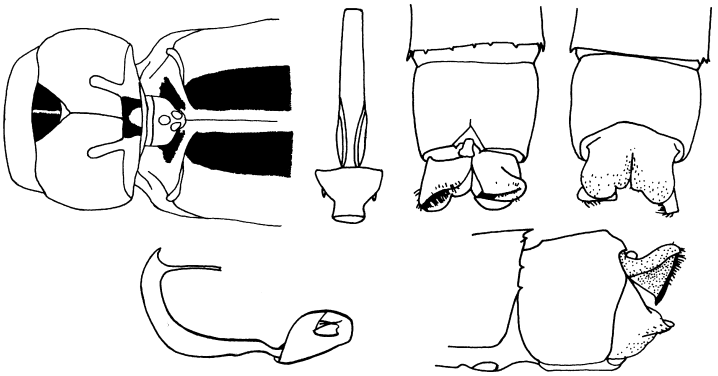


Fig. 3.1.521 *Telebasis carminita* male (upper row, left to right): prothorax and anterior part of the synthorax, penis in ventral view, apex of the abdomen of a male in dorsal and ventral view, and (below, left to right): penis in lateral view and the apex of the abdomen in lateral view. Based on Geijskes (1971).

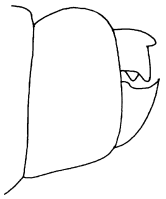


Fig. 3.1.522 Apex of the abdomen of a male *Telebasis selaopyge* in lateral view. Based on Bick and Bick (1995).

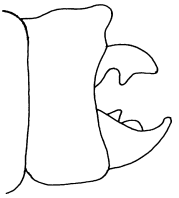


Fig. 3.1.523 Apex of the abdomen of a male *Telebasis abuna* in lateral view. Based on Bick and Bick (1995).

16. The short superior anal appendage bears two teeth on the ventral side, one ventrolateral and one near the middle (**Fig. 3.1.522**). Total length including anal appendages: 30 to 33 mm. Length of abdomen including appendages: 25 to 26 mm. Hind wing length: 15 to 16 mm.
.....*Telebasis selaopyge* De Marmels, 1989 (Venezuela).

- The superior anal appendage does not bear two teeth on the ventral side (**Fig. 3.1.523**). 17
17. The occipital area of the head is mainly black. 18
- The occipital area of the head is mainly pale. 32
18. The apical half of the inferior anal appendage is bent sharply dorsad. There is a conspicuous tooth at the midlength of the superior anal appendage (**Fig. 3.1.523**).
.....*Telebasis abuna* Bick and Bick, 1995 (Rondônia).
- The apical half of the inferior anal appendage is not bent sharply dorsad, or, if it is bent, there is no tooth at the midlength of the superior anal appendage (**Fig. 3.1.524**). 19
19. The color of the labrum is blue or black. 20
- The color of the labrum is reddish or reddish brown (**Fig. 3.1.525**). 26
20. The male abdomen is about 27 mm, and the hind wing of the male is about 17 mm. The color pattern is mainly blue and black and lacks any red. The head is black with blue markings on the frons, clypeus, and labrum. The thorax is mainly black with bluish stripes. The abdomen is mainly blue with black markings on the dorsal surfaces of the second through seventh and tenth segments. The superior anal appendage is truncate and dark at the apex with two minute ventral teeth. The legs are pale yellow with a black streak on each femur.
.....*Telebasis bastiaani* Bick and Bick, 1996 (Venezuela).
- The male abdomen is either shorter than 24 mm or longer than 32 mm. 21

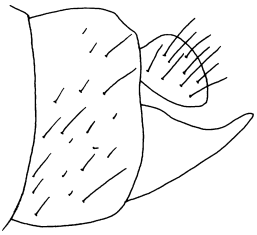


Fig. 3.1.524 Apex of the abdomen of a male *Telebasis garleppi* in lateral view. Based on Bick and Bick (1995).

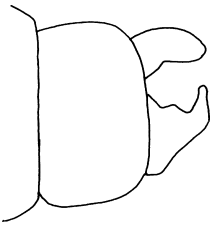


Fig. 3.1.525 Apex of the abdomen of a male *Telebasis coccinata* in lateral view. Based on Bick and Bick (1995).

21. The male abdomen is about 32 to 35 mm long. The hind wing of the male is about 22 mm long. In dorsal view, the superior anal appendages appear convergent at their apices (**Fig. 3.1.524**). The wings are strongly tinged with yellow, and the pterostigma is red and ferrugineous. The head is black on the occiput and pale yellow and green on the anterior surface. The prothorax is black dorsally and ferrugineous laterally, and the dorsum of the synthorax is very dark reddish brown, and its lateral surfaces are ferrugineous. The abdomen of the male is mainly brick red with light greenish yellow on the lateral surfaces of the first segment.
.....*Telebasis garleppi* Ris, 1918 (Central America, Ecuador).
- The male abdomen is 17 to 23 mm long. In lateral view, the superior anal appendage does not appear rounded (**Fig. 3.1.526**). 22

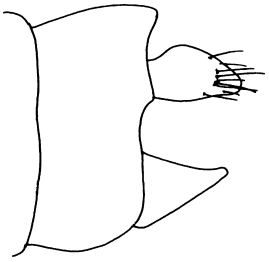


Fig. 3.1.526 Apex of the abdomen of a male *Telebasis flammeola* in lateral view. Based on Bick and Bick (1995).

22. Only the first and tenth abdominal segments of the male are red. There is a cone of setae at the apex of the superior anal appendage (**Fig. 3.1.526**). The female has not been described.
.....*Telebasis flammeola* Kennedy, 1936 (Ecuador).
- Either the eighth through tenth abdominal segments of the male are red, or all segments are red. There is no cone of setae at the apex of the superior anal appendage (**Fig. 3.1.527**). 23

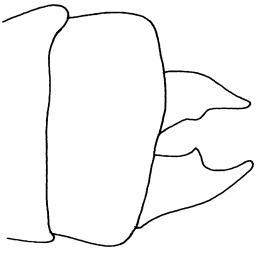


Fig. 3.1.527 Apex of the abdomen of a male *Telebasis livida* in lateral view. Based on Bick and Bick (1995).

23. Only the eighth through tenth abdominal segments of the male are red. The mesepisternum of the male is iridescent green. The superior anal appendage of the male is not longer then the tenth tergite, and it is not abruptly constricted just distal to the middle (**Fig. 3.1.527**). The female has not been described.
.....*Telebasis livida* Kennedy, 1936 (Ecuador, Peru, Bolivia).
- The abdomen of the male is nearly all red. 24
24. There is no broad, hairy process extending medially from the superior anal appendage, but there is a knob-like process that extends dorsad or posteriad (**Fig. 3.1.528**).
.....*Telebasis inalata* (Calvert, 1961) (Ecuador, Peru, Bolivia). Syn: *Aeloagrion inalatum* Calvert, 1961.
- There is a broad, basal hairy process extending medially from the superior anal appendage (**Fig. 3.1.529**). 25

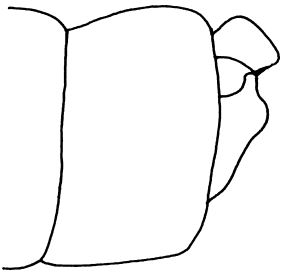


Fig. 3.1.528 Apex of the abdomen of a male *Telebasis inalata* in lateral view. Based on Bick and Bick (1995).

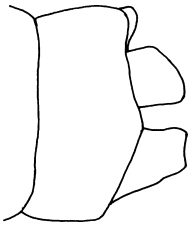


Fig. 3.1.529 Apex of the abdomen of a male *Telebasis filiola* in lateral view. Based on Bick and Bick (1995).

25. In ventral view, no apical projection is apparent on the dorsal side of the male inferior anal appendage (**Fig. 3.1.529**).
.....*Telebasis filiola* (Perty, 1834) (Mexico, Central America, West Indies, Colombia, Venezuela, Pará, Pernambuco, Bahia, Espírito Santo, Rio de Janeiro, Mato Grosso). Syn: *Agrion filiola* Perty, 1834.

- In ventral view, an apical projection is apparent on the dorsal side of the male inferior anal appendage; it may be concealed behind the superior anal appendage when in dorsal view. There is no elevated projection from the posteromedial surface of the female mesostigmal lamina (**Fig. 3.1.530**).
.....*Telebasis willinki* Fraser, 1948 (Argentina, Uruguay, Paraguay, São Paulo, Rio Grande do Sul).

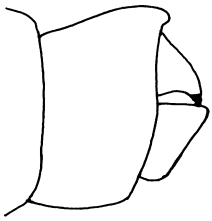


Fig. 3.1.530 Apex of the abdomen of a male *Telebasis willinki* in lateral view. Based on Bick and Bick (1995).

26. There is a dorsal swelling beginning near the base of the male superior anal appendage (**Fig. 3.1.531**).
.....*Telebasis carota* Kennedy, 1936 (Ecuador, Peru).
- There is no dorsal swelling near the base of the male superior anal appendage, and in lateral view, it does not appear rounded at its apex (**Fig. 3.1.532**). 27

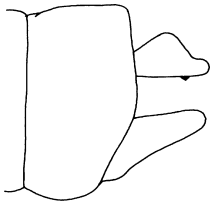


Fig. 3.1.531 Apex of the abdomen of a male *Telebasis carota* in lateral view. Based on Bick and Bick (1995).

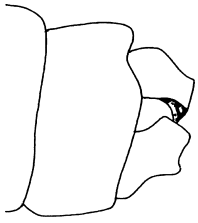


Fig. 3.1.532 Apex of the abdomen of a male *Telebasis dominicana* in lateral view. Based on Bick and Bick (1995).

27. The inferior anal appendage is truncate at the apex (**Fig. 3.1.532**).
.....*Telebasis dominicana* (Selys in Sagra, 1857) (West Indies, Guyana). Syn: *Agrion dominicanum* Selys, 1857; *Erythragrion dominicanum* Selys, 1876.
- The apex of the inferior anal appendage is acute (**Fig. 3.1.533**). 28
28. - The superior anal appendage is strongly bent ventrad, curving for most of its length (**Fig. 3.1.533**). 29
- The superior anal appendage of the male is not bent strongly ventrad, in some cases, curving slightly ventrad only at the apex. The male mesepimeron is not entirely covered by a broad black stripe. There is a small, black, subapical, decumbent tooth just proximal to the apex of the superior anal appendage (**Fig. 3.1.534**). 30

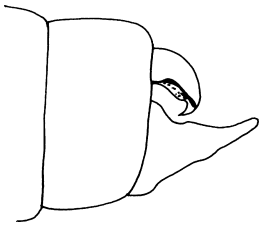


Fig. 3.1.533 Apex of the abdomen of a male *Telebasis digiticollis* in lateral view (left) and the prothorax of a female in dorsal view (right). Based on Bick and Bick (1995).

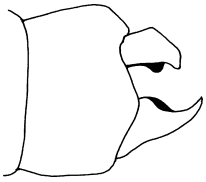


Fig. 3.1.534 Apex of the abdomen of a male *Telebasis watsoni* in lateral view. Based on Bick and Bick (1995).

29. The posterior lobe of the male prothorax is black dorsally. There is usually a black stripe on the mesepimeron of the male, but there is no black spot near the midlength of the first lateral suture (**Fig. 3.1.533**).
.....*Telebasis digiticollis* Calvert, 1902 (Mexico, Central America, Colombia, Venezuela).
- The posterior lobe of the male prothorax is brown or tan dorsally. There is no black stripe on the mesepimeron of the male, but there is sometimes a black spot near the midlength of the first lateral suture (**Fig. 3.1.535**).
.....*Telebasis limoncocha* Bick and Bick, 1995 (Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Argentina, São Paulo).

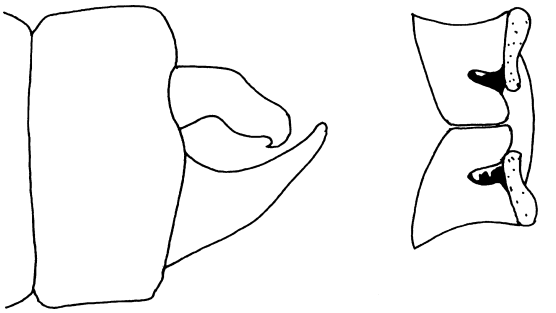


Fig. 3.1.535 Apex of the abdomen of a male *Telebasis limoncocha* in lateral view (left) and the prothorax of a female in dorsal view (right). Based on Bick and Bick (1995).

30. The inferior anal appendage curves dorsad toward its apex, which extends farther posteriad than the dorsal appendage (**Fig. 3.1.534**). Length of male abdomen: 26 to 29 mm. Hind wing length of male: 17 to 21 mm. The prothorax is mainly dull reddish brown, and the synthorax is gray with black covering half of the width of the mesepisternum and the mid-dorsal carina and reddish brown on the mesepimeron. The first four abdominal segments of the male are red, and the fifth through tenth are reddish brown with a darker area on the posterior part of the seventh segment.
.....*Telebasis watsoni* Bick and Bick, 1995 (Peru).
- If the inferior anal appendage curves dorsad toward its apex, it is shorter than the dorsal appendage, and if it is longer, it appears directed straight posterior along its dorsal margin, as seen in lateral view (**Fig. 3.1.536**). 31

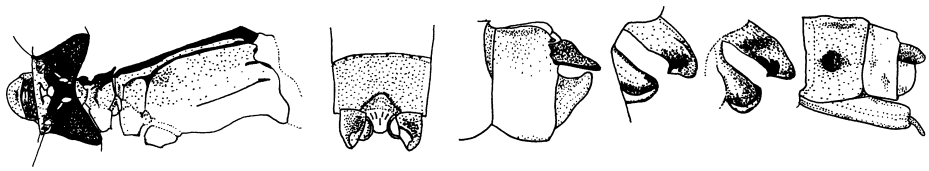


Fig. 3.1.536 *Telebasis bickorum* (left to right): head without compound eyes in dorsal view and thorax in lateral view, apex of the male abdomen in dorsal and lateral view, anal appendages of the male in oblique posterior and oblique anterior view, and apex of the female abdomen in lateral view. Based on Daigle (2002a).

31. The inferior anal appendage curves dorsad and is shorter than the superior appendage (**Fig. 3.1.536**). Total length, including appendages: c. 26 mm. Length of male abdomen: c. 20 mm. Fore-wing length of male: c. 15.5 mm. Hind wing length of male: c. 14.5 mm.
.....*Telebasis bickorum* Daigle, 2002 (Bolivia).
- The dorsal margin of the inferior anal appendage extends straight posteriod farther than the apex of the superior appendage, and its ventral margin appears excavated in lateral view (**Fig. 3.1.537**).
.....*Telebasis erythrina* (Selys, 1876) (Minas Gerais).

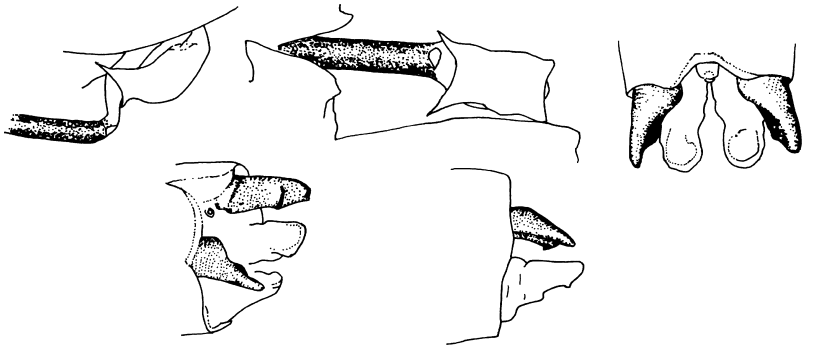


Fig. 3.1.537 *Telebasis erythrina* male (above, left to right): ventral margin of the second abdominal segment showing the apex of the penis in lateral view and in ventral view, apex of the abdomen in dorsal, dorsomedial (lower left), and lateral view (lower right). Based on Lencioni (2006).

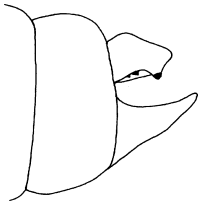


Fig. 3.1.538 Apex of the abdomen of a male *Telebasis salva* in lateral view. Based on Bick and Bick (1995).

32. The posterior portion of the mesepisternum is black, and it bears a lateral process. There are teeth subequal in size at the apex of the superior anal appendage (**Fig. 3.1.538**).
.....*Telebasis salva* (Hagen, 1861) (North and Central America, Colombia, Venezuela). Syn: *Agrion salvum* Hagen, 1861; *Erythragrion salvum* Selys, 1876; *Telebasis boucardi* Selys, 1868.

- There is no black process on the posterior part of the mesepisternum (**Fig. 3.1.539**). 33

33. The superior anal appendage bends nearly perpendicularly dorsad; it is about as long as the tenth abdominal segment and is subequal in length to the inferior appendage (**Fig. 3.1.525**).

.....*Telebasis coccinata* Calvert, 1909 (Paraguay, Brazil). Syn: *Agrion dispar* Hagen, 1861 *nomen nudum*; *Agrion rubens* Hagen 1861 *nomen nudum*.

- The superior anal appendage does not bend nearly perpendicularly dorsad (**Fig. 3.1.539**). 34

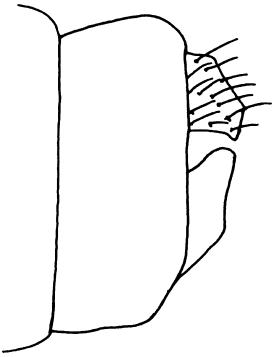


Fig. 3.1.539 Apex of the abdomen of a male *Telebasis brevis* in lateral view. Based on Bick and Bick (1995).

34. The posterior lobe of the prothorax of the male is greatly elevated and concave along the midline. The superior anal appendage is short and beset with long setae (**Fig. 3.1.539**).

.....*Telebasis brevis* Bick and Bick, 1995 (Ecuador).

- The posterior lobe of the prothorax of the male is not greatly elevated and not concave along the midline. The superior anal appendage is not long or not beset with long setae (**Fig. 3.1.540**). 35

35. The inferior anal appendage of the male is broadly truncate at the apex, and the superior appendage does not curve dorsad (**Fig. 3.1.540**). Length of the male abdomen: c. 27 mm. Hind wing length of the male: c. 16 mm.

.....*Telebasis isthmica* Calvert, 1902 (Central America, Colombia, Venezuela).

- The inferior anal appendage of the male is not broadly truncate at the apex, and the superior appendage curves dorsad (**Fig. 3.1.541**). Length of the male abdomen: c. 20 mm. Hind wing length of the male: c. 13 mm.

.....*Telebasis paraensei* Machado, 1956 (Minas Gerais).

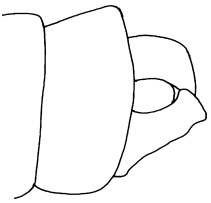


Fig. 3.1.540 Apex of the abdomen of a male *Telebasis isthmica* in lateral view. Based on Bick and Bick (1995).

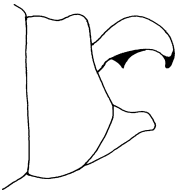


Fig. 3.1.541 Apex of the abdomen of a male *Telebasis paraensei* in lateral view. Based on Bick and Bick (1995).

Key to the species of adult female *Telebasis* in South America

Information for the key provided by Bick and Bick (1996), Daigle (2000, 2002a, b), and Lencioni (2006). Descriptions of *Telebasis versicolor, T. flammeola,* and *T. livida* are not available.

1. Horn-like processes obviously extend anteriad from the posterior lobe of the prothorax. 2
- Horn-like processes are either absent from the prothorax or minute and difficult to observe. 15
2. There are three transverse orange bands on the epicranium. The posterior part of the head is half black and half pale in color.
.....*Telebasis sanguinalis* Calvert, 1909
(Bolivia, Amazonas, Mato Grosso). Some specimens with less developed horns key out to Couplet 16.
- Either three transverse bands are not present on the epicranium, or the posterior part of the head is predominantly black or pale. 3
3. The posterior surface of the head is mainly pale. 4
- The posterior surface of the head is black, and the carina is always dark in color. 9
4. The mid-dorsal carina of the synthorax is dark.
.....*Telebasis coccinata* Calvert, 1909
(Paraguay, Brazil). Syn: *Agrion dispar* Hagen, 1861 *nomen nudum*; *Agrion rubens* Hagen 1861 *nomen nudum*.
- The mid-dorsal carina of the synthorax is pale. 5

5. The black marking on the posterior surface of the mesepisternum widens laterally. The prothoracic horns extend to the middle prothoracic lobe. .....*Telebasis salva* (Hagen, 1861) (North and Central America, Colombia, Venezuela). Syn: *Agrion salvum* Hagen, 1861; *Erythragrion salvum* Selys, 1876; *Telebasis boucardi* Selys, 1868. The Mexican species, *Telebasis incolumis* Williamson and Williamson, 1930, also keys out here, but its prothoracic horns do not extend above the middle prothoracic lobe, and the species is known only from Baja California.

- The black marking on the posterior surface of the mesepisternum does not widen laterally. 6

6. Length of female abdomen: c. 18 mm. Hind wing length of female: c. 12 mm. .....*Telebasis carminita* Calvert, 1909 (Venezuela, French Guiana, Surinam, Bolivia, Argentina, Roraima, Mato Grosso).

- The abdomen of the female is about 23 to 27 mm long. 7

7. The wings have a yellow tinge. Length of hind wing of female: 19.5 mm. Length of abdomen of female: 26 mm. The first antennal segment of the female is lighter than the fuscous apical segments. The labrum of the female is yellow, and the head bears yellow hairs. .....*Telebasis theodori* (Navás, 1934) (Argentina, Rio Grande do Sul). Syn: *Argia theodori* Navás, 1934; *Telebasis auripennis* Jurzitza, 1980. A Central American species, *Telebasis aurea* May, 1992, also has yellow-tinged wings, but it can be distinguished by the black occipital area of the head, which is pale in *T. theodori.*

- The wings are completely hyaline. 8

8. The posterior surface of the epicranium has a narrow pale occipital band connected to a small orange spots at each end. The prothoracic horns extend above less than a third of the length of the mid-prothoracic lobe. .....*Telebasis carmesina* Calvert, 1909 (Argentina, Paraguay, Mato Grosso, Minas Gerais, São Paulo).

- The posterior surface of the epicranium has a pair of large round orange spots connected to an occipital band. The prothoracic horns extend above more than half the length of the mid-prothoracic lobe. .....*Telebasis corallina* (Selys, 1876) (Cuba, Costa Rica, Venezuela, Bahia, Minas Gerais, São Paulo, Rio de Janeiro, Paraná, Rio Grande do Sul). Syn: *Erythragrion corallina* Selys, 1876.

9. The abdomen is about 35 mm long, and the hind wing length is about 24 mm. .....*Telebasis garleppi* Ris, 1918 (Central America, Ecuador).

- The abdomen is 24 to 31 mm long. 10

10. Most of the surface of the mesepimeron is black. Each prothoracic horn extends anteriad above a third or less of the middle prothoracic lobe. .....*Telebasis dominicana* (Selys in Sagra, 1857) (West Indies, Guyana). Syn: *Agrion dominicanum* Selys, 1857; *Erythragrion dominicanum* Selys, 1876. A species known only from the West Indies,

Telebasis vulnerata (Hagen in Selys, 1861), can be distinguished because each prothoracic horn extends anteriad above more than half of the middle prothoracic lobe.

- Most of the surface of the mesepimeron is pale. 11

11. The robust prothoracic horns extend almost as far as the anterior margin of the middle prothoracic lobe, and they are rounded at the apex.
.....*Telebasis abuna* Bick and Bick, 1995 (Rondônia).

- The prothoracic horns extend, at most, only as far as the mid-length of the middle prothoracic lobe. 12

12. The middle prothoracic lobe is almost entirely black dorsally. The posterior prothoracic lobe of the female is evenly rounded.
.....*Telebasis digiticollis* Calvert, 1902 (Mexico, Central America, Colombia, Venezuela).

- The middle prothoracic lobe is mainly brown dorsally. 13

13. The labrum, anteclypeus, and postclypeus are reddish brown.
.....*Telebasis carota* Kennedy, 1936 (Ecuador, Peru).

- The labrum, anteclypeus, and postclypeus are all yellowish brown. 14

14. The posteromedial part of the mesostigmal lamina is greatly elevated.
.....*Telebasis watsoni* Bick and Bick, 1995 (Peru).

- The posteromedial part of the mesostigmal lamina is not at all elevated. The posterior prothoracic lobe of the female is subdivided into three smaller lobes with the lateral wings curving dorsad.
.....*Telebasis limoncocha* Bick and Bick, 1995 (Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Argentina, São Paulo).

15. The posterior part of the head is about half black and half pale in color. 16

- Most of the posterior part of the head is either black of pale. 17

16. The epicranium does not have three transverse orange bands. The middle lobe of the prothorax is black with pale margins. The female abdomen is about 31 mm long.
.....*Telebasis garrisoni* Bick and Bick, 1995 (Colombia, Venezuela).

- There are three transverse orange bands on the epicranium. The middle lobe of the prothorax is pale with the middle part of its margin black.
.....*Telebasis sanguinalis* Calvert, 1909 (Bolivia, Amazonas, Mato Grosso). Specimens with larger horns key out to Couplet 2.

17. The posterior part of the head is mainly black. 18

- The posterior part of the head is mainly pale. 25

18. The middle part of the hind margin of the posterior prothoracic lobe is produced and indented, and the lateral part of the lobe is greatly elevated so that

it is highest in the middle and slopes ventrad toward its lateral margin. The abdomen of the female is a uniform dark brown or black.
.....*Telebasis racenisi* Bick and Bick, 1995 (Venezuela, Peru, Mato Grosso).
- The middle part of the hind margin of the posterior prothoracic lobe is not produced and indented, or the lateral part of the lobe is not greatly elevated so that it is highest in the middle and slopes ventrad toward its lateral margin. 19
19. The abdomen of the female is about 21 to 22 mm long. The fore-wing of the female is about 17 mm long, and the hind wing length is about 16 mm. The total length of the female is about 26 to 27 mm. 20
- The abdomen of the female is less than 19 or more than 23 mm long. 21
20. There is a long, black mesopleural stripe. The face is mainly light brown, while the dorsal margin of the postclypeus, most of the postfrons, and most of the dorsal and occipital regions of the head are black. There are small, blunt basal horns on the posterior lobe of the prothorax, which are about as high as the elevated posterior margin. The abdomen is mainly brown with few or no red markings. The ovipositor extends farther posteriad than the tenth abdominal segment.
.....*Telebasis bickorum* Daigle, 2002 (Bolivia).
- There is no long, black mesopleural stripe.
.....*Telebasis erythrina* (Selys, 1876) (Minas Gerais).
21. The carina is dark; the abdomen is 24 to 25 mm long. 22
- The carina is pale; the abdomen is 16 to 18 mm long. 23
22. The prothorax and abdomen have striking blue and black markings. There is a curving pale stripe on the epicranium running from one antenna base to the other through the median ocellus.
.....*Telebasis dunklei* Bick and Bick, 1995 (Ecuador, Peru).
- The prothorax and abdomen do not have a striking blue and black pattern, or there is no curving pale stripe from one antenna to the other through the median ocellus. The middle lobe of the prothorax is brown, and black lateral spots are absent.
.....*Telebasis selaopyge* De Marmels, 1989 (Venezuela).
23. There is a large, elongate, black, elevated projection from the posteromedial surface of the female mesostigmal lamina.
.....*Telebasis filiola* (Perty, 1834) (Mexico, Central America, West Indies, Colombia, Venezuela, Pará, Pernambuco, Bahia, Espírito Santo, Rio de Janeiro, Mato Grosso). Syn: *Agrion filiola* Perty, 1834.
- There is no large, elongate, black, elevated projection from the posteromedial surface of the female mesostigmal lamina. 24

24. A narrow pale band transversely divides the black marking on the tenth abdominal segment.
.....*Telebasis inalata* (Calvert, 1961) (Ecuador, Peru, Bolivia). Syn: *Aeloagrion inalatum* Calvert, 1961.
- The pattern on the tenth abdominal segment is other than black divided transversely by a narrow pale band.
.....*Telebasis willinki* Fraser, 1948 (Argentina, Uruguay, Paraguay, São Paulo, Rio Grande do Sul).
25. The carina is pale. The black marking on the mesepisternum does not widen laterally. 26
- The carina is dark bronze or black. 28
26. About ¾ of the width of the mesepisternum is covered by black markings. Length of female abdomen: c. 22 mm.
.....*Telebasis paraensei* Machado, 1956 (Minas Gerais).
- About 13% or less of the width of the mesepisternum is covered by black markings. Length of female abdomen: 25 to 26 mm. 27
27. On each side of the middle lobe of the prothorax is a lateral depression.
.....*Telebasis isthmica* Calvert, 1902 (Central America, Colombia, Venezuela).
- The middle prothoracic lobe lacks lateral depressions.
.....*Telebasis brevis* Bick and Bick, 1995 (Ecuador).
28. The eighth through tenth abdominal segments of mature specimens are mainly reddish, and the metepisternum, metepimeron, and first two abdominal segments are blue laterally.
.....*Telebasis rubricauda* Bick and Bick, 1995 (Venezuela, Ecuador, Peru, Bolivia, Rondônia, Territory of Acre).
- Either the eighth through tenth abdominal segments of mature specimens are not mainly reddish, or the metepisternum, metepimeron, or first two abdominal segments are not blue laterally. 29
29. The posteromedial margin of the compound eye is not bordered by a black band. The occiput has round orange spots connected by an orange band. The posterior margin of the mesostigmal lamina borders on a conspicuous elevation.
.....*Telebasis demararum* (Williamson, 1917) (Trinidad, Venezuela, Guyana, Surinam, French Guiana, Roraima). Syn: *Aeloagrion demararum* Williamson, 1917; *Telebasis fluviatilis* St. Quentin, 1960.
- The posteromedial margin of the compound eye is bordered by a black band, which extends a short distance toward the midline. The posterior margin of the mesostigmal lamina does not border on a conspicuous elevation.
.....*Telebasis bastiaani* Bick and Bick, 1996 (Venezuela).

Notes on the known larvae of *Telebasis* in South America

Information was provided by Geijskes (1941, 1943) and Bulla (1970).

1. The abdomen is short with relatively wide segments, so that the wing buds cover most of the five proximal segments (**Fig. 3.1.370**).
.....*Telebasis simulata* Tennessen, 2002 (Dominica, Trinidad, Venezuela, Surinam, French Guiana, Amazonas, Bahia).
- The abdomen is long and slender, with the wing buds covering only the proximal three segments (**Fig. 3.1.542**). 3

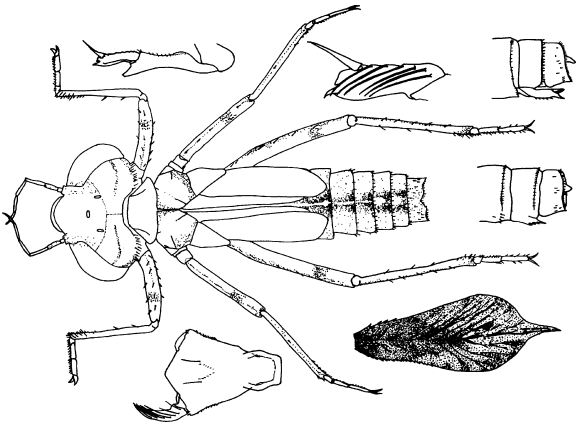


Fig. 3.1.542 *Telebasis willinki* larva: habitus (left), lateral view of the prementum and labial palp (upper left center), labial palp (upper right center), prementum with one labial palp in dorsal view (lower left center), apex of the abdomen of a male (middle right) and a female (upper right), and gill lamella (lower right). Based on Bulla (1970).

2. On each side of the narrow pale line along the dorsal midline of the fifth through ninth abdominal segments, there is a narrow dark area bordered by a dorsolateral pale area (**Fig. 3.1.542**).
.....*Telebasis willinki* Fraser, 1948 (Argentina, Uruguay, Paraguay, São Paulo, Rio Grande do Sul).
- On the fifth through ninth abdominal segments, there is a narrow pale line along the dorsal midline bordered by dark lines and paler dorsal areas; there are broad dark dorsolateral stripes on the fifth through eighth segments (**Fig. 3.1.543**).
.....*Telebasis demararum* (Williamson, 1917) (Trinidad, Venezuela, Guyana, Surinam, French Guiana, Roraima). Syn: *Aeloagrion demararum* Williamson, 1917; *Telebasis fluviatilis* St. Quentin, 1960.

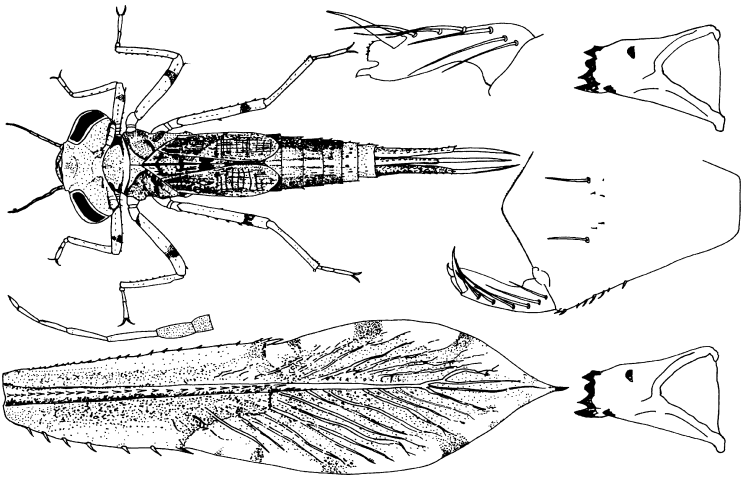


Fig. 3.1.543 *Telebasis demararum* larva: habitus (upper left), antenna (middle left), labial palp (upper right center), labium without one side of the prementum and one labial palp (middle right), mandibles (upper and lower right), and a lateral gill lamella (lower left to center). Based on Lencioni (2006).

Key to the species of adult male *Oxyagrion* in South America

Information for the key provided by Schmidt (1913), Fraser (1946a), Santos (1961c), Martins (1967), Bulla (1973b), Costa (1978, 1984, 1988), Jurzitza (1980b), Mauffray (1999), and Costa *et al.* (2000). The key is tentative because it depends chiefly on the characteristics of the male.

1. There are two horns directed posteriad on the dorsal surface of the tenth abdominal segment (**Fig. 3.1.544**). 2
 - There are no horn-like processes on the dorsal surface of the tenth abdominal segment (**Fig. 3.1.545**). 6
2. The abdomen is black dorsally. The distal segment of the penis is clearly wider than the second abdominal segment, and it is divided at the apex (**Fig. 3.1.358**).
.....*Oxyagrion sulinum* Costa, 1978
(São Paulo, Espírito Santo, Rio Grande do Sul).
 - The abdomen is not completely black dorsally. If the distal segment of the penis is as wide as the second abdominal segment, it is not divided at the apex (**Fig. 3.1.544**). 3
3. The abdomen is entirely red dorsally (**Fig. 3.1.546**). 4
 - Dorsally, the first two abdominal segments are black, and the third through tenth are red (**Fig. 3.1.544**). 5

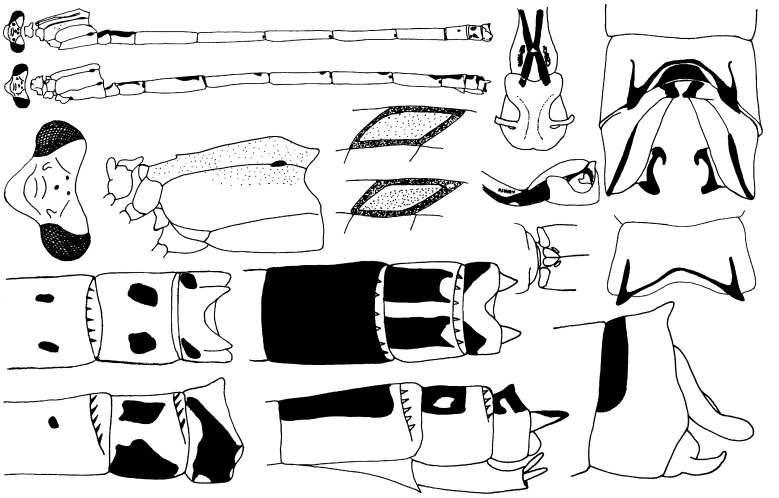


Fig. 3.1.544 *Oxyagrion basale:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); head in dorsal view and thorax in lateral view (upper middle left) of a female; penis in ventral and lateral view (upper right center, above and below, respectively); pterostigma of a male fore and hind wing (center); color pattern on the eighth through tenth abdominal segments of the male (lower left) and female (lower center) in dorsal and lateral view (above and below, respectively), without the appendages on the male; the apex of the male abdomen with the appendages in dorsal (upper right) and lateral view (lower right), with the tenth abdominal segment alone showing the horn-like processes in dorsal view (middle right); and dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (left of the male tenth abdominal segment). Based on Costa (1978).

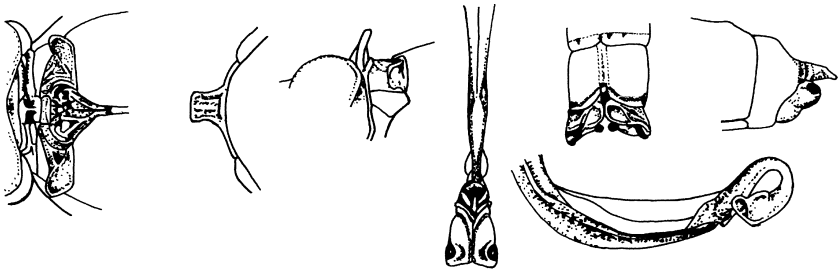


Fig. 3.1.545 *Oxyagrion pseudocardinale* male (left to right): prothorax in dorsal, posterior, and lateral view; penis in ventral and lateral view (lower right), and the apex of the abdomen in dorsal and lateral view (upper right, left and right, respectively). Based on Costa *et al.* (2000).

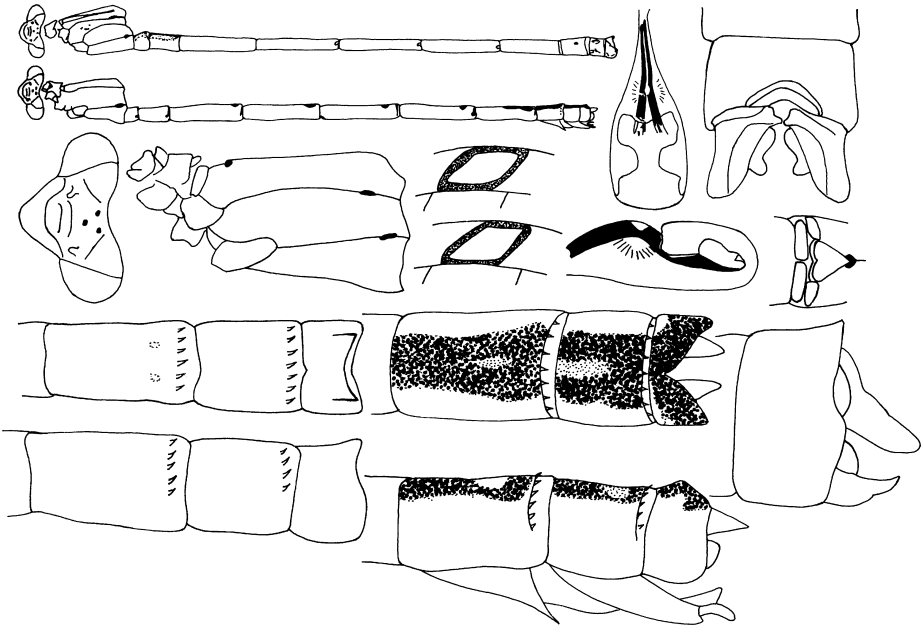


Fig. 3.1.546 *Oxyagrion impunctatum:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); head in dorsal view and thorax in lateral view (upper middle left) of a female, penis in ventral and lateral view (upper right center, above and below, respectively); pterostigma of a male fore and hind wing (center, above and below, respectively); color pattern on the eighth through tenth abdominal segments of the male (lower left) and female (lower center) in dorsal and lateral view (above and below, respectively), without the appendages on the male; the apex of the male abdomen with the appendages in dorsal (upper right) and lateral view (lower right); a dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (middle right). Based on Costa (1978).

4. The dorsal part of the face is deep red, and the synthorax lacks black dots (**Fig. 3.1.546**). Length of abdomen: c. 29 mm. Hind wing length: c. 20 mm.
.....*Oxyagrion impunctatum* Calvert, 1909
(Paraguay, Rio de Janeiro, Minas Gerais, São Paulo, Paraná, Distrito Federal, Goiás, Mato Grosso, Mato Grosso do Sul).

- The dorsal part of the face is not deep red, and the synthorax has black dots (**Fig. 3.1.547**).
.....*Oxyagrion sulmatogrossense* Costa, Irineu, and T. Santos, 2000
(Mato Grosso do Sul).

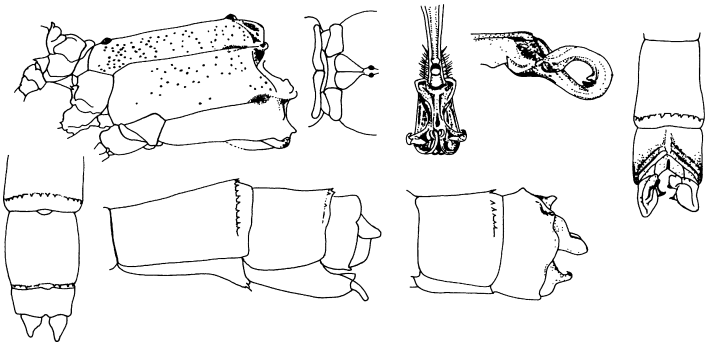


Fig. 3.1.547 *Oxyagrion sulmatogrossense* (upper row, left to right): thorax in lateral view; penis in ventral and lateral view, and the apical segments of the male abdomen in dorsal view, and (lower row, left to right): the apical segments of the female abdomen in dorsal and lateral view and the apical segments of the male abdomen in lateral view. Based on Costa *et al.* (2000).

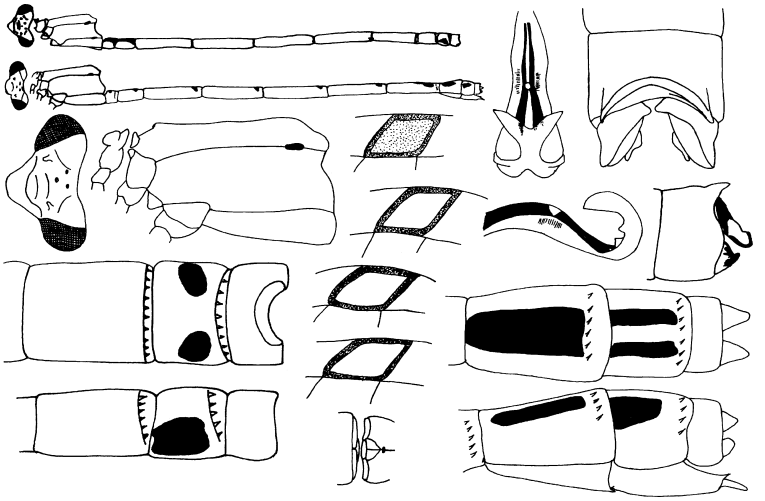


Fig. 3.1.548 *Oxyagrion chapadense:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); head in dorsal view and thorax in lateral view (upper middle left) of a female, penis in ventral and lateral view (upper right center, above and below, respectively); pterostigmas of a male and a female fore and hind wing (center, top to bottom); color pattern on the eighth through tenth abdominal segments of the male (lower left) and female (lower right) in dorsal and lateral view (above and below, respectively), without the appendages on the male; the apex of the male abdomen with the appendages in dorsal (upper right) and lateral view (upper middle right); a dorsal view of the genital fossae of the female at the junction of the prothorax and synthorax (lower center). Based on Costa (1978).

5. The shape of the pterostigma is quadrangular. The cerci are as long as the tenth abdominal segment. The penis lobes are elongate (**Fig. 3.1.548**). Length of abdomen: c. 26 mm. Hind wing length: c. 18 mm.
.....*Oxyagrion chapadense* Costa, 1978 (Argentina, Paraguay, Bahia, Goiás, Minas Gerais, São Paulo, Paraná, Mato Grosso).
- The pterostigma has the shape of a lozenge. The cerci are longer than the tenth abdominal segment. The penis lobes are not elongate (**Fig. 3.1.544**). Total length: 33 to 37 mm. Length of abdomen: 25 to 29 mm. Fore-wing length: 20 to 21.5 mm. The synthorax is olive green with black dots.
.....*Oxyagrion basale* Selys, 1876 (Argentina, Paraguay, Mato Grosso, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Rio Grande do Sul).

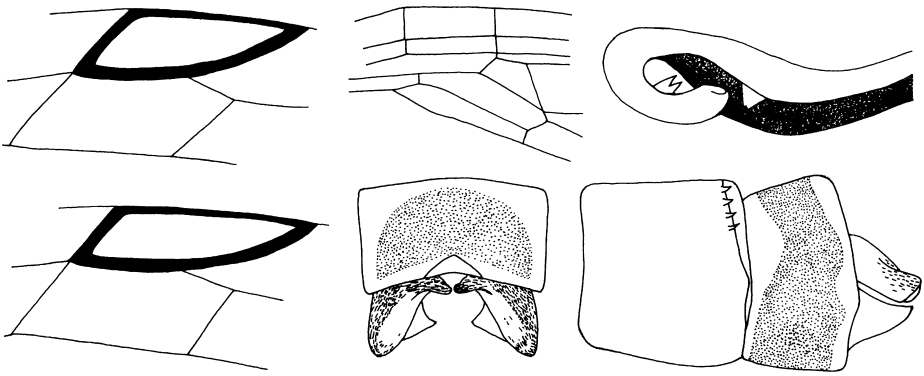


Fig. 3.1.549 *Oxyagrion fernandoi* male (upper row, left to right): pterostigma of the fore-wing, arrangement of the cubito-anal and first anal veins in the wing, and the penis in lateral view, and (lower row, left to right): the pterostigma of the hind wing and the apex of the abdomen in dorsal and lateral view. Based on Costa (1988).

6. The cubito-anal vein of the male is located proximal to the origin of the first anal vein, A_1 (**Fig. 3.1.549**). The first and second abdominal segments of the male each have a black marking. 7
- The cubito-anal vein of the male is located at or very near the origin of the first anal vein, A_1; species for which the locations of the wing veins have not been reported lack black markings on the first and second segments of the male abdomen, but obscure brown markings may be present (**Fig. 3.1.545**). 8

7. The pterostigma of the male is reddish and roughly diamond-shaped but extended along the costa toward the apex of the wing. The posterior margin of the tenth abdominal segment is raised dorsad at the dorsal midline only slightly above the level of the ninth segment (**Fig. 3.1.549**). The apical segment of the penis is wider than the width of the second abdominal segment. Fore-wing length: c. 19 mm; hind wing length: c. 18 mm. Length of abdomen: c. 25 mm. The abdomen of the male is mainly red and black. The female has not been described.
.....*Oxyagrion fernandoi* Costa, 1988 (Mato Grosso).
- The pterostigma of the male is black and not extended along the costa. The posterior margin of the tenth abdominal segment is raised dorsad at the dorsal midline well above the level of the ninth segment (**Fig. 3.1.550**). Hind wing length: 16 to 18 mm. Length of abdomen: 23 to 25 mm. The abdomen of the male is mainly brown and metallic black. The female has not been described.
.....*Oxyagrion egleri* (Santos, 1961) (Venezuela, Surinam, French Guiana, Pará). Syn: *Acanthagrion egleri* Santos, 1961.

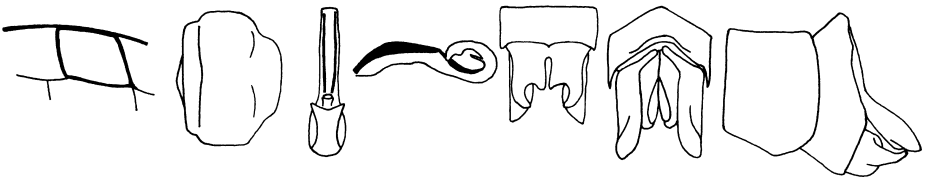


Fig. 3.1.550 *Oxyagrion egleri* male (left to right): pterostigma of the fore-wing, synthorax in dorsal view, penis in ventral and lateral view, and the apex of the abdomen in dorsal, ventral, and lateral view. Based on Santos (1961c).

8. The posterior lobe of the prothorax is quadrangular or subquadrangular. The shape of the posterior lobe of the prothorax is quadrangular in posterior view (**Fig. 3.1.545**). The thorax is light brown and reddish without any blue stripes. The fore-wing has 18 postnodal cross veins, and the hind wing has 17. Total length: c. 32 mm. Length of abdomen: c. 27 mm. Hind wing length: c. 17 mm. The female has not been described.
.....*Oxyagrion pseudocardinale* Costa, Irineu, and T. Santos, 2000 (Minas Gerais, São Paulo).
- The posterior lobe of the prothorax is linear in shape (**Fig. 3.1.551**). 9
9. The abdomen lacks blue markings (**Fig. 3.1.551**). 10
- The abdomen has blue markings. (**Fig. 3.1.552**). 12

10. The eighth, ninth, and tenth segments are black. In lateral view, the inferior anal appendage extends posteriad beyond the rounded apex of the superior appendage (**Fig. 3.1.551**). In ventral view, the apical segment of the penis is wider than the second abdominal segment. Length of abdomen: c. 30 mm. Hind wing length: c. 20 mm.
.....*Oxyagrion miniopsis* Selys, 1876 (Colombia, Peru, Bolivia).
- The eighth, ninth, and tenth segments are all or partly red (**Fig. 3.1.553**). 11

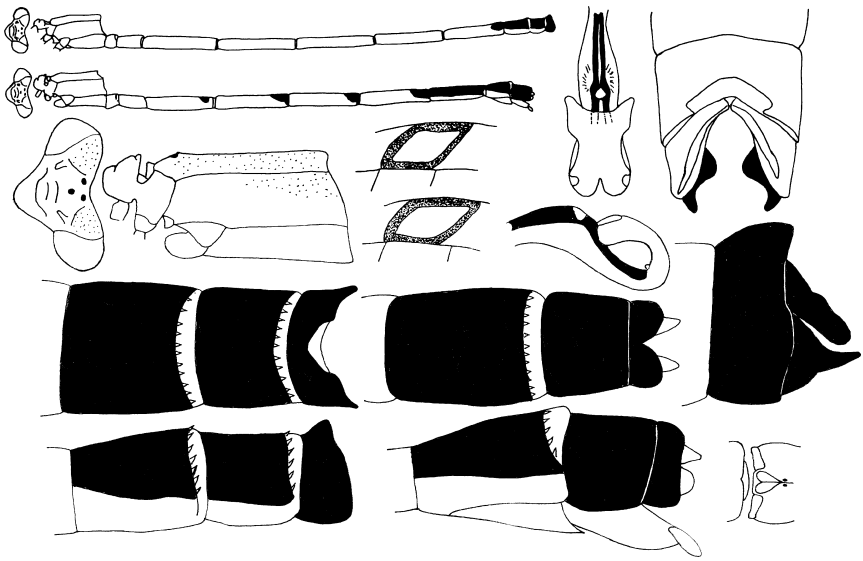


Fig. 3.1.551 *Oxyagrion miniopsis:* head in dorsal view and body in lateral view (upper left) showing the red and black color pattern of the male (above) and female (below); head in dorsal view and thorax in lateral view (upper middle left) of a female, penis in ventral and lateral view (upper right center, above and below, respectively); pterostigma of a male fore and hind wing (center, above and below, respectively); color pattern on the eighth through tenth abdominal segments of the male (lower left) and female (lower center) in dorsal and lateral view (above and below, respectively), without the appendages on the male; the apex of the male abdomen with the appendages in dorsal (upper right) and lateral view (middle right); a dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (lower right). Based on Costa (1978).

11. The cubitoanal cross vein is located at the level of the first antenodal cross vein. The head and synthorax have no dark spots. The pterostigma is lozenge-shaped. The superior anal appendage is more than twice as long as the inferior and appears narrow, almost acutely pointed, and curved dorsad in lateral view; in dorsal view, a tooth-like process directed toward the midline is apparent. The

abdomen is entirely red, except sometimes for part of the ninth and tenth segments, which have a bluish tinge (**Fig. 3.1.553**). In ventral view, the apical segment of the penis is wider than the second abdominal segment. Total length: 33 to 38 mm. Length of abdomen: 25 to 28 mm. Fore-wing length: 19 to 22 mm.
.....*Oxyagrion rubidum* (Rambur, 1842)
(Argentina, Chile, Paraguay, Uruguay). Syn: *Agrion rubidum* Rambur, 1842; *Agrion rufulum* Hagen, 1861.

- Vein cac is located between the first and second antenodal cross veins. The head and synthorax have dark spots. The pterostigma has the shape of a parallelogram. The superior anal appendage is less than twice as long as the inferior and is truncate at the apex (**Fig. 3.1.554**). In ventral view, the apical segment of the penis is short and narrower than the second abdominal segment. Length of abdomen: c. 25 mm. Fore-wing length: c. 18 mm; hind wing: c. 17 mm.
.....*Oxyagrion pavidum* Hagen in Selys, 1876
(Pernambuco, Alagoas, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso).

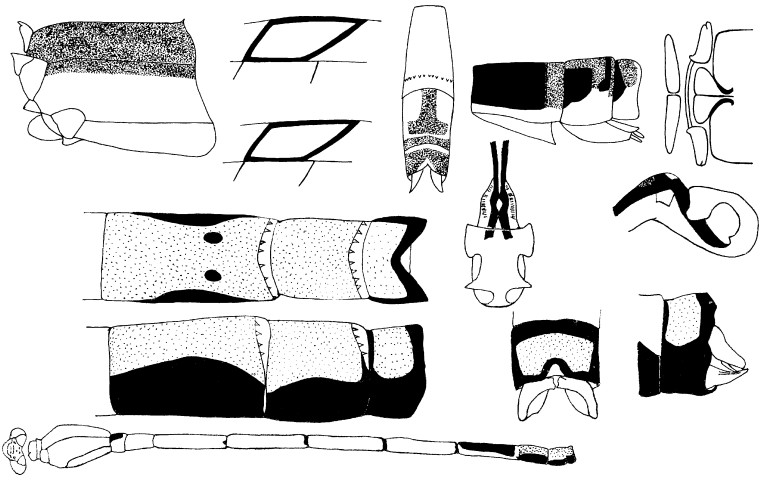


Fig. 3.1.552 *Oxyagrion haematinum*: synthorax of a female in lateral view (upper left), pterostigma of the female on the fore (upper left center, below) and hind wing (upper left center, above), pattern on the apex of the abdomen in dorsal (upper center) and lateral view (upper right center), dorsal view of the female genital fossa between the prothorax and synthorax (upper right), penis in ventral and lateral view (middle right, left and right, respectively), pattern on the apical abdominal segments of a male in dorsal and lateral view without the appendages (middle left, above and below, respectively), apex of the male abdomen in dorsal (lower right center) and lateral view (lower right), head in dorsal and thorax and abdomen of a male in lateral view (lower left). Based on Costa (1978, 1984).

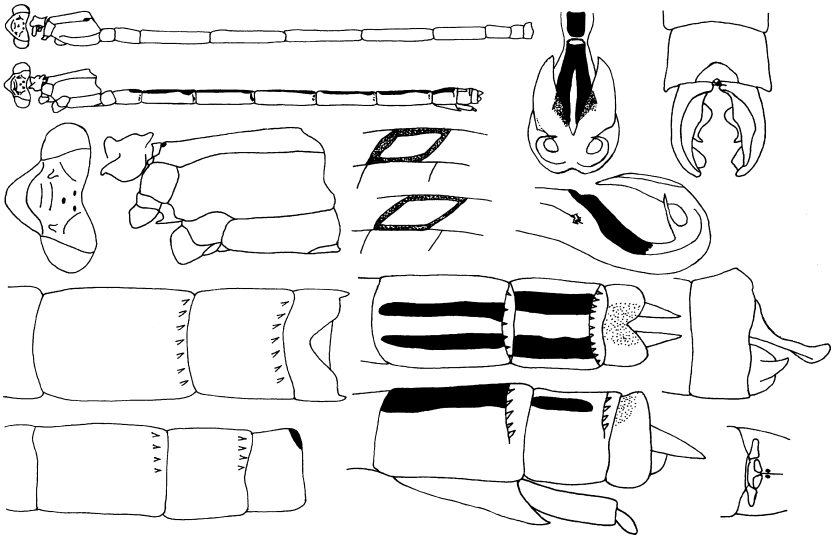


Fig. 3.1.553 *Oxyagrion rubidum:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); head in dorsal view and thorax in lateral view (upper middle left) of a female, penis in ventral and lateral view (upper right center, above and below, respectively); pterostigma of a male fore and hind wing (center, above and below, respectively); color pattern on the eighth through tenth abdominal segments of the male (lower left) and female (lower center) in dorsal and lateral view (above and below, respectively), without the appendages on the male; the apex of the male abdomen with the appendages in dorsal (upper right) and lateral view (middle right); a dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (lower right). Based on Costa (1978).

12. There are usually blue markings on the eighth, ninth, and tenth abdominal segments, but such markings may be absent on one or two of the segments in some specimens (**Fig. 3.1.552**). 13
- Blue markings are always absent from the eighth abdominal segment (**Fig. 3.1.555**). 16

13. Black dorsolateral spots are absent from both the eighth and ninth abdominal segments. The eighth, ninth, and tenth abdominal segments are all partially blue and partially black. In lateral view, the inferior anal appendage extends beyond the middle of the superior, but its apex does not appear to touch it (**Fig. 3.1.556**). Total length: c. 32 mm. Length of abdomen: c. 26 mm. Fore-wing length: 19 to 20 mm; hind wing: 18 to 19 mm.
.....*Oxyagrion bruchi* Navás, 1924 (Argentina, Bolivia).

- A black dorsolateral spot is present on each side of the eighth abdominal segment (**Fig. 3.1.552**). 14

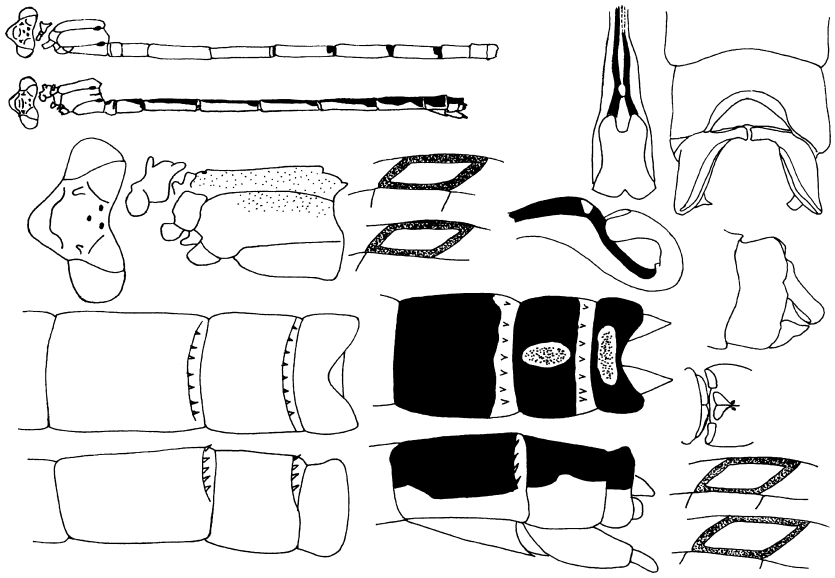


Fig. 3.1.554 *Oxyagrion pavidum:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); head in dorsal view and thorax in lateral view (upper middle left) of a female, penis in ventral and lateral view (upper right center, above and below); pterostigma of a male fore and hind wing (center, above and below, respectively) and of a female fore and hind wing (lower right, above and below); color pattern on the eighth through tenth abdominal segments of the male (lower left) and female (lower center) in dorsal and lateral view (above and below, respectively), without the appendages on the male; the apex of the male abdomen with the appendages in dorsal (upper right) and lateral view (upper middle right); a dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (lower middle right). Based on Costa (1978).

14. The blue marking on the tenth abdominal segment occupies almost all of the segment. There is a black dorsolateral spot on each side of the eighth abdominal segment. In lateral view, the apices of the superior and inferior anal appendages appear to touch (**Fig. 3.1.552**). Length of abdomen: 30 to 32 mm. Fore-wing length: 22 to 23 mm; hind wing: 21 to 22 mm.
.....*Oxyagrion haematinum* Selys, 1876 (Minas Gerais).

- The tenth abdominal segment of the male is black except for small blue markings (**Fig. 3.1.557**). 15

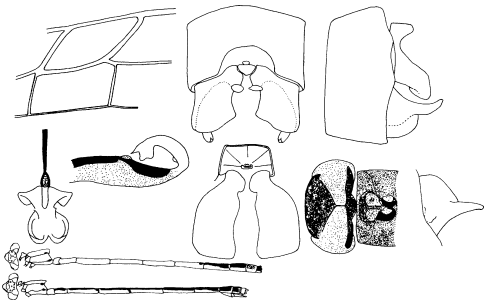


Fig. 3.1.555 *Oxyagrion santosi* (upper row, left to right): pterostigma of the fore-wing, apex of the male abdomen in dorsal and lateral view; (middle row, left to right): penis in ventral and lateral view, superior anal appendages in posterior view, female prothorax and genital grooves, inferior anal appendage, and (below left) head in dorsal view and body in lateral view showing the color pattern of the male (above) and female (below). Based on Martins (1967) and Costa (1978).

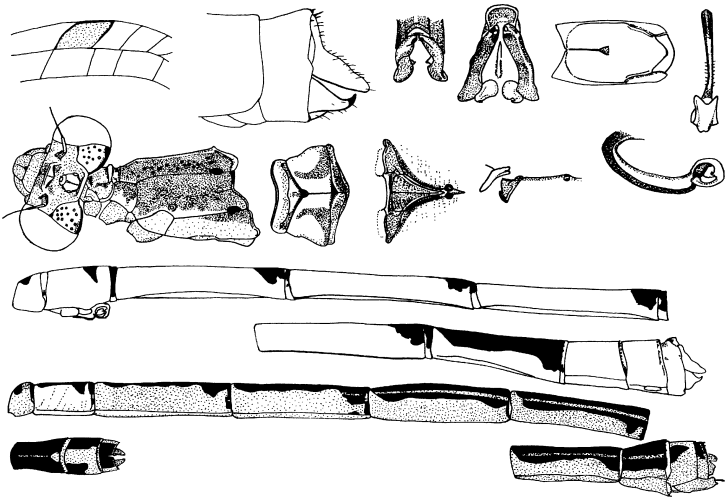


Fig. 3.1.556 *Oxyagrion bruchi* (upper row, left to right): pterostigma of the hind wing, apex of male abdomen in lateral view, male anal appendages in dorsal and posterior view, synthorax and penis both in ventral view, and (second row, left to right): female head and thorax, female prothorax in dorsal view, posterior margin of prothorax mesostigmal plates in dorsal and lateral view, penis in lateral view, and (below, top to bottom), lateral views of the first five abdominal segment and sixth through tenth segments of the male, first six abdominal segments and seventh through tenth segments of a female (right), three apical abdominal segments of a female in dorsal view (lower left). Based on Navás (1924) and von Ellenrieder and Garrison (2006).

14. The tenth abdominal segment of the male is black dorsally with three narrow, pale subapical markings, which are variable and not present on all males. The inferior anal appendage reaches almost as far postriad as the superior appendage. The superior appendage is black and broadly rounded at the apex, and the inferior appendage is yellow with an acute, blackish, upturned apex. The dorsal swelling on the tenth abdominal segment is prominent and rises above the level of the ninth segment (**Fig. 3.1.557**). The first six abdominal segments are scarlet or crimson red with some brown markings. The seventh is mainly blackish with a pale basal ring and a bluish apical ring. Total length: 30 to 37.5 mm. Abdomen length: 25 to 29 mm. Hind wing length: 17.5 to 21.5 mm.
.....*Oxyagrion tennesseni* Mauffray, 1999 (Ecuador).
- The tenth abdominal segment of the male is entirely black except for one small blue lateral spot on each side. In dorsal view, the apex of the inferior anal appendage appears to touch a point at the midlength of the superior appendage (**Fig. 3.1.558**). The dorsal swelling on the tenth abdominal segment is higher than wide and with a triangular indentation. The superior appendage appears narrow, almost acutely pointed, and curved dorsad in lateral view. The sixth abdominal segment is black on the apical fourth; the seventh is entirely black, and the eighth and ninth are blue with a black dorsolateral spot on each side of each segment. The distal side of the pterostigma is the longest. Total length: 33 to 38 mm. Abdomen length: 26 to 28.5 mm. Fore-wing length: 18.5 to 22 mm.
.....*Oxyagrion hempeli* Calvert, 1909 (Argentina, Uruguay, Paraguay, Brasília, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santo Catarina, Rio Grande do Sul).

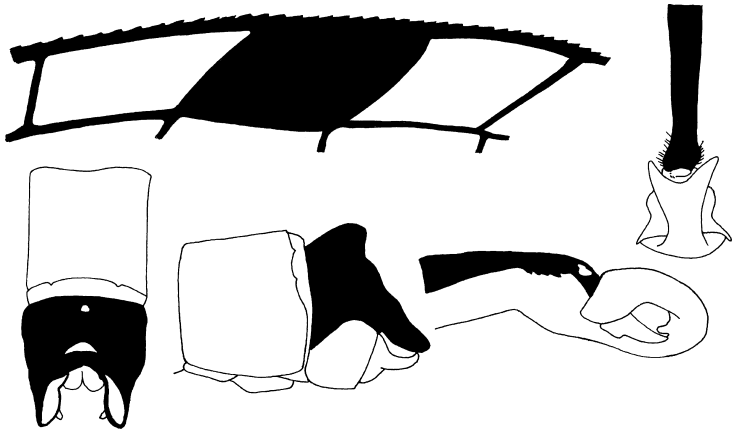


Fig. 3.1.557 *Oxyagrion tennesseni* male: pterostigma (upper left), apex of penis in ventral (upper right) and lateral view (lower right), and the apex of the male abdomen in dorsal (lower left) and lateral view (lower center). Based on Mauffray (1999).

16. The ninth segment is blue, and the tenth segment is black. In lateral view, the inferior anal appendage extends beyond the apex of the superior (**Fig. 3.1.554**). Abdomen length: 23 to 25 mm. Fore-wing length: 15 to 17 mm; hind wing: 16 to 17 mm.
.....*Oxyagrion santosi* Martins, 1967
(Goiás, Minas Gerais, São Paulo, Paraná, Rio Grande do Sul).
- Both the ninth and tenth segments have blue markings (**Fig. 3.1.559**). 17

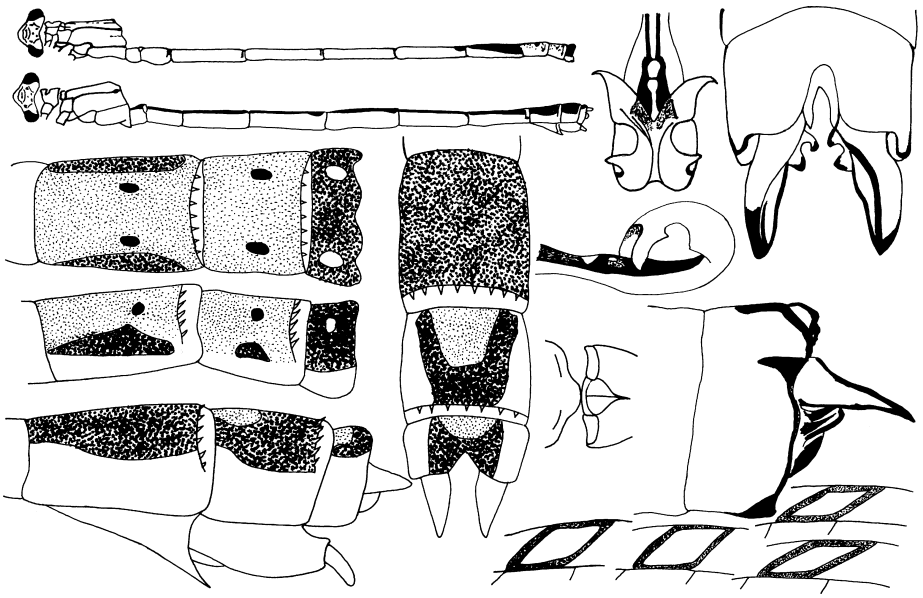


Fig. 3.1.558 *Oxyagrion hempeli*: head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); penis in ventral and lateral view (upper right center, above and below); pterostigma of a male fore and hind wing (lower right center, left and right, respectively) and of a female fore and hind wing (lower right, above and below, respectively); color pattern on the eighth through tenth abdominal segments of the male without the appendages (middle left, above and below, respectively) and female in dorsal (lower center) and lateral view (lower left); the apex of the male abdomen with the appendages in dorsal (upper right) and lateral view (middle right); a dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (left of the apex of the male abdomen in lateral view). Based on Costa (1978).

17. In dorsal view, the ninth abdominal segment of the male is entirely blue without any notable dark markings. In lateral view, the apex of the inferior anal appendage does not touch the superior appendage (**Fig. 3.1.559**). 18

- In dorsal view, the ninth abdominal segment of the male is blue with a pair of black spots or more extensive dark markings (**Fig. 3.1.560**). 19

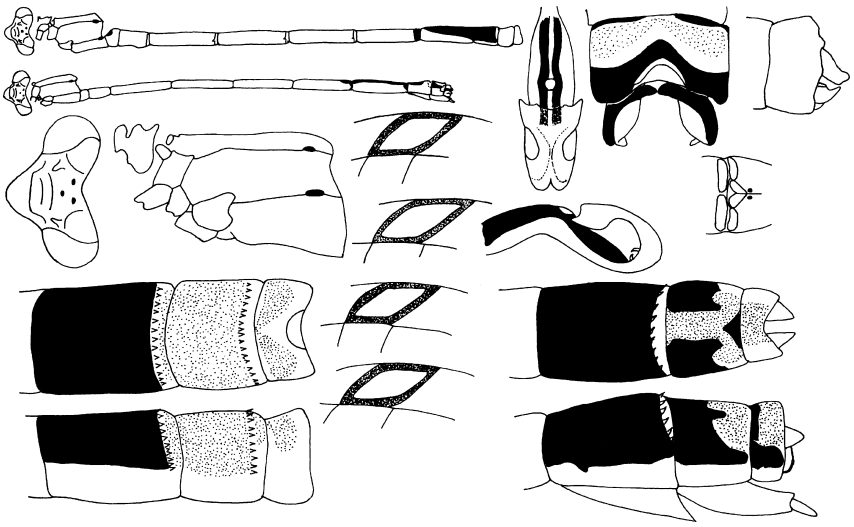


Fig. 3.1.559 *Oxyagrion simile:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); head in dorsal view and thorax in lateral view (upper middle left) of a female, penis in ventral and lateral view (upper right center, above and below); pterostigma of a male fore and hind wing and of a female fore and hind wing (lower center, top to bottom); color pattern on the eighth through tenth abdominal segments of the male (lower left) and female (lower right) in dorsal and lateral view (above and below, respectively), without the appendages on the male and with stippled surfaces blue; the apex of the male abdomen with the appendages in dorsal (upper right center) and lateral view (upper right); a dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (lower middle right). Based on Costa (1978).

18. The blue dorsolateral markings on the tenth abdominal segment barely touch at one point along the dorsal midline. The apical part of the sixth segment of the male abdomen does not have any black marking other than a ring along the posterior articulation. The length of the superior anal appendage of the male is less than twice its maximum width (**Fig. 3.1.559**). Total length: 34 to 35 mm. Abdomen length: c. 27.5 mm. Fore-wing length: c. 20 mm. Hind wing length: 19 to 20 mm.

.....*Oxyagrion simile* Costa, 1978

(Minas Gerais, Goiás, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Rio Grande do Sul).

- The blue dorsolateral markings on the tenth abdominal segment are broadly confluent along the dorsal midline. The sixth abdominal segment is bronzed greenish black on the apical fourth; and the seventh and eighth are entirely that color. The length of the superior anal appendage of the male is about three times its maximum width; it is thick and nearly cylindrical in lateral view (**Fig. 3.1.561**). Total length: 34 to 35 mm. Abdomen length: 25 to 27.5 mm. Forewing length: 19 to 20 mm.
.....*Oxyagrion terminale* Selys, 1876
(Argentina, Uruguay, Paraguay, Bolivia, Amazonas, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul).

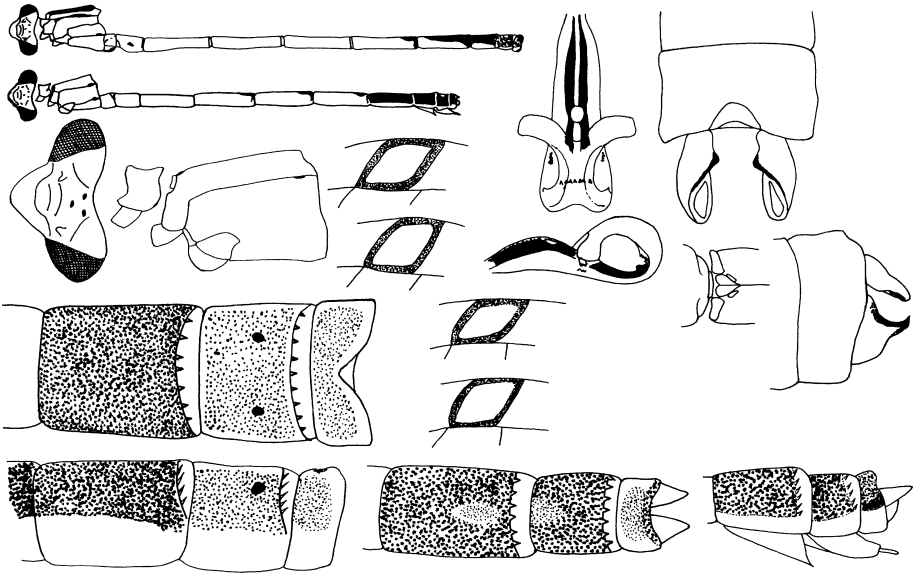


Fig. 3.1.560 *Oxyagrion brevistigma:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); head in dorsal view and thorax in lateral view (upper middle left) of a female, penis in ventral and lateral view (upper right center, above and below); pterostigma of a male fore and hind wing (left center, above and below, respectively) and of a female fore and hind wing (lower center, above and below); color pattern on the eighth through tenth abdominal segments of the male without appendages in dorsal and lateral view (lower left, above and below) and female in dorsal (lower center) and lateral view (lower right), all with stippled surfaces blue; the apex of the male abdomen with the appendages in dorsal (upper right) and lateral view (middle right); a dorsal view of the genital fossae of the female at the junction of the prothorax and synthorax (below and left of the apex of the male abdomen). Based on Costa (1978).

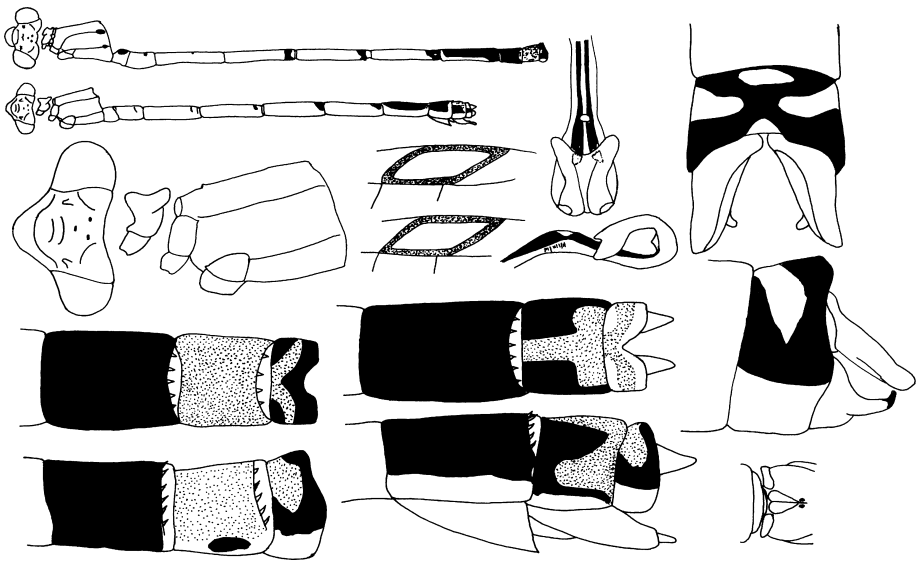


Fig. 3.1.561 *Oxyagrion terminale:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); head in dorsal view and thorax in lateral view (upper middle left) of a female, penis in ventral and lateral view (upper right center, above and below); pterostigma of a male fore and hind wing (center, above and below, respectively); color pattern on the eighth through tenth abdominal segments of the male (lower left) and female (lower center) in dorsal and lateral view (above and below, respectively), without the appendages on the male and with stippled surfaces blue; the apex of the male abdomen with the appendages in dorsal (upper right) and lateral view (middle right); a dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (lower right). Based on Costa (1978).

19. The dark markings on the ninth abdominal segment of the male are limited to a pair of black spots (**Fig. 3.1.562**). 20
- The dark markings on the ninth abdominal segment of the male are more extensive than a pair of black spots (**Fig. 3.1.563**). 21

20. The blue markings on the tenth abdominal segment of the male are confluent along the midline. The superior anal appendage is about twice as long as its maximum width, and it extends about as far posterior as the inferior anal appendage (**Fig. 3.1.560**). Abdomen length: 23 to 30 mm. Fore-wing length: 21 to 22 mm. Hind wing length: 20 to 21 mm.
.....*Oxyagrion brevistigma* Selys, 1876 (Argentina, Rio de Janeiro, São Paulo, Minas Gerais, Espírito Santo, Paraná, Santa Catarina, Rio Grande do Sul).

- The blue markings on the tenth abdominal segment of the male are not in contact along the midline. The superior anal appendage is about twice as long as the inferior appendage (**Fig. 3.1.562**). Abdomen length: 24 to 26 mm. Fore-wing length: 18 to 19 mm. Hind wing length: 17 to 18 mm.
.....*Oxyagrion microstigma* Selys, 1876 (Argentina, Paraguay, Minas Gerais, São Paulo, Paraná, Mato Grosso). Syn: *Oxyagrion divaricatum* Calvert, 1909.

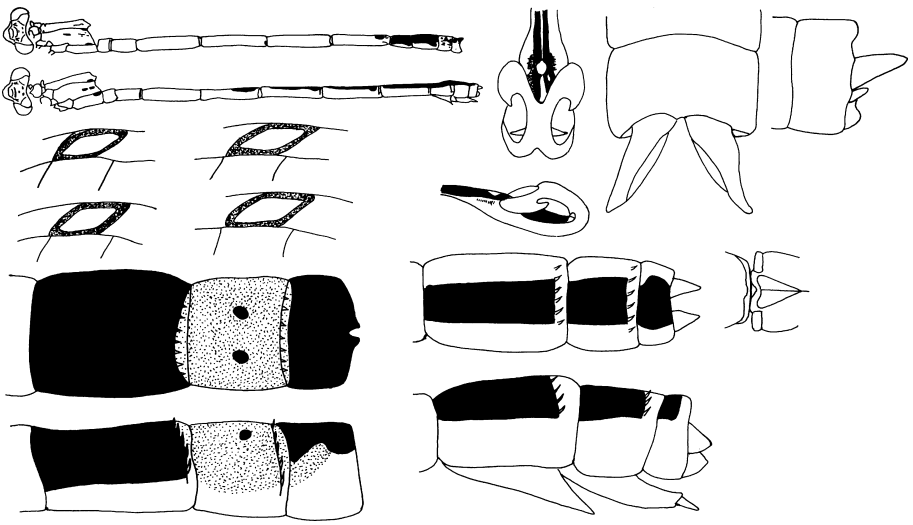


Fig. 3.1.562 *Oxyagrion microstigma:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); pterostigma of a male fore and hind wing and of a female fore and hind wing (middle left, left and right, respectively); color pattern on the eighth through tenth abdominal segments of the male (lower left) and female (lower right center) in dorsal and lateral view (above and below, respectively), without the appendages on the male; the apex of the male abdomen with the appendages in dorsal (upper right center) and lateral view (upper right); a dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (middle right). Based on Costa (1978).

21. In dorsal view, the blue marking on the ninth abdominal segment is in the shape of a "T," and that on the tenth segment is a spot. The length and maximum width of the superior anal appendage of the male are about equal. In lateral view, the superior and inferior anal appendages are about equal in length

(**Fig. 3.1.563**). The penis is wider than the second abdominal segment. Abdomen length: 21 to 23 mm. Fore-wing length: 15 to 17 mm. Hind wing length: 14 to 16 mm.

.....*Oxyagrion evanescens* Calvert, 1909 (Argentina, Mato Grosso).

- The blue markings on the ninth abdominal segment are shaped like goblets. The superior anal appendage is about twice as long as its maximum width, and it does not appear to touch the inferior appendage in lateral view (**Fig. 3.1.564**). Abdomen length: c. 28 mm. Fore-wing length: c. 19 mm. Hind wing length: c. 18 mm.

.....*Oxyagrion machadoi* Costa, 1978 (Paraguay, Minas Gerais, São Paulo).

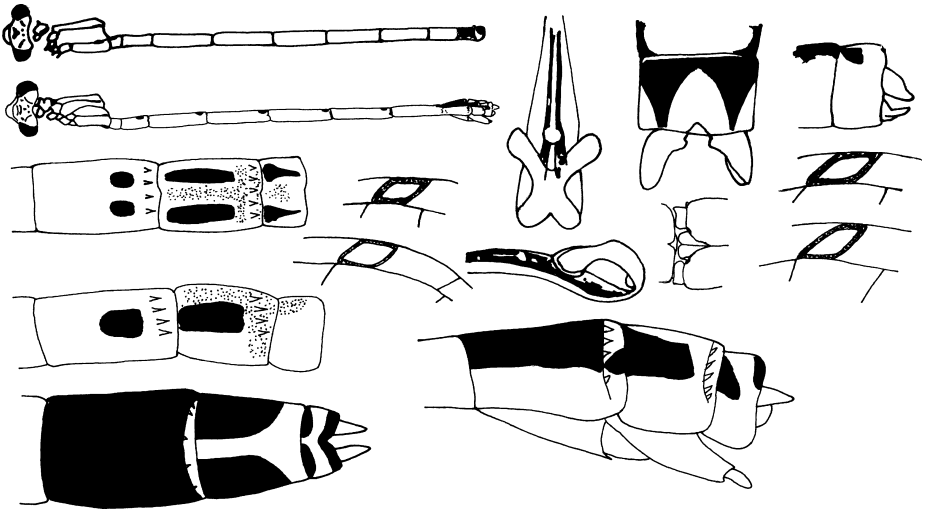


Fig. 3.1.563 *Oxyagrion evanescens:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); penis in ventral and lateral view (center, above and below); pterostigma of a male fore and hind wing (center, above and below, respectively) and of a female fore and hind wing (middle right, above and below); color pattern on the eighth through tenth abdominal segments of the male without the appendages and with the stippled surfaces blue (middle left, above and below, respectively) and the same segments of a female in dorsal (lower left) and lateral view (lower right); the apex of the male abdomen with the appendages in dorsal (upper right center) and lateral view (upper right); a dorsal view of the genital fossa of the female at the junction of the prothorax and synthorax (left of the female pterostigmas). Based on Costa (1978).

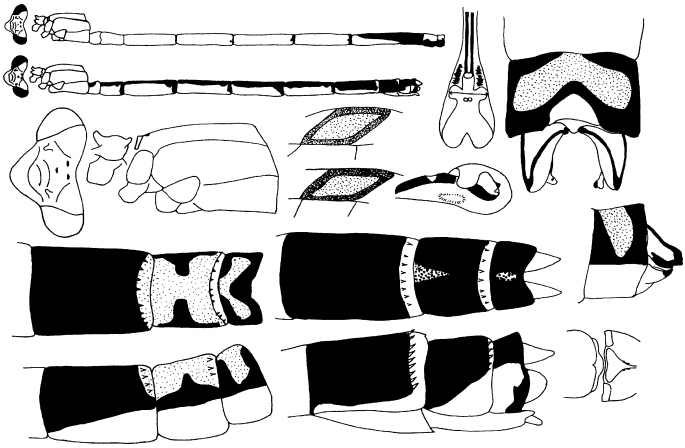


Fig. 3.1.564 *Oxyagrion machadoi:* head in dorsal view and body in lateral view (upper left) showing the color pattern of the male (above) and female (below); head in dorsal view and thorax in lateral view of a female (upper middle left), penis in ventral and lateral view (upper right center, above and below); pterostigmata of the male fore and hind wing (center, above and below, respectively); color pattern on the eighth through tenth abdominal segments of a male (lower left) and female (lower center) in dorsal and lateral view (above and below, respectively) without appendages on the male and with the stippled surfaces blue; the apex of the male abdomen with appendages in dorsal (upper right) and lateral view (middle right); dorsal view of the female genital fossa at the junction of the pro and synthorax (lower right). Based on Costa (1978).

Key to the species of adult female *Oxyagrion* in South America

Information for the key provided by Schmidt (1913), Fraser (1946a), Martins (1967), Bulla (1973b), Costa (1978, 1984, 1988), Mauffray (1999), and Costa *et al.* (2000). The females of *Oxyagrion fernandoi, O. pseudocardinale,* and *O. egleri* have not been described.

1. The eighth abdominal segment lacks a ventral spine. The genital fossae between the prothorax and synthorax do not extend beyond the dorsal carina; the acrotergal area is small and shaped like an equilateral triangle. There is a blue, T-shaped dorsal marking on the ninth abdominal segment and a curved blue dorsal band across the tenth (**Fig. 3.1.563**). Abdomen length: 23 to 26 mm. Fore-wing length: 16 to 18 mm. Hind wing length: 15 to 17 mm.
.....*Oxyagrion evanescens* Calvert, 1909
(Argentina, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Brasília, Goiás, Mato Grosso).

- There is a ventral spine on the eighth abdominal segment (**Fig. 3.1.562**). The synthorax is yellowish or olive brown. 2

2. The entire thorax is olive brown, except for a pair of small black spots surrounding the pits at the branches of the mid-dorsal carina, which surround a heart-shaped plate, which is longer than wide. The first abdominal segment is yellow; the second through fifth are scarlet or crimson with yellowish brown dorsolateral markings; the sixth is scarlet with a dark apical band; the seventh is mainly black with a pale posterior band. The eighth and ninth are blackish brown with small lighter spots, while the tenth is black. The anal appendages are yellowish brown. Total length: 30 to 37.5 mm. Abdomen length: 25 to 29 mm. Hind wing length: 17.5 to 21.5 mm.
.....*Oxyagrion tennesseni* Mauffray, 1999 (Ecuador).

- The synthorax is mainly yellowish (**Fig. 3.1.562**). 3

3. There are no genital fossae on the synthorax (**Fig. 3.1.562**). 4

- Genital fossae are present on the synthorax (**Fig. 3.1.564**). 5

4. The ninth and tenth abdominal segments are black dorsally without blue markings. The posterior lobe of the prothorax has a median process that extends dorsad. The acrotergal area forms an isosceles triangle that is longer than the mesostigmal lamina (**Fig. 3.1.562**). Abdomen length: 24 to 26 mm. Fore-wing length: 18 to 19 mm. Hind wing length: 17 to 18 mm.
.....*Oxyagrion microstigma* Selys, 1876 (Argentina, Paraguay, Minas Gerais, São Paulo, Paraná, Mato Grosso). Syn: *Oxyagrion divaricatum* Calvert, 1909.

- The ninth and tenth abdominal segments have round blue markings. The posterior lobe of the prothorax has a semi-circular median process that does not extend dorsad. The acrotergal area forms a nearly equilateral triangle about the same length as the mesostigmal lamina (**Fig. 3.1.558**). Total length: 34 to 37 mm. Abdomen length: 25 to 27 mm. Fore-wing length: 20.5 to 22 mm.
.....*Oxyagrion hempeli* Calvert, 1909 (Argentina, Uruguay, Paraguay, Brasília, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santo Catarina, Rio Grande do Sul).

5. In lateral view, the genital fossae are not elevated and remain below the level of the dorsal carina (**Fig. 3.1.564**). 6

- In lateral view, the genital fossae are raised above the level of the dorsal carina (**Fig. 3.1.548**). 12

6. Each genital fossa is a shallow sulcus. The acrotergal area is triangular and wider than long. The three apical segments of the abdomen are black without blue markings (**Fig. 3.1.564**). Abdomen length: c. 26 mm. Fore-wing length: c. 21 mm. Hind wing length: c. 19 mm.
.....*Oxyagrion machadoi* Costa, 1978 (Minas Gerais).

- Each genital fossa is round or elongated (**Fig. 3.1.553**). 7

7. Each genital fossa is round. The rectangular acrotergal area is wider than long. The tenth abdominal segment has a blue marking (**Fig. 3.1.553**). Total

length: 34 to 37 mm. Abdomen length: 24 to 27 mm. Fore-wing length: 20 to 21 mm.
.....*Oxyagrion rubidum* (Rambur, 1842) (Argentina, Chile, Paraguay, Uruguay). Syn: *Agrion rubidum* Rambur, 1842; *Agrion rufulum* Hagen, 1861.
- The acrotergal area is triangular (**Fig. 3.1.551**). 8
8. The isotergites forms an isosceles triangle longer than wide and as long as the mesotigmal lamina. Each genital fossa is round. There are fine punctures in the synthorax. The black apical abdominal segments are not marked with blue (**Fig. 3.1.551**). Length of abdomen: c. 28 to 29 mm. Hind wing length: c. 20 mm.
.....*Oxyagrion miniopsis* Selys, 1876 (Colombia, Peru, Bolivia).
- The acrotergites form an equilateral triangle shorter than the mesostigmal lamina (**Fig. 3.1.554**). 9
9. Dark dots cover the dorsal surfaces of the head and synthorax. The ninth and tenth abdominal segments may have blue markings, including a T-shaped mark on the ninth segment. The genital fossae are round (**Fig. 3.1.554**). 10
- Dark dots are absent from the head and synthorax (**Fig. 3.1.560**). 11
10. Dark dots on the head and synthorax are strong and numerous. The three apical abdominal segments are entirely black, or each has a small blue dorsal marking (**Fig. 3.1.554**). Length of abdomen: c. 23 to 27 mm. Fore-wing length: 18 to 20 mm; hind wing: 17 to 19 mm.
.....*Oxyagrion pavidum* Hagen in Selys, 1876 (Pernambuco, Alagoas, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso).
- Dark dots on the head and synthorax are isolated, fine, or nearly absent. The two apical abdominal segments have blue dorsal markings, including a T-shaped mark on the ninth (**Fig. 3.1.559**). Total length: 33 to 35 mm. Abdomen length: c. 26 to 28 mm. Fore-wing length: 20 to 21 mm. Hind wing length: 19 to 20 mm.
.....*Oxyagrion simile* Costa, 1978 (Minas Gerais, Goiás, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Rio Grande do Sul).
11. The ninth and tenth abdominal segments have blue dorsal markings; that on the ninth is T-shaped. The genital fossae are round and large with their bases bordering on the posterior acrotergal vertex or carina (**Fig. 3.1.555**). Abdomen length: 23 to 25 mm. Fore-wing length: 15 to 17 mm; hind wing: 16 to 17 mm.
.....*Oxyagrion santosi* Martins, 1967 (Goiás, Minas Gerais, São Paulo, Paraná, Rio Grande do Sul).
- The ninth and tenth abdominal segments are black with a blue dorsal marking only on the tenth. The genital fossae are elongate, narrow, and located along the sides of the triangular acrotergites (**Fig. 3.1.560**). Abdomen length: 23 to 30 mm. Fore-wing length: 21 to 22 mm. Hind wing length: 20 to 21 mm.
.....*Oxyagrion brevistigma* Selys, 1876 (Argentina, Rio de Janeiro, São Paulo, Minas Gerais, Espírito Santo, Paraná, Santa Catarina, Rio Grande do Sul).

12. The acrotergal area forms an equilateral triangle (**Fig. 3.1.548**). 13
- The acrotergal area forms an isosceles triangle (**Fig. 3.1.544**). 14
13. The acrotergal triangle is shorter than the mesostigmal lamina. The three apical segments of the abdomen are black and red without any blue markings (**Fig. 3.1.548**). Length of abdomen: c. 26 mm. Hind wing length: c. 18 mm.
.....*Oxyagrion chapadense* Costa, 1978
(Argentina, Paraguay, Bahia, Goiás, Minas Gerais, São Paulo, Paraná, Mato Grosso).
- The acrotergal triangle is longer than the mesostigmal lamina. A dorsal midline marking along the ninth and tenth abdominal segments is blue (**Fig. 3.1.546**).
.....*Oxyagrion impunctatum* Calvert, 1909
(Paraguay, Rio de Janeiro, Minas Gerais, São Paulo, Paraná, Goiás, Mato Grosso, Mato Grosso do Sul).
14. The head and thorax do not have dark points (**Fig. 3.1.358**). Length of abdomen: c. 30 mm. Hind wing length: c. 23 mm.
.....*Oxyagrion sulinum* Costa, 1978
(São Paulo, Espírito Santo, Rio Grande do Sul).
- The head and thorax are marked with dark points (**Fig. 3.1.544**). 15
15. The ninth and tenth abdominal segments are black and red without blue markings (**Fig. 3.1.544**). Total length: 32 to 33 mm. Abdomen length: c. 26 mm. Fore-wing length: 20 to 21 mm.
.....*Oxyagrion basale* Selys, 1876
(Argentina, Paraguay, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Rio Grande do Sul).
- The ninth and tenth abdominal segments have blue markings; that on the ninth is shaped like a T (**Fig. 3.1.561**). Total length: 33 to 35 mm. Abdomen length: 26 to 28 mm. Fore-wing length: 20 to 21 mm.
.....*Oxyagrion terminale* Selys, 1876
(Argentina, Uruguay, Paraguay, Bolivia, Amazonas, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul).

Key to the species of final instar larvae of *Oxyagrion* in South America

Information for the key was provided by Bulla (1973b), Costa (1979a, b), Costa *et al.* (2000), and von Ellenrieder and Garrison (2006).

1. Transverse sutures are evident near the middle or in the apical half of the gill lamella (**Fig. 3.1.565**). 2
- Transverse sutures are not evident on the gill lamellae (**Fig. 3.1.566**). 5
2. The gill lamellae are obviously narrowed at the suture in the apical half, but the branching of the veins remains relatively simple. There are two long setae on each side of the mentum, two small spines at the base of each palp, and four

long setae on each labial palp. The length of the gills is 5.5 to 7 times the length. The row of spines along the posterior border of the tenth abdominal segment is interrupted at the location of the anal appendages. There is a small spine along the external border of the labial palp at the level of the apical lateral seta. The length of the anal appendage is more than half the length of the tenth abdominal segment (**Fig. 3.1.567**).

.....*Oxyagrion hempeli* Calvert, 1909

(Argentina, Uruguay, Paraguay, Brasília, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santo Catarina, Rio Grande do Sul).

- The gill lamellae are not obviously narrowed at the suture, which is located at about the mid-length of the gill lamella (**Fig. 3.1.565**). 3

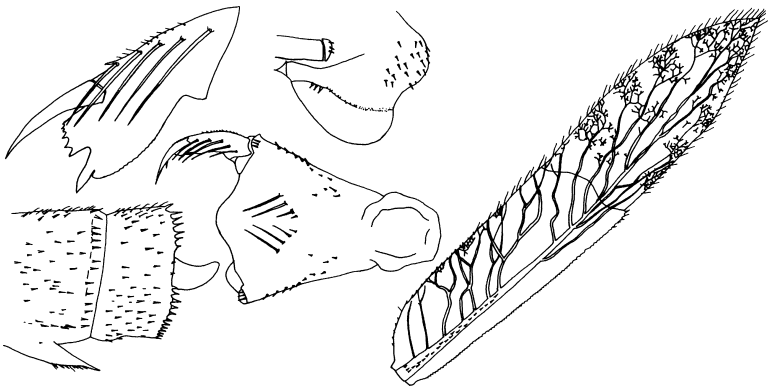


Fig. 3.1.565 *Oxyagrion rubidum* larva: labial palp (upper left), labium with one palp removed (lower center), right side of the head in ventral view (upper center), apex of the abdomen of a male in lateral view (lower left), and lateral gill lamella (right). Based on Bulla (1973b).

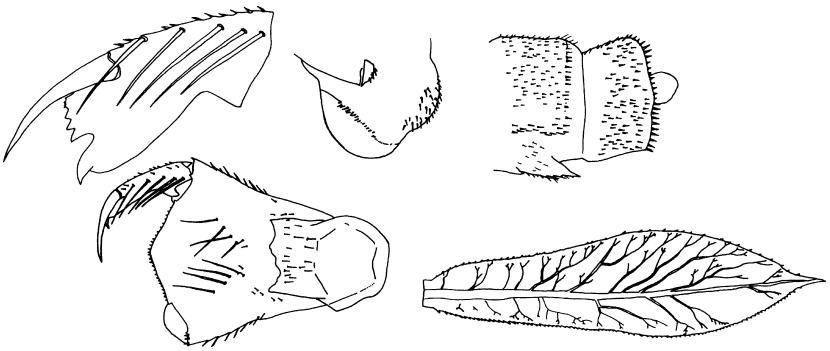


Fig. 3.1.566 *Oxyagrion terminale* larva (upper row, left to right): labial palp, right side of the head in ventral view, apex of the abdomen of a male larva, and (below, left and right): the labium with one of its palps and a lateral gill lamella. Based on Bulla (1973b).

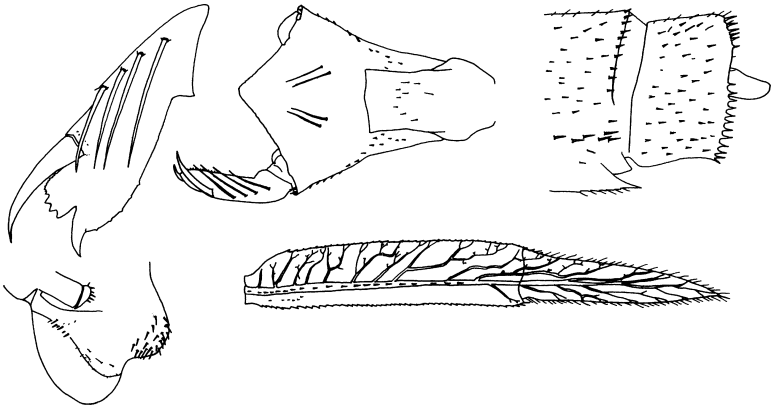


Fig. 3.1.567 *Oxyagrion hempeli* larva (upper row, left to right): labial palp, labium with one palp removed, apex of the abdomen of a male in lateral view, and (below, left to right): right side of the head in ventral view, lateral gill lamella. Based on Bulla (1973b).

3. Apical to the suture, secondary branching of the veins produces zones of dense patches on the gill lamellae. There are three or rarely two long setae on each side of the mentum, three small spines at the base or each palp, and five or six long setae on each labial palp. The length of the gills is 5.5 to 7 times the length. The row of spines along the posterior border of the tenth abdominal segment is interrupted at the location of the anal appendages. There is a small spine along the external border of the labial palp at the level of the apical lateral seta. The length of the anal appendage is more than half the length of the tenth abdominal segment (**Fig. 3.1.565**).
.....*Oxyagrion rubidum* (Rambur, 1842) (Argentina, Chile, Paraguay, Uruguay). Syn: *Agrion rubidum* Rambur, 1842; *Agrion rufulum* Hagen, 1861.

- Apical to the suture, the branching of the veins is simple, and there are no zones with dense patches of veins on the gill lamellae (**Fig. 3.1.568**). 4

4. There are three long setae on each side of the mentum, one short spine at the base of each palp, and four long setae on each labial palp (**Fig. 3.1.377**).
.....*Oxyagrion microstigma* Selys, 1876 (Argentina, Paraguay, Minas Gerais, São Paulo, Paraná, Mato Grosso). Syn: *Oxyagrion divaricatum* Calvert, 1909.

- There are four long setae on each side of the mentum, two short spines at the base of each palp, and six long setae on each labial palp (**Fig. 3.1.568**). Total length without gill lamellae: c. 16.5 mm. Length of median and lateral gill lamellae: c. 5.4 mm.
.....*Oxyagrion haematinum* Selys, 1876 (Minas Gerais).

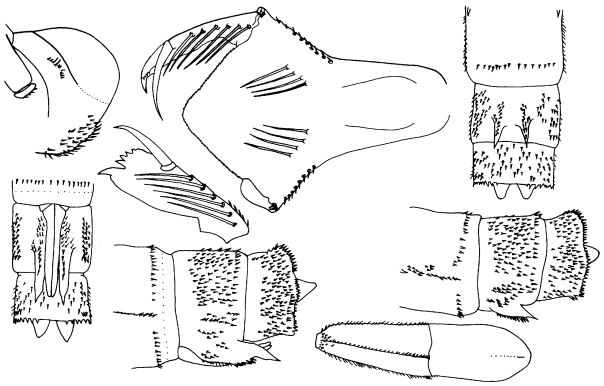


Fig. 3.1.568 *Oxyagrion haematinum* larva (above, left to right): left side of head in ventral view, labial palp below the labium with one palp removed, apex of the abdomen of a male larva in ventral (upper right) and lateral view (middle right), and (below, left to right): the apex of the abdomen of a female larva in ventral and lateral view and a lateral gill lamella. Based on Costa *et al*. (2000).

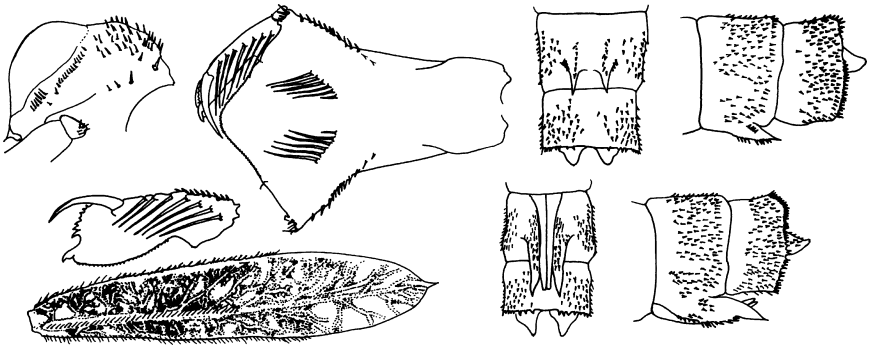


Fig. 3.1.569 *Oxyagrion sulinum* larva: ventral view of one side of the head (upper left), labial palp (middle left), labium with one palp removed (upper left center), lateral gill lamella (lower left), apex of the abdomen of a male (upper right center) and a female in ventral view (lower right center) and in lateral view (upper and lower right, respectively). Based on Costa *et al.* (2000).

5. There are five long setae and one secondary seta on each side of the mentum, as well as seven long setae on each labial palp. There is a row of seven large spines followed by many tiny ones along the ventral border of each eye. The caudal lamella is foliate with some secondary tracheae (**Fig. 3.1.569**). Total length without the gill lamellae: c. 15 mm. Length of middle caudal lamella: c. 6.5 mm; length of lateral lamellae: 7.1 mm.
.....*Oxyagrion sulinum* Costa, 1978
(São Paulo, Espírito Santo, Rio Grande do Sul).

- The total number of long setae on each side of the prementum is less than six (**Fig. 3.1.566**). 6

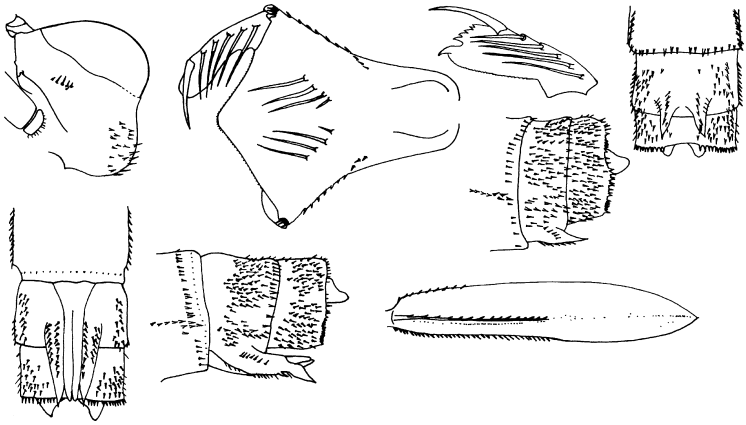


Fig. 3.1.570 *Oxyagrion basale* larva (above, left to right): left side of head in ventral view, labium, labial palp (above) and the apex of the abdomen of a male larva in lateral (below the palp) and ventral view, and (below, left to right): apex of the abdomen of a female larva in ventral and lateral view and a lateral gill lamella. Based on Costa *et al*. (2000).

6. There are two or three long setae on each side of the prementum (**Fig. 3.1.570**). 7
- There is a row of four or five long setae on each side of the prementum (**Fig. 3.1.566**). 11
7. There are two long setae on each side of the prementum, but there may also be one supplementary seta on one side (**Fig. 3.1.571**). 8
- There is a row of three long setae on each side of the prementum (**Fig. 3.1.570**). 9

Fig. 3.1.571 *Oxyagrion pavidum* larva (above, left to right): left side of head in ventral view, labium, labial palp, apex of the abdomen of a male larva in lateral and ventral view, and a lateral gill lamella (lower right center). Based on Costa *et al*. (2000).

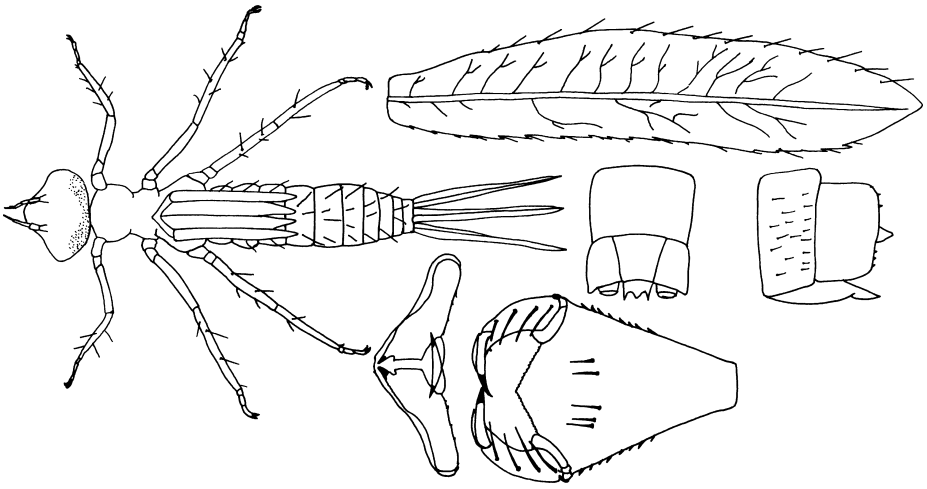


Fig. 3.1.572 *Oxyagrion evanescens* larva: habitus (left), labium in frontal view (lower center), labium (lower right), gill lamella (upper right), and apex of the abdomen of a female larva in dorsal (right center) and lateral view (middle right). Based on Costa (1979b).

8. There are two long and one secondary seta on each side of the prementum and four palpal setae. There is a row of three large spines followed by six or seven shorter ones along the ventral border of each eye near the maxillae. Only vestigial secondary tracheae are present on the gill lamellae, and there are short spines only on the proximal half of the lateral and dorsal carinae (**Fig. 3.1.571**).
.....*Oxyagrion pavidum* Hagen in Selys, 1876
(Pernambuco, Alagoas, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso).

- There are two long and sometimes also one supplemental seta on each side of the prementum and five palpal setae. There is a row of three large spines along the ventral border of each eye. Secondary tracheae are obvious on the gill lamellae, and there are short spines along the entire lengths of the lateral and dorsal carinae (**Fig. 3.1.572**).
.....*Oxyagrion evanescens* Calvert, 1909
(Argentina, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Brasília, Goiás, Mato Grosso).

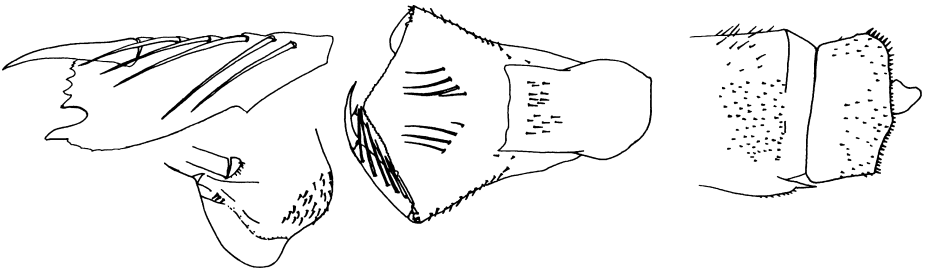


Fig. 3.1.573 *Oxyagrion chapadense* larva (left to right): labial palp (above), right side of the head in ventral view (below), labium with one of its palps, and apex of the abdomen of a male larva. Based on Bulla (1973b), who mistook it for *O. basale*.

9. The gill lamellae lack secondary tracheae, are not pigmented, and are as wide in the distal half as they are in the proximal half. There are two large and four short claviform spines along the ventral margin of each eye. The row of short spines along the posterior border of the tenth abdominal segment is interrupted at the bases of the lateral appendages. There are spiniform setae on the anterior 2/3 of the palp (**Fig. 3.1.570**). Total length without gill lamellae: c. 12.7 mm. Length of gill lamellae: 6.0 to 6.6 mm.
.....*Oxyagrion basale* Selys, 1876
(Argentina, Paraguay, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Rio Grande do Sul).
- The gill lamellae have very prominent secondary tracheae, and are wider in the distal half than in the proximal half (**Fig. 3.1.573**). 10
10. There are usually five long setae in the row proximal to the moveable hook on each labial palp. The row of short spines along the posterior border of the tenth abdominal segment is not interrupted at the bases of the lateral appendages. There are four spines along the ventral margin of each eye near the maxillae (**Fig. 3.1.573**).
.....*Oxyagrion chapadense* Costa, 1978
(Argentina, Paraguay, Bahia, Goiás, Minas Gerais, São Paulo, Paraná, Mato Grosso).
- There are usually six long setae in the row proximal to the moveable hook on each labial palp. The row of short spines along the posterior border of the tenth abdominal segment is interrupted for short distances lateral to the bases of the cerci. The legs lack dark bands, but there are narrow dark longitudinal stripes (**Fig. 3.1.574**). The branching veins in the gill lamellae are darkened, and there is a vague dark area at the apices of each lamella. Total length of final instar larvae: 10 to 16 mm.
.....*Oxyagrion bruchi* Navás, 1924
(Argentina, Bolivia).

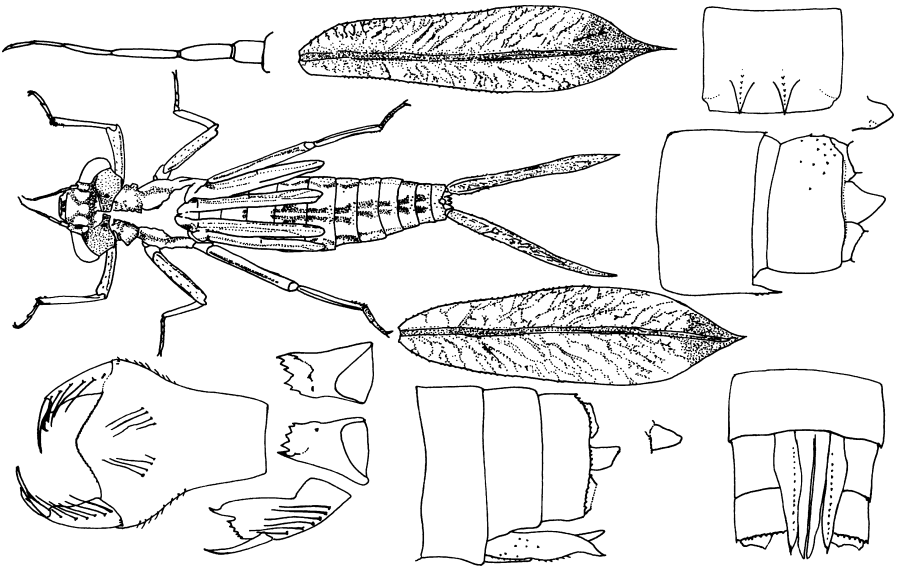


Fig. 3.1.574 *Oxyagrion bruchi* larva: habitus from an exuvia with the middle gill lamella broken off (middle left), antenna (upper left), labium (lower left), mandibles (above) and labial palp (below, lower left center), apex of the male larval abdomen in ventral (upper right) and lateral view (middle right) with a dorsal outline of a cercus to their right, apex of a female larval abdomen in ventral (lower right) and lateral view (lower center) with the dorsal profile of a cercus between them, and the middle (right center) and a lateral gill lamella (upper center). Based on von Ellenrieder and Garrison (2006).

Fig. 3.1.575 *Oxyagrion santosi* larva: left side of head in ventral view (upper left), labium (upper center), labial palp (above posterior part of labium), apex of the abdomen of a female larva in ventral (upper right) and lateral view (lower left), and a lateral gill lamella (lower right). Based on Costa *et al*. (2000).

11. There are more than three long setae on each side of the prementum (**Fig. 3.1.11**).
.....*Oxyagrion simile* Costa, 1978
(Minas Gerais, Goiás, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Rio Grande do Sul).
- There are three long setae on each side of the prementum, and the rest are short (**Fig. 3.1.566**). 12
12. There are 10 to 12 spines followed by 5 or 6 shorter ones along the ventral border of each eye near the maxilla. Secondary tracheae are present on the gill lamellae (**Fig. 3.1.566**).
.....*Oxyagrion terminale* Selys, 1876
(Argentina, Uruguay, Paraguay, Bolivia, Amazonas, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul).
- There are fewer than 10 long spines along the ventral border of the eye near the maxilla, sometimes accompanied by very tiny spinules (**Fig. 3.1.575**). 13

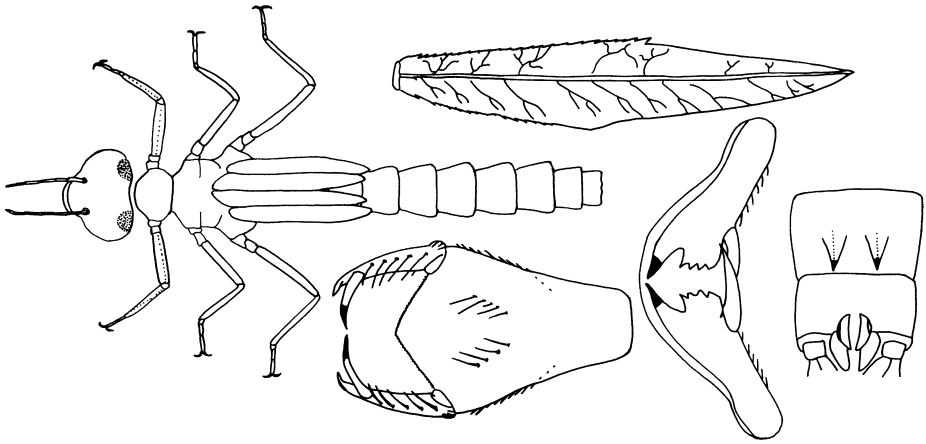


Fig. 3.1.576 *Oxyagrion impunctatum* larva: habitus without the gill lamellae (left), labium in ventral (lower center) and frontal view (lower right center), gill lamella (upper right), and the apical segments of the male abdomen in ventral view (right). Based on Costa (1981).

13. There are five setae on the labial palp. There are three large and two secondary setae on each side of the prementum. There is one large spine followed by a poorly defined row of very tiny spinules below each eye near the maxilla. The gills lack secondary tracheae (**Fig. 3.1.575**). The dorsum of the abdomen is not pigmented. Total length without gill lamellae: c. 13.5 mm.

Length of median gill lamella: c. 5.1 mm; length of lateral gill lamellae: c. 5.1 mm.
.....*Oxyagrion santosi* Martins, 1967 (Goiás, Minas Gerais, São Paulo, Paraná, Rio Grande do Sul).
- There are six setae on the labial palp. There are nine short spines below each eye near the maxilla. Secondary tracheae are present on the gills (**Fig. 3.1.576**). The dorsum of the abdomen is pigmented. Total length without gill lamellae: c. 12.0 mm. Length of median gill lamella: c. 5.7 mm; length of lateral gill lamellae: c. 5.75 mm.
.....*Oxyagrion impunctatum* Calvert, 1909 (Paraguay, Rio de Janeiro, Minas Gerais, São Paulo, Paraná, Goiás, Mato Grosso, Mato Grosso do Sul).

Key to the species of adult *Enallagma* in South America

Information for the key provided by Calvert (1907). The larvae of two of the three South American species have not been described.

1. The abdomen of the male is mainly black dorsally and laterally with only narrow pale anterior bands and brilliant blue on the dorsal surface of the anterior 2/3 of the eighth and most of the ninth segment (**Fig. 3.1.577**).
.....*Enallagma novaehispaniae* (Calvert, 1907) (North and Central America, Trinidad, Tobago, Ecuador, Peru, Colombia, Venezuela, Argentina, Espirito Santo, São Paulo). Syn: *Enallagma ypsilon* Needham, 1942.
- There are extensive blue or violet markings on the male abdomen, including extensive pale markings on the second and third segments (**Fig. 3.1.361**). 2

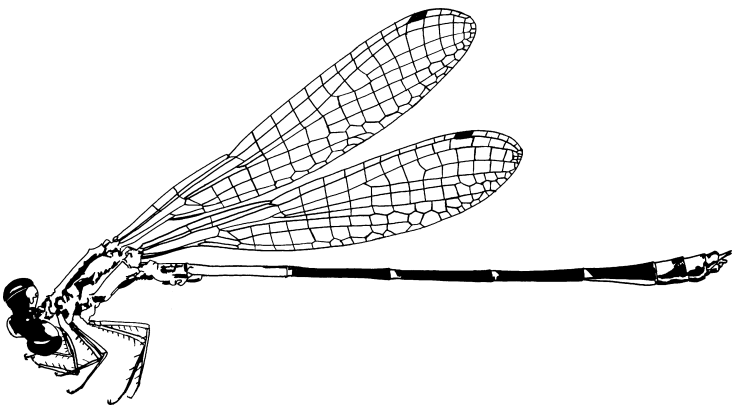


Fig. 3.1.577 Habitus of an adult male *Enallagma novaehispaniae,* showing only one of each wings, the head in dorsal view, and the rest in lateral view. The dark color is mainly black, while the pale color is vivid blue.

2. There is no black U-shaped marking on the second abdominal segment. The abdomen of the male is mainly brilliant blue dorsally and laterally with metallic black on the posterior fifth of the second through fifth segments, the posterior half of the dorsal surface of the sixth, and most of the dorsal surface of the seventh. There is also a small black dorsal spot on the tenth and another at the base of the superior anal appendage (**Fig. 3.1.361**). The thorax and abdomen of the female are mainly darkened ochraceous dorsally and bluish gray laterally; black markings, usually with bronze iridescence, are confined to narrow stripes on the thorax and squarish posterior markings connected to narrower middorsal stripes, most of which do not reach the anterior margin on the fourth through seventh segments. The black on the first abdominal segment of the female reaches the posterior margin of the segment. The dorsal surfaces of the eighth and ninth abdominal segments of the female are black.
.....*Enallagma civile* (Hagen, 1861)
(North and Central America, West Indies, Colombia, Venezuela). Syn: *Agrion civile* Hagen, 1861; *Enallagma civile plebeium* Selys, 1876; *Enallagma civile* race *simile* Selys, 1876.

- There is a black U-shaped marking with the open end facing anteriad on the second abdominal segment. The third abdominal segment is mainly violet rather than blue. The eighth segment of the male is either entirely blue dorsally or blue with the posterior part black. The ninth segment is entirely blue dorsally. The eighth and ninth have black ventrolateral stripes. The superior anal appendage is widely forked with a longer dorsal branch, best seen in dorsal view. The black on the first abdominal segment of the female does not reach the posterior margin of the segment. The eighth abdominal segment of the female is blue with black dorsally on the posterior fourth and over the ventrolateral surface; the ninth segment of the female abdomen is black with a pair of blue apical spots.
.....*Enallagma coecum* (Hagen, 1861)
(North and Central America, West Indies, Venezuela, Pernambuco?). Syn: *Agrion coecum* (Hagen, 1861.

Key to the species of adult male *Acanthagrion* reported from South America

Information for the keys to this genus was provided by Calvert (1909), Williamson (1916a), Schmidt (1942), Fraser (1946a), Santos (1965a), Gloger (1967), Bulla (1975), Leonard (1977), Jurzitza (1980a), De Marmels (1985d, 1989a,b), Tennessen (2003), and Muzón and Lozano (2005).

1. The tibial spines are longer than the spaces separating them. The dorsal penis segment is simple and flap-like; the second penis segment is fringed with setae (**Fig. 3.1.578**). 2

- The tibial spines are equal to or shorter than the spaces separating them. If the spines of some specimens are longer than the spaces between them, then the

dorsal penis segment is complex and bears folds, hooks, or membranous lobes (**Fig. 3.1.579**). 5

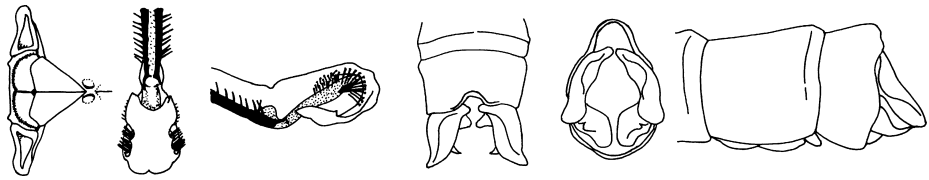


Fig. 3.1.578 *Acanthagrion rubrifrons* (left to right): female mesepisternal fossae, penis in ventral and lateral view, and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

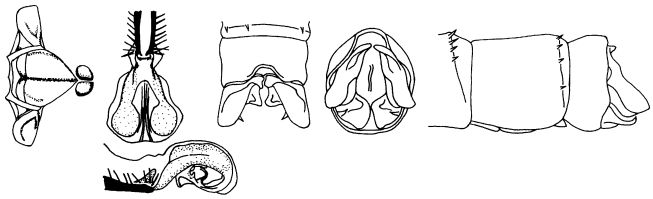


Fig. 3.1.579 *Acanthagrion amazonicum* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

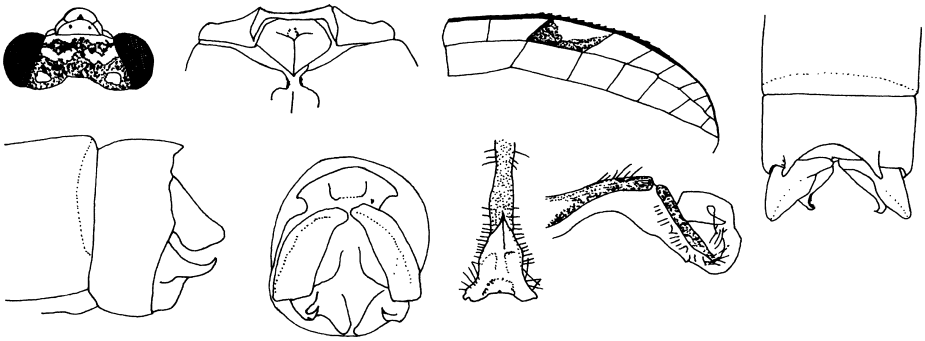


Fig. 3.1.580 *Acanthagrion dichrostigma* (upper row, left to right): head of a male in dorsal view, mesepistigmal laminas and episternal fossa of a female, apex of the fore-wing, apex of the male abdomen in dorsal view; and (lower row, left to right): lateral and posterior view of the apex of the male abdomen and penis in ventral and lateral view. Based on De Marmels (1985d).

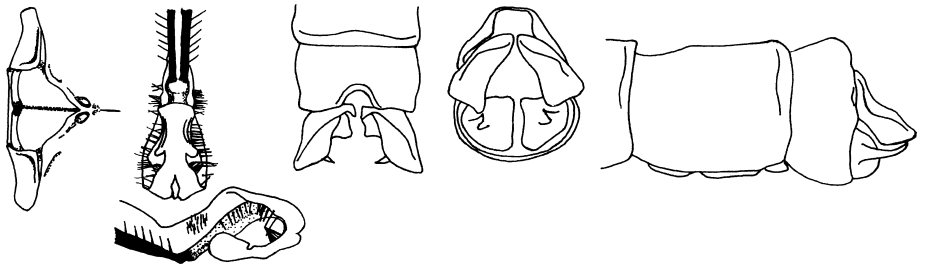


Fig. 3.1.581 *Acanthagrion longispinosum* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

2. The light ground color of the body is yellow or orange. The apical half of the distal penis segment is obviously expanded, while the base is slightly constricted near the junction with the second segment. The posterior margin of each superior appendage is nearly straight in profile (**Fig. 3.1.578**). Length of abdomen: 20.5 to 23 mm. Hind wing length: 14 to 16 mm.

.....*Acanthagrion rubrifrons* Leonard, 1977
(Venezuela, Guyana, Amazonas, Pará).
- The light ground color of the body is blue or green. 3
3. The apices of the inferior anal appendages each taper to a point and curve inward. The distal segment of the penis is expanded somewhat subapically but tapers to a point (**Fig. 3.1.580**). Total length: 29 to 31 mm. Length of abdomen: 23.5 to 24 mm. Hind wing length: 16.5 to 17 mm.
.....*Acanthagrion dichrostigma* De Marmels, 1985
(Venezuela).
- The distal penis segment is expanded apically and subapically but constricted in the middle (**Fig. 3.1.581**). 4
4. The posterior margin of the superior appendage is somewhat sinuous in profile (**Fig. 3.1.581**). There is a strong constriction at the midlength of the distal segment of the penis. Length of abdomen: 19.5 to 23.5 mm. Hind wing length: 14.5 to 16 mm. The head is mainly black and light blue, while the thorax and abdomen are mainly black with olive and brown markings.
.....*Acanthagrion longispinosum* Leonard, 1977
(Bolivia, Rondônia)
- The apex of the penis, viewed ventrally, seems to form two lateral lobes with a shallow median impression between them (**Fig. 3.1.582**). Total length: 29 to 31 mm. Length of abdomen: c. 24 mm. Hind wing length: 16 to 17.5 mm.
.....*Acanthagrion tepuiense* De Marmels, 1985
(Venezuela).

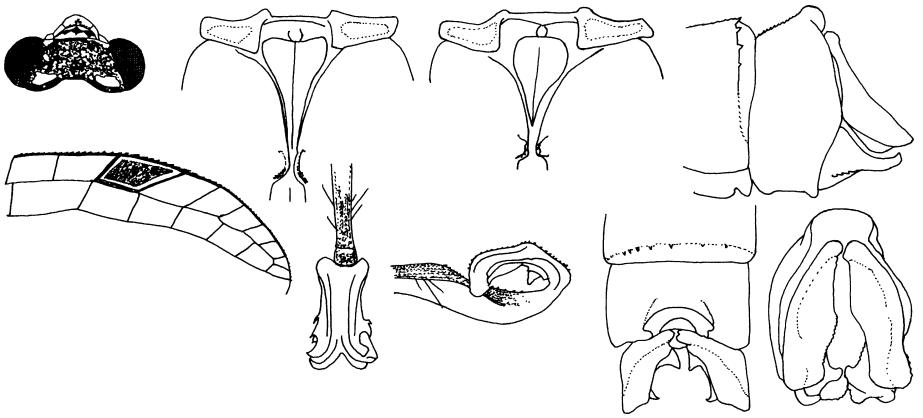


Fig. 3.1.582 *Acanthagrion tepuiense* (upper row, left to right): head of a male in dorsal view, dorsal views of the mesepistigmal laminae and episternal fossa of two different females, apex of the male abdomen in lateral view; and (lower row, left to right): apex of the fore-wing of a male, penis in ventral and lateral view, and dorsal and posterior view of the apex of the male abdomen. Based on De Marmels (1985d).

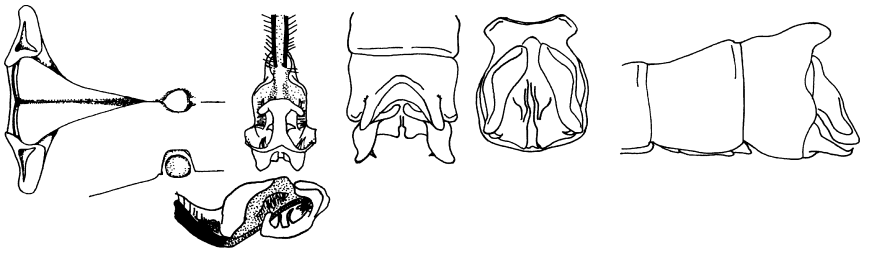


Fig. 3.1.583 *Acanthagrion phallicorne* (left to right): mesepisternal fossae and tubercle on the synthorax of the female (above) with the polished tubercle located at the posterior end of the interlaminar sinus in lateral view (below), penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

5. A pair of long, curved sclerotized hooks is located on the ental surface of the apical penis segment. The tenth abdominal segment is, at most, only a little higher than the ninth when viewed laterally (**Fig. 3.1.579**). 6
- A pair of long, curved sclerotized hooks is never present on the ental surface of the distal penis segment; hooks, if present, are usually short and robust (**Fig. 3.1.583**). 10

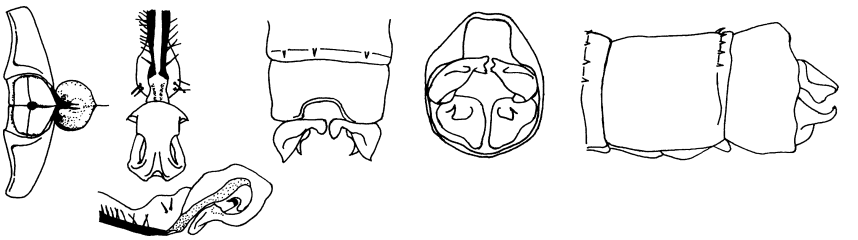


Fig. 3.1.584 *Acanthagrion jessei* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

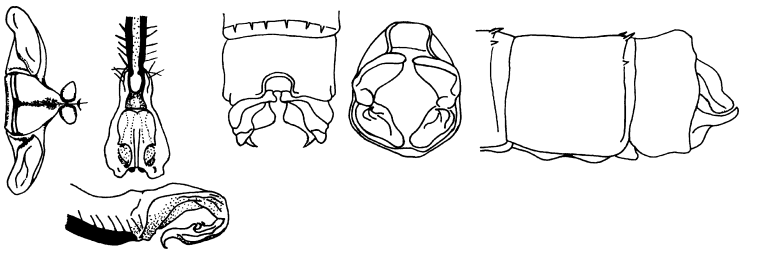


Fig. 3.1.585 *Acanthagrion temporale* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

6. The distal penis segment is considerably longer than the greatest width of the second segment. The ental hooks of the distal segment are only slightly sclerotized (**Fig. 3.1.584**). Length of abdomen: 21 to 23 mm. Hind wing length: 14 to 15.5 mm. The head is mainly black with greenish markings; the thorax is mainly black with light green markings, and the abdomen is mainly black with bluish green and brown markings.

.....*Acanthagrion jessei* Leonard, 1977 (Rondônia).

- The second penis segment is as wide or wider than the greatest length of the second segment. The ental hooks of the distal segment are heavily sclerotized (**Fig. 3.1.579**). 7

7. When viewed ventrally, the terminal half of the distal penis segment is expanded enough to cover the corresponding portion of the second segment. The superior appendages are constricted subapically (**Fig. 3.1.585**). Length of abdomen: 20 to 22.5 mm. Hind wing length: 13 to 16 mm. The color is mainly blue with black and brown markings.

.....*Acanthagrion temporale* Selys, 1876 (Venezuela, Argentina, Roraima, Bahia, Minas Gerais, São Paulo, Mato Grosso).

- The terminal expansion of the distal penis segment is about a third of the width of the corresponding sclerotized portion of the second segment. The superior appendages are widest at the apex (**Fig. 3.1.579**). 8

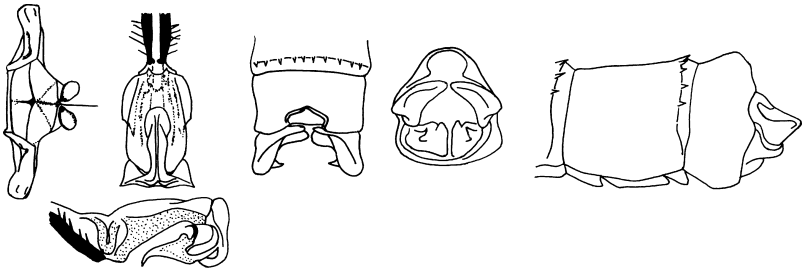


Fig. 3.1.586 *Acanthagrion abunae* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

8. The sclerotized hooks of the ental surface of the distal penis segment arise nearer to the base than to the apex. The outline of the tip of the distal segment appears smoothly eliptical when viewed ventrally. The apex of the superior appendage is shallowly indented (**Fig. 3.1.586**). Length of abdomen: 23 to 26 mm. Hind wing length: 14 to 16 mm. The head is mainly black, light olive green, and greenish yellow; the thorax and abdomen are mainly black with blue markings dorsally and greenish yellow ventrally.

.....*Acanthagrion abunae* Leonard, 1977 (Guyana, Paraguay, Rondônia)

- The sclerotized hooks of the ental surface of the distal penis segment arise nearer to the apex than to the base. The outline of the inflated tip of the distal segment appears triangular or pentagonal when viewed ventrally. There is a fenestrate marking on either side of the second segment near the apex (**Fig. 3.1.579**). 9

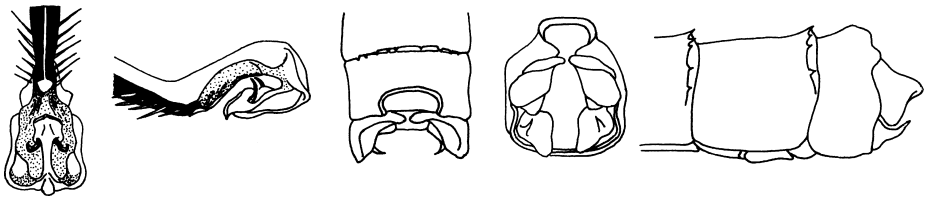


Fig. 3.1.587 *Acanthagrion inexpectum* male (left to right): penis in ventral and lateral view and the apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

9. The greatest width of the second segment of the penis is greater than the length of the apical segment. There is a well-developed tubercle on the superior anal appendage, easily visible in lateral view (**Fig. 3.1.579**). Total length: c. 26 mm. Length of abdomen without appendages: c. 21 mm. Hind wing length: c. 14 mm. The head is mainly black with bluish green, green, brownish yellow, and yellowish white markings. The thorax is mainly black and dark brown with a few blue markings. The anterior part of the abdomen is black with bluish markings, while the posterior part is mainly brownish.
.....*Acanthagrion amazonicum* Sjöstedt, 1918 (Amazonas, Rondônia).
- The greatest width of the second segment of the penis and the length of the apical segment are nearly equal. The tubercle on the superior anal appendage is not well developed and not visible in lateral view (**Fig. 3.1.587**). Length of abdomen: 25 to 26 mm. Hind wing length: 16 to 17 mm. The head is mainly black with bright green, bluish buff, and light brown markings; the thorax and abdomen are mainly black with blue, greenish blue, and brown markings. The abdomen is black dorsally and bluish or brownish laterally. The female has not been described.
.....*Acanthagrion inexpectum* Leonard, 1977 (Mexico, Central America, Venezuela).

Fig. 3.1.588 *Acanthagrion ablutum* (left to right): mesepisternal fossae and tubercle on the synthorax of the female, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

10. The posterior margin of the tenth abdominal segment is elevated along the dorsal midline to form a plate, from which a pair of lobes or horns extends dorsad or posteriad. If lobes are present, they extend posteriad and are separated by a short, shallow excision. The distal penis segment is armed apically with a pair of short, robust, sclerotized hooks or, if not, then the second segment bears a tuft of setae, not to be confused with the row of long setae on the third segment (**Fig. 3.1.583**). 11

- The posterior margin of the tenth abdominal segment is never produced along the posterior margin to form two horn-like projections. If the posterior margin is elevated, the entire dorsal surface of the tenth segment is elevated, so a distinct plate does not extend above the plane along the dorsal midline. If not, then the excision in the middle is deep and wide, or any suggestion of lobes are not directed posteriad but more inward toward each other or dorsad (**Fig. 3.1.588**). In case of doubt, the distal segment of the penis is not armed apically with a pair of short, robust, sclerotized hooks, and the second segment of the penis does not bear setae. 15

11. The posterior margin of the tenth abdominal segment is produced above the plane of the rest of the dorsal surface and bears two lobes directed posteriad and separated by a short, shallow excision (**Fig. 3.1.589**). Total length of male: 34.5 to 36 mm. Length of male abdomen: 27.5 to 30 mm. Hind wing length of male: 18 to 19 mm. The head is mainly blue with a yellow labium and a brown spot on the labrum, and a ferrugineous occiput with vaguely defined postocular spots, which each have about 10 brown spots in them, most bearing a tiny seta. The thorax is mainly ferrugineous marked with blue. The abdomen is mainly blue with ferrugineous markings, but the seventh segment is dark brown or black. The legs are mainly cream-colored, but the apices of the femora and tibiae and the spines are brown.
.....*Acanthagrion fluviatile* (De Marmels, 1984) (Venezuela). Syn: *Oxyagrion fluviatile* De Marmels, 1984.

- The dorsum of the tenth abdominal segment is produced to form two posteriorly directed lateral horns (**Fig. 3.1.583**). 12

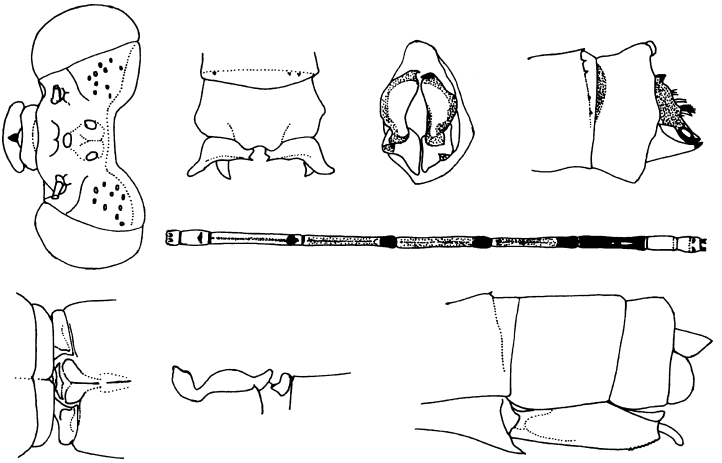


Fig. 3.1.589 *Acanthagrion fluviatile* (upper row, left to right): head of a female in dorsal view; apex of the male abdomen in dorsal, posterior, and lateral view; and (below, left to right): posterior part of prothorax and anterior part of synthorax in dorsal and lateral view; apex of the female abdomen in lateral view; and (center): abdomen of a male in dorsal view. Based on De Marmels (1984b).

12. The second penis segment bears a dense patch of setae on either side of the midline. There are no sclerotized hooks near the tip of the distal penis segment. The dorsal horns on the tenth abdominal segment are rounded, not acutely pointed (**Fig. 3.1.583**). Length of abdomen: 24 to 26 mm. Hind wing length: 16 to 18.5 mm. The head is mainly black with bluish green markings and dark buff postocular spots; the thorax is mainly black with bluish, bluish gray, buff, and orange markings. The abdomen is almost entirely black with only a few dark tan and greenish blue markings.
.....*Acanthagrion phallicorne* Leonard, 1977 (Ecuador, Peru, Rondônia).
- The second penis segment lacks setae. There is a short, heavy, sclerotized hook on either side of the distal penis segment near the tip. The dorsal horns on the tenth abdominal segment are acutely pointed (**Fig. 3.1.590**). 13

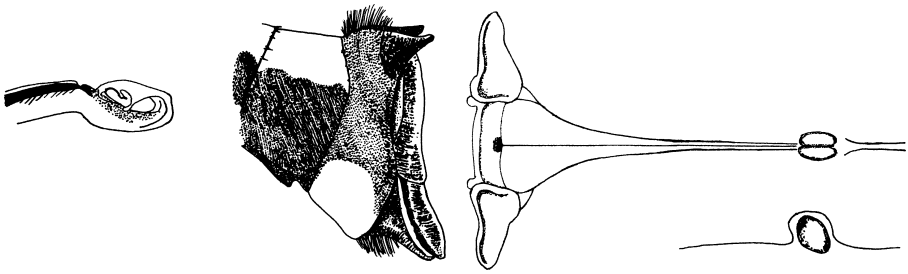


Fig. 3.1.590 *Acanthagrion apicale* (left to right): lateral views of the apices of the penis and male abdomen and the mesepisternal fossae and tubercle on the synthorax of the female (above) with the polished tubercle located at the posterior end of the interlaminar sinus in lateral view (below). Based on Fraser (1946a) and Leonard (1977).

13. The apex of the apical penis segment is not inflated (**Fig. 3.1.590**). Length of abdomen: 24.5 to 29.5 mm. Hind wing length: 17.5 to 20.5 mm. The head is bright orange, reddish orange, pale yellow, cream or light brown, and black. The thorax is mainly orange with black markings. The abdomen is mainly black with brown markings.
.....*Acanthagrion apicale* Selys, 1876 (Venezuela, Guyana, French Guiana, Colombia, Ecuador, Peru, Bolivia, Pará, Rondônia). Syn: *Acanthagrion apicale descendens* Fraser, 1946.
- The apex of the apical penis segment is inflated (**Fig. 3.1.591**). 14
14. The pterostigma is carmine. The abdomen is mainly black dorsally with extensive yellow markings laterally and ventrally. In lateral view, a dorsal elevation at the midlength of the tenth abdominal segment is evident, and it extends farther dorsad than the apical horns (**Fig. 3.1.591**). Total length: c. 32 mm. Length of abdomen: c. 27 mm. Hind wing length: c. 19 mm. The wings of young adults are hyaline with black veins, but the membrane becomes cloudy

with age. The head and prothorax are dark orange with extensive black markings on the posterior part of the head. The synthorax is black with an orange red antehumeral stripe.
.....*Acanthagrion obsoletum* (Förster, 1914)
(Colombia, Ecuador, Peru, Bolivia). Syn: *Myagrion obsoletum* Förster, 1914; *Acanthagrion leonora* Gloger, 1967; *Acanthagrion luna* Ris, 1918.
- The pterostigma is black. The abdomen is mainly black dorsally with blue markings, including dark blue on the eighth and ninth segments of the abdomen. The dorsal horns on the tenth abdominal segment extend farther dorsad than the proximal parts of the segment, as seen in lateral view (**Fig. 3.1.592**). The prothorax is black dorsally with brown on the anterior lobe, and it is pale blue laterally and ventrally. The synthorax is light blue with dark markings. The head is dark dorsally with light blue or orange markings. Length of male abdomen: 26 to 29 mm. Hind wing length of male: 16.5 to 18.5 mm. Length of pterostigma: 0.5 to 0.6 mm. The female has not been described.
.....*Acanthagrion hartei* Muzón and Lozano, 2005
(Ecuador).

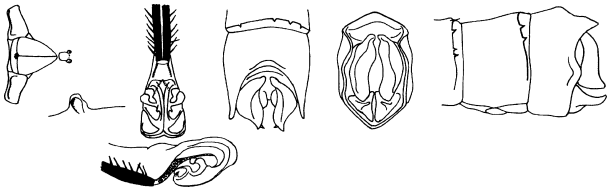


Fig. 3.1.591 *Acanthagrion obsoletum* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

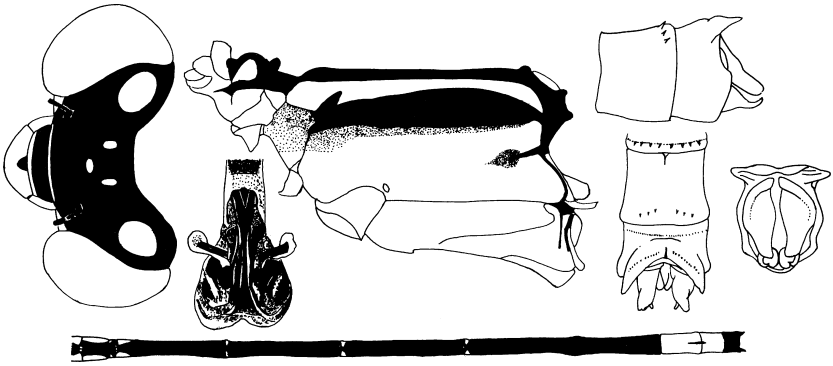


Fig. 3.1.592 *Acanthagrion hartei* male: head in dorsal view (upper left), thorax in lateral view (upper left center), abdomen in dorsal view (below), penis in ventral view (left of center), and apex of the abdomen in dorsal (right of center), posterior (middle right), and lateral view (upper right). Based on Muzón and Lozano (2005).

15. There are no postocular spots, or such spots are faded and barely perceptible. The distal segment of the penis is convex, giving it a semicircular outline (**Fig. 3.1.588**). 16
- Distinct postocular spots are present. The distal segment of the penis does not appear strongly convex in lateral view (**Fig. 3.1.593**). 18

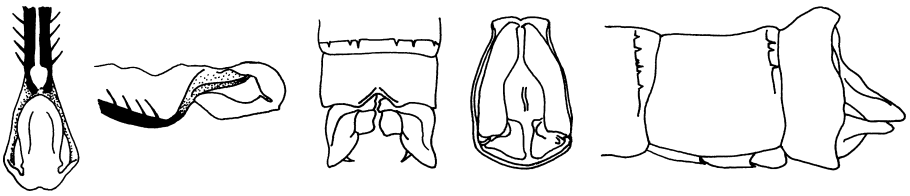


Fig. 3.1.593 *Acanthagrion williamsoni* male (left to right): penis in ventral and lateral view, and apex of the abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

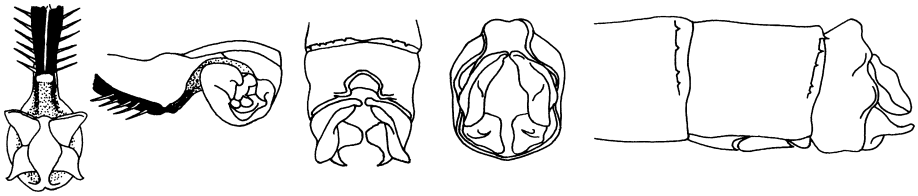


Fig. 3.1.594 *Acanthagrion hermosae* male (left to right): penis in ventral and lateral view, and apex of the abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

16. There is no short, transverse, double fold on the ental surface of the apical penis segment. Vestiges of bluish postocular spots are present. The head is otherwise mainly light greenish blue and black. The metapleurite is bright blue or green on a darker background (**Fig. 3.1.588**). Length of abdomen: 26 to 27.5 mm. Hind wing length: 18 to 20 mm. The abdomen is mainly black with blue or brown markings.
.....*Acanthagrion ablutum* Calvert, 1909 (Argentina, Bolivia, Paraguay, Uruguay).
- There is a short, transverse, double fold on the ental surface of the apical penis segment. There is no trace of postocular spots (**Fig. 3.1.594**). 17

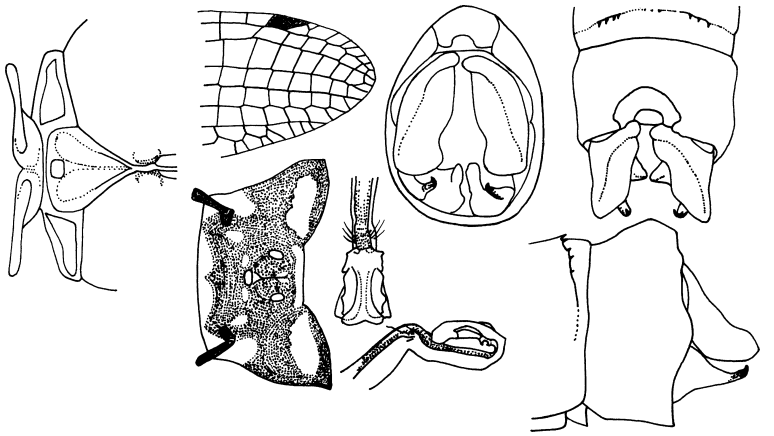


Fig. 3.1.595 *Acanthagrion imeriense:* posterior border of the prothorax and anterior part of the synthorax of a female in dorsal view (left), apex of the fore-wing of a female (upper left center), color pattern on the dorsal surface of the head of a male between the compound eyes (lower left center), penis in ventral (center) and lateral view (lower right center), and apex of the male abdomen in posterior (upper right center), dorsal (upper right), and lateral view (lower right). Based on De Marmels (1989a).

17. The second segment of the penis has a row of evenly spaced setae on each side. The apex of the inferior anal appendage is rounded and points posteriad (**Fig. 3.1.594**). The metapleurite is bright red or purple on a darker background. Length of abdomen: 25 to 27 mm. Hind wing length: 17.5 to 19 mm. The head is mainly black with dark green, slate gray, obscure blue, and brown markings. The thorax and abdomen are mainly black with greenish brown and yellowish brown markings on the thorax, a pair of cherry-red lateral spots on the first abdominal segments, and blue on the eighth and ninth segments. The female has not been described.
.....*Acanthagrion hermosae* Leonard, 1977 (Peru).
- The second segment of the penis is not lined with setae and only bears a group of about three setae on each side of its apical end. The apex of the inferior anal appendage is almost acute and curves strongly dorsad (**Fig. 3.1.595**). Total length of male including anal appendages: c. 34 mm. Length of male abdomen including appendages: c. 26.5 mm. Hind wing length: c. 18 mm.
.....*Acanthagrion imeriense* De Marmels, 1989 (Venezuela). The two nominal species in this couplet resemble each other closely enough to raise the suspicion that they are conspecific.

18. The apical penis segment is flap-like and lacks distinctively modified structures between its mid-length and apex, although such structures may be present at its base near the junction with the second segment (**Fig. 3.1.593**). ...19
- The apical segment of the penis has distinctively modified structures, such as processes or internal carinae, between its middle and apex (**Fig. 3.1.296**). 21

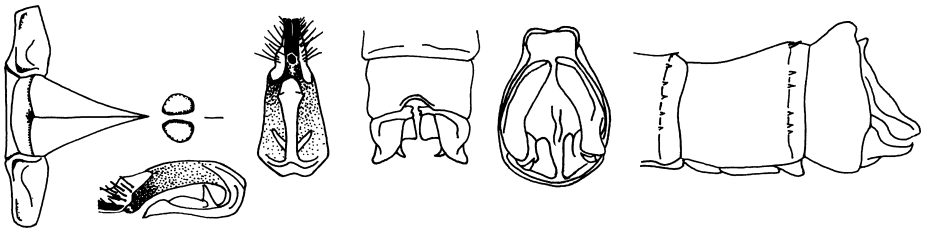


Fig. 3.1.596 *Acanthagrion kennedii* (left to right): female mesepisternal fossae (above), penis in lateral (below) and ventral view, and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Kennedy (1916) and Leonard (1977).

19. In lateral view, the apex of the tenth abdominal segment conceals the dorsal extremities of the superior anal appendage. The apical segment of the penis is widest at midlength, and its apex is bluntly rounded (**Fig. 3.1.593**). Length of abdomen: 24.5 to 26 mm. Hind wing length: 16 to 17.5 mm. The head is blue with a greenish tinge, yellowish green, and black with whitish or pale buff maxillae. The thorax is mainly black with blue markings. The abdomen is black with blue markings, including those covering the seventh and eighth segments. The female has not been described.
.....*Acanthagrion williamsoni* Leonard, 1977 (Colombia).
- In lateral view, the dorsal extremities of the superior anal appendage are visible. The apical segment of the penis is wider near the apex than at its midlength (**Fig. 3.1.597**). 20

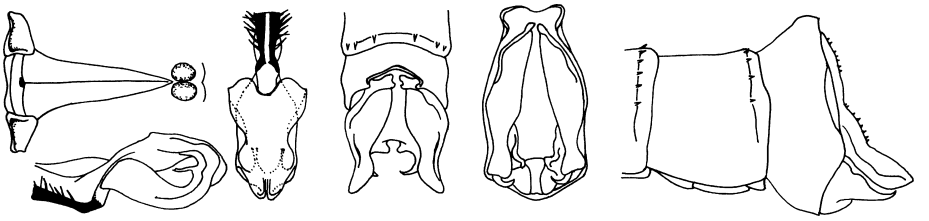


Fig. 3.1.597 *Acanthagrion yungarum* (left to right): female mesepisternal fossae (above), penis in lateral (below) and ventral view, and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

20. In lateral view, the basal portions of the superior anal appendage do not extend dorsad as far as the dorsal margin of the tenth abdominal segment. The ental surface of the apical segment of the penis bears a pair of slightly sclerotized rods with bluntly notches apices, which nearly touch the second segment of the penis (**Fig. 3.1.597**). Length of abdomen: 24 to 28 mm. Hind wing length: 17 to 19 mm. The head is black with greenish and sometimes pale buff or amber markings. The thorax is black and greenish blue, blue, and buff. The abdomen is dark brown and black with blue markings covering all or part of the first, second, eighth, and ninth segments.
.....*Acanthagrion yungarum* Ris, 1918 (Ecuador, Peru).
- In lateral view, the basal portions of the superior anal appendage extend dorsad as far as the dorsal margin of the tenth abdominal segment. At the base of the apical segment of the penis, there is a double transverse fold (**Fig. 3.1.598**). Length of abdomen: 23.5 to 28.5 mm. Hind wing length: 16 to 18 mm. The head is black with bluish green markings, flesh-colored postgenae, and yellowish white on the labium and maxillae. The thorax is black with bluish green and yellowish or flesh-colored markings. The abdomen is mainly black with blue markings of the first, second, third, eighth, and ninth segments.
.....*Acanthagrion vidua* Selys, 1876 (Trinidad, Venezuela, Bolivia). Syn: *Acanthagrion risi* Leonard, 1977.

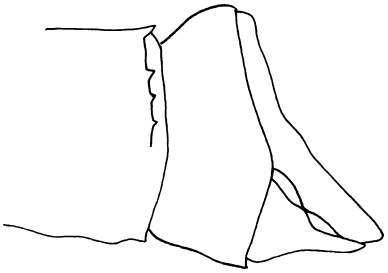


Fig. 3.1.598 Apex of the abdomen of a male *Acanthagrion vidua* in lateral view. Based on Rácenis (1958).

21. In lateral view, the tenth abdominal segment appears considerably higher than the ninth. The color and surface texture of the superior anal appendages are uniform (**Fig. 3.1.596**). 22
- Viewed laterally, the tenth abdominal segment is slightly or not at all higher than the ninth, or, if it is higher, then the inner face of the superior appendage is different in color and surface texture from the outer face (**Fig. 3.1.599**). 26
22. The distal penis segment is narrow basomesally, and apically, it is expanded to about twice its mesal width, but it narrows again before reaching the second segment (**Fig. 3.1.596**). Length of abdomen: 23 to 27 mm. Hind wing length: 15 to 17.5 mm. The head is green and black with pale buff or a flesh color on the

labium and exposed parts of the maxillae. The thorax is mainly greenish yellow and black, and the abdomen is black with blue markings, including one covering much of the seventh and eighth segments.

.....*Acanthagrion kennedii* Williamson, 1916 (Panama, Trinidad, Tobago, Venezuela, Pará).

- Viewed ventrally, the mesal or apical modifications of the distal penis segment extend beyond the edge of the second segment (**Fig. 3.1.600**). 23

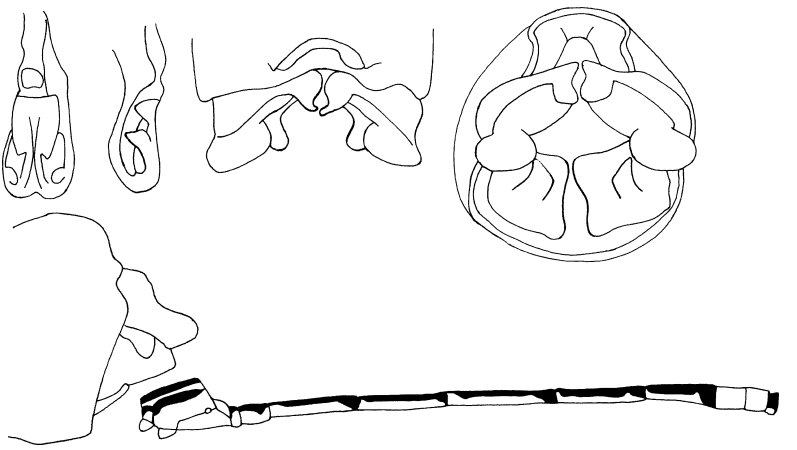


Fig. 3.1.599 *Acanthagrion cuyabae* male (upper row, left to right): penis in ventral and lateral view, apex of the abdomen in dorsal and posterior view, and (below, left and right): apex of the abdomen in lateral view and the color pattern on the thorax and abdomen, shown in lateral view. Based on Jurzitza (1980a), who referred to the specimen as *Acanthagrion leonardi.*

23. The apex of the distal penis segment is greatly expanded; it is twice as wide as the portion of the second segment it overlies. Its lateral lobes do not reach the margins of the second segment. The tenth segment of the abdomen is moderately elevated and not constricted dorsally (**Fig. 3.1.601**). Length of abdomen: 24 to 27.5 mm. Hind wing length: 15 to 17 mm. The head and thorax are mainly light blue and black. The abdomen is mainly black with a few variable blue markings, including one covering the tenth segment.

.....*Acanthagrion quadratum* Selys, 1876 (United States, Mexico, Central America, Brazil?). Syn: *Acanthagrion gracile* var. *quadratum* Selys, 1876. In spite of an apparently erroneous report, this is probably not a South American species.

- The prominent lateral lobes of the distal penis segment are located in the proximal half of the segment. The tenth segment of the abdomen is very much elevated and constricted dorsoventrally (**Fig. 3.1.600**). 24

Fig. 3.1.600 *Acanthagrion ascendens* (left to right): apex of the penis of two specimens, one from a specimen labeled *Acanthagrion ascendens* and the other labeled *A. luteum* in ventral view (above) and the apical segments of the penis in lateral view (below); apex of the male abdomen in lateral view, the superior anal appendage in dorsomedial view, and the synthorax of a female in ventral view. Based on Rácenis (1958) and Tennessen (2003).

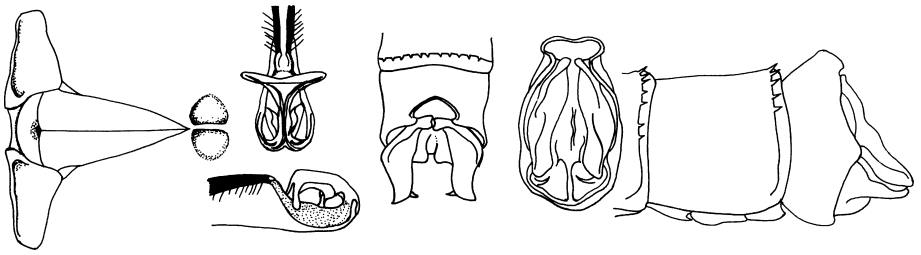


Fig. 3.1.601 *Acanthagrion quadratum* (left to right): mesostigmal fossae of the female, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

24. The lateral lobes on the distal penis segment are curved cephalad and wider at the apex than at the base (**Fig. 3.1.602**). Length of abdomen: 24 to 30 mm. Hind wing length: 15.5 to 19.5 mm. The head is mainly black with blue markings and light tan or buff on the labium and exposed parts of the maxillae. The thorax is mainly black with blue markings. The abdomen is mainly black with a few blue markings, including light blue markings on the first and second segments and slate blue on the seventh and eighth segments.
.....*Acanthagrion trilobatum* Leonard, 1977 (Southern Panama, Colombia, Ecuador, Venezuela).
- The lateral lobes on the distal penis segment are recurved caudad and narrower at the apex than at the base (**Fig. 3.1.600**). 25

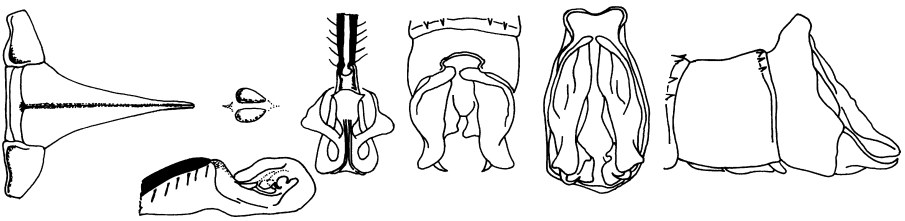


Fig. 3.1.602 *Acanthagrion trilobatum* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

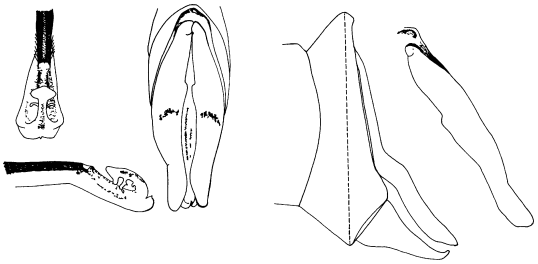


Fig. 3.1.603 *Acanthagrion aepiolum* male (left to right): apical segments of the penis in ventral (above) and lateral view (below), apex of the abdomen in posterior and lateral view with a broken line showing where the height is measured, and the superior anal appendage. Based on Tennessen (2003).

25. There are two pairs of patches of fine setae on the second segment of the penis. In lateral view, the genital ligula protrudes posteriad at the junction of the two apical segments of the penis. The superior anal appendage of the male is constricted subapically (**Fig. 3.1.600**). The maximum length of the superior anal appendage usually ranges from 1.21 to 1.41 mm. The tenth segment of the abdomen, measured obliquely to record its maximum height, is 1.31 to 1.53 mm. The head is black and shades of green with buff on the postgenae and exposed parts of the maxillae and olivaceous postocular spots.
.....*Acanthagrion ascendens* Calvert, 1909 (Trinidad, Colombia, Venezuela, Guyana, Surinam, Ecuador, Peru, Paraguay, Argentina, Santa Catarina, São Paulo, Goiás, Mato Grosso, Rondônia). Syn: *Acanthagrion luteum* Racenis, 1958.
- There are no patches of fine setae on the second segment of the penis. In lateral view, there is no indication of the genital ligula protruding posteriad at the junction of the two apical segments of the penis. The maximum length of the superior anal appendage usually ranges from 1.77 to 2.09 mm. The tenth segment of the abdomen, measured obliquely to record its maximum height, is

1.65 to 1.93 mm (**Fig. 3.1.603**). Total length of male: 30.2 to 33.6 mm. Length of male abdomen: 25.0 to 27.8 mm. Hind wing length of male: 16.1 to 18.6 mm. The female has not been described.
.....*Acanthagrion aepiolum* Tennessen, 2004 (Peru, Bolivia, Argentina, Minas Gerais, São Paulo, Rondônia). Syn: *Acanthagrion ascendens* nec Calvert, 1909.
26. The inner surface of the superior appendage is lighter in color than the outer surface, and its surface texture is duller than the outer; the line separating the colors is marked by a deeply impressed groove. In ventral view, modifications of the distal penis segment are visible (**Fig. 3.1.599**). 27
- The color and surface texture on the superior appendage are uniform. In case of doubt, the modifications on the ental surface of the distal penis segment are not clearly visible when viewed ventrally (**Fig. 3.1.604**). 34

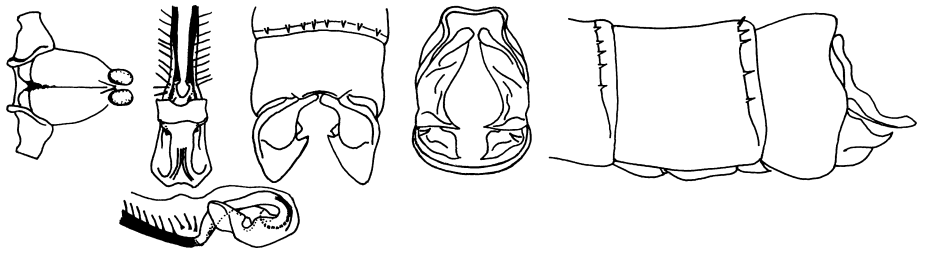


Fig. 3.1.604 *Acanthagrion adustum* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

27. The inferior anal appendage of the male forms robust hooks that bend dorsad (**Fig. 3.1.599**). Length of abdomen: 24 to 26 mm. Hind wing length: c. 16 mm. The color is mainly black, greenish blue and greenish yellow. The labium is ivory white. The female has not been described.
.....*Acanthagrion cuyabae* Calvert, 1909 (Bolivia, Argentina, Mato Grosso, São Paulo, Rio Grande do Sul). Syn: *Acanthagrion cuyabae fimense* Calvert, 1909; *Acanthagrion cuyabae freirense* Calvert, 1909; *Acanthagrion leonardi* Jurzitza, 1980.
- The inferior anal appendage of the male does not form robust hooks bending dorsad (**Fig. 3.1.605**). 28
28. The apical penis segment is rather narrow basomesally and slightly expanded at the apex; it has membranous lateral lobes produced from either side of the mesal region. The tenth abdominal segment is clearly higher than the ninth in lateral view. The superior appendages are either subplanate or concave in lateral view (**Fig. 3.1.605**). 29

- The apical penis segment is broad and approximately uniform in width for its entire length, except for the extreme tip, which is slightly expanded. The tenth abdominal segment is slightly higher than the ninth. The superior anal appendages are very much constricted subbasally and subapically. The inferior anal appendages are sharply recurved at the tip (**Fig. 3.1.606**). 32

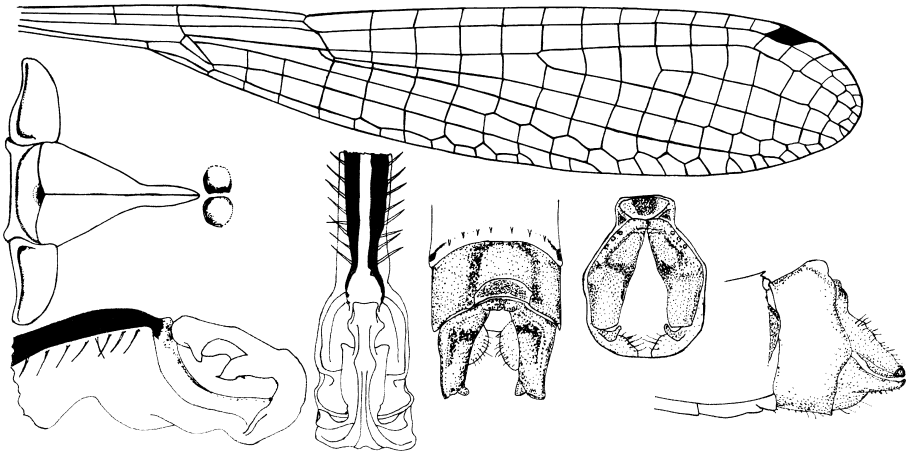


Fig. 3.1.605 *Acanthagrion gracile:* fore-wing (above) and (below, left to right): mesepisternal fossae of a female (above), penis in lateral (below) and ventral view; apex of the male abdomen in dorsal, posterior, and lateral view. Based on Munz (1919) and Leonard (1977).

29. The apical segment of the penis is simple and short, directed dorsad and not laterad (**Fig. 3.1.605**). The general coloration is azure blue with black markings. The wings are hyaline. 30
- The lateral lobes on the apical segment of the penis extend beyond the lateral borders of the second segment and are directed laterad and anteriad (**Fig. 3.1.606**). 31

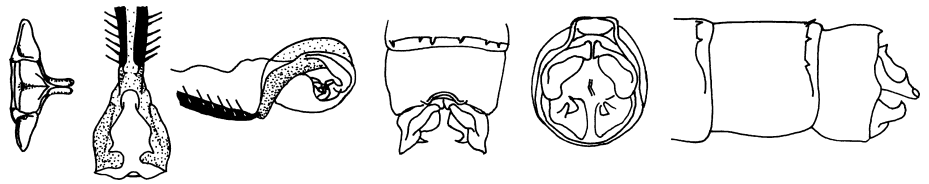


Fig. 3.1.606 *Acanthagrion truncatum* (left to right): female mesepisternal fossae, penis in ventral and lateral view, and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

30. The penis lacks a long tongue-like process that extends obliquely anteroventrad from the third segment (**Fig. 3.1.605**). Length of abdomen: 23 to 26 mm. Hind wing length: 15 to 17 mm. The head is black with bluish and greenish markings. The thorax is brightly colored with blue, olive, yellow, and brown on black. The first seven abdominal segments are black dorsally, usually with azure blue lateral markings. The eighth and ninth segments are blue, and the tenth is black dorsally and brown ventrally.
.....*Acanthagrion gracile* (Rambur, 1842)
(Mexico, Central America, Colombia, Ecuador, Peru, Bolivia, Paraguay, Uruguay, Argentina, Bahia, São Paulo, Rio de Janeiro, Rio Grande do Sul; Mato Grosso). Syn: *Agrion gracile* Rambur, 1842; *Agrion gracile* var. *cuneatum* Selys, 1876; *Agrion gracile* var. *maculae* Sjöstedt, 1918; *Acanthagrion* race *minarum* Selys, 1876.

- The penis bears a long tongue-like process that extends obliquely anteroventrad from the third segment (**Fig. 3.1.608**). Length of male abdomen: 25 mm; hind wing: 16 mm. Color of male: Azure blue with black markings. Wings hyaline. The female has not been described.
.....*Acanthagrion floridense* Fraser, 1946
(Colombia). Syn: *Acanthagrion gracile floridense* Fraser, 1946.

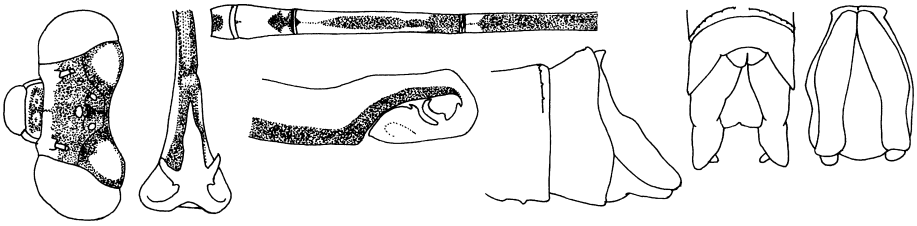


Fig. 3.1.607 *Acanthagrion peruanum* male (left to right): head in dorsal view, penis in ventral and lateral view (lower left center), color pattern on the first four segments of the abdomen (upper center), and apex of the abdomen in lateral (lower right center), dorsal, and posterior view. Based on Schmidt (1942).

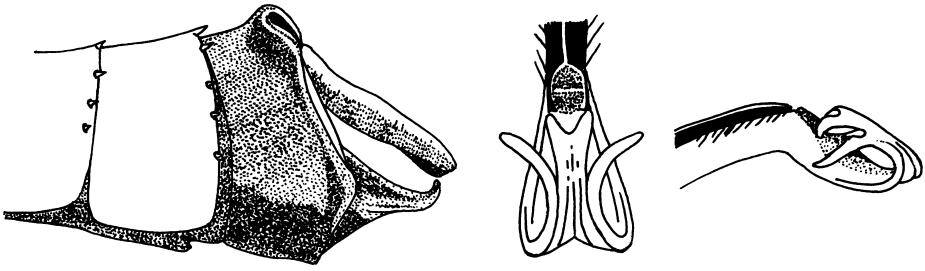


Fig. 3.1.608 *Acanthagrion floridense* male (left to right): apex of the abdomen in lateral view and penis in ventral and lateral view. Based on Fraser (1946a).

31. The lateral profile of the posterior border of the superior anal appendage is nearly straight, and the basal extremities of that appendage are directed dorsad and reach the level of the apex of the tenth abdominal segment. The distal penis segment has a pair of short, heavy, sclerotized hooks on the caudal margin of its lateral lobes on each side of the midline (**Fig. 3.1.607**). Length of male abdomen: c. 25.5 mm. Hind wing length of male: c. 17 mm.
.....*Acanthagrion peruanum* Schmidt, 1942 (Peru). Syn: *Acanthagrion deceptum* Leonard, 1977.

- In lateral view, the posterior border of the superior anal appendages appears concave, and its basal extremities do not reach the apical margin of the tenth abdominal segment (**Fig. 3.1.609**). The apical penis segment has lateral lobes that are long, simple, and tapering. Length of abdomen: 24 to 26 mm. Hind wing length: 16 to 17 mm. The head is mainly light blue, greenish blue, and black with blue postocular spots, cream and brownish maxillae, and pale buff postgenae. The thorax is mainly black with light blue and flesh-colored markings. The abdomen is mainly black dorsally with blue markings, including one covering the eighth and ninth segments. The lateral surfaces of the abdomen are mainly bluish.
.....*Acanthagrion peruvianum* Leonard, 1977 (Ecuador, Peru, Argentina, Rondônia).

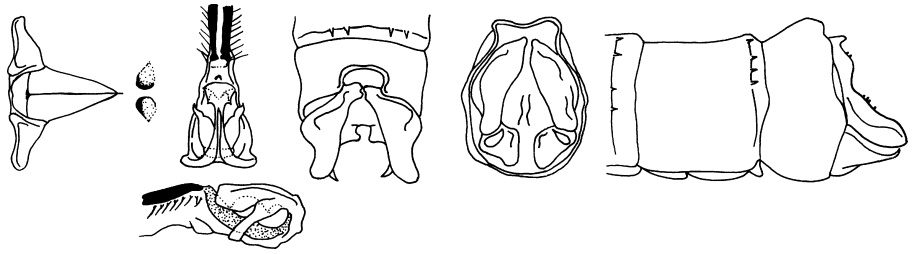


Fig. 3.1.609 *Acanthagrion peruvianum* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

32. The terminal expansion of the distal penis segment is most noticeable when viewed laterally. The transverse double fold of the ental surface does not reach the lateral margins of the distal segment. The posterior face of the superior anal appendage is rounded at the apex (**Fig. 3.1.606**). Length of abdomen: 19.5 to 21.5 mm. Hind wing length: 12 to 13.5 mm. The posterior surface of the head is entirely pale yellow, while the face has blue, greenish blue, brown, and black markings. The maxillae are yellow. The thorax is mainly blue, black, and yellow; the abdomen is mainly black dorsally and blue laterally, but the entire dorsal surfaces of the eighth and ninth segments are blue.
.....*Acanthagrion truncatum* Selys, 1876 (Venezuela, Guyana, Minas Gerais, São Paulo, Mato Grosso).

- The terminal expansion of the distal penis segment is most noticeable when viewed ventrally. The transverse double fold of the ental surface extends beyond the lateral margins of the distal segment; making it appear hollow with rounded lobes visible in ventral view. The superior anal appendage is square in form at the apex (**Fig. 3.1.610**). 33

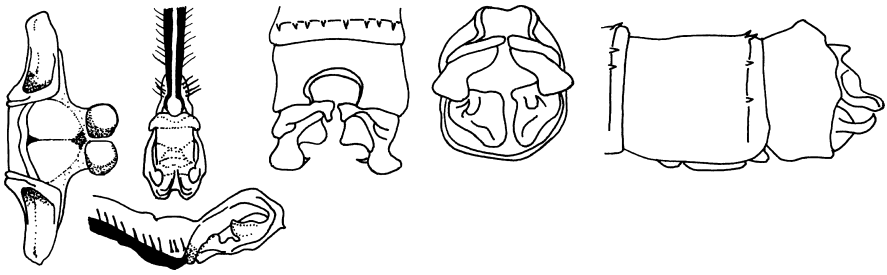


Fig. 3.1.610 *Acanthagrion viridescens* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

33. The hollow lateral lobes of the distal penis segment are barely visible is ventral view. The terminal expansion is slight, and the remainder of the distal segment is uniformly wide. The tubercle at the dorsal end of the superior appendages is prominent (**Fig. 3.1.610**). Length of abdomen: 20 to 24.5 mm. Hind wing length: 14 to 16.5 mm. The head is bluish green and yellowish green with black markings and yellowish white maxillae. The thorax is mainly black with bluish and olive green markings. The abdomen is mainly black dorsally and green laterally, but the eighth and ninth segments are blue.
.....*Acanthagrion viridescens* Leonard, 1977
(Ecuador, Bolivia, Rondônia).

- The hollow lateral lobes of the distal penis segment are plainly visible is ventral view and overlap the lateral margin of the second segment. The tubercle at the dorsal end of the superior appendages is very small (**Fig. 3.1.611**). Length of abdomen: 23 to 26 mm. Hind wing length: 15 to 18 mm. The head is mainly greenish blue with black markings and light brown on the maxillae and labium. The thorax is mainly blue and black with some yellow mixed in near the intersternite. The abdomen is mainly black dorsally and blue or brownish laterally with the eighth and ninth segments entirely blue and the tenth segment brown.
.....*Acanthagrion lancea* Selys, 1876
(Ecuador, Peru, Paraguay, Argentina, Rio Grando do Sul, São Paulo, Santa Catarina).

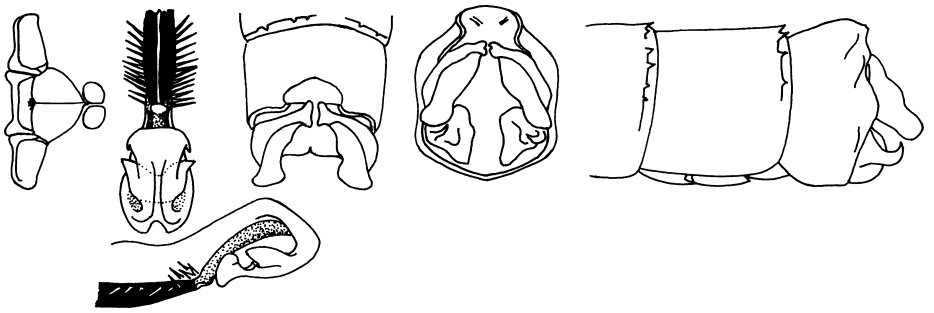


Fig. 3.1.611 *Acanthagrion lancea* (left to right): female mesepisternal fossae, penis in ventral (above) and lateral view (below), and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

34. The superior appendages slant toward the inferior ones from the base to the apex; their apices are rounded, truncate, or spatulate, never acutely pointed. The distal penis segment in incised apically (**Fig. 3.1.604**). 35
- The superior appendages are directed posteriad and do not obviously slant toward the inferior ones. The tips of these appendages are acutely pointed or each bears a small, angular, apical tubercle (**Fig. 3.1.612**). 39

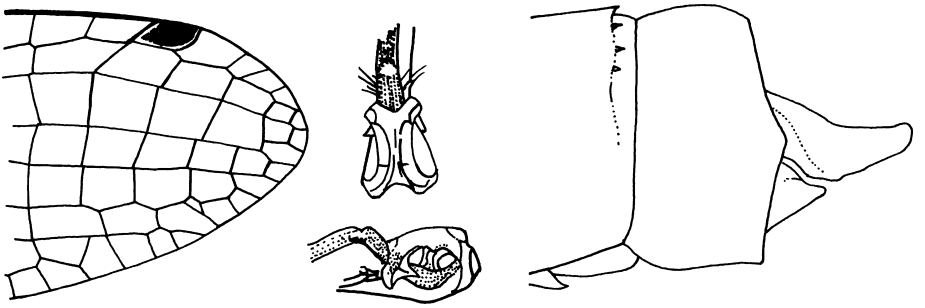


Fig. 3.1.612 *Acanthagrion chacoense* male (left to right): apex of the fore-wing, penis in ventral (above) and lateral view (below), and apex of the abdomen. Based on De Marmels (1989a).

35. The superior anal appendage of the male appears parallel-sided and truncate in lateral view, giving a quadilateral silouette without evidence of processes. It curves evenly ventrad to almost touch the inferior appenage, which has a high base and narrow apical process, which ends in an acute apex curving dorsad. The third segment of the penis has an internal carina, and there are thick lateral processes at the junction with the second segment (**Fig. 3.1.613**). The head has

black, blue, green, and yellow markings, while the thorax is mainly black with blue markings, and the abdomen is blue with prominent longitudinal black dorsal markings on the first seven and the tenth segments. Length of male abdomen: c. 22 mm. Hind wing length of male: c. 15 mm. The female has not been described.
.....*Acanthagrion hildegarda* Gloger, 1967 (Argentina, Uruguay).
- The superior anal appendage is conical or irregular in lateral profile (**Fig. 3.1.614**). 36

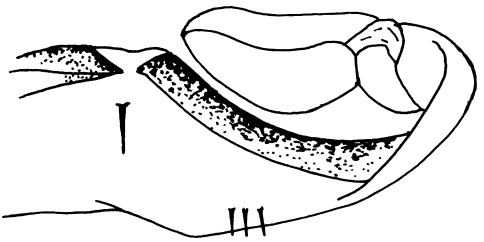


Fig. 3.1.613 Penis of *Acanthagrion hildegarda* in lataral view. Based on Bulla (1975).

36. The ental surface of the penis is emarginated along the midline at the apex, and a pair of prominent lateral processes extends laterad, curving slightly toward the base at their apices. The abdomen is mainly black, but the eighth through tenth abdominal segments are blue with a black marking at the apex of the tenth (**Fig. 3.1.341**). Length of abdomen: 25 to 27 mm. Hind wing length: 16 to 18 mm.
.....*Acanthagrion taxaense* Santos, 1965 (Argentina, Rio de Janeiro). Syn: *Acanthagrion taxaensis* Santos, 1965 (error in Latin grammar).
- The penis has an acutely pointed median lobe or a rounded transverse ridge on the ventral surface (**Fig. 3.1.614**). 37
37. There is a rounded transverse ridge on the ental surface of the apical penis segment located at about 1/3 of the way from the base to the apex. In posterior view, the apices of the superior anal appendages appear rounded (**Fig. 3.1.614**). Length of abdomen: 17 to 20 mm. Hind wing length: 13 to 14.5 mm. The head is mainly bluish green, olive green, and black with a light cream color on the labium and maxillae. The thorax is mainly light blue and black, and the abdomen in mainly black dorsally and blue laterally, except for the eighth and ninth segments, which are blue dorsally except for a black basal triangular spot on the eighth. The female has not been described.
.....*Acanthagrion minutum* Leonard, 1977 (Peru, Bolivia, Venezuela, São Paulo).

- There is a membranous acutely pointed median lobe on the ental surface of the apical penis segment located at about half way from the base to the apex. In posterior view, the apices of the superior anal appendages do not appear rounded (**Fig. 3.1.604**). 38

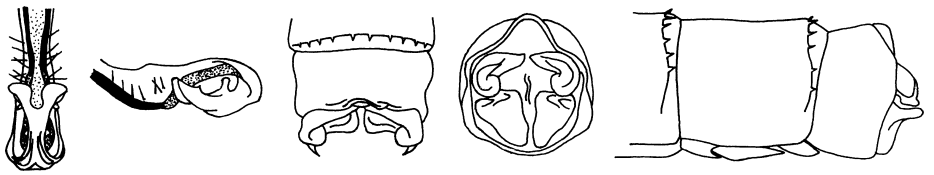


Fig. 3.1.614 *Acanthagrion minutum* male (left to right): penis in ventral and lateral view, and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

38. The apex of the penis has a shallow midline indentation. The superior anal appendages appear as flattened plates in dorsal and posterior view (**Fig. 3.1.604**). Length of abdomen: 20 to 23 mm. Hind wing length: 13.5 to 15 mm. The head is mainly black marked with orange and various shades of brown. The labium is yellowish white, and the maxillae are light brown. The thorax is multi-colored, mainly greenish yellow, reddish brown, and brownish green with prominent black stripes. The abdomen is mainly black dorsally and yellowish or brownish green ventrolaterally, with part of the eighth and all of the ninth segments bluish.
.....*Acanthagrion adustum* Williamson, 1916 (Venezuela, Guyana, Surinam, Pará, Amazonas, Roraima, Rondônia).

- The apex of the penis is deeply emarginate along the midline, and the apical expansion is bifurcate on either side. The superior anal appendages are not flattened plates, and the apices are strongly divaricate (**Fig. 3.1.615**). Length of abdomen: 22.5 to 23.5 mm. Hind wing length: 14 to 16 mm. The head is black with greenish and greenish blue markings, a cream-colored labium, and light brown on the maxillae. The thorax is extensively black marked with light blue and light green coxae and trochanters. Except for the blue eighth and ninth segments, the abdomen is almost entirely black dorsally and laterally. The female has not been described.
.....*Acanthagrion indefensum* Williamson, 1916 (Venezuela, Guyana, French Guiana, Surinam,).

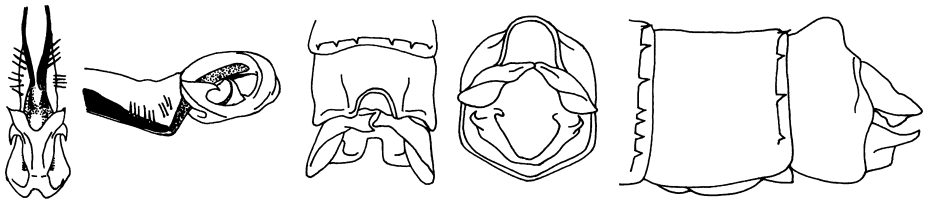


Fig. 3.1.615 *Acanthagrion indefensum* male (left to right): penis in ventral and lateral view, and apex of the abdomen in dorsal, posterior, and lateral view. Based on Leonard (1977).

39. The superior and inferior anal appendages are nearly equal in length, and the superior appendages each terminate in a small, angulate tubercle (**Fig. 3.1.616**). Length of abdomen: 24.5 to 25.5 mm. Hind wing length: 15.5 to 17 mm. The head is mainly black with light green or yellow markings, including green postocular spots. The thorax is mainly black dorsally and yellow laterally. The first seven abdominal segments and the tenth are mainly blackish metallic green dorsally and laterally. The eighth and ninth segments are blue with a narrow apical black band. The ventral surface of the entire abdomen is yellow. The female has not been described.
.....*Acanthagrion latapistylum* Calvert, 1899 (Paraguay).
- The superior anal appendages are much longer than the inferior appendages, generally directed posteriad, and curve somewhat dorsad at the apex (**Fig. 3.1.617**). 40

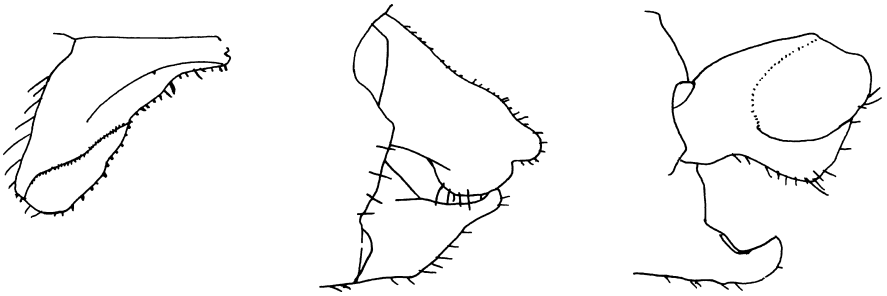


Fig. 3.1.616 *Acanthagrion latapistylum* male (left to right): the left superior anal appendage in dorsal view, the anal appendages in lateral view, and the apex of the abdomen with the left superior appendage removed to reveal the inner side of the right superior appendage. Based on Calvert (1899).

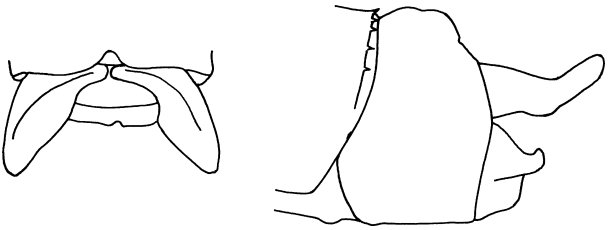


Fig. 3.1.617 *Acanthagrion chararum* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Calvert (1909).

40. Viewed laterally, the superior anal appendages gradually taper to an acute point; the tips are bent very slightly (**Fig. 3.1.612**). Length of abdomen: 25 to 26 mm. Hind wing length: c. 17 mm. The head is mainly black with a few bluish markings. The thorax and abdomen are mainly black with bluish markings, including one covering the eighth and ninth abdominal segments. The female has not been described.
.....*Acanthagrion chacoense* Calvert, 1909 (Venezuela, Peru, Bolivia, Mato Grosso do Sul).
- The superior anal appendages are bent dorsad, forming an obtuse angle at the midlength; the apices are blunt (**Fig. 3.1.617**). Length of abdomen: 26 to 28.5 mm. Hind wing length: 18 to 19.5 mm. The head is mainly black with some blue markings, including very large postocular spots. The thorax is blackish brown with reddish brown and bluish markings. The first, second, eighth, ninth, and tenth abdominal segments are largely blue, and the rest are mainly black with blue basal rings. The female has not been described.
.....*Acanthagrion chararum* Calvert, 1909 (Mato Grosso).

Key to the species of known adult female *Acanthagrion* from South America

Information was provided by Calvert (1909), Leonard (1977), and De Marmels (1985d, 1989a,b). Providing a key to the females is somewhat premature because information on many of them is lacking or sketchy. The females of *Acanthagrion aepiolum, A. chararum, A. cuyabae, A. floridense, A. hartei, A. hermosae, A. hildegarda, A. indefensum, A. inexpectum, A. latapistylum, A. minutum,* and *A. williamsoni* have not yet been described, and those of *A. chacoense* and *A. taxaense* have not been described in sufficient detail to place the species in the key.

1. The tibial spines are definitely as long or longer than the spaces separating them. 2
- The tibial spines are shorter than the spaces separating them. 6

2. The outer border of each mesepisternal fossa is distinct. The posterolateral borders of the interlaminar sinus are obviously sinuate. The mesostigmal laminae are subplanar except for an admesal ridge along the posterior border (**Fig. 3.1.581**).
.....*Acanthagrion longispinosum* Leonard, 1977 (Bolivia, Rondônia)
- The mesepisternal fossae have poorly defined outer margins (**Fig. 3.1.578**). ..3
3. The labrum is dark brown. The posterolateral borders of the interlaminar sinus are straight. The mesostigmal lamina is depressed in the middle and elevated peripherally (**Fig. 3.1.578**). Length of female abdomen: 20.5 to 23 mm. Hind wing length of female: 14 to 16 mm.
.....*Acanthagrion rubrifrons* Leonard, 1977 (Venezuela, Guyana, Amazonas, Pará).
- The labrum of the female is pale, usually orange or yellow, sometimes with a greenish tinge, or green. The mesostigmal lamina is not depressed in the middle and elevated peripherally (**Fig. 3.1.582**). 4
4. In life, the labrum, labium, mandibles, portions of the clypeus, and much of the posterior surface of the head are green; these are blue in the male. The posterior margin of the prothorax is straight in the middle (**Fig. 3.1.595**). Total length: c. 34 to 35 mm. Length of abdomen: c. 26 mm. Hind wing length: c. 21 to 22 mm.
.....*Acanthagrion imeriense* De Marmels, 1989 (Venezuela).
- The pale areas of the head are usually orange or yellow, sometimes with a greenish tinge. 5
5. The mesostigmal lamina is longer than wide (**Fig. 3.1.582**). Total length: 30 to 34 mm. Length of female abdomen: 24 to 27 mm. Hind wing length of female: 17 to 19 mm.
.....*Acanthagrion tepuiense* De Marmels, 1985 (Venezuela).
- The mesostigmal lamina is wider than long (**Fig. 3.1.580**). Total length: c. 28.5 mm. Length of female abdomen: c. 22 mm. Hind wing length of female: c. 17 mm.
.....*Acanthagrion dichrostigma* De Marmels, 1985 (Venezuela).
6. Mesepisternal fossae are absent, although tiny holes are sometimes observed in their place, apparently scars from mating. The posterior margin of the prothorax is almost straight. The ovipositor almost reaches the posterior margin of the tenth abdominal segment (**Fig. 3.1.589**). Total length: 32 to 35 mm. Length of female abdomen: 26 to 28.5 mm. Hind wing length of female: 18 to 20 mm. The head is mainly blue with a yellow labium and a brown spot on the labrum, and a ferrugineous occiput with vaguely defined postocular spots, which each have about 10 brown spots in them, most bearing a tiny seta. The thorax is mainly ferrugineous marked with blue. The abdomen is mainly blue with ferrugineous markings, but the seventh segment and basal half of the

eighth are dark brown or black. The legs are mainly cream-colored, but the apices of the femora and tibiae and the spines are brown.
.....*Acanthagrion fluviatile* (De Marmels, 1984) (Venezuela). Syn: *Oxyagrion fluviatile* De Marmels, 1984.
- Mesepisternal fossae are present (**Fig. 3.1.584**). 7
7. The mesostigmal lamina is crossed diagonally by a strong fold. The subtriangular area between this fold and the admesal borders of the lamina is subplanar (**Fig. 3.1.584**). 8
- The mesostigmal border is strongly emarginate along the anterior border (**Fig. 3.1.583**). 11
8. The mesepisternal fossae are heart-shaped and broadly confluent posteriorly; they are separated anteriorly by a low, thin septum (**Fig. 3.1.584**).
.....*Acanthagrion jessei* Leonard, 1977 (Rondônia).
- The mesepisternal fossae are elliptical and separated along the midline (**Fig. 3.1.585**). 9
9. The pointed end of the mesepisternal fossa is directed laterad; its margin at this point is indistinct and merges with the mesepisternal surface (**Fig. 3.1.585**).
.....*Acanthagrion temporale* Selys, 1876 (Venezuela, Argentina, Roraima, Bahia, Minas Gerais, São Paulo, Mato Grosso).
- The pointed end of the mesepisternal fossa is directed mesad, and its periphery is indistinctly impressed (**Fig. 3.1.586**). 10
10. The mesepisternal fossae encroach on the interlaminar sinus; the pointed ends of the fossae are directed cephalad (**Fig. 3.1.586**).
.....*Acanthagrion abunae* Leonard, 1977 (Guyana, Paraguay, Rondônia).
- The interlaminar sinus is fully intact; the fossae adjoin it but are distinct from its posterior end. The pointed ends of the fossae are directed caudad (**Fig. 3.1.579**).
.....*Acanthagrion amazonicum* Sjoestedt, 1918 (Amazonas, Rondônia)
11. The portion of the mid-dorsal carina separating the mesepisternal fossae is always considerably elevated to form a tubercle, which is broad on top (**Fig. 3.1.583**). 12
- If the portion of the mid-dorsal carina separating the mesepisternal fossae is elevated, it is always narrow (**Fig. 3.1.600**). 14
12. The mesostigmal laminae are impressed in the middle and elevated peripherally. The mesepisternal tubercle is erect (**Fig. 3.1.583**).
.....*Acanthagrion phallicorne* Leonard, 1977 (Ecuador, Peru, Rondônia).
- The mesostigmal laminae are subplanar except for the anteriomesal ridge. The mesepisternal tubercle leans cephalad (**Fig. 3.1.590**). 13
13. The distance between the mesepisternal tubercle and the anterior margin of the interlaminar sinus is much greater than the width of the sinus plus that of the

mesostigmal laminae. This tubercle is impressed deeply along the middorsal line (**Fig. 3.1.590**). The sinus has concave posterolateral margins.
.....*Acanthagrion apicale* Selys, 1876 (Venezuela, Guyana, French Guiana, Colombia, Ecuador, Peru, Bolivia, Pará, Rondônia). Syn: *Acanthagrion apicale descendens* Fraser, 1946.
- The distance between the mesepisternal tubercle and the anterior margin of the interlaminar sinus is much less than the width of the sinus plus that of the mesostigmal laminae. The dorsal surface of the tubercle is glabrous (**Fig. 3.1.591**). The sinus has convex posterolateral margins.
.....*Acanthagrion obsoletum* (Förster, 1914) (Colombia, Ecuador, Peru, Bolivia). Syn: *Myagrion obsoletum* Förster, 1914; *Acanthagrion leonora* Gloger, 1967; *Acanthagrion luna* Ris, 1918.
14. A sharply defined ridge marks the posterolateral margin of the interlaminar sinus, which has a flat dorsal surface (**Fig. 3.1.622**).
.....*Acanthagrion ablutum* Calvert, 1909 (Argentina, Bolivia, Paraguay, Uruguay).
- A narrowly impressed suture marks the posterolateral margin of the interlaminar sinus (**Fig. 3.1.600**). 15
15. The interlaminar sinus is subplanar; a narrowly impressed groove runs along its median line, or, if it is concave, the fossae are separated from the posterior end of the sinus by more than their own length, and their long axes are parallel to the mid-dorsal carina. The fossae are never confluent (**Fig. 3.1.600**). 16
- The interlaminar sinus is concave and V-shaped in cross section. The fossae are separated from the posterior end of the sinus by less than their own length, or, if by more than their length, their long axis is transverse to the mid-dorsal carina (**Fig. 3.1.606**). 19
16. The mesepisternal fossae are separated from the posterior end of the interlaminar sinus by more then their own length. The sinus is deeply concave (**Fig. 3.1.600**). 17
- The mesepisternal fossae are separated from the posterior end of the interlaminar sinus by less then their own length. The sinus is subplanar (**Fig. 3.1.600**). 18
17. The distance between a mesepimeral fossa and the sinus is double the length of the fossa. The mid-dorsal carina does not fade out between the mesepimeral fossae and the posterior end of the interlaminar sinus (**Fig. 3.1.600**).
.....*Acanthagrion ascendens* Calvert, 1909 (Trinidad, Colombia, Venezuela, Guyana, Surinam, Ecuador, Peru, Paraguay, Argentina, Santa Catarina, São Paulo, Goiás, Mato Grosso, Rondônia). Syn: *Acanthagrion luteum* Racenis, 1958.
- The distance between a mesepimeral fossa and the sinus is only slightly more than the length of the fossa. The mid-dorsal carina fades out between the mesepimeral fossae and the posterior end of the interlaminar sinus (**Fig. 3.1.602**).
.....*Acanthagrion trilobatum* Leonard, 1977 (Southern Panama, Colombia, Ecuador, Venezuela).

18. The posterolateral margins of the interlaminar sinus are concave; the sinus is about the same width as each mesostigmal lamina (**Fig. 3.1.598**).
.....*Acanthagrion kennedii* Williamson, 1916 (Panama, Trinidad, Tobago, Venezuela, Pará).
- The posterolateral margins of the interlaminar sinus are convex; the sinus is much narrower than each mesostigmal lamina (**Fig. 3.1.601**).
.....*Acanthagrion quadratum* Selys, 1876 (United States, Mexico, Central America, Brazil?). Syn: *Acanthagrion gracile* var. *quadratum* Selys, 1876. In spite of an apparently erroneous report, this is probably not a South American species.
19. The mesepisternal fossae are confluent, or they are separated from each other by more than their own width (**Fig. 3.1.597**). 20
- The mesepisternal fossae are never confluent. The interlaminar sinus is subplanate with a narrowly impressed groove along its midline. If they are concave, the distance between the fossae and the posterior end of the sinus is greater than their own length, and they are parallel to the longitudinal axis of the middorsal carina (**Fig. 3.1.610**). 21
20. The mesepisternal fossae are confluent, with the free parts separated by a low, narrow septum; their long axis is parallel to the middorsal carina. The interlaminar sinus has sinuate posterolateral margins (**Fig. 3.1.597**). Length of abdomen: 24 to 28 mm. Hind wing length: 17 to 19 mm.
.....*Acanthagrion yungarum* Ris, 1918 (Ecuador, Peru).
- The distance between the mesepisternal fossae is greater than the width of one fossa. The interlaminar sinus has straight posterolateral margins (**Fig. 3.1.598**).
.....*Acanthagrion vidua* Selys, 1876 (Trinidad, Venezuela, Bolivia). Syn: *Acanthagrion risi* Leonard, 1977.
21. The mesepisternal fossae are much longer than wide and slightly divaricate anteriad (**Fig. 3.1.606**).
.....*Acanthagrion truncatum* Selys, 1876 (Venezuela, Guyana, Minas Gerais, São Paulo, Mato Grosso).
- The mesepimeral fossae are rounded or elliptical (**Fig. 3.1.610**). 22
22. The mesepisternal fossae encroach strongly on the interlaminar sinus. The posterolateral margins of the sinus are deeply concave (**Fig. 3.1.610**).
.....*Acanthagrion viridescens* Leonard, 1977 (Ecuador, Bolovia, Rondônia).
- The interlaminar sinus is not interrupted. Its posterolateral margin is convex or sinuous (**Fig. 3.1.611**). 23
23. The mesepimeral fossae are separated from the anterior margin of the interlaminar sinus by a distance about equal to the greatest length of one mesostigmal lamina. The posterolateral margins of the sinus are smoothly convex (**Fig. 3.1.611**).
.....*Acanthagrion lancea* Selys, 1876 (Ecuador, Peru, Paraguay, Argentina, Rio Grando do Sul, São Paulo, Santa Catarina).

- The mesepimeral fossae are separated from the anterior margin of the interlaminar sinus by more than twice the greatest length of one mesostigmal lamina (**Fig. 3.1.604**). 24

24. The mesepimeral fossae adjoin or encroach on the posterior end of the interlaminar sinus (**Fig. 3.1.604**). 25

- The mesepimeral fossae and the posterior end of the interlaminar sinus are separated by a distance at least as great as the width of the fossae, which may be widely separated or confluent (**Fig. 3.1.609**). 26

25. The mesepisternal fossae encroach on the interlaminar sinus. The mesostigmal laminae are subplanar, except at the admesal ridge (**Fig. 3.1.604**). .....*Acanthagrion adustum* Williamson, 1916 (Venezuela, Guyana, Surinam, Amazonas, Pará).

- The mesepisternal fossae adjoin but do not encroach on the interlaminar sinus. Each mesostigmal lamina is bordered by an elevated ridge anteriorly and mesally (**Fig. 3.1.605**). .....*Acanthagrion gracile* (Rambur, 1842) (Mexico, Central America, Colombia, Ecuador, Peru, Bolivia, Paraguay, Uruguay, Argentina, Bahia, São Paulo, Rio de Janeiro, Rio Grande do Sul; Mato Grosso). Syn: *Agrion gracile* Rambur, 1842; *Agrion gracile* var. *cuneatum* Selys, 1876; *Agrion gracile* var. *maculae* Sjöstedt, 1918; *Acanthagrion* race *minarum* Selys, 1876.

26. The mesepisternal fossae are far apart and have indistinct lateral margins (**Fig. 3.1.609**). .....*Acanthagrion peruvianum* Leonard, 1977 (Ecuador, Peru, Argentina, Rondônia).

- The mesepisternal fossae are almost confluent, being separated by a low, narrow septum. The longitudinal axis of the fossae runs transverse to the mid-dorsal carina and has distinct margins (**Fig. 3.1.607**). .....*Acanthagrion peruanum* Schmidt, 1942 (Peru). Syn: *Acanthagrion deceptum* Leonard, 1977.

Information on the known *Acanthagrion* larvae from South America

Information was provided by Geijskes (1943), De Marmels (1990b, 1992a, 2007a), Muzón *et al.* (2001), and Pessacq *et al.* (2005). Too few of the larvae have been described to provide a reliable key. To distinguish those which have already been described, the following tentative notes are provided.

1. On each side of the prementum, there is only one long seta. At or apical to the midlength of each gill lamella, there is a clear fracture dividing an inner part with spined margins and an outer part with only tiny spines around the edges (**Fig. 3.1.618**). 2

- On each side of the prementum, there is a row of at least three setae, at least two of which are long (**Fig. 3.1.619**). 3

2. The wing buds reach beyond the midlength of the fifth abdominal segment. The lateral margins of the abdominal segments are nearly straight and directed somewhat laterad so that the middle segments are wider at the posterior than at the anterior margin (**Fig. 3.1.618**).
.....*Acanthagrion indefensum* Williamson, 1916 (Venezuela, Guyana, French Guiana, Surinam,).
- The wing buds do not reach the midlength of the fifth abdominal segment, ending just beyond the anterior margin of that segment. The lateral margins of the abdominal segments are somewhat convex so that their width at the anterior and posterior corners is subequal (**Fig. 3.1.620**).
.....*Acanthagrion adustum* Williamson, 1916 (Venezuela, Guyana, Surinam, Pará, Amazonas, Roraima, Rondônia).
3. The margins of the gill lamellae show little sign of a transverse fracture, and their margins are lined with only small spines or setae. On each side of the prementum, there is a row of three long and one short seta (**Fig. 3.1.619**). 4
- The gill lamellae show distinct signs of a fracture near the midlength, with an indentation of the margin or a transverse septum or both and a distinct change in the marginal armament from coarser basal spines to smooth edges with, at most, only a sparse line of weak, well-spaced setae. On each side of the prementum, there is a row of two long setae and a third about half as long as the other two or shorter (**Fig. 3.1.621**). 5

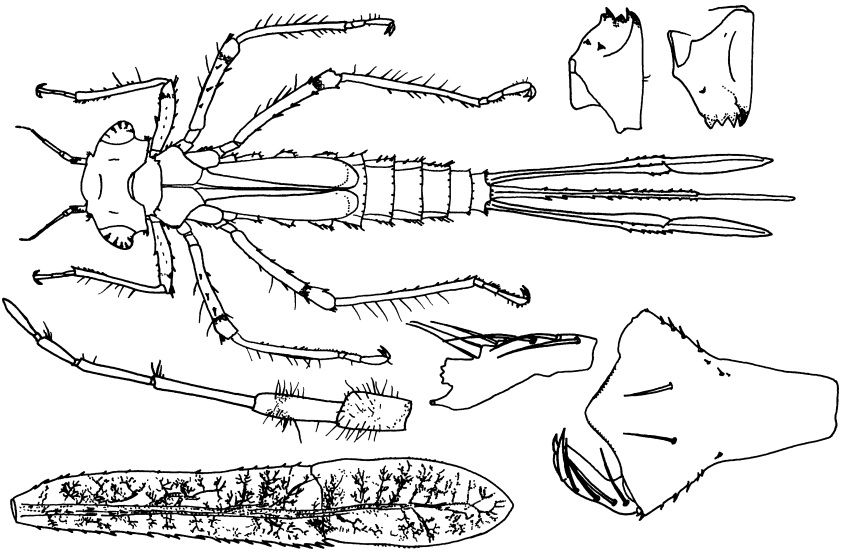


Fig. 3.1.618 *Acanthagrion indefensum* larva: habitus (upper left), enlarged antenna (middle left), left and right mandibles (upper right, left and right, respectively), inner surface of the labium (lower right), right palp of the labium (left of the labium), and the left lateral gill lamella (lower left). Based on Geijskes (1943).

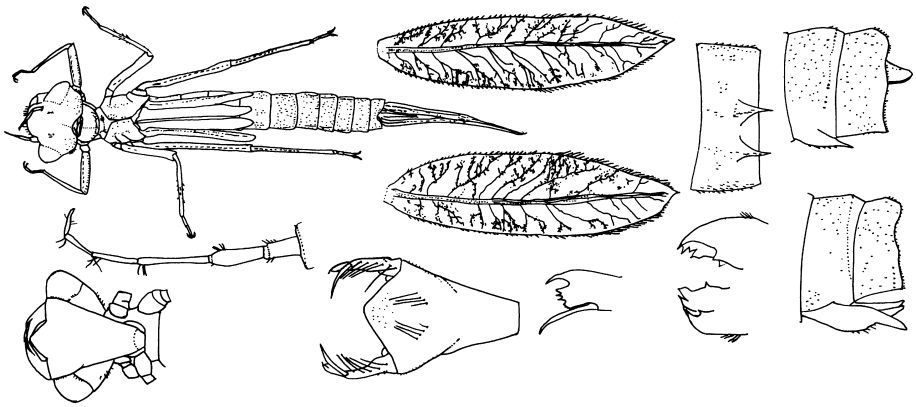


Fig. 3.1.619 *Acanthagrion imeriense* larva: habitus from a male exuvia (upper left), male antenna (middle left), head of a male showing the labium (lower left), labium of a male in dorsal view (lower middle left), apex of a labial palp in external view (lower center), apices of the mandibles in ventral view (lower right center), gonapophyses of a male in ventral view (upper right center), apices of a male (upper right) and a female abdomen (lower right), and a lateral (upper center) and middle gill lamella (center). Based on De Marmels (2007a).

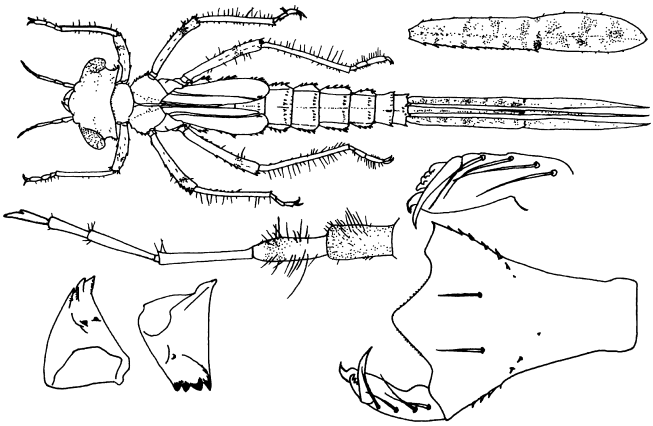


Fig. 3.1.620 *Acanthagrion adustum* larva: habitus (upper left), enlarged antenna (middle left), left and right mandibles (lower left, left and right, respectively), ental surfact of the labium (lower right), right labial palp (lower middle right), and left lateral gill lamella (upper right). Based on Geijskes (1943).

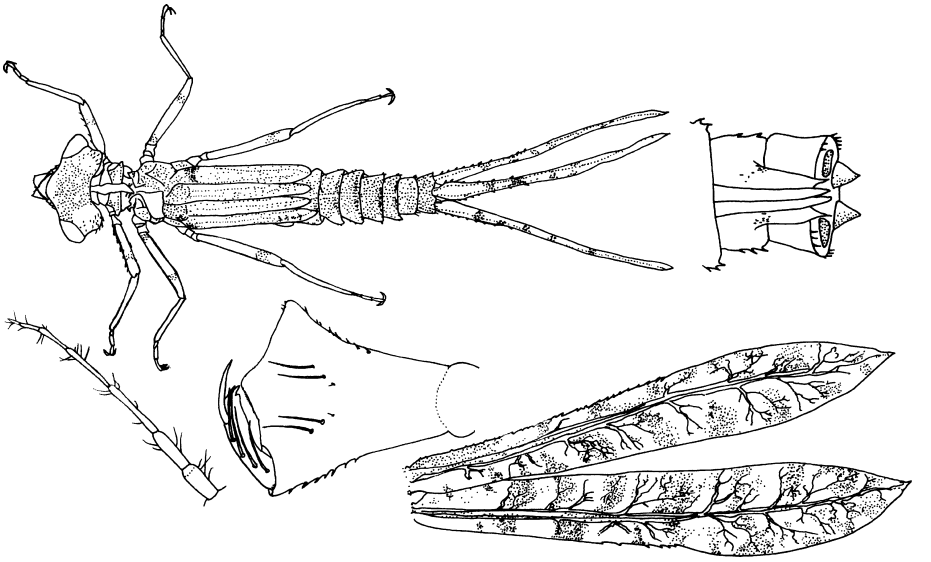


Fig. 3.1.621 *Acanthagrion apicale* larva: habitus (upper left), antenna (lower left), labium in dorsal view (lower center), apex of the abdomen in ventral view without the gill lamellae (upper right), median and a lateral gill lamella (lower right, above and below, respectively). Based on De Marmels (1992a).

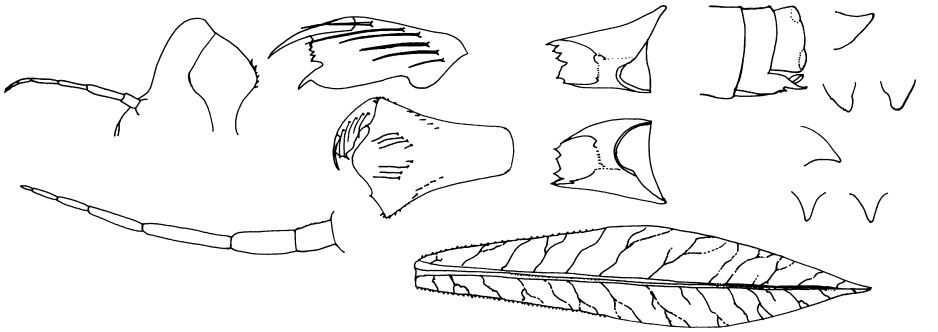


Fig. 3.1.622 *Acanthagrion ablutum* larva: right half of the head in dorsal view (upper left), antenna (lower left), prementum with one labial palp in dorsal view (left center) and a labial palp in dorsal view (upper left center), mandibles (upper center), apex of a female abdomen showing the gonapophyses (upper right center), cerci of a female in lateral and dorsal view (upper right, above and below, respectively), cerci of a male in lateral and dorsal view (middle right, above and below, respectively), and a lateral gill lamella (lower right). Based on Pessacq *et al.* (2005).

4. The gill lamellae have lateral margins that are convex from the base to the apex, so that the middle portion does not change much in width; there may be a trace of an indentation near the midlength of each lateral gill lamella. The two apical segments of the antenna may appear fused, making it seem that the antenna consists of six segments. The anterior margin of the prementum forms an angle of slightly more than 90º in the middle (**Fig. 3.1.619**).
.....*Acanthagrion imeriense* De Marmels, 1989 (Venezuela).

- Each gill lamella has lateral margins that run nearly straight for long distances, making the width appear much greater near the mid-length than near the base or apex. There is no sign of an indentation of the margin near the midlength. The antenna clearly consists of seven segments. The middle portion of the premental anterior margin is roundly convex (**Fig. 3.1.622**).
.....*Acanthagrion ablutum* Calvert, 1909 (Argentina, Bolivia, Paraguay, Uruguay).

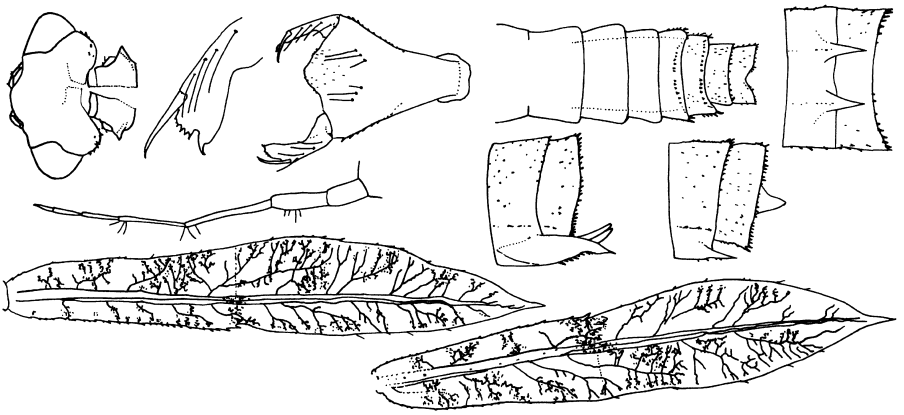


Fig. 3.1.623 *Acanthagrion vidua* larva from exuviae (upper row, left to right): head and pronotum of a male in dorsal view, labial palp of a male in dorsal view, labium in dorsal view, arrangement of spines on the abdominal segments of a male in dorsal view, and (middle row, left to right): male antenna, apex of the abdomen of a female and a male, and (below) the middle (left) and lateral gill lamella (right) of a male. Based on De Marmels (2007a).

5. The dorsal parts of the seventh and eighth segments have transverse rows of short preapical setae, and these segments are much shorter than the fourth and fifth. The third antennal segment is approximately 0.8 to 0.9 times as long as the first and second segments combined and 1.3 to 1.4 times as long as the fourth segment (**Fig. 3.1.623**).
.....*Acanthagrion vidua* Selys, 1876 (Trinidad, Venezuela, Bolivia). Syn: *Acanthagrion risi* Leonard, 1977.

- Short setae scattered on the eighth abdominal segment are not arranged in a preapical row, and the fourth, fifth, and seventh segments are subequal, or the seventh is the longest of the three (**Fig. 3.1.621**). 6
6. Five long setae are in the row on each labial palp proximal to the moveable hook. The three setae in a row on each side of the prementum are all relatively long. The third antennal segment is 0.8 to 0.9 times the length of the first and second combined. The antenna consists of seven segments.
.....*Acanthagrion hildegarda* Gloger, 1967 (Argentina, Uruguay).
- Four long setae are in the row on each labial palp. There are two long setae and a tiny one on each side of the prementum. The third antennal segment is less than 0.8 times as long as the first and second combined (**Fig. 3.1.621**). 7
7. The antenna appears to consist of six segments. Pale postocular areas surround large, dark lateral spots and are bordered by large crescents running posteriad from the inner margins of the compound eyes. The compound eyes occupy most of the anterior margin of the head (**Fig. 3.1.371**).
.....*Acanthagrion ascendens* Calvert, 1909 (Trinidad, Colombia, Venezuela, Guyana, Surinam, Ecuador, Peru, Paraguay, Argentina, Santa Catarina, São Paulo, Goiás, Mato Grosso, Rondônia). Syn: *Acanthagrion luteum* Racenis, 1958.
- The antenna consists of seven segments. Pale postocular areas form large round spots. The small compound eyes are situated laterally (**Fig. 3.1.621**).
.....*Acanthagrion apicale* Selys, 1876 (Venezuela, Guyana, French Guiana, Colombia, Ecuador, Peru, Bolivia, Pará, Rondônia). Syn: *Acanthagrion apicale descendens* Fraser, 1946.

Key to the species of adult male *Leptobasis* in South America

Information for the key was provided by Calvert (1909), Williamson (1915), Santos (1957a), DeMarmels (1992a), and Lencioni (2006). The male of *Leptobasis cardinalis* has not been described.

1. The inferior anal appendage extends slightly farther posteriad than the superior appendage, best seen in lateral view (**Fig. 3.1.624**). 2
- In lateral view, the inferior anal appendage is narrow, curved, and at least twice as long as the superior appendage; its base is thickened (**Fig. 3.1.625**). …...…..5
2. In dorsal view, the apices of the inferior anal appendages are curved strongly inward for their whole lengths and bear hooks bending anteriad (**Fig. 3.1.624**).
.....*Acanthagrion raineyi* Williamson, 1915 (Trinidad, not yet reported from continental South America).
- In dorsal view, the inferior anal appendages are directed posteriad but may bear small hooks directed mesad at the apex (**Fig. 3.1.352**). 3
3. In lateral view, the base of the inferior anal appendage is rectangular, and its conical outer process ends in a sharp hook directed mesad (**Fig. 3.1.352**).
.....*Leptobasis mammilaris* Calvert, 1909 (Venezuela, Mato Grosso).

- In lateral view, the inferior anal appendage appears triangular at the base, and its outer process is rounded at the apex (**Fig. 3.1.626**). 4

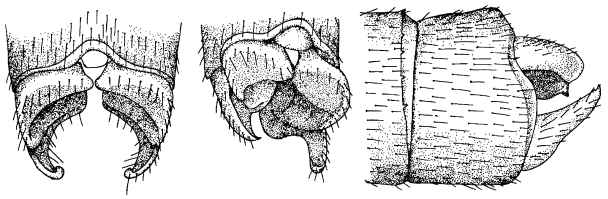


Fig. 3.1.624 *Leptobasis raineyi* male (left to right): apex of the abdomen in dorsal, oblique posterior, and lateral view. Based on Williamson (1915).

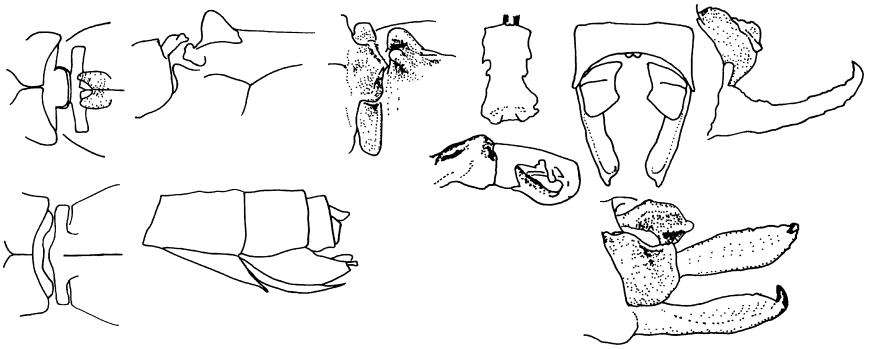


Fig. 3.1.625 *Leptobasis inversa* (above, left to right): posterior part of male prothorax and anterior part of the synthorax in dorsal, lateral, and dorsolateral view; penis in ventral view, and apex of the male abdomen in dorsal and lateral view; and (below, left to right): posterior part of the female prothorax and anterior part of the synthorax in dorsal view; apex of the female abdomen in lateral view; penis in lateral view; apex of the male abdomen in dorsomedial view. Based on Lencioni (2006).

4. The dorsal part of posterior margin of the tenth abdominal segment curves dorsad along the midline, making it appear roundly excavated in dorsal view. The inferior anal appendage narrows abruptly posterior to its midlength, and the apical process curves posteriad (**Fig. 3.1.626**). Length of abdomen: 27.5 to 29 mm. Hind wing length: 15 to 17 mm.
.....*Leptobasis vacillans* Selys, 1877
(Mexico, Central America, West Indies, Venezuela, Surinam, French Guiana, Ecuador, Brazil). Syn: *Hylaeagrion crocea* Förster, 1906; *Leptobasis atrodorsum* Calvert, 1902. Three subspecies are recognized: *Leptobasis vacillans vacillans* from all reported countries except Brazil; *Leptobasis vacillans ecuadorica* Calvert, 1909; from Ecuador, and *Leptobasis vacillans guianiae* Calvert, 1909, from Brazil.

- The dorsal part of posterior margin of the tenth abdominal segment is not elevated or excavated along the midline. The inferior anal appendage is conical, narrows evenly, and appears to have a straight dorsal margin in lateral view (**Fig. 3.1.627**). Length of abdomen: 27.5 to 29 mm. Hind wing length: 15 to 17 mm.
.....*Leptobasis yanomami* De Marmels, 1992 (Venezuela, Brazil).

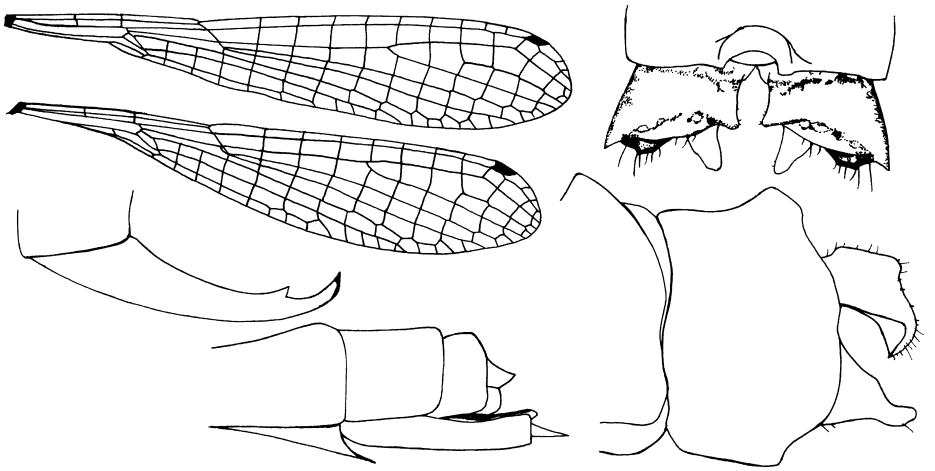


Fig. 3.1.626 *Leptobasis vacillans:* fore and hind wing (upper left), tarsal claw (lower left), apex of the male abdomen in dorsal (upper right) and lateral view (lower right), and apex of the female abdomen in lateral view (lower center). Based on Eaton and Calvert (1892-1907) and Williamson (1915).

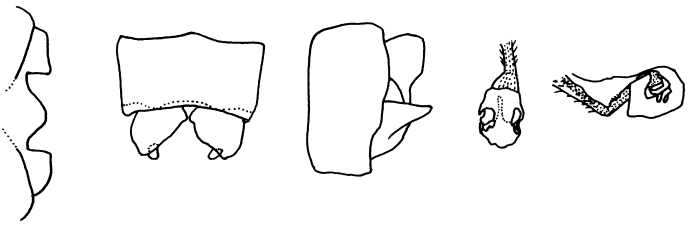


Fig. 3.1.627 *Leptobasis yanomami* male (left to right): posterior margin of the prothorax of a female, apex of the male abdomen in dorsal and lateral view, and apex of the penis in ventral and lateral view. Based on De Marmels (1992b).

5. The inferior anal appendages curve inward toward each other at the apices (**Fig. 3.1.628**). Length of abdomen: 32 to 35 mm. Hind wing length: 19 to 23 mm.
.....*Leptobasis costalimai* Santos, 1957 (Espírito Santo).
- The inferior anal appendages curve dorsad at the apices (**Fig. 3.1.625**).
.....*Leptobasis inversa* Selys, 1876 (Venezuela, Pará). Syn: *Leptobasis tuberculata* Santos, 1961.

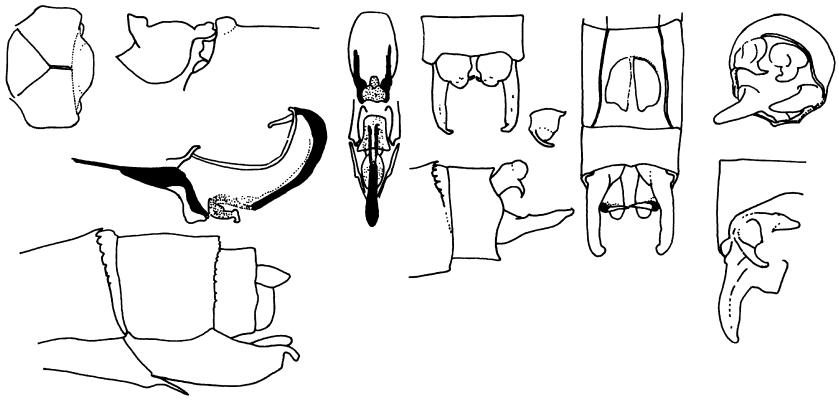


Fig. 3.1.628 *Leptobasis costalimai:* prothorax of the male in dorsal and lateral view (upper left, left and right, respectively); penis cleared with diaphane in ventral (above, left of center) and lateral view (middle left), apex of the male abdomen in dorsal view with one of the superior anal appendages in oblique view to its lower right (above, right of center) and in ventral (right center), lateral (below, right of center), and posterior view (upper right); the anal appendages on one side in dorsomedial view (lower right), and apex of the female abdomen in lateral view (lower left). Based on Santos (1957a).

Key to the species of adult female *Leptobasis* in South America

Information for the key provided by Calvert (1909), Santos (1957a), and De Marmels (1992b). Descriptions of the females of *Leptobasis vacillans* and *L. raineyi* are not yet available or are insufficient to include the species in the key.

1. The posterior margin of the female prothorax is deeply and broadly indented in the middle but convex along the dorsal midline within the indentation (**Fig. 3.1.627**). 2
- The posterior margin of the prothorax is not broadly indented but is rather broadly produced along the dorsal midline (**Fig. 3.1.628**). 3

2. The lateral margins of the broad indentation along the posterior margin of the female prothorax are straight and nearly parallel, and the midline process between them is strongly convex along the midline (**Fig. 3.1.627**).
.....*Leptobasis yanomami* De Marmels, 1992 (Venezuela, Brazil).
- The lateral margins of the broad indentation along the posterior margin of the female prothorax are shallowly curved, and the process between them has only a slightly convex margin. There is a short, straight spine on the eighth abdominal segment extending under the ovipositor valves (**Fig. 3.1.625**).
.....*Leptobasis inversa* Selys, 1876 (Venezuela, Pará). Syn: *Leptobasis tuberculata* Santos, 1961.
3. Length of abdomen: 28.5 to 29 mm. Hind wing length of male: c. 16 mm; female: c. 19.5 mm. The posterior margin of the prothorax has a process that ends in an obtuse angle, as seen in dorsal view (**Fig. 3.1.352**).
.....*Leptobasis mammilaris* Calvert, 1909 (Venezuela, Mato Grosso).
- Length of abdomen: 32 to 35 mm. Hind wing length: 19 to 23 mm. 4

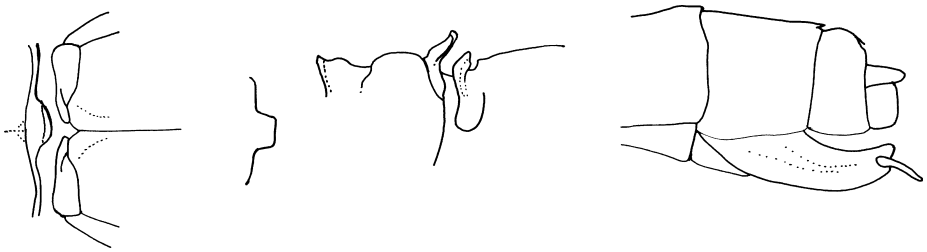


Fig., 3.1.629 *Leptobasis cardinalis* female (left to right): posterior lobe of the prothorax and anterior part of the synthorax in dorsal view with the mesostigmal lamina in dorsal view, posterior lobe of the prothorax in anterodorsal view, lateral view of the prothorax and anterior part of the synthorax, and apex of the female abdomen, which does not show the sharp spine on the eighth abdominal segment described by Fraser (1946a). Based on De Marmels (1984b).

4. There is a strong spine on the eighth abdominal segment extending under the ovipositor valves, which curves posteriad to remain in contact with the valves. The ovipositor valve does not extend posteriad quite as far as the inferior anal appendage. The synthorax is red with blue humeral and antehumeral stripes. The posterior lobe of the prothorax is subquadrangular (**Fig. 3.1.629**). The first two abdominal segments are blue laterally. The wings are hyaline. The fore-wing has 13 postnodal cross veins, and the hind wing has 11. Total length: c. 40 mm.

Length of abdomen: c. 33 mm. Hind wing length: c. 20 mm. The color is mainly reddish or reddish brown. The male has not been described.
.....*Leptobasis cardinalis* Fraser, 1946 (Peru). Syn: *Oxyagrion cardinalis* Fraser, 1946; *Oxyagrion cardinale* Fraser, 1946 cited by Rácenis (1959c).

- There is a strong spine curving slightly ventrad on the eighth abdominal segment extending under and separated from the ovipositor valves. The valve of the ovipositor extends farther posteriad than the inferior anal appendage (**Fig. 3.1.628**).
.....*Leptobasis costalimai* Santos, 1957 (Espírito Santo).

Tentative key to adult female *Chrysobasis* in South America

Information for the key was provided by Rácenis (1959b) and Lencioni (2006). Although a revision has not yet been published, von Ellenrieder and Garrison (2007a) found that the female syntype of *Telagrion fulvellum* appears to belong to *Chrysobasis.* It is likely, therefore that female specimens will key to this genus. Official change of the valid name must await examination of male specimens. Information on the larvae is not yet available.

1. The eighth and ninth segments of the female abdomen are yellowish basally and dark brown or black apically, with the dark marking covering more of the lateral than the dorsal surface; the tenth segment and anal appendages are entirely dark (**Fig. 3.1.630**). A description of the male is not yet available.
.....*Telagrion fulvellum* Selys, 1876 (Amazonas). Probable correct name after revision: *Chrysobasis fulvella* (Selys, 1876). Although *Telagrion fulvellum* is still technically valid, a systematically correct name for this poorly known species will surely be applied in a future publication. According to von Ellenrieder and Garrison (2007a), the female appears to belong to *Chrysobasis,* but revision must await examination of a male specimen.

- The three apical abdominal segments of the female are greenish blue with a black basal mark on the eighth segment; the first seven segments are greenish yellow with a broad black dorsal stripe. The head of the only male is yellow and black with blue postocular spots, and that of the female is yellow and dark brown with smaller postocular spots, which may be overlooked in some specimens. The thorax is yellow and black in the male and yellow and brown in the female. The inferior anal appendage of the female is coated apically with long setae, and there is a tuft of setae between the anal appendages of the male (**Fig. 3.1.365**). Length of the abdomen of the only species presently assigned to this genus: 26 to 28 mm. Hind wing length: 15 to 18 mm.
.....*Chrysobasis buchholtzi* Rácenis, 1959 (Colombia, Venezuela).

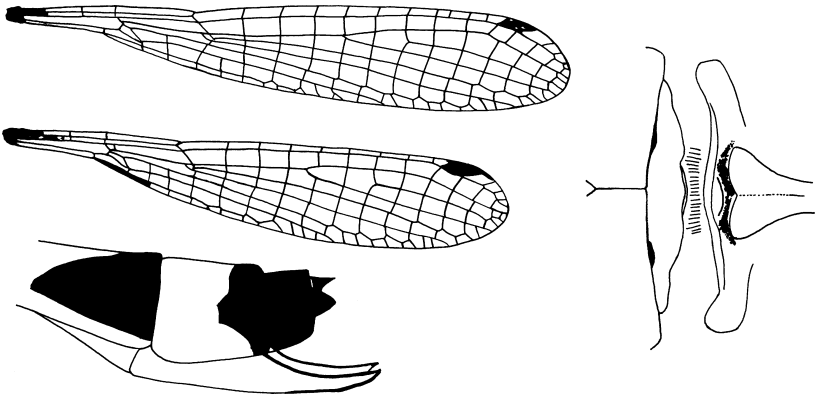


Fig. 3.1.630 *Telagrion fulvellum* female: fore and hind wing (upper left), prothorax (right), and apex of the abdomen in lateral view (lower left), which is black and orange or reddish. Based on Lencioni (2006).

Key to the species of adult male *Cyanallagma* in South America

Information for the key provided by Bulla (1972b), Cruz (1986), Lencioni (2001), and De Marmels (1990c, 1997a, 2003, 2007). This key includes the species presently called *Argia hebdomatica* Navás (1934), which apparently should be included in *Cyanallagma* (R. Garrison, pers. com.), pending published revision.

1. The inferior anal appendage is obviously longer than the superior appendage and appears broadly rounded at the apex in lateral view (**Fig. 3.1.631**). .....*Cyanallagma trimaculatum* (Selys, 1876) (Uruguay?, Rio de Janeiro). Syn: *Acanthagrion trimaculatum* Selys, 1876.
- The inferior anal appendage is subequal to or shorter than the superior appendage (**Fig. 3.1.632**). 2

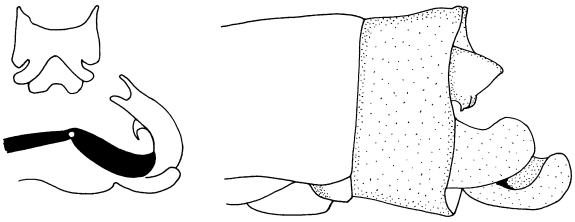


Fig. 3.1.631 *Cyanallagma trimaculatum* male: penis in ventral (upper left) and lateral view (lower left) and apex of the abdomen in lateral view (right). Based on Lencioni (2006).

2. The superior anal appendage has a finger-shaped ventral branch that is considerably longer than the dorsal branch, which is rudimentary and hooked to point posteriad at the apex (**Fig. 3.1.632**). There is a group of delicate, hair-like setae on the lateral membrane of the first penis segment close to where it joins the second. The sixth abdominal segment is mainly blue dorsally. Total length: 35 to 36 mm. Length of abdomen: 28 to 29 mm. Hind wing length: 19 to 20 mm. The female has not been described.
.....*Cyanallagma tepuianum* De Marmels, 1997 (Venezuela).
- The superior anal appendage lacks a finger-shaped ventral branch much longer than the hooked, rudimentary dorsal branch (**Fig. 3.1.633**). 3
3. The third though seventh abdominal segments are blue with a black dorsal fringe on the anterior margin and along the midline (**Fig. 3.1.633**). 4
- The sixth abdominal segment is mainly black dorsally. The lateral membrane of the first penis segment has no more than a few short setae (**Fig. 3.1.634**). 5

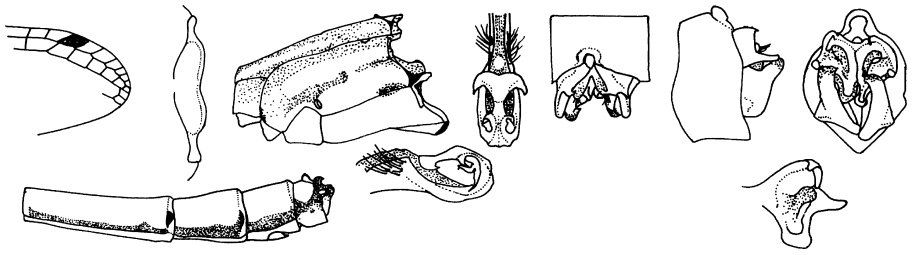


Fig. 3.1.632 *Cyanallagma tepuianum* male (above, left to right): apex of the fore-wing, posterior lobe of the prothorax in dorsal view, synthorax in lateral view, penis in ventral view, apex of the abdomen in dorsal, lateral, and posterior view, and (below, left to right), apical abdominal segments in lateral view, penis in lateral view, and inner view of the superior anal appendage. Based on De Marmels (1997).

4. The superior anal appendage of the male has a robust ventral appendage. The lateral membrane of the penis is lined with about eight setae (**Fig. 3.1.633**). Total length of male: 26 to 28.5 mm; female: 29 to 30 mm. Length of male abdomen: 20 to 22.5 mm; female: c. 22.5 mm. Hind wing length of male: 15 to 16 mm; female: 17 to 18 mm. The prothorax is black dorsally and yellow laterally, while the synthorax is brilliant black dorsally and blue with black markings laterally.
.....*Cyanallagma interruptum* (Selys, 1876) (Argentina, Chile, Uruguay, São Paulo). Syn: *Acanthagrion interruptum* Selys, 1876.

- The superior anal appendage of the male has only a small pointed process on the ventral side near the apex (**Fig. 3.1.635**). The penis does not have setae on its lateral membrane. Total length: 27 to 30.5 mm. Length of male abdomen: 21.5 to 24 mm. Hind wing length of male: 16.5 to 19 mm. The thorax is black dorsally and blue with black markings laterally.
.....*Cyanallagma bonariense* (Ris, 1913)
(Argentina, Uruguay). Syn: *Acanthagrion interruptum bonariense* Ris, 1913.

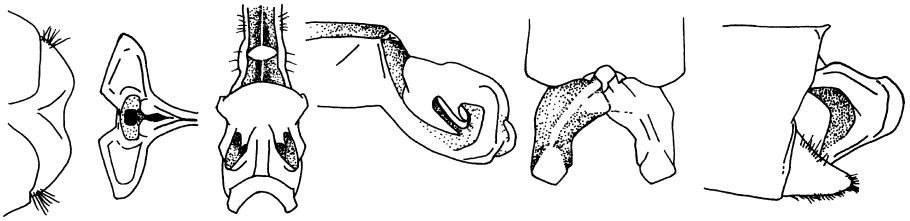


Fig. 3.1.633 *Cyanallagma interruptum* (left to right): posterior lobe of the prothorax and mesostigmal lamina of the female, penis in dorsal and lateral view, and apex of the abdomen of a male in ventral and lateral view. Based on Bulla (1972b).

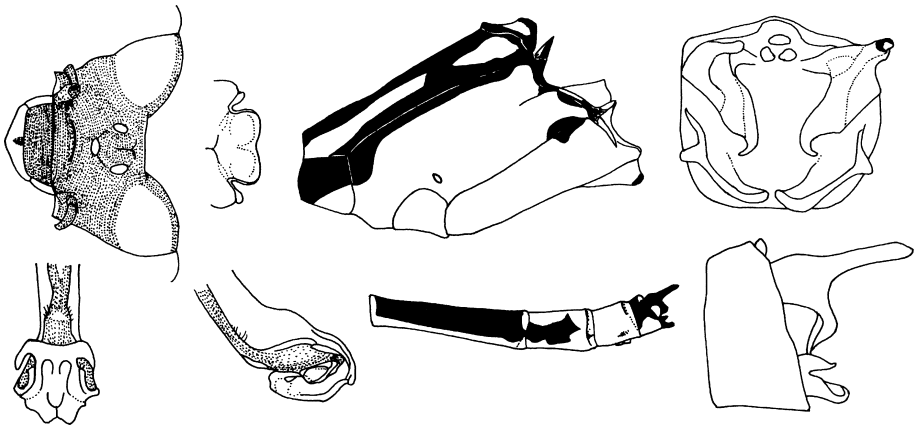


Fig. 3.1.634 *Cyanallagma acutum* male (upper row, left to right): pattern on the dorsal surface of the head between the compound eyes, posterior margin of the prothorax in dorsal view, color pattern on the lateral surface of the synthorax, and the apex of the abdomen in posterior view, and (lower row, left to right): penis in ventral and lateral view, color pattern on the apical segments of the abdomen, and the apex of the abdomen in lateral view. Based on De Marmels (1989b), who referred to the species by its synonym, *Acanthagrion acutum*.

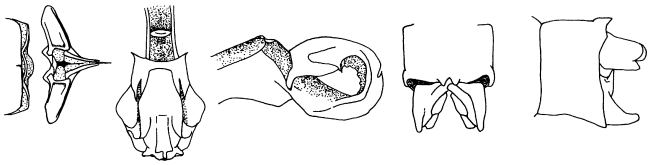


Fig. 3.1.635 *Cyanallagma bonariense* (left to right): posterior lobe of the prothorax and mesostigmal lamina of the female, penis in dorsal and lateral view, and apex of the abdomen of a male in dorsal and lateral view. Based on Bulla (1972b).

5. The dorsal branch of the superior anal appendage is considerably longer than the tenth abdominal segment measured where the appendage is inserted. There is a small hook at the apex of this superior appendage. The distal lateral lobe of the penis is narrow and reverses its direction sharply so that its apex reaches the level of the proximal lateral lobe (**Fig. 3.1.634**).
.....*Cyanallagma acutum* (Ris, 1918) (Bolivia). Syn: *Acanthagrion acutum* Ris, 1918.
- The dorsal branch of the superior anal appendage is at most slightly longer than the tenth abdominal segment measured where the appendage is inserted. If the distal lateral lobe of the penis reverses its direction sharply, its apex does not reach the level of the proximal lateral lobe (**Fig. 3.1.636**). 6
6. The dorsal branch of the superior anal appendage is only a small protuberance with an inner branch bearing a sharp subapical spine pointed ventrad. There is an extensive blue marking broadly bordered in black on the dorsal surface of the seventh abdominal segment (**Fig. 3.1.636**).
.....*Cyanallagma ovigerum* (Calvert, 1909) (Colombia). Syn: *Enallagma ovigerum* Calvert, 1909.
- The dorsal branch of the superior anal appendage is well developed. If there is a blue marking on the seventh abdominal segment, it is not broadly bordered by black on the apical edge (**Fig. 3.1.637**). 7

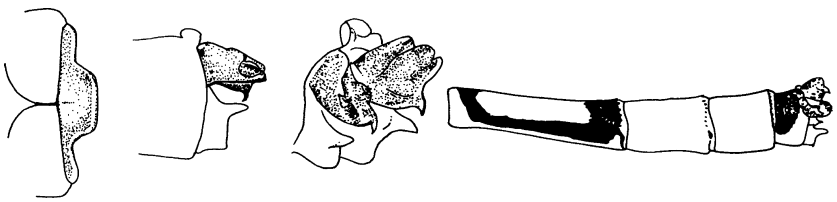


Fig. 3.1.636 Penis of *Cyanallagma ovigerum* male (left to right): posterior lobe on the prothorax, apex of the abdomen in lateral and oblique dorsolateral view, and apical abdominal segments in lateral view. Based on De Marmels (1997a).

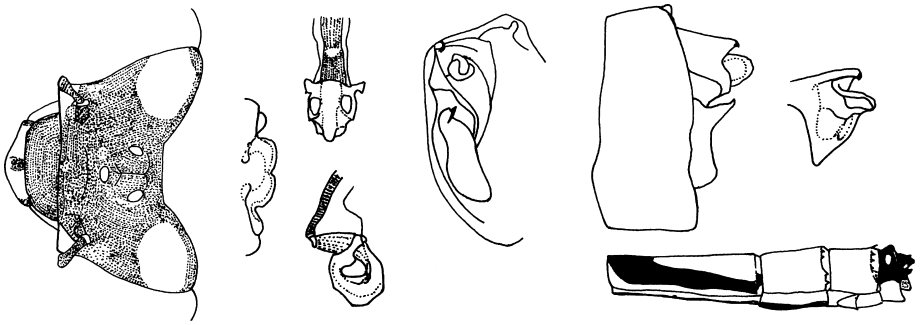


Fig. 3.1.637 *Cyanallagma risi* male (left to right): color pattern on the dorsal surface of the head, posterior border of the prothorax in dorsal view, the penis in ventral (above) and lateral view (below), posterior view of the left half of the apex of the abdomen, the apex of the abdomen in lateral view with an enlargement of the superior appendage viewed from its inner side to the right (above), and the apical segments of the abdomen in lateral view. Based on De Marmels (1989b) who referred to it as *Enallagma ovigerum.*

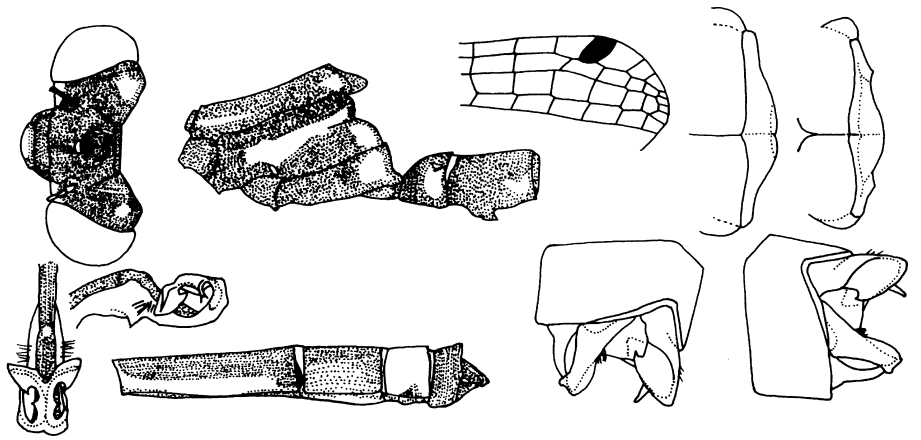


Fig. 3.1.638 *Cyanallagma ferenigrum* (upper row, left to right): head of a male; color pattern on the lateral surfaces of the synthorax and first two abdominal segments of a male, whereby the darker and lighter areas are black and blue, respectively; region of the pterostigma on the hind wing of a male; posterior lobe of the prothorax of a male and a female in dorsal view; and (lower row, left to right): penis in ventral and lateral view; color pattern on the lateral surface of the apical segments of the male abdomen; apex of the male abdomen in oblique dorsal and lateral view. Based on De Marmels (2003).

7. There is a barb-like process on the inner ventral surface of the superior anal appendage of the male that originates at or near the midlength and is directed anteroventrad, and the dorsal surface of the seventh abdominal segment is almost entirely dark (**Fig. 3.1.638**). 8
- If there is a small hook on the superior anal appendage, it is at the apex (**Fig. 3.1.637**). 10
8. The ninth segment is obviously paler on the dorsal surface than the eighth and the tenth. The inferior anal appendage of the male tapers to an acute point at the apex directed dorsoposteriad, and it is almost as long as the superior appendage (**Fig. 3.1.638**).
.....*Cyanallagma ferenigrum* De Marmels, 2003 (Mato Grosso).
- The tenth and posterior part of the eighth segment are as pale on the dorsal surface as the ninth segment. The inferior anal appendage appears truncate or broadly rounded at the apex and is no more than about half as long as the superior appendage (**Fig. 3.1.639**). 9

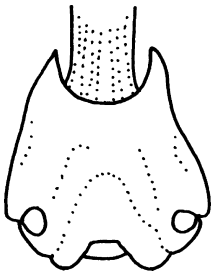


Fig. 3.1.639 Apex of the penis of *Cyanallagma angelae* in ventral view. Based on De Marmels (2003).

9. The inferior anal appendage is rounded at the apex and about half as long as the superior appendage. The tenth abdominal segment is not incised laterally and is no more than slightly higher than the eighth segment (**Fig. 3.1.639**). Total length of male, including appendages: c. 28 mm. Length of male abdomen: c. 23 mm. Fore-wing length of male: c. 16 mm. Hind wing length of male: c. 15 mm.
.....*Cyanallagma angelae* Lencioni, 2001 (São Paulo).
- The inferior anal appendage is truncate at the apex and much less than half as long as the superior appendage. The tenth abdominal segment is incised laterally and is considerably higher than the eighth segment (**Fig. 3.1.640**).
.....*Cyanallagma nigrinuchale* (Selys, 1976) (Argentina, Minas Gerais, São Paulo, Mato Grosso). Syn: *Acanthagrion nigrinuchale* Selys, 1976.

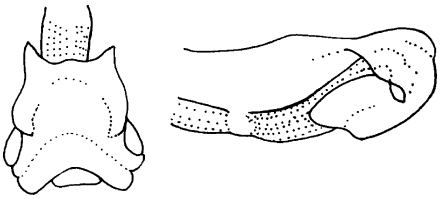


Fig. 3.1.640 Penis of *Cyanallagma nigrinuchale* in ventral (left) and lateral view (right). Based on De Marmels (2003).

10. There is no small hook at the apex of the dorsal branch of the superior anal appendage, which appears narrow, straight, and with an acutely pointed apex when viewed laterally; the ventral branch is vestigial. The inner branch of the appendage forms a large, curved, claw-like structure, which curves inward, ventrad, and proximad (**Fig. 3.1.641**). The dorsal surface of the seventh abdominal segment is black. Total length: greater than 44 mm.
.....*Cyanallagma thelkterion* De Marmels, 1997 (Venezuela).
- The dorsal branch of the superior anal appendage is stout and bears a small hook at the apex (**Fig. 3.1.642**). Total length: shorter than 39 mm. 11

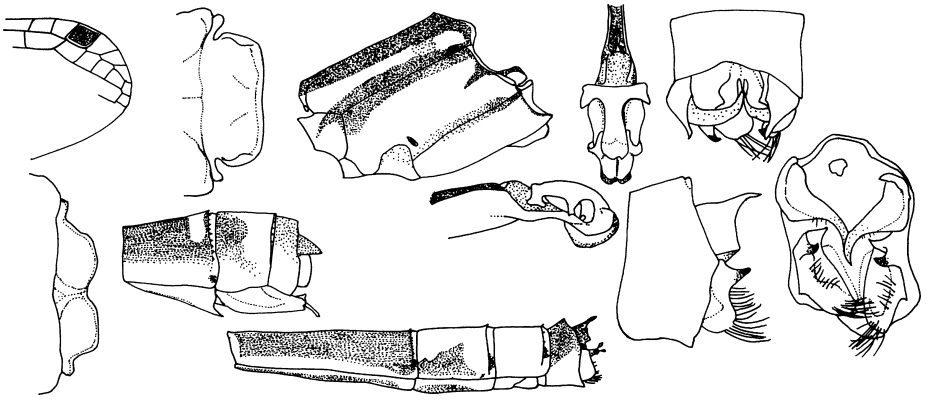


Fig. 3.1.641 *Cyanallagma thelkterion* (upper row, left to right): apex of the fore-wing of a male, posterior lobe of the male prothorax in dorsal view, male synthorax in lateral view, penis in ventral view, apex of the male abdomen in dorsal view, and (below, left to right) : prothorax of a female in dorsal view, apical segments of the female abdomen in lateral view (above), apical segments of the male abdomen in lateral view (below), penis in lateral view (center), and apex of a male abdomen in lateral and posterior view. Based on De Marmels (1997).

11. The posterior pronotal lobe has a narrow, grooved median process with flanged lateral margins. The penis has a proximal lateral lobe that appears to be directed straight posteriad in lateral view. There is some blue color on the dorsal surface of the seventh abdominal segment (**Fig. 3.1.364**). Total length: c. 29 mm. Abdomen length: c. 22.5 mm. Hind wing length: c. 16.4 mm.
.....*Cyanallagma demarmelsi* Cruz, 1986 (Colombia).
- The lateral margins of the median process of the posterior pronotal lobe are, at most, only somewhat raised. The penis has a proximal lateral lobe that never appears to be directed straight posteriad in lateral view. The dorsal surface of the seventh abdominal surface is usually black (**Fig. 3.1.642**). 12
12. In lateral view, the inner branch of the superior anal appendage appears as a thick process protruding posteriad between the dorsal and ventral branches. The distal lateral lobe of the penis is larger than the proximal lateral lobe (**Fig. 3.1.642**). 13
- In inner view, the ventral part of the inner branch of the superior anal appendage appears triangular. The distal and proximal lateral lobes of the penis are about the same size (**Fig. 3.1.643**). 14

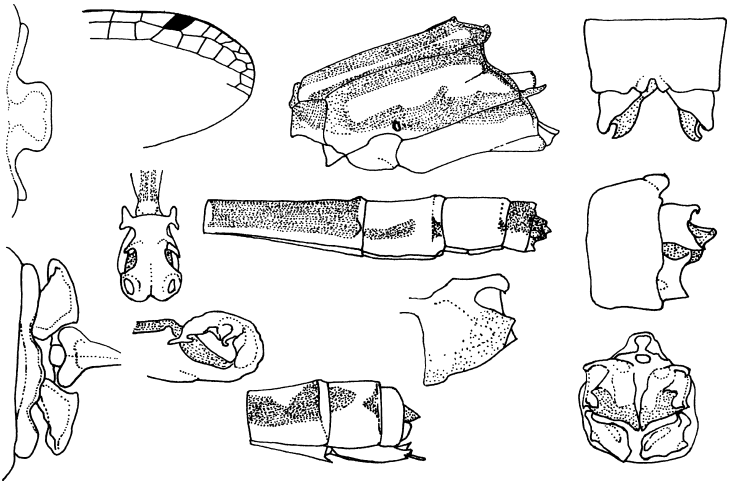


Fig. 3.1.642 *Cyanallagma tamaense:* hind lobe of the pronotum of a male (upper left) and a female (lower left); area of the pterostigma of a male fore-wing (upper left center); markings on the lateral surfaces of the synthorax (upper right center) and apical abdominal segments of a male (below synthorax) and apex of a female abdomen (lower center); penis in ventral and lateral view (below pterostigma, above and below, respectively); apex of the male abdomen in dorsal, lateral, and posterior view (right, above to below); and an interior view of the male superior anal appendage (lower right center). Based on De Marmels (1997a). The correct name for this species will possibly become *Cyanallagma hebdomatica* after the next revision, as explained in the note in the keys.

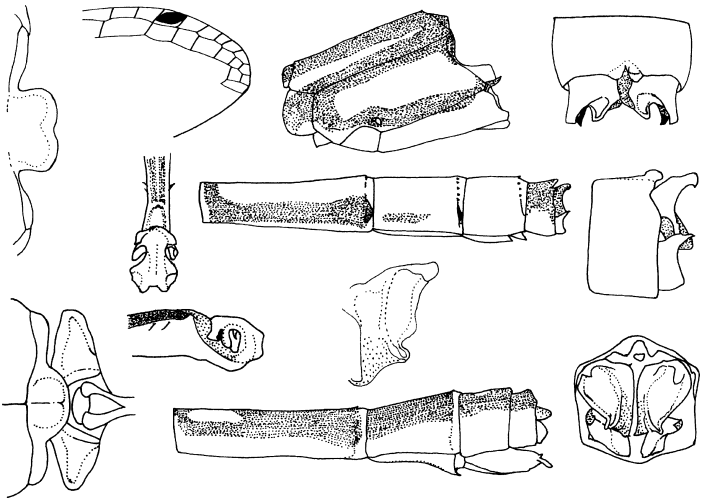


Fig. 3.1.643 *Cyanallagma laterale:* hind lobe of the pronotum of a male (upper left) and a female (lower left); area of the pterostigma of a male fore-wing (upper left center); markings on the lateral surfaces of the synthorax of a male (upper right center) and the seventh through tenth abdominal segments of a male (below synthorax) and a female (lower center); penis in ventral and lateral view (below pterostigma, above and below, respectively); apex of the male abdomen in dorsal, lateral, and posterior view (right, above to below); and an interior view of the male superior anal appendage (center). Based on De Marmels (1997a).

13. The inner surface of the inner branch of the superior anal appendage is shaped like a hatchet ventrally (**Fig. 3.1.342**). The dorsal surface of the seventh abdominal segment is entirely black, or it has a blue marking limited to the apical 1/3.
.....*Cyanallagma tamaense* De Marmels, 1988
(Venezuela, Colombia?). Probable correct name: *Cyanallagma hebdomatica* (Navás, 1934). According to R. Garrison (pers. comm.), the male type specimen of the poorly known species, *Argia hebdomatica* Navás, 1934, from Colombia, does not belong to *Argia* but rather *Cyanallagma*, and it appears to be identical with *C. tamaense.* If this proves to be correct, the older name, *hebdomatica*, has priority, and *C. tamaense* becomes its junior synonym. Because a revison has not yet been published, however, both names are maintained separately in lists.
- The inner surface of the inner branch of the superior anal appendage is triangular with an acute apex ventrally (**Fig. 3.1.637**). The dorsal surface of the seventh abdominal segment is blue on the apical 2/3. Length of abdomen: c. 30 mm. Hind wing length: c. 24.5 mm.
.....*Cyanallagma risi* De Marmels, 1997
(Ecuador). Syn : *Enallagma ovigerum* auctt. nec Calvert, 1909

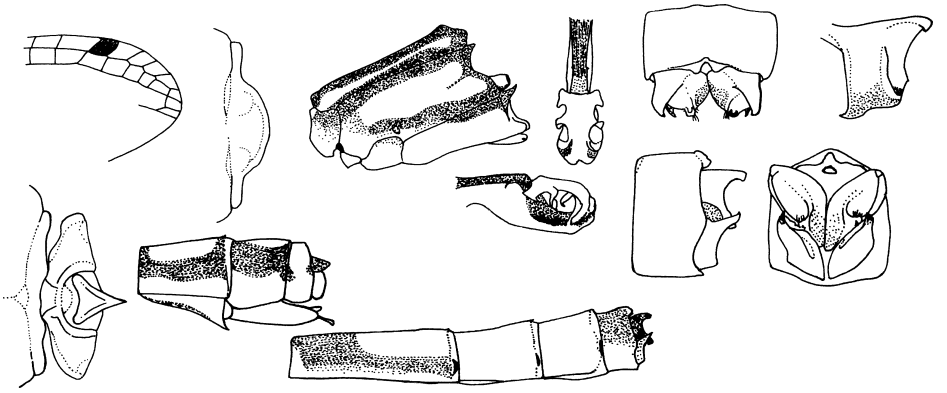


Fig. 3.1.644 *Cyanallagma gaianii* (upper row, left to right): apex of the forewing of a male, posterior lobe of the male prothorax in dorsal view, male synthorax in lateral view, penis in ventral view, apex of the male abdomen in dorsal view, inner surface of the superior anal appendage of a male, and (below, left to right) : prothorax of a female in dorsal view, apical segments of the female abdomen in lateral view (above), apical segments of the male abdomen in lateral view (below), penis in lateral view (center), and apex of a male abdomen in lateral and posterior view. Based on De Marmels (1997).

14. The hind lobe of the pronotum has a median process that is squarish, or its base is slightly constricted. The penis has proximal and distal lateral lobes that are similar in shape and in contact. The dorsal surface of the seventh abdominal segment is blue with a narrow black band on the proximal margin (**Fig. 3.1.643**).
.....*Cyanallagma laterale* (Selys, 1876) (Ecuador, Colombia, Venezuela). Syn: *Acanthagrion laterale* Selys, 1876; *Argia ternaria* Navás, 1934; *Argia trina* Navás, 1934.

- The hind lobe of the pronotum has a median process that is semicircular and not constricted at its base. The penis has proximal and distal lateral lobes that are different in shape and widely separated. Only the distal 2/3 of the dorsal surface of the seventh abdominal segment is blue (**Fig. 3.1.644**).
.....*Cyanallagma gaianii* De Marmels, 1997 (Venezuela).

Key to the species of known adult female *Cyanallagma* in South America

Information for the key provided by Bulla (1972b), De Marmels (1997a, 2003), and Lencioni (2001). Because adequate descriptions of *Cyanallagma acutum, C. ferenigrum, C. ovigerum, C. risi, C. tepuianum,* and *C. trimaculatum* are not available, they are not included in the key.

1. The hind wing is only about 13 mm long. In dorsal view, the posterior lobe of the prothorax is evenly rounded and not divided into two or three lobes; its ventral surface is never visible from above.
.....*Cyanallagma nigrinuchale* (Selys, 1976) (Argentina, Minas Gerais, São Paulo, Mato Grosso). Syn: *Acanthagrion nigrinuchale* Selys, 1976.
- The hind wing is at least 15 mm long. In dorsal view, the posterior lobe of the prothorax is obviously divided into two or three lobes (**Fig. 3.1.633**). 2
2. The posterior lobe of the prothorax is greatly produced posteriad along the midline, forming a narrow, folded dorsal projection with a triangular ventral base. Total length: c. 30 to 31 mm. Abdomen length: c. 24 mm. Length of forewing: 19 to 20 mm; hind wing: 18 to 19 mm. The apex of the ovipositor extends slightly beyond the posterior margin of the tenth abdominal segment. The color is mainly black dorsally with blue markings, including antehumeral stripes, intersegmental rings between the seventh and eighth and eighth and ninth abdominal segments, and most of the dorsal surface of the tenth segment. The anal appendages and ovipositor are pale (**Fig. 3.1.364**).
.....*Cyanallagma demarmelsi* Cruz, 1986 (Colombia).
- If the posterior lobe of the prothorax is produced, the process is wider than long (**Fig. 3.1.633**). 3
3. The posterior margin of the posterior lobe of the prothorax is broadly produced along the dorsal midline to form a single process with a convex margin in the middle (**Fig. 3.1.644**). 4
- The posterior margin of the posterior lobe of the pronotum is divided into two or three processes divided by excavations, as best seen in dorsal view (**Fig. 3.1.635**). 5
4. The dorsal surface of the seventh abdominal segment is almost entirely black. Near the lateral margins, the anterior edges of the mesostigmal laminae are elevated somewhat (**Fig. 3.1.644**). Total length : 33 to 36 mm. Length of abdomen: 26 to 29 mm. Hind wing length : 18 to 22 mm.
.....*Cyanallagma gaianii* De Marmels, 1997 (Venezuela).
- Much of the dorsal surface of the seventh abdominal segment is blue. The anterior edge of the mesostigmal lamina is not elevated anywhere (**Fig. 3.1.643**).
.....*Cyanallagma laterale* (Selys, 1876) (Ecuador, Colombia, Venezuela). Syn: *Acanthagrion laterale* Selys, 1876; *Argia ternaria* Navás, 1934; *Argia trina* Navás, 1934.

5. In dorsal view, the posterior lobe of the prothorax is divided into two lobes along its posterior margin, separated by a shallow excavation across its dorsal midline (**Fig. 3.1.633**). 6
- In dorsal view, the posterior lobe is divided into three lobes with the medial part of the posterior margin produced posteriad; its ventral surface is visible from above (**Fig. 3.1.635**). 7
6. Total length: 29 to 30 mm. Length of abdomen: 22 to 23 mm. Hind wing length: 17 to 18 mm. In dorsal view, the posterior lobe of the prothorax is divided into two lobes separated by a recessed medial border; its posterolateral corners are not produced, but each bears a tuft of setae. The ventral surface of the posterior lobe is not visible in dorsal view (**Fig. 3.1.633**).
.....*Cyanallagma interruptum* (Selys, 1876) (Argentina, Chile, Uruguay, São Paulo). Syn: *Acanthagrion interruptum* Selys, 1876.
- Total length: 43 to 44 mm. Length of abdomen: 34 to 35 mm. Hind wing length: 25 to 26 mm. The lateral corners of the posterior lobe of the prothorax are produced laterad to form short, finger-like projections (**Fig. 3.1.641**).
.....*Cyanallagma thelkterion* De Marmels, 1997 (Venezuela).
7. The middle of the three lobes along the posterior margin of the prothorax is itself divided into three shallow lobes. The entire posterior lobe is very narrow and nowhere projects very far posteriad (**Fig. 3.1.342**). The anterior edge of the mesostigmal lamina is elevated near the anterolateral corners.
.....*Cyanallagma tamaense* De Marmels, 1988 (Venezuela, Colombia?). Probable correct name: *Cyanallagma hebdomatica* (Navás, 1934). According to R. Garrison (pers. comm.), the male type specimen of the poorly known species, *Argia hebdomatica* Navás, 1934, from Colombia, does not belong to *Argia* but rather *Cyanallagma*, and it appears to be identical with *C. tamaense.* If this proves to be correct, the older name, *hebdomatica*, has priority, and *C. tamaense* becomes its junior synonym. Because a revison has not yet been published, however, both names are still maintained separately in lists.
- The posterior margin of the prothorax has an evenly rounded or rectangular process in the middle (**Fig. 3.1.635**). 8
8. The medial lobe of the prothorax is relatively small, and its ventral surface is strongly produced posteriad and evenly rounded along its apical margin (**Fig. 3.1.635**). Total length: 27.5 to 30.5 mm. Length of abdomen: 21.5 to 24 mm. Hind wing length: 18.5 to 19.5 mm.
.....*Cyanallagma bonariense* (Ris, 1913) (Argentina, Uruguay). Syn: *Acanthagrion interruptum bonariense* Ris, 1913.
- The medial lobe of the prothorax is relatively large, and its ventral surface is strongly produced posteriad and rectangular with rounded corners along its apical margin. Hind wing length: c. 15 mm.
.....*Cyanallagma angelae* Lencioni, 2001 (São Paulo).

Comparison of the species of known *Cyanallagma* larvae in South America

Information for the key provided by Bulla (1972b) and De Marmels (1997a, 2007a). The larvae of most South American species have not been described, so a reliable key cannot yet be provided.

1. The length of a lateral gill lamella is less than four times its greatest width (**Fig. 3.1.645**). 2
- The length of a lateral gill lamella is more than four times its greatest width (**Fig. 3.1.646**). 4

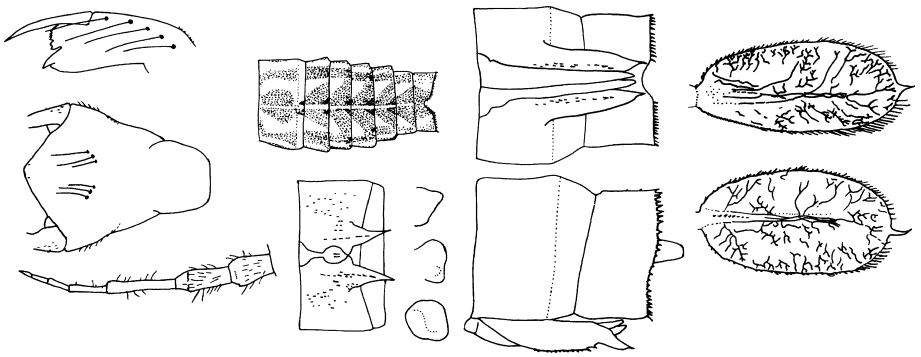


Fig. 3.1.645 *Cyanallagma tamaense* larva: prementum of a male with the bases of the labial palps (middle left); labial palp of a male (upper left); male antenna (lower left); pattern on the male abdomen in dorsal view (upper left center); ninth abdominal segment in ventral view showing the male gonapophyses (lower left center); cercus of a male in lateral, internal, and posterior view (lower center, above to below); apex of a female abdomen in ventral (upper right center) and lateral view (lower right center); and a lateral (upper right) and middle gill lamella (lower right). Based on De Marmels (2007a).

2. There are about three setae in each of the paired rows of long setae on the prementum and about five long setae proximal to the moveable hook on the labial palp. The length of a lateral gill lamella is less than three times its greatest width. The pattern on the fourth through ninth segments of the abdomen consists of a pale, narrow midline stripe, dark apical triangles on each side of the midline, and dark lateral stripes (**Fig. 3.1.645**).
.....*Cyanallagma tamaense* De Marmels, 1988 (Venezuela, Colombia?). Probably *Cyanallagma hebdomatica;* see p. 541.

- There are about four long setae and sometimes one or two short ones in each row of setae on the prementum and about six long setae proximal to the moveable hook on the labial palp (**Fig. 3.1.647**). 3

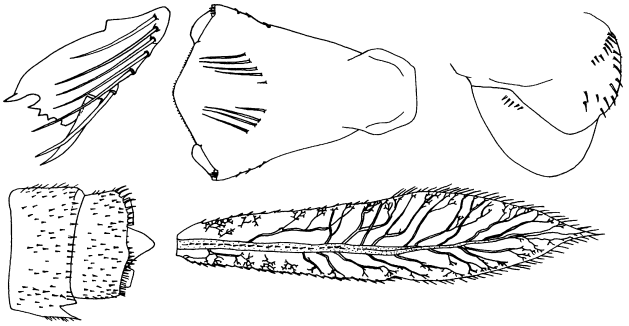


Fig. 3.1.646 *Cyanallagma interruptum* larva (upper row, left to right): labial palp, labium with palps removed, right side of the head in ventral view, and (below, left and right): apex of the abdomen of a male larva in lateral view and a lateral gill lamella. Based on Bulla (1972b).

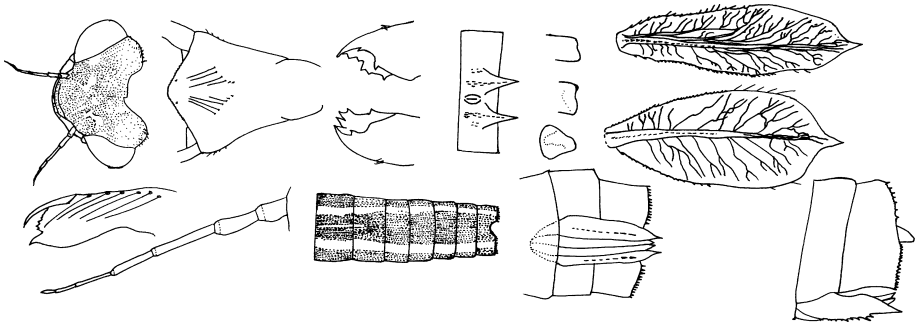


Fig. 3.1.647 *Cyanallagma laterale* larva (upper row, left to right): head in dorsal view; prementum with bases of the labial palps; apices of the mandibles; ninth abdominal segment of a male showing the gonapophyses; apex of a male cercus in lateral, internal, and posterior view (above to below); a lateral (above) and middle gill lamella (below); and (below, left to right): a labial palp in dorsal view; antenna; abdomen in dorsal view; apex of a female abdomen showing the anlage of the ovipositor in ventral and lateral view. Based on De Marmels (2007a).

3. The length of a lateral gill lamella is less than three times its greatest width. There is seldom or never a short seta in addition to the four long ones on the prementum. The fourth through ninth segments of the abdomen are mainly pale with diffuse dark pigment along the midline of each segment forming a dark marking that widens toward the posterior margin of each segment and is divided by a narrow pale midline stripe on the third through seventh segments (**Fig. 3.1.371**).
.....*Cyanallagma gaianii* De Marmels, 1997 (Venezuela).
- The length of a lateral gill lamella is more than three times its greatest width. There are usually one or two short setae in addition to the four long ones on the prementum. The pattern on the fourth through ninth segments of the abdomen consists of a pale, narrow midline stripe only on the fourth and anterior part of the fifth segment, a broad, dark midline stripe, and dark lateral areas (**Fig. 3.1.647**).
.....*Cyanallagma laterale* (Selys, 1876) (Ecuador, Colombia, Venezuela). Syn: *Acanthagrion laterale* Selys, 1876; *Argia ternaria* Navás, 1934; *Argia trina* Navás, 1934.

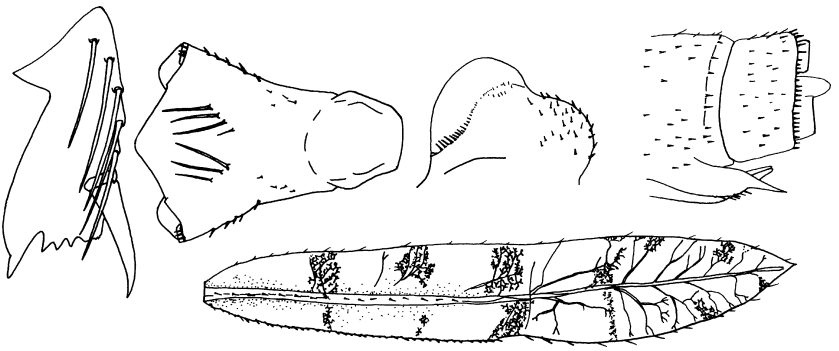


Fig. 3.1.648 *Cyanallagma bonariense* larva (upper row, left to right): labial palp, prementum, left side of the head in ventral view, apex of the abdomen of a female larva in lateral view, and (below) a lateral gill lamella. Based on Bulla (1972b).

4. There are about four long setae and sometimes one short one in each row of setae on the prementum and about six long setae proximal to the moveable hook on the labial palp. Each lateral gill lamella becomes notably wider apical of the mid-length, and its length is less than five times its width at its widest point (**Fig. 3.1.646**).
.....*Cyanallagma interruptum* (Selys, 1876) (Argentina, Chile, Uruguay, São Paulo). Syn: *Acanthagrion interruptum* Selys, 1876.

- There are about three long setae and sometimes one short one in each row of setae on the prementum and about five long setae proximal to the moveable hook on the labial palp. Each lateral gill lamella widens only slightly apical from the mid-length, and its length is more than five times its width at its widest point (**Fig. 3.1.648**).
.....*Cyanallagma bonariense* (Ris, 1913) (Argentina, Uruguay). Syn: *Acanthagrion interruptum bonariense* Ris, 1913.

Key to the species of adult *Ischnura* in South America

Information for the key provided by Blanchard (1845), Ris (1908), Schmidt (1942), Fraser (1948b), and De Marmels (1987b). There are poorly know South American species still maintained in this genus, even though they probably belong to other genera but have never been re-examined to determine their actual status.

1. The predominant color on the male abdomen is mainly red, while the female abdomen is orange or black, probably depending on the age. The pterostigmata on the fore and hind wings are similar, with the costal side longer than the proximal side and the anterior angle very small. There is no bifid dorsal process on the tenth abdominal segment of the male. The female has a spine on the eighth abdominal segment ventral to the ovipositor valves and lacks an external black stripe on the middle and hind tibiae. The postocular spots of the females tend to fade out.
.....*Ischnura hastata* (Say, 1839) (Central America, West Indies, Galapagos Islands, Venezuela). Syn: *Agrion hastata* Say, 1839; *Agrion anomala* Rambur, 1842; *Agrion venerinotata* Haldeman, 1844; *Anomalagrion hastatum* (Say, 1839).
- The predominant color on the male abdomen is not mainly red, and the female abdomen is never orange. Females have a black stripe, sometimes broken into short sections, on the external surfaces of the middle and hind femora. 2
2. The color is mainly black with testaceous, dark red, and greenish red markings or black with metallic green, yellow, and blue markings on the thorax. Apparently, there are no blue markings on the posterior part of the abdomen. ...3
- The color pattern is mainly black, blue, and yellowish with some blue markings on some of the apical abdominal segments. 4
3. The color pattern includes no metallic green on the anterior parts of the body, no blue stripes on the thorax, and prominent testaceous, dark reddish, and reddish markings, including greenish red on the preapical abdominal segments. The head is black with reddish testaceous ocular and labral markings. The wings are hyaline with black veins. Total length: c. 38 mm. Wing span, 45 mm. Apparently the type specimen of this poorly known species was a male. The description is sketchy, and little of importance is shown in the one illustration.

It is unlikely that this species can be reliably identified, and assignment to the genus *Ischnura* is provisional.

.....*Ischnura rufovittata* (Blanchard, 1845) (Bolivia). Syn: *Agrion rufovittata* Blanchard, 1845.

- The predominant color on the head, thorax, and abdomen is metallic green and blackish green without any blue markings on the apical abdominal segments but with bluish markings on the thorax, more extensive in the female. The occiput is whitish. The pterostigma of the fore-wing is much larger than that of the hind wing; that of the male is whitish with a gray area in the posterior corner, and that of the female is yellow with a darkened area in the middle. The legs are whitish with fine black lines on the femora and tibiae. The body appears thin and delicate. The superior anal appendage of the male has a long, narrow, pointed process that curves ventrad (**Fig. 3.1.649**). Length of abdomen: c. 19 mm. Hind wing length: 11.5 to 12 mm. Length of the pterostigma margin along the costal vein: 0.5 to 0.6 mm.

.....*Ischnura ultima* Ris, 1908 (Argentina, Chile). Syn: *Ischnura indefinita* Fraser, 1947 (*nomen nudum*).

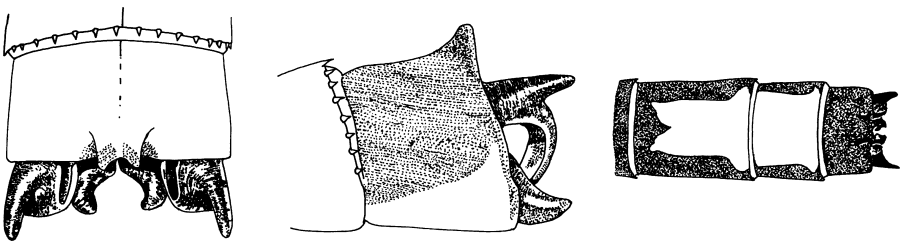


Fig. 3.1.649 *Ischnura ultima* male (left to right): apex of the abdomen in dorsal and lateral view and a dorsal view of the apical abdominal segments showing the color pattern. Based on Fraser (1948b).

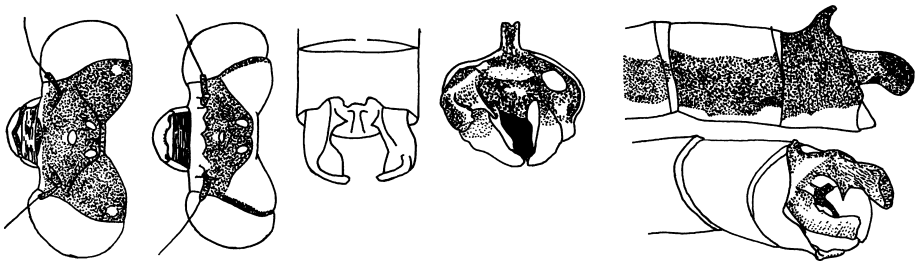


Fig. 3.1.650 *Ischnura sobrina* (left to right): head of a male, which is black with a slight greenish tinge; head of a female, which is black and reddish brown with a yellow anteclypeus; apex of the abdomen of a male in dorsal, posterior, lateral (above) and oblique posterior view (below). Based on Schmidt (1942).

4. The color pattern is mainly yellowish and black with blue dorsal markings on the eighth and ninth abdominal segments. The inferior anal appendage of the male is strongly curved inwards so that only its base is visible in lateral view (**Fig. 3.1.650**).
.....*Ischnura sobrina* Schmidt, 1942 (Peru).
- The color pattern is mainly metallic or light blue and black. 4
5. Both the superior and inferior anal appendages are directed generally posteriad (**Fig. 3.1.651**). 6
- The superior anal appendage curves ventrad at the apex, while the inferior appendage curves dorsad, and the apices of both are acutely pointed or only slightly blunted (**Fig. 3.1.652**). 7

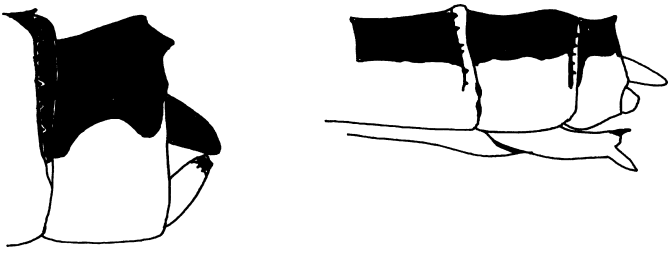


Fig. 3.1.651 *Ischnura fluviatilis*: apex of the abdomen of a male (left) and a female (right), not to scale. Based on Fraser (1948b) and Böttger and Jurzitza (1967).

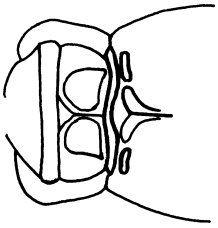


Fig. 3.1.652 *Ischnura capreola* female: anterior part of thorax in dorsal view. Based on Rácenis (1958).

6. The apex of the male superior anal appendage is broadly rounded, while the inferior appendage ends in an acutely pointed apical process at the dorsal end. The median lobe of the female pronotum has a small deep excavation near the posterior margin on each side (**Fig. 3.1.651**).
.....*Ischnura fluviatilis* Selys, 1876 (Argentina, Chile, Bolivia, Paraguay, Uruguay, Venezuela, French Guiana, Pará, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso). Syn: *Ischnura bizonata* Selys, 1876.

- The apices of the superior and inferior anal appendages of the male are broadly rounded. The median lobe of the female pronotum has no deep dorsolateral excavations near the posterior margin (**Fig. 3.1.653**).
.....*Ischnura ramburii* (Selys, 1850)
(North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, French Guiana, Surinam, Chile, Paraguay, Espírito Santo). Syn: *Agrion ramburii* Selys, 1850; *Agrion ramburii* var. *aurantiaca* Hagen, 1861; *Agrion credula* Hagen, 1861; *Agrion defixa* Hagen, 1861; *Agrion iners* Hagen, 1861; *Agrion tuberculata* Selys in Sagra, 1857; *Agrion experta* Hagen, 1861 (*nomen nudum*).

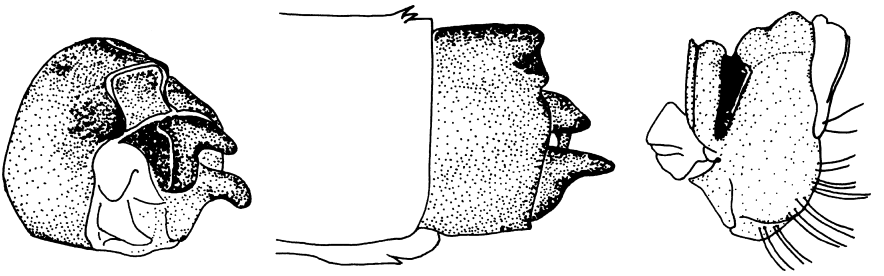


Fig. 3.1.653 *Ischnura ramburii* (left to right): apex of the male abdomen in dorsomedial and lateral view and the female pronotum in dorsolateral view. Based on Lencioni (2006).

7. The superior anal appendage does not have a large ventral process. The first abdominal segment is black dorsally and light blue laterally. The second through seventh are black with a greenish copper sheen dorsally, and the second is blue laterally; the rest are yellow laterally. The eighth and ninth abdominal segments are bright blue. The posterior margin of the female prothorax is excavated across the midline (**Fig. 3.1.654**). Length of abdomen: c. 18.5 mm. Hind wing length: c. 11 mm.
.....*Ischnura indivisa* (Ris, 1918)
(Colombia, Ecuador). Syn: *Ceratura indivisa* Ris, 1918.
- The superior anal appendage has a large ventral or ventrally directed process (**Fig. 3.1.652**). 8

Fig. 3.1.654 *Ischnura indivisa* female: anterior part of thorax in dorsal view. Based on Rácenis (1958).

8. The apex of the tenth abdominal segment has a pair of middorsal processes on the posterior margin that are curved sharply so that their apices are directed posteriad. The superior anal appendage has a large ventral process separated from the dorsal apex by a broad excavation (**Fig. 3.1.652**). The size varies considerably. Length of abdomen: 16.5 to 21 mm. Hind wing length: 10 to 21 mm.
.....*Ischnura capreola* (Hagen, 1861)
(North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, French Guiana, Guyana, Surinam, Argentina, Paraguay, Bahia, Pernambuco, Pará, Mato Grosso, Espirito Santo, Rio de Janeiro, São Paulo, Rio Grande do Sul). Syn: *Agrion capreolus* Hagen, 1861; *Ceratura capreola* (Hagen, 1861).
- The apex of the tenth abdominal segment is produced mediodorsally to form a long extension slightly excavated at the apex and directed dorsoposteriad. The superior anal appendage has a long internal process directed ventrad (**Fig. 3.1.362**). Total length including anal appendages: 25 to 27 mm. Length of abdomen: 18.5 to 21 mm. Hind wing length: 13.5 to 15.5 mm.
.....*Ischnura cruzi* De Marmels, 1987
(Colombia).

Notes on the known species of *Ischnura* larvae in South America

Information for the key provided by Geijskes (1941) and Muzón and Pessacq (2005).

1. The length of the hind femur is less than 2 mm, and each lateral gill lamella is shorter than 4 mm. Two molar teeth are present on the right mandible. Setae are present on the dorsal surface of the abdomen only at the apices of the segments. There are four long setae proximal to the moveable hook on the labial palp and four setae, one short and three long, in a row on each side of the prementum (**Fig. 3.1.378**). Total length: 11 to 12.5 mm. Length of abdomen: 5 to 6.5 mm. Length of a gill lamella: 3 to 3.5 mm. Reported from lotic habitats.
.....*Ischnura capreola* (Hagen, 1861)
(North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, French Guiana, Guyana, Surinam, Argentina, Paraguay, Bahia, Pernambuco, Pará, Mato Grosso, Espirito Santo, Rio de Janeiro, São Paulo, Rio Grande do Sul). Syn: *Agrion capreolus* Hagen, 1861; *Ceratura capreola* (Hagen, 1861).
- The length of the hind femur is more than 2 mm, and each lateral gill lamella is longer than 4 mm. 2
2. The lateral gill lamellae are lined with robust setae along more than 40% of the dorsal margin and more than 30% of the ventral margin. There are no dark spots on the gill lamellae. Only one molar tooth is present on the right mandible. The setae on the dorsal surface of the abdomen are distributed uniformly. There are five long setae on each side of the prementum, the innermost of which is usually at least 1/3 the length of the others. There are about six long setae

proximal to the moveable hook on each labial palp (**Fig. 3.1.655**). The median gill lamella is about 4.7 mm long, while each lateral lamella is about 4.3 mm long. The hind femur is about 2.5 mm long.
.....*Ischnura ultima* Ris, 1908 (Argentina, Chile). Syn: *Ischnura indefinita* Fraser, 1947 (*nomen nudum*).

- The lateral gill lamellae are lined with robust setae along less than 40% of the dorsal margin and less than 30% of the ventral margin. There are five setae, one very short and four long, in a row on each side of the prementum (**Fig. 3.1.656**). 3

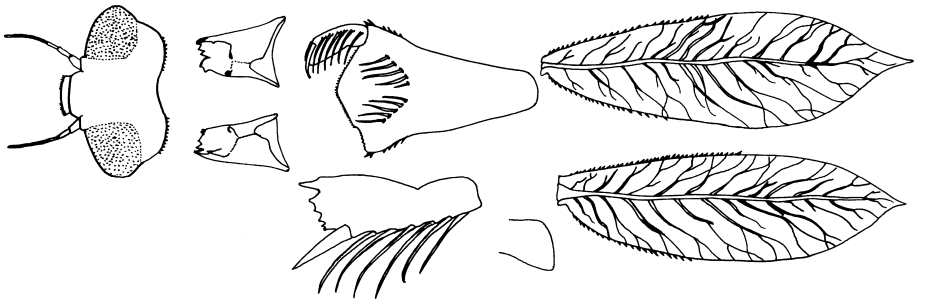


Fig. 3.1.655 *Ischnura ultima* female final instar larva (left to right): head in dorsal view, mandibles, labium in dorsal view with one palp removed (above), labial palp in dorsal view (below), apex of a cercus in lateral view (right of palp), and a median (above) and lateral gill lamella in lateral view (below). Based on Muzón and Pessacq (2005).

3. There are five long setae proximal to the moveable hook on the labial palp (**Fig. 3.1.657**). Total length: 16 to 19 mm. Length of abdomen: 7 to 8 mm. Length of a gill lamella: 4.5 to 5 mm. Reported from standing water bodies in coastal regions.
.....*Ischnura ramburii* (Selys, 1850) (North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, French Guiana, Surinam, Chile, Paraguay, Espírito Santo). Syn: *Agrion ramburii* Selys, 1850; *Agrion ramburii* var. *aurantiaca* Hagen, 1861; *Agrion credula* Hagen, 1861; *Agrion defixa* Hagen, 1861; *Agrion iners* Hagen, 1861; *Agrion tuberculata* Selys in Sagra, 1857; *Agrion experta* Hagen, 1861 (*nomen nudum*).

- There are six long setae proximal to the moveable hook on the labial palp (**Fig. 3.1.656**).
.....*Ischnura fluviatilis* Selys, 1876 (Argentina, Chile, Bolivia, Paraguay, Uruguay, Venezuela, French Guiana, Pará, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso). Syn: *Ischnura bizonata* Selys, 1876.

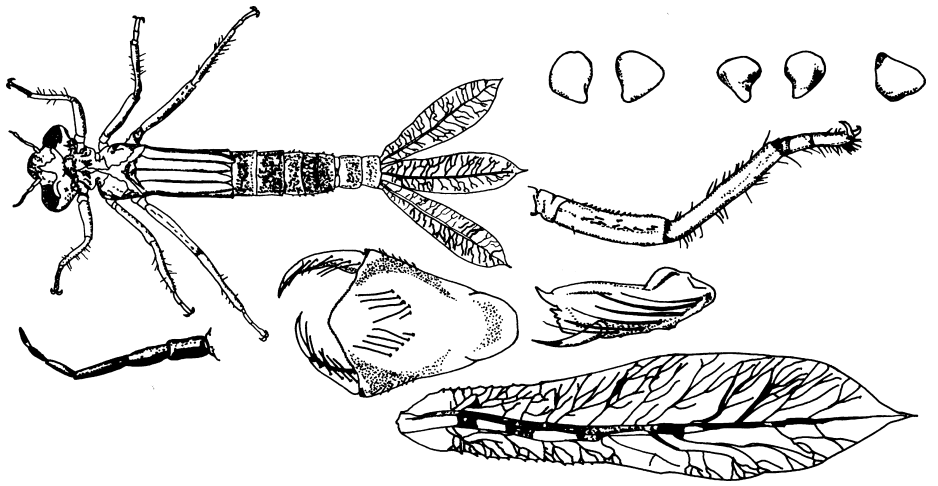


Fig. 3.1.656 *Ischnura fluviatilis* larva: habitus of an exuvia (upper left); antenna (lower left); labium (center); labial palp (lower middle right); fore-leg (upper middle right); cerci in dorsolateral, posterior, and lateral view (upper right, left to right); lateral gill lamella (lower right). Based on Fonseca and Pujol-Luz (1999).

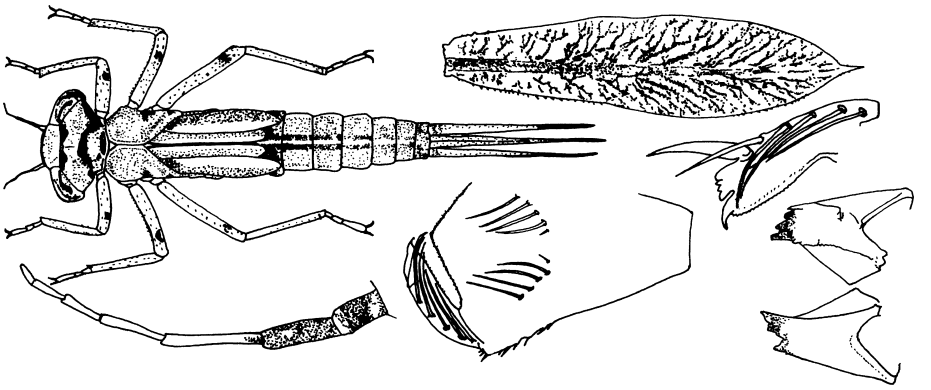


Fig. 3.1.657 *Ischnura ramburii* larva: habitus (upper left), antenna (lower left), labium without one palp (lower center), labial palp (middle right), mandibles (lower right), and lateral gill lamella (upper right). Based on Geijskes (1941).

Key to the species of adult *Homeoura* in South America

Information for the key provided by Ris (1928b), Bulla (1971) and Lencioni (2006).

1. The eighth abdominal segment is mainly dark dorsally (**Fig. 3.1.658**). 2
 - The eighth abdominal segment lacks dark dorsal markings (**Fig. 3.1.659**). 4

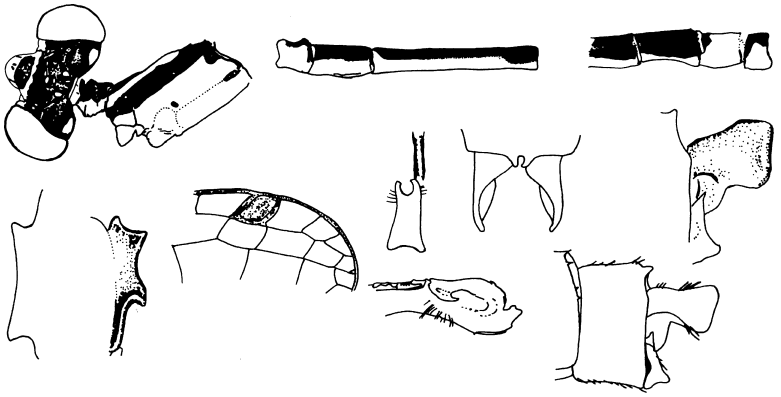


Fig. 3.1.658 *Homeoura nepos* male: head in dorsal view and lateral views of the thorax, first through third, posterior part of the seventh, and the eighth, ninth, and tenth abdominal segments without the appendages (above, left to right); hind lobe of the prothorax in dorsal and lateral view (below left), pterostigma of the fore-wing (lower left center), penis in ventral (center) and lateral view (lower center): apex of the abdomen with appendages in dorsal (right center) and lateral view (lower right); anal appendages in lateral view enlarged (middle right). Based on Lencioni (2006).

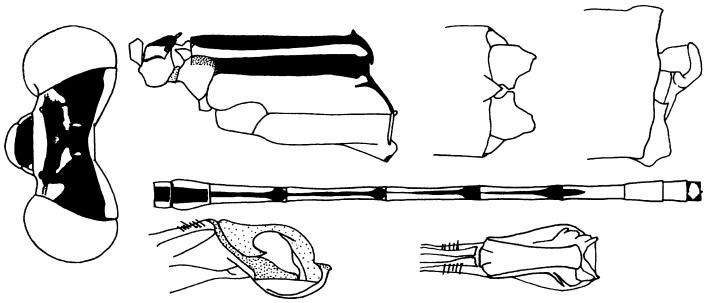


Fig. 3.1.659 *Homeoura silviae:* head (left), thorax in lateral view (upper left center), apex of the abdomen of a male in dorsal (upper right center) and lateral view (upper right), color pattern on the abdomen of a male (middle, right of head), and penis in lateral (lower left) and ventral view (lower right). Based on Bulla (1971).

2. The tenth abdominal segment is almost entirely dark dorsally, and the ninth is mainly pale dorsally with a dark marking at the base. In lateral view, a ventral process on the superior anal appendage of the male is evident, and the apex appears widened (**Fig. 3.1.658**).
.....*Homeoura nepos* (Selys, 1876)
(Peru, Venezuela, French Guiana, Paraguay, Bolivia, Pará, Amazonas, Mato Grosso). Syn: *Ischnura nepos* Selys, 1876; *Agrion nepos* Selys, 1876.
- The ninth and tenth abdominal segments are almost entirely pale, but small dark markings are present on at least one of these segments (**Fig. 3.1.660**). 3

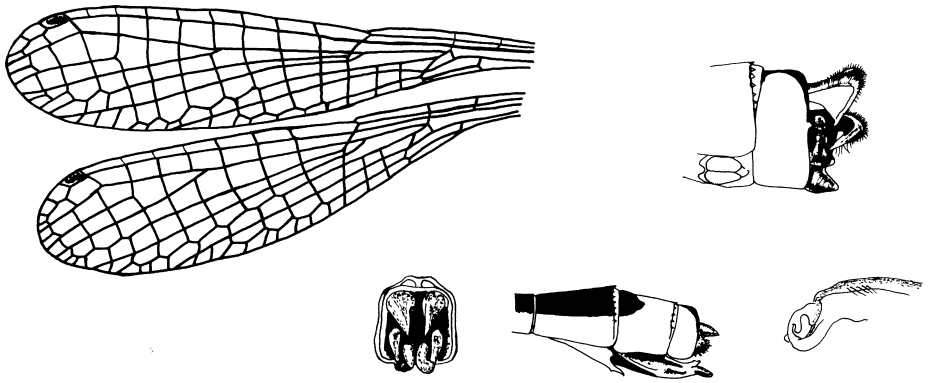


Fig. 3.1.660 *Homeoura ambigua:* fore and hind wing (left), apex of male abdomen in ventrolateral (upper right) and posterior view (lower left center), apex of penis in lateral view (lower right), and apex of the female abdomen in lateral view (lower right center) apices of male (upper left) and a female abdomen in lateral view (lower right center). Based on Fraser (1948b), illustrated as *Argentagrion ambiguum.*

3. The ninth and tenth abdominal segments are pale, except for a narrow band at their junction and some darkening at the posterior margin of the tenth segment. The anal appendages of the male are dark, and in dorsal view, the superior anal appendage appears nearly parallel-sided from the base to near the apex (**Fig. 3.1.335**).
.....*Homeoura chelifera* (Selys, 1876)
(Venezuela, Argentina, Uruguay, Rio Grande do Sul, Paraná, São Paulo, Rio de Janeiro, Espirito Santo, Minas Gerais, Bahia, Brasilia). Syn: probably *Acanthagrion cheliferum* Selys, 1876; *Acanthagrion chelifera rustica* Calvert, 1909, *Enallagma cheliferum* (Selys, 1876).
- The ninth and tenth abdominal segments are dull blue, except for a pair of small black triangles at the base of the ninth segment. On the abdomen of the female, the third through sixth abdominal segments are yellowish

without black markings. Length of abdomen: 20 to 21 mm. Fore-wing length: c. 14 mm.
.....female *Homeoura lindneri* Ris, 1928 (Argentina, Minas Gerais, São Paulo). Syn: *Acanthagrion lindneri* Ris, 1928.

4. The dorsal surface of the eighth abdominal segment lacks dark markings, while that of the ninth is entirely blackish. The black markings on the third through seventh abdominal segments are broad and cover most of the dorsal surface of the segments. Viewed dorsally, each superior anal appendage appears much longer than its width at the base (**Fig. 3.1.660**). Length of male: abdomen 17.5 to 20 mm; female: c. 21 mm. Fore-wing length of male: 11.2 to 14 mm. Hind wing length of male: c. 18.4 mm; female: c. 14 mm.
.....*Homeoura ambigua* (Ris, 1904) (Argentina, Paraguay, Uruguay, São Paulo). Syn: *Enallagma ambiguum* Ris, 1904; *Acanthagrion ambiguum* (Ris, 1904); *Argentagrion ambiguum* (Ris, 1904).

- The eighth and ninth abdominal segments of the male are entirely pale dorsally (**Fig. 3.1.659**). 4

4. The black markings on the third through sixth abdominal segments are very narrow, except at the posterior margin, and that on the seventh is limited to the anterior third. Viewed dorsally, each superior anal appendage appears no longer than its width at the base (**Fig. 3.1.659**).
..... *Homeoura silviae* (Bulla, 1971) (Paraguay, Rio de Janeiro, São Paulo). Syn: *Argentagrion silviae* Bulla, 1971.

- The black markings on the third through sixth abdominal segments of the male cover the entire dorsum except for a pale basal ring, which covers a maximum of 1/8 of the segment. The eighth through tenth segments of the male are entirely bright blue. In dorsal view, the superior anal appendage of the male appears considerably longer than its width at the base. There is an oval excision along the midline of the posterior margin of the tenth abdominal segment of the male, which is bordered by small processes that curve dorsoposteriad (**Fig. 3.1.661**). Length of abdomen: 20 to 21 mm. Fore-wing length: c. 14 mm.
.....male *Homeoura lindneri* Ris, 1928 (Argentina, Minas Gerais, São Paulo). Syn: *Acanthagrion lindneri* Ris, 1928.

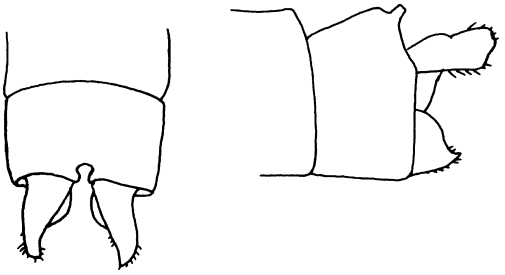


Fig. 3.1.661 *Homeoura lindneri* male: apex of the abdomen in dorsal and lateral view. Based on Ris (1928b).

Platystictidae

This family is represented by a single genus in South America: *Palaemnema* Selys, 1860.

Key to the species of adult *Palaemnema* in South America

Information for the key was provided by Ris (1916), Calvert (1931), Cowley (1934), Kennedy (1942b), De Marmels (1989c), and Machet (1990).

1. The coloration is mainly light brown and brownish red. The dorsal side of the prothorax is reddish with an extensive light brown marking on the lobes, and otherwise pale brown. An incomplete, brownish red antehumeral stripe is present which covers about ¾ of the width of the mesepisternum. The abdomen is largely reddish brown and light brown. In lateral view, the superior anal appendage of the male appears strongly folded ventrad (**Fig. 3.1.662**). The wings are hyaline or slightly smoky with black veins and a pale brown pterostigma with a pale border. Total length of male: c. 40 mm. Length of the male abdomen including appendages: c. 34 mm. Fore-wing of the male: c. 23 mm. Length of the hind wing of the male: c. 22.5 mm. The female has not been described.
.....*Palaemnema brevignoni* Machet, 1990 (Venezuela, French Guiana).
- The main color of the propleuron, the lateral part of the prothorax, is blue, a shade of yellow, dark brown, or black (**Fig. 3.1.663**). 2

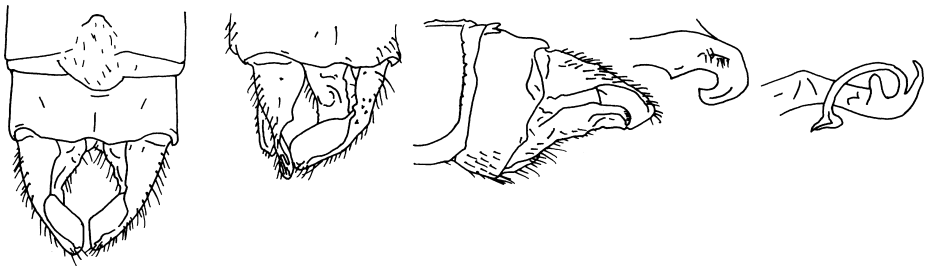


Fig. 3.1.662 *Palaemnema brevignoni* male (left to right): apex of the abdomen in dorsal, dorsal oblique, and lateral view; the apex of the superior anal appendage in posterior view; the penis in lateral view. Based on Machet (1990).

2. The main color of the propleuron is blue or a shade of yellow. The wings are hyaline or faintly clouded at the apices (**Fig. 3.1.663**). 3
- The main color of the propleuron is dark brown or black (**Fig. 3.1.664**). 8

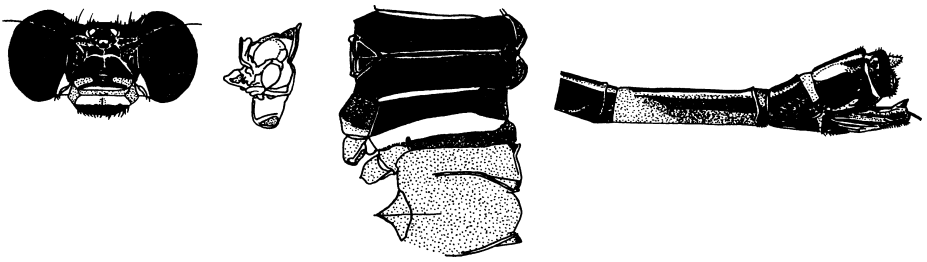


Fig. 3.1.663 *Palaemnema melanocauda* female (left to right): head in anterior view, prothorax in lateral view, diagram of the color pattern on the unfolded meso and metathorax, apex of the abdomen. Based on Kennedy (1942b).

Fig. 3.1.664 *Palaemnema mutans* (upper row, left to right): thorax of a male in lateral view, penis in ventral and lateral view, apex of the abdomen of a male in dorsal view, and two views of the superior anal appendage of the male more obliquely toward the internal surface of the dorsal side, antennae from two specimens, the upper one apparently abnormal (middle left), apex of the male abdomen in lateral view (center), and the inferior anal appendage of a male viewed from a dorsoposterior internal view (middle right center) five views of its apex on various specimens and at different angles (lower right, below and to the right of the whole appendage), the posterior border of the head and anterior part of the thorax of a female in dorsal view (lower left) with dotted lines to indicate the locations of the pale spots, and the left side of the lateral margin of the posterior part of the head (lower left center). Based on Calvert (1931).

3. A pale antehumeral line or stripe is absent in the male (**Fig. 3.1.665**). The female has not been described.
.....*Palaemnema edmondi* Calvert, 1931 (Colombia). Two Central American species share the characteristics in the key. *P. edmondi* can be distinguished from them by its superior appendage of the male, which is not excised but is in the two Central American species.
- On the males and on some females, there is a pale antehumeral line or stripe (**Fig. 3.1.663**). 4

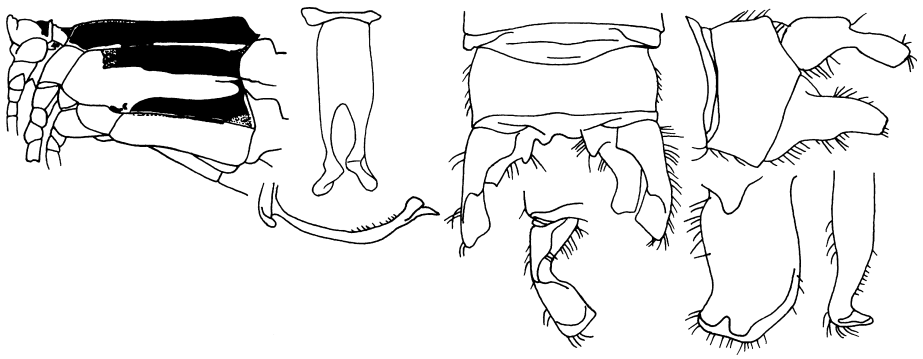


Fig. 3.1.665 *Palaemnema edmondi* (left to right)*:* thorax of a male in lateral view, penis in ventral (above) and lateral view (below), apex of the male abdomen in dorsal view above a superior anal appendage in dorsointernal view, and the apex of the same abdomen in lateral view above views of the inferior anal appendage in dorsoposterior internal and dorsolateral view (left and right, respectively). Based on Calvert (1931).

4. The antehumeral line on the female and known males is less than 1 mm wide (**Fig. 3.1.663**). 5
- The antehumeral stripe on the male is blue and at least 1.5 mm wide. The dorsal surfaces of the eighth through tenth abdominal segments of the female are mainly dark brown or blackish, or the ninth has a pair of blue spots, each usually longer than half the segment length, and the tenth segment may sometimes be extensively blue (**Fig. 3.1.666**). 6
5. The antehumeral line on the male and female is greenish yellow and about 0.8 mm wide. The dorsal surfaces of the eighth through tenth abdominal segments of the female of the one species described are orange with a narrow black line at the base of the eighth and lateral black longitudinal stripes along each segment. The superior appendage of the male is only slightly angulated on its ventral margin; the apex shows a very slight excision in the middle and lacks a superior tooth (**Fig. 3.1.667**).
.....*Palaemnema croceicauda* Calvert, 1931 (Colombia).

- The antehumeral line on the female is blue. There is a pair of blue dots on the dorsal surface of the ninth abdominal segment (**Fig. 3.1.663**). Length of abdomen, including appendages: c. 30 mm. Hind wing length: c. 22 mm. The male has not been described.
.....*Palaemnema melanocauda* Kennedy, 1942 (Ecuador).

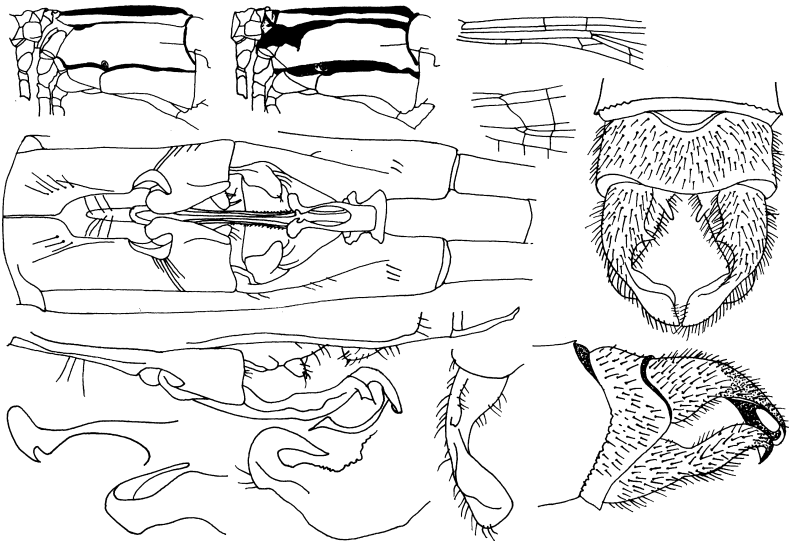


Fig. 3.1.666 *Palaemnema nathalia:* thoraces of two male specimens in lateral view (upper left and center), veins at the base of the wing of a female (upper right) and the region of the arculus of a male (below veins of female wing), genitalia in the second abdominal segment of a male in ventral (upper middle left) and lateral view (lower middle left) with an enlargement of one side of the apex of the penis (lower left), apex of the male abdomen in dorsal (middle right) and lateral view (lower right), superior anal appendage in dorsointernal view (lower right center), and the inferior anal appendage in dorsoposterior internal and dorsolateral view (lower center and left center). Based on Calvert (1931).

6. There is no brown or black stripe running from the posterior end of the metepimeron across the lateroventral carina and the metasternum nearly as far as the hind coxa. There is a tooth on the dorsal surface of the superior appendage of the male that is 0.27 to 0.40 times the length of the appendage. There are 20 to 26 postnodal cross veins in the fore-wing, and the nodal sector, Rs, arises at the eighth or ninth (**Fig. 3.1.666**). Length of abdomen: c. 33 mm. Hind wing length: c. 23 mm.
.....*Palaemnema nathalia* Selys, 1886 (Central America, Venezuela). The species was submitted for the national Red Data Book of Venezuela (De Marmels, 1999a).

- There is a brown or black stripe or brownish cloud on the metepimeron (**Fig. 3.1.668**). There are 17 to 23 postnodal cross veins in the fore-wing, and the nodal sector, Rs, arises between the seventh and ninth. 7

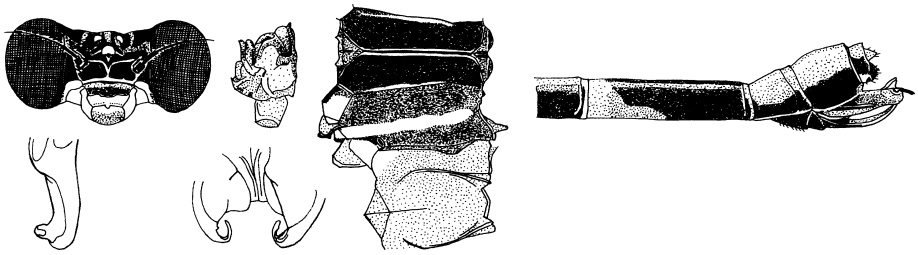


Fig. 3.1.667 *Palaemnema croceicauda*: head of a female in anterior view (upper left), prothorax of a female in lateral view (upper left center), diagram of the color pattern on the unfolded meso and metathorax of a female (right center), apex of the female abdomen (right), and the inferior appendages of a male (lower left center) with one enlarged (lower left). In life, unstippled areas are blue, lightly stippled areas are yellow, and dark areas are black or dark brown. Based on Kennedy (1938, 1942b).

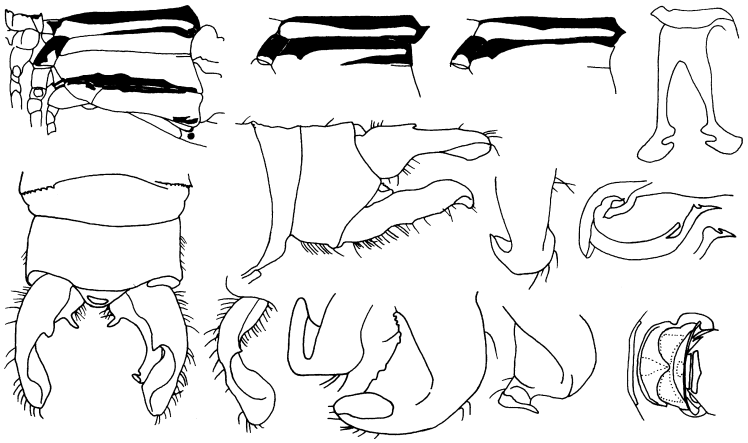


Fig. 3.1.668 *Palaemnema clementia* (upper row, left to right): thorax of a male in lateral view and upper part of the thoraces of two other male specimens; penis in ventral view; and apex of the abdomen of a male in dorsal (lower left) and lateral view (left center); apex of the inferior anal appendage of a male in dorsolateral view (middle right center) and in posterior, dorsoposterior internal, and anterodorsal view (lower center to right, left to right respectively), superior anal appendage of a male in dorsointernal view (lower left center), penis in lateral view with the apex shown again from a slightly different angle (middle right), and the occipital margin of the head and anterior portion of the thorax of a female with the positions of the light markings shown by dotted lines (lower right). Based on Calvert (1931).

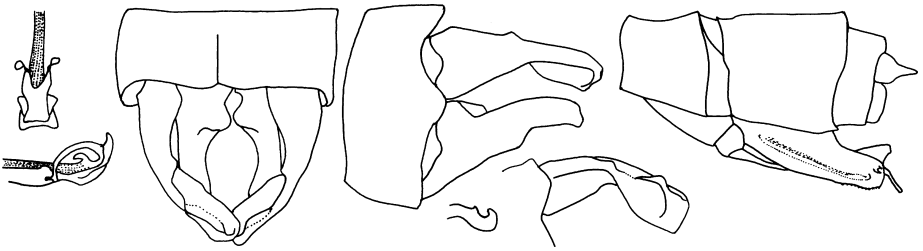


Fig. 3.1.669 *Palaemnema tepuica* (left to right): penis in ventral (above) and lateral view (below); apex of the male abdomen in dorsal and lateral view with the apex of the inferior anal appendage in posterior view and the superior anal appendage in dorsointernal view below it (left and right, respectively), and the apex of the female abdomen in lateral view. Based on De Marmels (1989c).

7. There is only a tubercle on the dorsal surface of the superior anal appendage of the male (**Fig. 3.1.669**). There are about 17 postnodal cross veins in for fore-wing of the male, and about 19 in the female, and the nodal sector arises at the seventh. There is a brownish cloud on the ventral margin of the metepimeron. Much of the tenth abdominal segment is blue. Total length: 44 to 50 mm, including appendages. Length of abdomen: 36 to 42 mm, including appendages. Hind wing length: 26 to 28 mm.
.....*Palaemnema tepuica* De Marmels, 1989 (Venezuela).

- There is a tooth on the dorsal surface of the superior appendage of the male that is 0.38 to 0.48 times the length of the appendage. There are 18 to 23 postnodal cross veins in the fore-wing of the female, and the nodal sector usually arises at the eighth or ninth. There is a brown or black stripe running from the posterior end of the metepimeron across the lateroventral carina and the metasternum nearly as far as the hind coxa; it is brown in the female and brown or black in the male (**Fig. 3.1.668**). The tenth abdominal segment is black.
.....*Palaemnema clementia* Selys, 1886 (Colombia, Ecuador, Peru, Venezuela).

8. There is a pale antehumeral stripe, at least a very short one at the ventral end of the mesepisternum (**Fig. 3.1.664**). 9

- There is no pale antehumeral stripe on the male, although a spot at the inferior end may be present (**Fig. 3.1.670**). The eighth abdominal segment of the male is mainly black. 15

9. At the apex, the superior appendage of the male is excised to form an angle of 90º (**Fig. 3.1.664**). 10

- The superior appendage of the male is excised only slightly at the apex, if at all (**Fig. 3.1.671**). 12

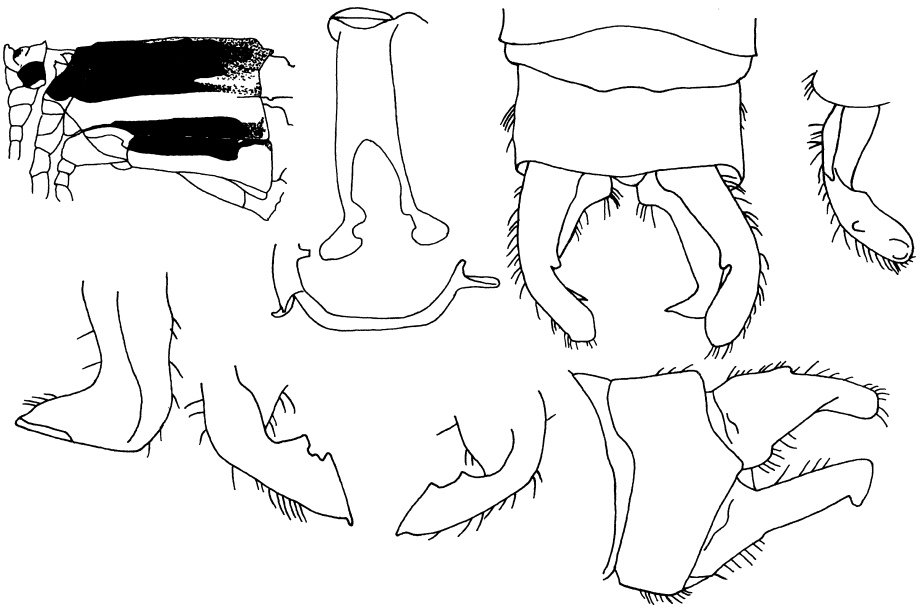


Fig. 3.1.670 *Palaemnema azupizui* male (upper row, left to right): thorax in lateral view; penis in ventral (above) and lateral view (below); apex of the abdomen in dorsal view; superior anal appendage in dorsointernal view; and (lower row, left to right): apex of the inferior anal appendage in dorsointernal posterior view, apices of the left and right inferior anal appendages in posterior view, and apex of the abdomen in lateral view. Based on Calvert (1931).

Fig. 3.1.671 *Palaemnema peruviana* male (left to right): appendages at the apex of the abdomen in dorsal and lateral view, the superior anal appendage in dorso-internal and dorso-external view, and the inferior anal appendage in ventral oblique view. Based on Calvert (1931).

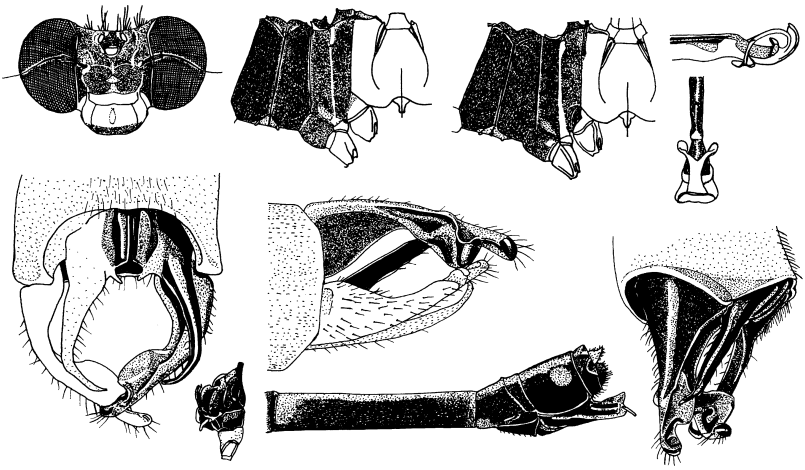


Fig. 3.1.672 *Palaemnema lorena* (upper row, left to right): head of a male in anterior view, diagram of the meso and metathoracic color patterns of a male and a female, and the penis in dorsal (below) and lateral view (above); the apex of the male abdomen in ventral (lower left), dorsolateral (middle), and posteroventral view (lower right), prothorax of a male (lower left center) and the apical part of the abdomen of a female (lower right center). Based on Kennedy (1942b).

10. The dorsal margin of the superior appendage of the male is not at all produced; the apex has a narrow terminal lobe and a large flat lobe with a U-shaped ridge on the inner surface (**Fig. 3.1.672**). Length of abdomen, including appendages: 35 to 36 mm. Hind wing length: 26 to 27 mm.
.....*Palaemnema lorena* Kennedy, 1942 (Ecuador).

- The dorsal margin of the superior appendage of the male is extended to form a long process (**Fig. 3.1.664**). The blue antehumeral stripe is 0.16 to 0.50 mm long and located just posterior to the anterior mesepisternal margin. It may fade out in dried specimens. 11

11. Transmitted light through the pterostigma is wine-red. The apical 1/4 to 1/3 of the eighth abdominal segment and all of the ninth and tenth segments of the male are blue dorsally. The apex of the inferior appendage of the male is trough-shaped and turns dorsad to form a hemispherical knob (**Fig. 3.1.664**).
.....*Palaemnema mutans* Calvert, 1931 (Venezuela).

- In transmitted light, the pterostigma appears brownish or blackish. The apical segments of the abdomen of the male are all black or may have small blue markings on the eighth and ninth segments. The apex of the inferior appendage of the male is forked (**Fig. 3.1.21**). Length of male abdomen, including

appendages: 34 to 39 mm; female abdomen: 28 to 33 mm. Hind wing length of male: 22 to 27 mm; female: 23 to 26 mm.
.....*Palaemnema picicaudata* Kennedy, 1938 (Ecuador).
12. There is no slender, spine-like tooth at the base of each inferior appendage; there is either a blunt tubercle or no structure at all. The ninth abdominal segment of the male has only a black ventral stripe on each side of the midline running the length of the segment (**Fig. 3.1.673**). 13
- There is a slender, spine-like tooth about half as long as the width of the apex of the superior appendage at the base of each inferior appendage of the male (**Fig. 3.1.673**). 14

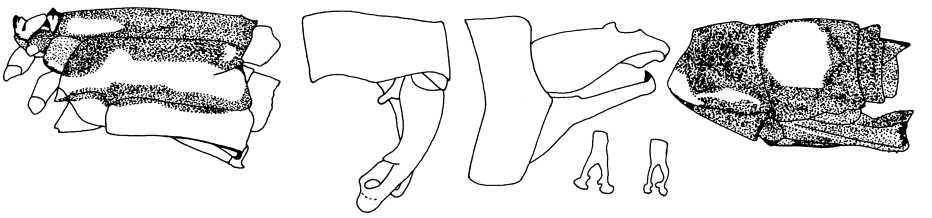


Fig. 3.1.673 *Palaemnema orientalis* (left to right): color pattern on the thorax with the darker areas blackish, and the lighter ones, blue; the tenth abdominal segment with one set of the appendages removed in dorsal and lateral view; the end segments of the penis of two different specimens (below lateral view of appendages); the apex of the abdomen of a female. Based on De Marmels (1989c).

13. There is only a blunt tubercle at the base of the inferior appendage of the male and no tooth is present at about the mid-length on the inner margin. There is no black dorsal spot on the eighth abdominal segment (**Fig. 3.1.671**). Length of abdomen: c. 38 mm. Hind wing length: c. 26 mm.
.....*Palaemnema peruviana* Ris, 1918 (Peru).
- There is no blunt tubercle at the base of the inferior appendage of the male, but there is a small tooth at about the mid-length on the inner margin. There is a black dorsal spot at the base of the eighth abdominal segment (**Fig. 3.1.674**). Length of male abdomen: c. 40 mm. Hind wing length of male: c. 26.5 mm. Length of pterostigma along the costal margin: 0.95 mm in the fore-wing and 1.15 mm in the hind wing. The predominant colors are black, yellow, and blue. The female has not been described.
.....*Palaemnema martini* Cowley, 1934 (Peru).

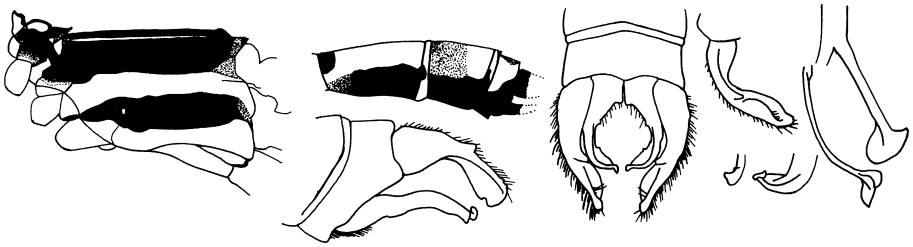


Fig. 3.1.674 *Palaemnema martini* male: thorax in lateral view (left), eighth through tenth abdominal segments in lateral view showing only the bases of the anal appendages (upper left center), apex of the abdomen with appendages in dorsal (right of center) and lateral view (lower left center), superior anal appendage in dorsomedial view (upper right center), right terminal filament of the penis in ventral (upper right) and lateral view (middle to lower right), and the apex of the inferior anal appendage in posterior and oblique posterodorsal view from the inner aspect (lower right center, left and right, respectively). Based on Cowley (1934).

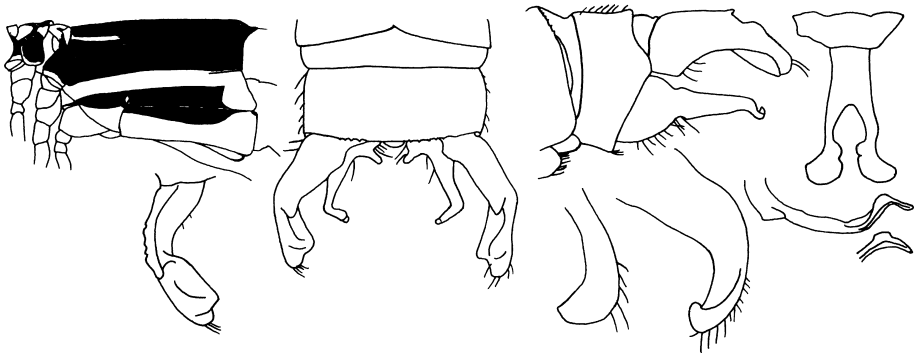


Fig. 3.1.675 *Palaemnema melanostigma:* thorax of a male in lateral view (upper left), penis in ventral (upper right) and lateral view with the apex viewed at another angle below it (lower right), apex of the abdomen in dorsal (upper left center) and lateral view (upper right center), apex of the inferior anal appendage in posterior and dorsoposterior internal view (lower right center, left and right, respectively), and the superior anal appendage in dorsal internal view (lower left). Based on Calvert (1931).

14. Beyond the dorsal tooth just beyond the middle of the superior appendage of the male, the height of the appendage in lateral view decreases almost by half. The ninth abdominal segment of the male has a black ventral stripe on each side of the midline running the length of the segment and black transverse dorsal markings at the anterior and posterior ends of the segment (**Fig. 3.1.675**).
.....*Palaemnema melanostigma* Hagen in Selys, 1860 (Venezuela).
- Beyond the dorsal tooth just beyond the middle of the superior appendage of the male, the appendage changes little in height and tapers gradually toward the apex (**Fig. 3.1.673**). Total length, including appendages: 43 to 48 mm. Length of abdomen: 35.5 to 40 mm. Hind wing length: 24 to 28 mm. The color is mainly black with blue markings, a greenish yellow ventral half of the metepimeron, and a beige labium.
.....*Palaemnema orientalis* De Marmels, 1989 (Venezuela).
15. The ninth abdominal segment of the male is mainly blue dorsally (**Fig. 3.1.676**). 16
- The ninth abdominal segment of the male is black dorsally (**Fig. 3.1.677**). ...18
16. The tenth segment is black. There is a blue ventrolateral triangle on the eighth abdominal segment, evident in lateral view. The ninth segment of the male has a large blue, saddle-shaped marking on the dorsal side, while the ninth segment of the female is black dorsally (**Fig. 3.1.676**). Length of male abdomen, including appendages: 35 to 39 mm; female: 31 to 38 mm. Hind wing length: 24 to 29 mm.
.....*Palaemnema brucelli* Kennedy, 1938 (Ecuador).
- The tenth segment of the male is mainly or entirely blue (**Fig. 3.1.670**). 17

Fig. 3.1.676 *Palaemnema brucelli* (left to right): color pattern on the thorax in lateral view, penis in ventral (above) and lateral view (below), apices of the inferior anal appendages of two specimens (above and below), enlarged posterior view of the inferior anal appendage, and color patterns on the apices of the male (above) and female abdomen (below). Based on Kennedy (1938).

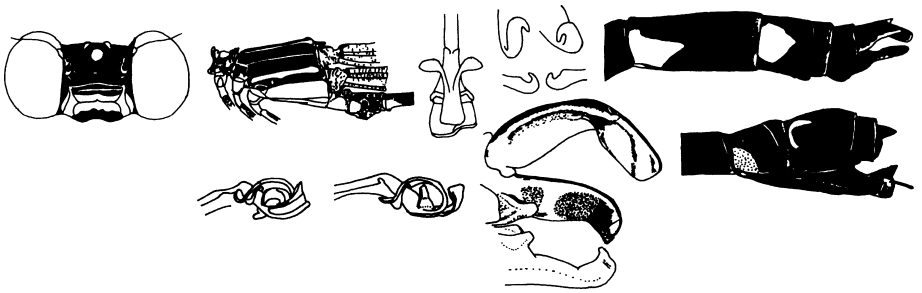


Fig. 3.1.677 *Palaemnema abbreviata* (above, left to right): head in anterior view showing the pattern of black and gleaming bluish white, color pattern on the thorax in lateral view, penis in ventral view, apices of inferior anal appendages of two specimens (above and below), color pattern on the apical segments of the male abdomen, and (below, left to right): lateral views of the penes of two specimens, anal appendages in ventrolateral view, and color pattern on the apical segments of the female abdomen. Based on Kennedy (1938).

Fig. 3.1.678 *Palaemnema brucei:* thorax of a male in lateral view (upper left), penis in ventral (upper left center) and lateral view with the apex viewed at another angle below it (lower left center), apex of the abdomen in dorsal (upper right center) and lateral view (upper right), apex of the inferior anal appendage in dorsoposterior internal view (lower left) and its apex in posterior view (lower right center), and the superior anal appendage in dorsal internal view (lower right). Based on Calvert (1931).

17. There is a pale, obcuneate antehumeral spot at the inferior end, about 0.33 to 0.65 mm long (**Fig. 3.1.678**). The posterior 1/4 to 1/5 of the eighth abdominal segment is blue dorsally.
.....*Palaemnema brucei* Calvert, 1931 (Central America, Colombia).
- There is no pale antehumeral spot or stripe. There is no blue on the dorsal surface of the eighth abdominal segment (**Fig. 3.1.670**). Length of male abdomen: 40 mm. Hind wing length of male: 26.5 mm. Length of pterostigma of fore-wing measured along the costa: 1.9 to 2.0 mm. Color of male: metallic green, blue, and black on the thorax; blue and black abdomen; hyaline wings. The female has not been described.
.....*Palaemnema azupizui* Calvert, 1931 (Peru).

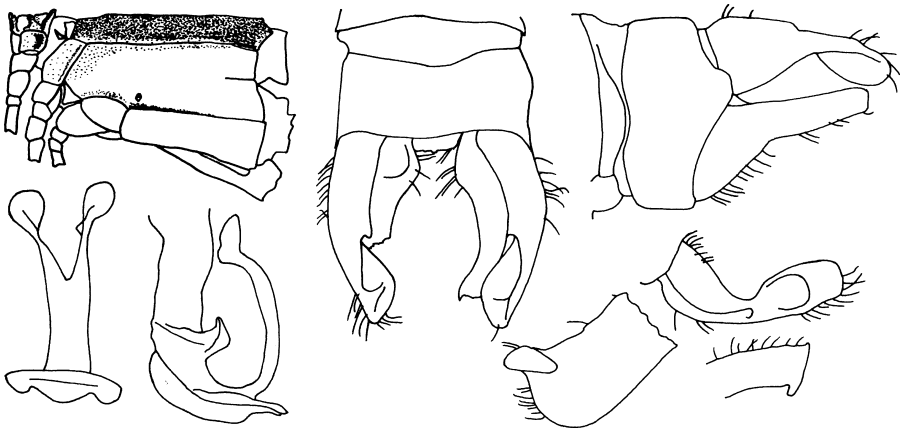


Fig. 3.1.679 *Palaemnema carmelita* male (upper row, left to right): color pattern on the lateral surface of the thorax, apex of the male abdomen in dorsal and lateral view, and (below, left and right) the apex of the penis in ventral and lateral view, inferior appendage, the left superior appendage in dorsomesal view (above), and apex of the right inferior appendage in dorsolateral view (below). Based on Calvert (1931).

18. The basal tooth of the male inferior appendage is only a blunt, sometimes triangular tubercle, which does not resemble the base of a spine. The length of the superior tooth of the superior appendage of the male is 0.48 to 0.53 times the appendage length. The color of the mesepimeron and mesepisternum is dark bronze violet (**Fig. 3.1.679**). Length of male abdomen: c. 42 mm; female abdomen: c. 38 mm. Hind wing length: 29 to 30 mm.
.....*Palaemnema carmelita* Ris, 1916 (Colombia).

- The basal tooth of the male inferior appendage forms a truncate lobe resembling the base of a spine, 1/6 to 2/5 as long as the width of the superior appendages (**Fig. 3.1.680**). 19

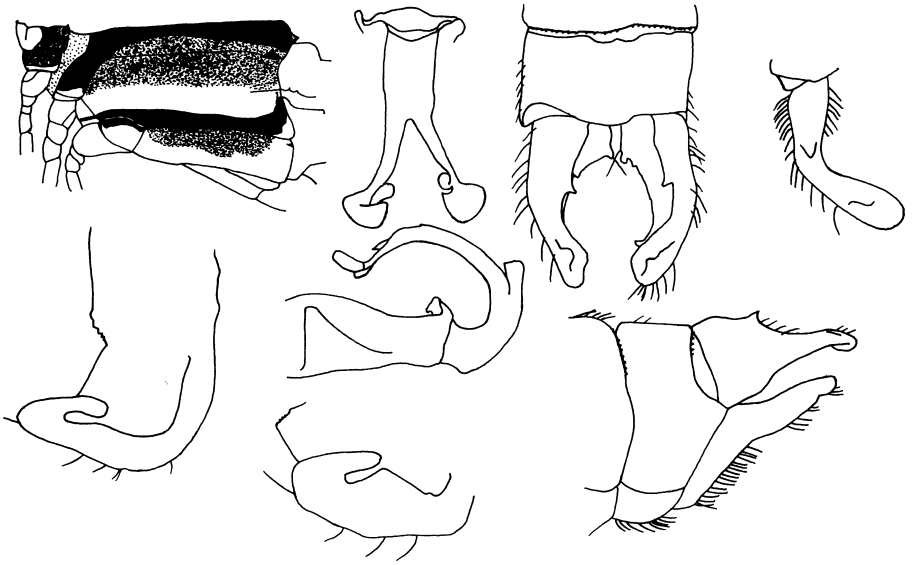


Fig. 3.1.680 *Palaemnema apicalis* male (upper row, left to right): thorax in lateral view; penis in ventral (above) and lateral view (below); apex of the abdomen in dorsal view; superior anal appendage in dorsointernal view; and (lower row, left to right): apex of the inferior anal appendages in dorsointernal and posterior view, and apex of the abdomen in lateral view. Based on Calvert (1931).

19. The length of the basal tooth on the male inferior appendage is 1/6 to 1/4 the width of the superior appendage. The length of the superior tooth of the superior appendage of the male is 0.43 times the appendage length. The color of the mesepimeron and posterior half of the mesepisternum is ferrugineous brown (**Fig. 3.1.680**).
.....*Palaemnema apicalis* Navás, 1924 (Colombia).
- The length of the basal tooth on the male inferior appendage is 1/3 to 2/5 the width of the superior appendage. The length of the superior tooth of the superior appendage of the male is 0.6 times the appendage length. The dark color on the thorax is mainly black (**Fig. 3.1.677**). Length of abdomen, including appendages: 35 to 37 mm. Hind wing length: 25 to 26 mm.
.....*Palaemnema abbreviata* Kennedy, 1938 (Ecuador).

Notes on the known *Palaemnema* larva from South America

Information was provided by De Marmels (2007a).

The larva of only one South American species, *Palaemnema clementia* Selys, 1886, has been described. Some of its features are shown in **Fig. 3.1.681**.

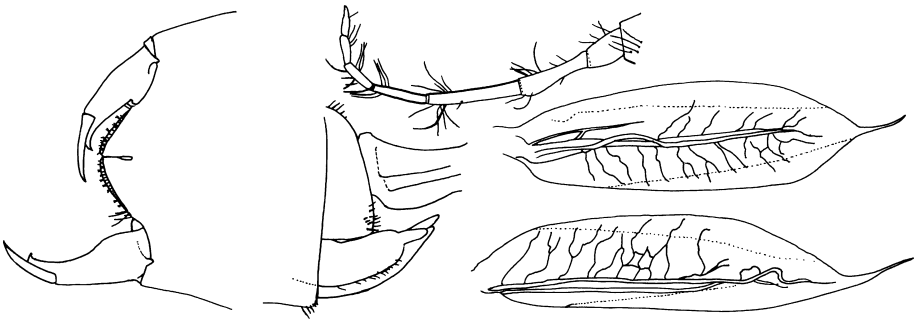


Fig. 3.1.681 *Palaemnema clementia* larva: apical margin of the prementum and the labial palps (left), antenna (upper center), developing ovipositor on the final instar larva (lower left center), and a lateral (upper right) and middle gill lamella (lower right). Based on De Marmels (2007a).

Protoneuridae

Key to the genera of adults in South America

Information for the key was provided by Williamson (1915, 1916b), Munz (1919), Santos (1966c), Rácenis (1968a), Machado (1985b,c,d), Lencioni (1999), and De Marmels (2003).

1. Vein Cu_2 forms one long cell, sometimes divided by a cross vein, which extends beyond the distal margin of the quadrangle (**Fig. 3.1.682**).
.....*Proneura* Selys, 1889
The only species described in this genus is *Proneura prolongata* Selys, 1889, from Peru.
- Vein Cu_2 is reduced to a cross vein, or it is entirely absent; it never extends beyond the distal margin of the quadrangle (**Fig. 3.1.683**). 2
2. Vein A extends beyond vein Ac (**Fig. 3.1.683**). 3
- Vein A is absent, indicated only by vein Ac (**Fig. 3.1.684**). 5

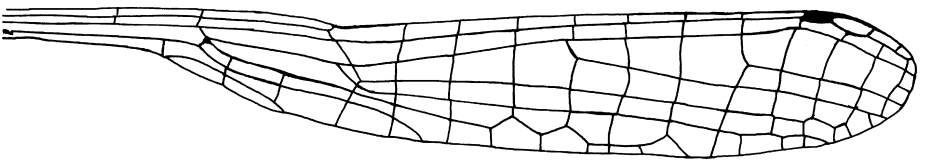


Fig. 3.1.682 Fore-wing of a male *Proneura prolongata.* Based on Munz (1919).

3. The petiole of the wing extends almost as far as vein Ac. Vein Cu_1 meets the margin of the wing three to five cells distal to the level of the subnodus. There are three cells between the subnodus and fork in vein R_3 of the fore-wing (**Fig. 3.1.685)**.
.....*Peristicta* Selys, 1860..p. 583
- The petiole of the wing extends as far or slightly distal to vein Ac. Vein Cu_1 meets the margin of the wing less than one cells distal to the level of the subnodus. There are sometimes more than three cells between the subnodus and fork in vein R_3 of the fore-wing (**Fig. 3.1.683**). 4

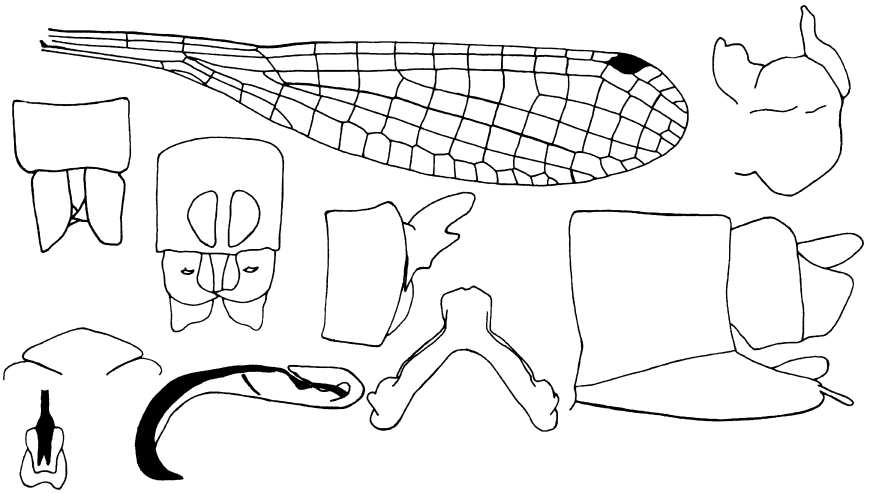


Fig. 3.1.683 *Idioneura ancilla:* hind wing (upper left); apex of the abdomen of a male in dorsal, ventral, and lateral view (middle left, left to right); posterior lobe of the male prothorax in dorsal view (lower middle left); penis in ventral (lower left) and lateral view (lower left center); prothorax of a female in lateral view (upper right); posterior lobe of the prothorax of a female in ventral view (lower right center); apex of a female abdomen in lateral view (lower right). Based on Munz (1919) and Santos (1962c).

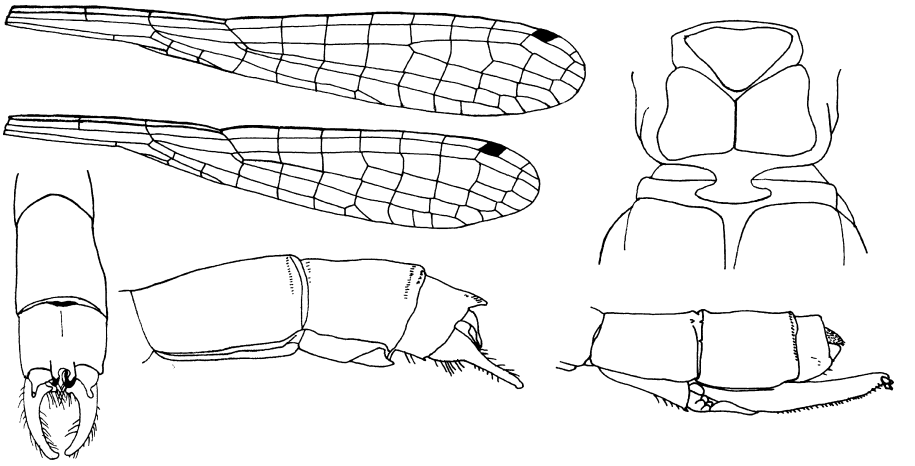


Fig. 3.1.684 *Junix elumbis:* fore and hind wing (upper left), prothorax in dorsal view (upper right), apex of the abdomen of a male in dorsal (lower left) and lateral view (lower center), and apex of the abdomen of a female in lateral view (lower right). Based on Rácenis (1968a).

4. Vein Ac is not farther from the level of the first antenodal cross vein than from that of the second. The first antenodal space is more than 1.5 times as long as the second. Distal to the pterostigma in the hind wing, there are at least five cross veins in the costal space (**Fig. 3.1.686**). The tibial spines are short.
.....*Neoneura* Selys, 1860..p. 585
- Vein Ac is farther from the level of the first antenodal cross vein than from that of the second. The first antenodal space is less than 1.5 times as long as the second. Distal to the pterostigma in the hind wing, there are three or four cross veins in the costal space (**Fig. 3.1.683**).
.....*Idioneura* Selys, 1860
There is only one species in this genus: *Idioneura ancilla* Selys, 1860, from Bahia, Espirito Santo, Rio de Janeiro, and São Paulo.
5. The inferior anal appendage of the male is at least twice as long and the superior appendage. Do not mistake the long ventral apophysis on the superior appendage for an inferior appendage. At the posterior margin of the tenth abdominal segment, there is a deeply forked median process with parallel branches. The ovipositor extends posterior to the apex of the female abdomen by a distance greater than the length of the tenth segment. The first antenodal cell is slightly longer than the second and subequal to the third (**Fig. 3.1.684**).
.....*Junix* Rácenis, 1968
The only known species in this genus is *Junix elumbis* Rácenis, 1968, from Venezuela.

- The male inferior anal appendage is about equal to or shorter than the superior appendage (**Fig. 3.1.687**). 6
6. The lengths of the antenodal cells are subequal (**Fig. 3.1.687**). 7
- The lengths of the antenodal cells are unequal (**Fig. 3.1.688**). 8

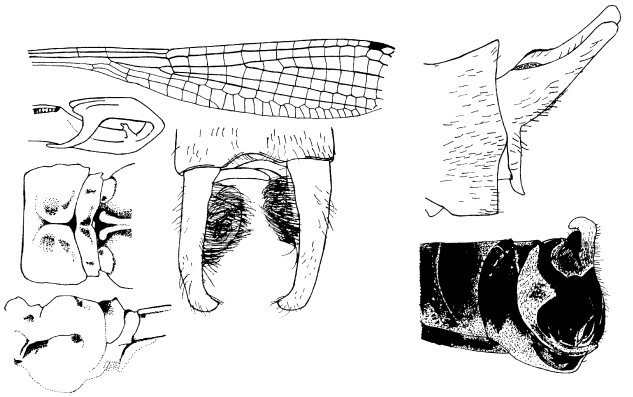


Fig. 3.1.685 *Peristicta forceps:* hind wing of a female with the apex missing (above); penis in lateral view (upper middle left); apex of the male abdomen in dorsal (lower center), oblique posterior (lower right), and lateral view (upper right); pronotum and mesostigmal lamina of a female in dorsal (lower middle left) and lateral view (lower left). Based on Munz (1919) and Pessacq (2007).

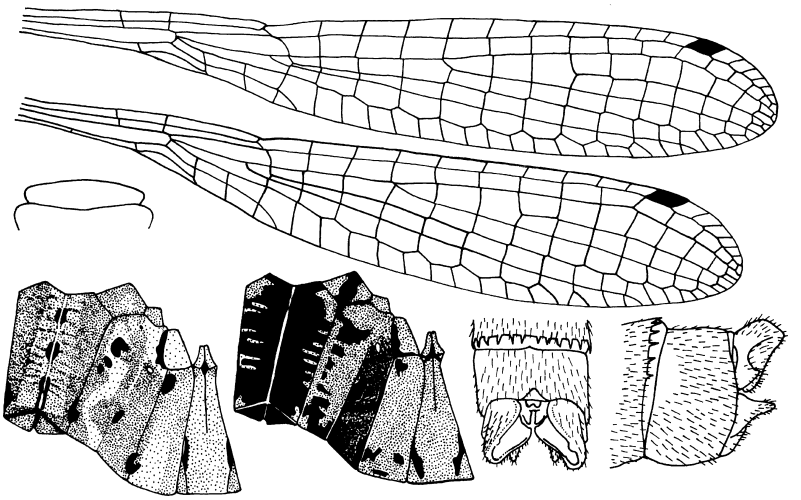


Fig. 3.1.686 *Neoneura rubriventris* male: fore and hind wing (above), posterior lobe of the prothorax (middle left), and (lower row, left to right) diagram of the color patterns on the synthoraces of two specimens, and the apex of the abdomen in dorsal and lateral view. Based on Williamson (1917b).

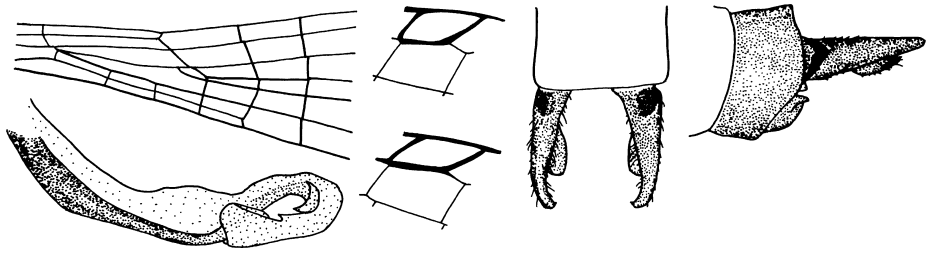


Fig. 3.1.687 *Phasmoneura janirae* male: base of the hind wing (upper left), pterostigmata of the fore and hind wing (left center, above and below, respectively), penis in lateral view (lower left), and the apex of the male abdomen in dorsal (right center) and lateral view (right). Based on Lencioni (2005).

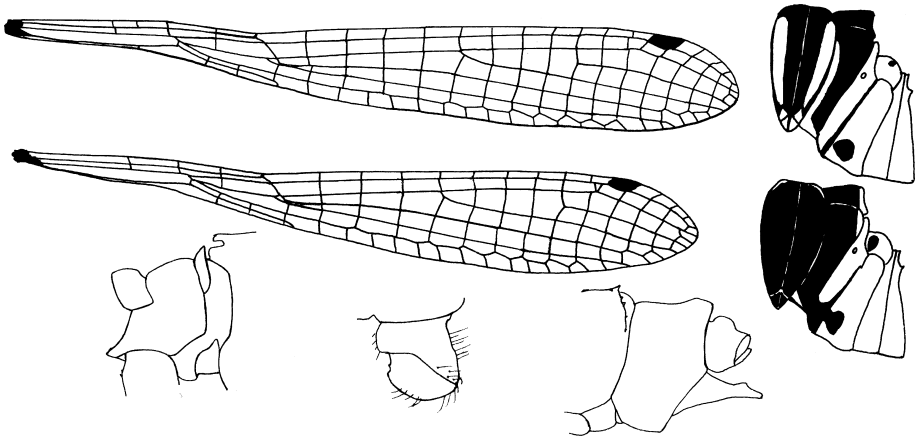


Fig. 3.1.688 *Protoneura amatoria:* fore and hind wing (upper left), diagram of the color pattern on the synthorax of a male (upper right) and a female (lower right), prothorax of a female in lateral view (lower left), superior anal appendage of a male in dorsal view (lower left center), and apex of a male abdomen in lateral view (lower right center). Based on Eaton and Calvert (1892-1907) and Williamson (1915).

7. The superior anal appendage of the male has a ventral apophysis, that is, a large tooth on the distal half projecting from the inner or ventral margin, in the form of a simple lobe. The internal fold of the penis does not reach the third segment ventrally, and the apex of the third segment does not bear filaments (**Fig. 3.1.687**).
.....*Phasmoneura* Williamson, 1916..p. 600
- The superior anal appendage of the male has a ventral apophysis in the form of a lobe divided into two apical branches. The apex of the third segment of the penis bears a pair of long filaments (**Fig. 3.1.22**).
.....*Lamproneura* De Marmels, 2003
The only species in this genus is *Lamproneura lucerna* De Marmels, 2003, from Venezuela.
8. The antenodal cell closest to the wing root is at least twice as long as the second. The origins of veins R_3 and R_{4+5} are separated, and that of R_{4+5} is located at the subnodus (**Fig. 3.1.688**). 9
- The first antenodal cell is longer than the second but less than twice as long (**Fig. 3.1.689**). 10

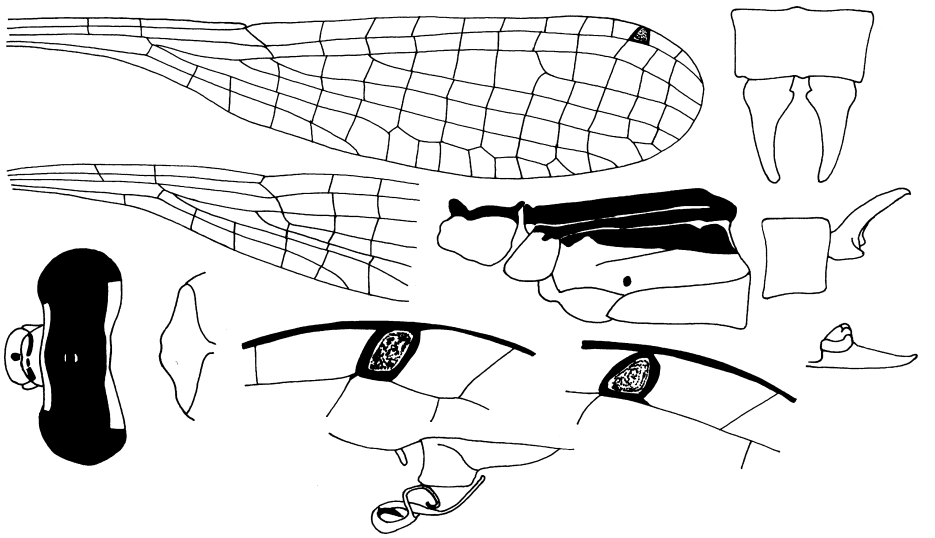


Fig. 3.1.689 *Roppaneura beckeri*: hind wing of a male (upper left) and base of the hind wing of a female (middle left), head of a male in dorsal view (lower left), prothorax of a male in dorsal view (lower left center), the pterostigma of a male (lower right) and a female (left of male), color pattern on the thorax in lateral view (above pterostigmas), male genitalia on the second abdominal segment in lateral view (lower center), apex of the male abdomen in dorsal (upper right) and lateral view (middle right), superior anal appendage of the male in ventral oblique view (lower right). Based on Santos (1966c).

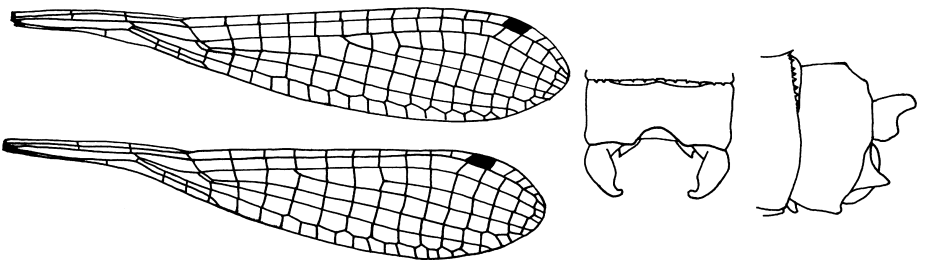


Fig. 3.1.690 *Epipleoneura fuscaenea* male (left to right): fore and hind wing and the apex of the abdomen in dorsal and lateral view. Based on Williamson (1915).

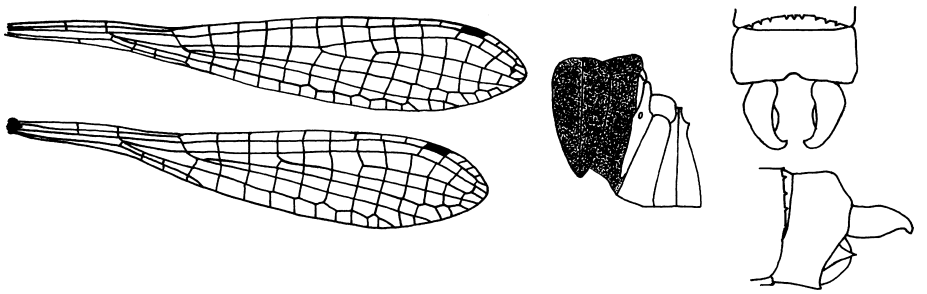


Fig. 3.1.691 *Epipotoneura nehalennia* male: fore and hind wing (left), lateral view of the thorax showing the color pattern (center), and apex of the abdomen in dorsal (upper right) and lateral view (lower right). Based on Williamson (1915).

9. The width of each wing is about 1/7 of its length or less. The space between the first complete antenodal cross vein and the wing root is longer than the third space and about twice as long as the second or longer. In the fore-wing, vein R_{4+5} arises proximal to the fifth postnodal vein, and vein R_3 arises at the same distance or slightly proximal to it. In the hind wing, vein R_3 arises at or just proximal to the fourth postnodal vein. Vein R_{4+5} ends distal to the pterostigma. The male does not have a supra-anal plate (**Fig. 3.1.688**).
.....*Protoneura* Selys, 1857..p. 601

- The width of each wing is nearly 1/6 of its length or greater. The space between the antenodal cell closest to the wing root is about equal in length to the third space, and each is approximately twice as long as the second space. The distance from the base to the nodus is about 1/3 of the length of the wing or less. Vein R_3 arises directly posterior the nodus, and R_{4+5} always arises proximal to it. Vein Cu_1 extends beyond the vein that arises posterior to the nodus. The male has a supra-anal plate (**Fig. 3.1.690**). Most or all species of this genus seem to be forest dwellers, which develop as larvae in pools of water trapped in epiphytic plants or holes in trees.
.....*Epipleoneura* Williamson, 1915..p. 608

10. Vein R_3 arises at the subnodus, and R_{4+5} arises separately, well proximal to the subnodus (**Fig. 3.1.689**). The length of the male abdomen of the only species described is c. 28 mm, and the hind wing length of the male is c. 15.5 mm. Its coloration is mainly black and pale yellow.
.....*Roppaneura* Santos, 1966

The only species described in this genus is *Roppaneura beckeri* Santos, 1966, from Minas Gerais.

- The origins of veins R_3 and R_{4+5} are joined in one vein, which arises at or distal to the subnodus (**Fig. 3.1.691**). 11

11. Vein Cu_1 extends distad to the cross vein that runs posterior from the nodus. Vein M_2 arises at the level of the fifth postnodal cross vein in the fore-wing and at the level of the third or at least proximal to the fourth in the hind wing. The first and third costal spaces from the wing root are equally long, and the second is more than half as long but shorter than the third. The width of the stigma is less than half its length (**Fig. 3.1.691**).
.....*Epipotoneura* Williamson, 1915

The only species in this genus is *Epipotoneura nehalennia* Williamson, 1915, from Guyana.

- Vein Cu_1 ends at the cross vein that runs posterior from the nodus. All three costal spaces proximal to the nodus are about equal in length. Inferior anal appendages are absent (**Fig. 3.1.692**). 12

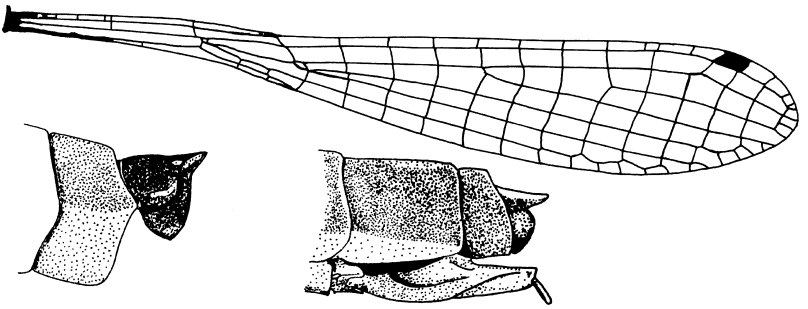


Fig. 3.1.692 *Psaironeura remissa:* hind wing of a male (above), and the apex of the abdomen of a male (lower left) and a female (lower right) in lateral view. Based on Munz (1919) and Esquivel (1993).

12. M_2 in the fore-wing arises proximal to the seventh postnodal vein, usually at the sixth or even more proximal, and in the hind wing, it arises at or proximal to the fourth (**Fig. 3.1.692**). The color pattern is reddish.
.....*Psaironeura* Williamson, 1915..p. 624
- M_2 in the fore-wing arises at the seventh postnodal vein, and in the hind wing, it arises at the fifth. The superior anal appendage bears an internal apophysis and a branch directed ventrad. The penis has an internal fold in contact with the third segment, which bears two long filaments at its apex (**Fig. 3.1.693**).
.....*Forcepsioneura* Lencioni, 1999..p. 625

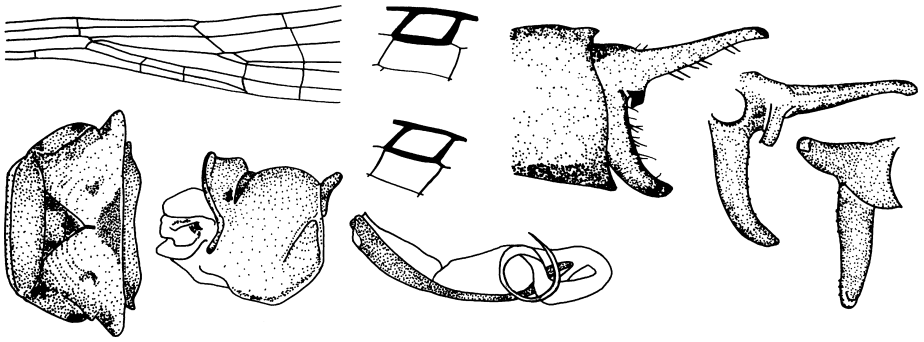


Fig. 3.1.693 *Forcepsioneura garrisoni* male (above, left to right): veins at the base of the hind wing, pterostigmata of the fore (above) and hind wing (below), apex of the abdomen in lateral view, superior anal appendage in internal and posterior view, and (below, left to right): prothorax in dorsal and lateral view, and the penis in lateral view. Based on Lencioni (1999, 2005).

Information on the genera of known larvae in South America

Information for the key was provided by Santos (1969b, 1972b) and De Marmels (2007a). The larvae of few South American species have been described, making it premature to prepare a reliable key to the genera.

1. There are three long setae in a row on each side of the prementum and five long setae in a row on each labial palp proximal to the moveable hook. The caudal gills are long and petiolate and end in a nearly acute tip (**Fig. 3.1.694**).
.....*Idioneura* Selys, 1860
There is only one species in this genus: *Idioneura ancilla* Selys, 1860, from Rio de Janeiro and Espirito Santo.
- There is only one long seta on each side of the prementum and three or four long setae in a row on each labial palp proximal to the moveable hook (**Fig. 3.1.695**). 2

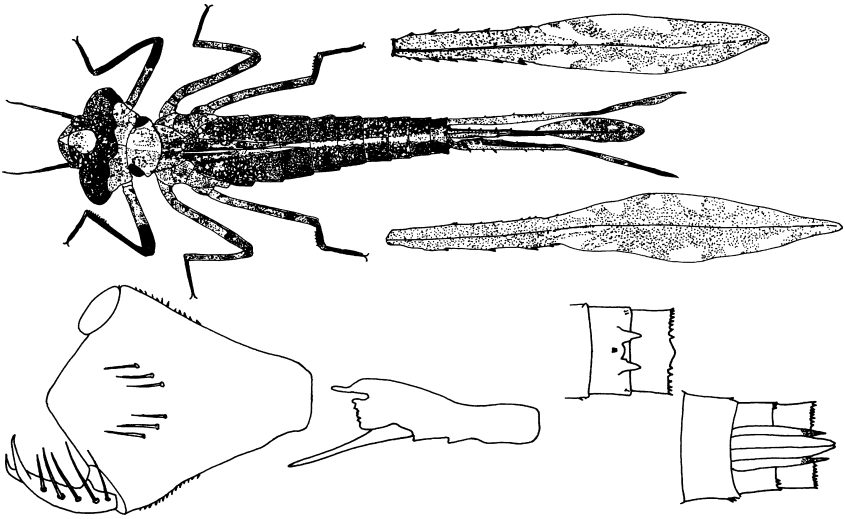


Fig. 3.1.694 *Idioneura ancilla* larva: habitus (upper left), labium with one palp removed (lower left), labial palp (lower center), median (upper right) and lateral gill lamella (middle right), and apical abdominal segments of a male (lower right center) and a female (lower right) in ventral view. Based on Santos (1969b).

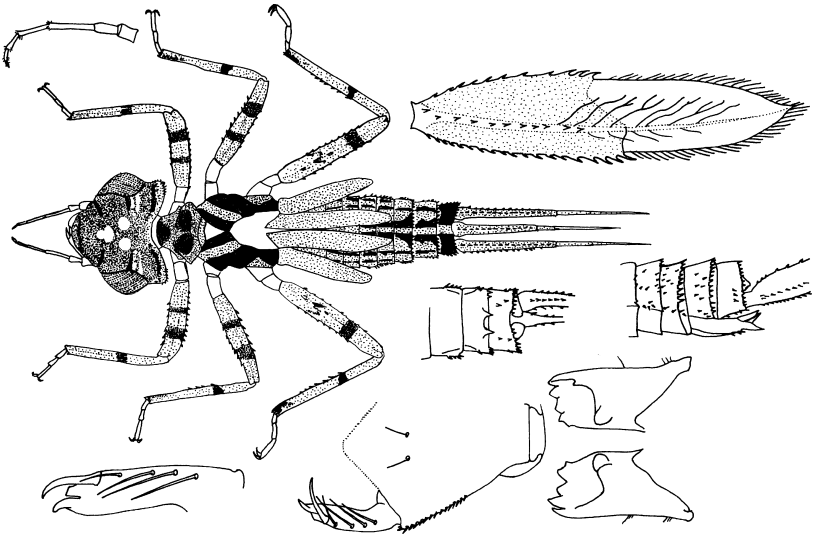


Fig. 3.1.695 *Neoneura joana* larva: antenna (upper left), habitus (middle left), labial palp (lower left), one side of the prementum and one labial palp (lower center), mandibles (lower right), apical segments of a male abdomen in ventral view (lower center) and a female abdomen in lateral view (middle right), and a gill lamella in lateral view (upper right). Based on Lencioni (2005).

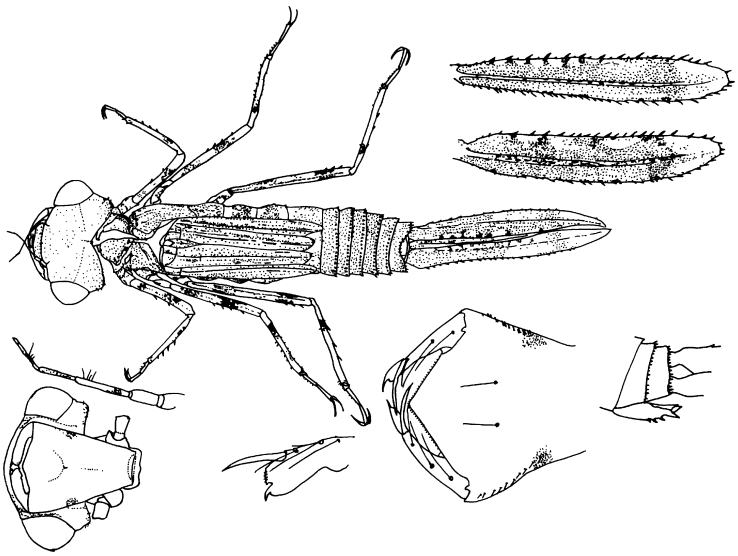


Fig. 3.1.696 *Epipleoneura metallica* female larva: habitus from an exuvia (upper left), antenna (middle left), ventral side of the head (lower left), labial palp (lower left center), anterior part of the labium in dorsal view (lower right center), apex of a abdomen in lateral view (lower right), and the lateral (upper right) and middle gill lamella (lower middle right). Based on De Marmels (2007a).

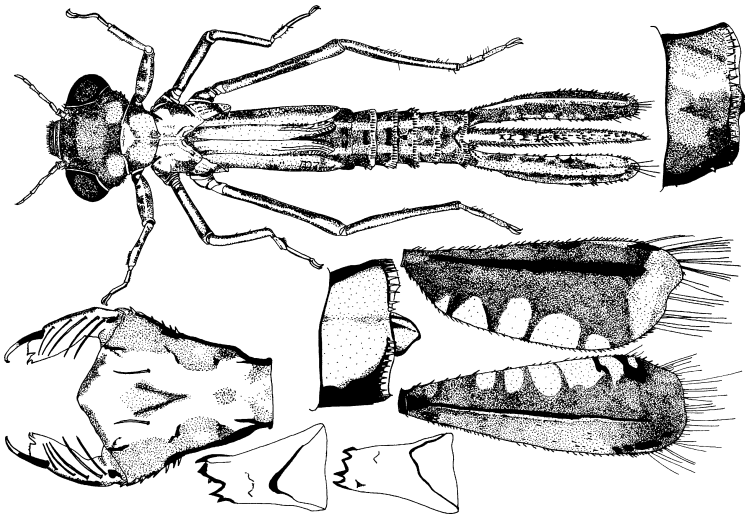


Fig. 3.1.697 *Peristicta forceps* larva: habitus (upper left), labium (lower left), mandibles (lower center), apical segment larval abdomen with appendages of a male (center) and a female (upper right), and a caudal (middle right) and middle gill lamella (lower right). Based on Pessacq (2007).

2. The margins of the gill lamellae are spined along only the basal half; the apical half is separated by a constriction and lined only with long setae. The only known South American larvae have a row of four setae on each labial palp proximal to the moveable hook (**Fig. 3.1.695**).
.....*Neoneura* Selys, 1860..p. 585
- The margins of the caudal gill lamellae are spined along most of their length, and no constriction is evident near the midlength (**Fig. 3.1.696**). 3
3. The only known South American larva has a row of three setae on each labial palp proximal to the moveable hook (**Fig. 3.1.696**). Larvae of the known species develop in pools of water trapped in epiphytic plants or holes in trees.
.....*Epipleoneura* Williamson, 1915..p. 608
- The only known South American larva has a row of five setae on each labial palp proximal to the moveable hook. The caudal gill lamellae are mainly brown with a distinctive pattern of pale markings (**Fig. 3.1.697**).
.....*Peristicta* Selys, 1860..p. 583

Key to the species of adult male *Peristicta* in South America

Information for the key was provided by Navás (1921), Santos (1968e), Jurzitza (1981b), Lencioni (2005), and Pessacq (2007). The key is reliable only for males because the females of most species remain undescribed.

1. In ventral or posterior view, the apex of the male superior anal appendage appears broadened and has a deep incision, producing two evenly rounded lobes. The pterostigma in the hind wing is more triangular than rhomboidal in shape. In ventral view, the apical segment of the penis appears truncate with a shallow excavation in the middle and a pair of prominent lateral processes (**Fig. 3.1.698**). Length of abdomen: 21 to 22.5 mm. Hind wing length: 14 to 14.5 mm. The male is predominantly black with greenish reflections; yellow markings are evident along the margin of the labrum and ventral side of the apical abdominal segments. The female is black with more extensive yellow markings.
.....*Peristicta gauchae* Santos, 1968 (Rio Grande do Sul).
- The apex of the male superior anal appendage is narrowly rounded and has no medial incision at the apex (**Fig. 3.1.699**). 2
2. In dorsal view, the margins of the superior anal appendage of the male appear nearly parallel in the proximal half, but beyond the ventral process at mid-length, the appendage narrows abruptly to about half of its proximal width. A pair of long preapical processes near the apex of the penis curve to become parallel to the first penis segment (**Fig. 3.1.685**). Except for the depiction of the basal portion of a wing, no information about the female is available.
.....*Peristicta forceps* Hagen in Selys, 1860 (Minas Gerais). Syn: *Peristicta aeneoviridis* sensu Ris, 1913 (nec Calvert, 1909). The female described by Ris (1913) actually belongs to *P. aeneoviridis*.

- In dorsal view, the basal part of each superior anal appendage appears thicker than its apical parts; the apical half tapers or varies its width from the thicker base toward the apex (**Fig. 3.1.699**). 3

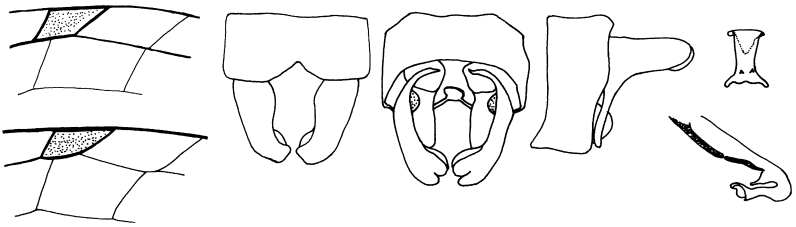


Fig. 3.1.698 *Peristicta gauchae* (left to right): pterostigmata of the fore and hind wing, apex of the abdomen of a male in dorsal, ventral, and lateral view, and the penis is ventral (above) and lateral view (below). Based on Santos (1968e).

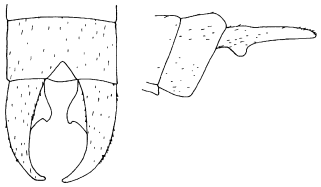


Fig. 3.1.699 *Peristicta lizeria* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Navás (1921).

3. The superior anal appendage tapers gradually to an acutely pointed apex and lacks a long basal process that extends ventrad. However, this appendage has a broadly triangular ventral process about 1/3 of the way from the base, which extends mesad (**Fig. 3.1.699**). Total length of the male: c. 32 mm. Length of male abdomen: c. 26 mm. Fore-wing length: c. 17 mm. Hind wing length: 16.5 mm. The head is black dorsally with a bluish sheen on the labrum. Ventrally, the head is yellow and yellowish green. The thorax and abdomen are predominantly black dorsally with yellow markings on the ventral side.
.....*Peristicta lizeria* Navás, 1921 (Argentina).

- In dorsal view, the basal part of each superior anal appendage appears swollen and lined on the inner margin with long setae, and it bears a long ventral process along its basal half as well as a shorter inner process near its mid-length; the apical half of this appendage tapers or varies its width toward the apex. The penis is broadly and deeply excised at the apex of the third segment and bears wing-like lateral processes (**Fig. 3.1.700**). The head is black, sometimes with a green metallic shine on the dorsal surface.
.....*Peristicta aeneoviridis* Calvert, 1909 (Argentina, Paraguay, São Paulo, Minas Gerais?). Syn: *Peristicta misionera* Jurzitza, 1981.

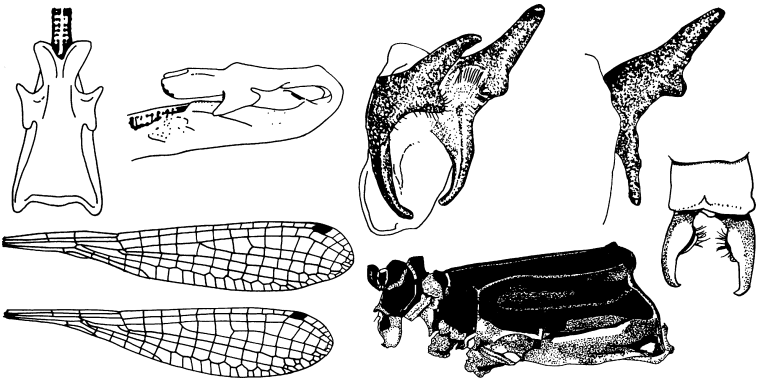


Fig. 3.1.700 *Peristicta aeneoviridis* male (above, left to right): penis in ventral and lateral view, anal appendages in posterolateral and lateral view, and (below, left to right): fore and hind wing, thorax in lateral view, and apex of the male abdomen in dorsal view. Based on Lencioni (2005).

Key to the species of adult *Neoneura* in South America

Information for the key was provided by Williamson (1917b), Garrison (1999), and Machado (2002b,c, 2003, 2005b).

1. The superior anal appendage has a decumbent appendage in the form of a shelf that occupies the entire middle extension of the appendage from base to apex (**Fig. 3.1.701**). The inferior anal appendage is approximately 3/4 to 7/8 as long as the superior appendage. Length of abdomen: 26 to 28.5 mm. Hind wing length: 16.5 to 18.5 mm. Pterostigma length: c. 0.7 mm. The head is yellow on its anterior surface; the postclypeus is dark with a pale spot at each side. The frons is reddish brown with black markings, and a curved black marking runs between the compound eyes. The thorax is mainly reddish brown with black markings and a yellow mid-dorsal carina. The abdomen is mainly orange red with faint brownish transverse carinae, a round dark brown subapical spot on the seventh segment, dark brown proximal and distal markings on the eighth and ninth segments, dark brown distal markings on the tenth, and a brown lateral stripe of the first and second segments. The superior anal appendages are brown, and the inferior ones are yellowish brown. The female has not been described. .....*Neoneura leonardoi* Machado, 2005 (Santa Catarina, Rio Grande do Sul).

- If the superior anal appendage has a decumbent appendage, it is not in the form of a shelf that occupies the entire middle extension of the appendage from base to apex. The inferior anal appendage of the male is only half as long as the superior appendage, or it is subequal or longer (**Fig. 3.1.702**). 2

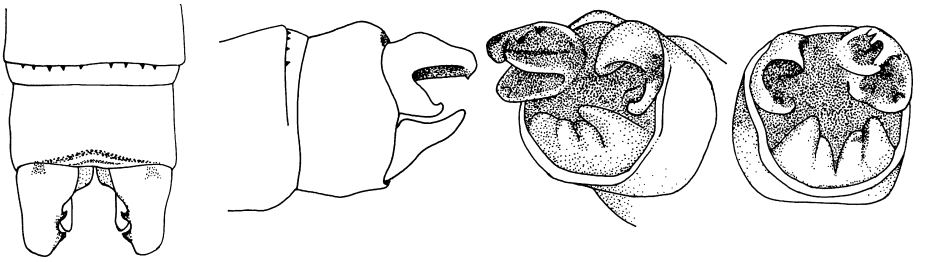


Fig. 3.1.701 *Neoneura leonardoi* male (left to right): apex of the abdomen in dorsal, lateral, lateroposterior, and posterior view. Based on Machado (2005b).

2. In lateral view, the inferior and superior anal appendages of the male are about the same length, or the inferior appendage is longer. The superior appendage is no longer than the tenth abdominal segment (**Fig. 3.1.703**). 3
- The inferior anal appendage of the male is only half as long as the superior appendage (**Fig. 3.1.702**). 17

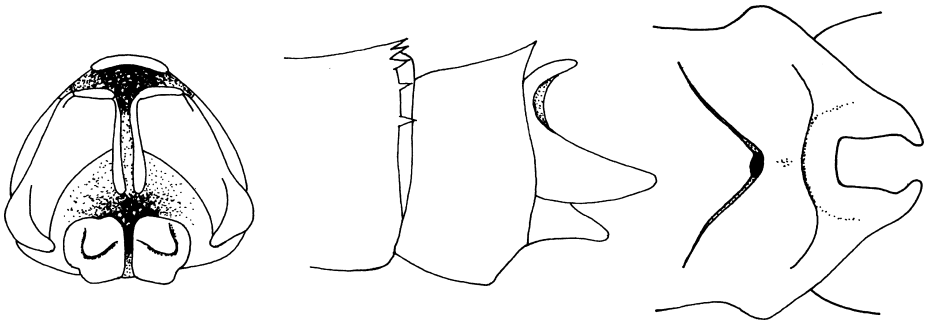


Fig. 3.1.702 *Neoneura cristina* (left to right): the apex of the male abdomen in posterior and lateral view and the median and posterior lobes of the female prothorax. Based on Rácenis (1955b).

3. The superior anal appendage of the male is only about 2/3 as long as the inferior (**Fig. 3.1.703**). In the cases of females that have already been described, the dorsal surface of the synthorax is mainly pale in color, and the median lobe of the prothorax is larger than the lateral lobe, which bears a small extra lobe. The apices of the known female femora are black.
.....*Neoneura joana* Williamson, 1917
(Venezuela, Guyana, French Guiana, Surinam, Pará, Roraima, Amapá).

- The superior and inferior anal appendages of the male are approximately equal in length, or the superior anal appendage is slightly longer (**Fig. 3.1.704**). The female synthorax is mainly dark in color, or, if it is mainly pale, then the median lobe of its prothorax is not larger than the lateral lobe; the lateral lobe does not bear a small extra lobe, or the apices of the legs are entirely pale. 4

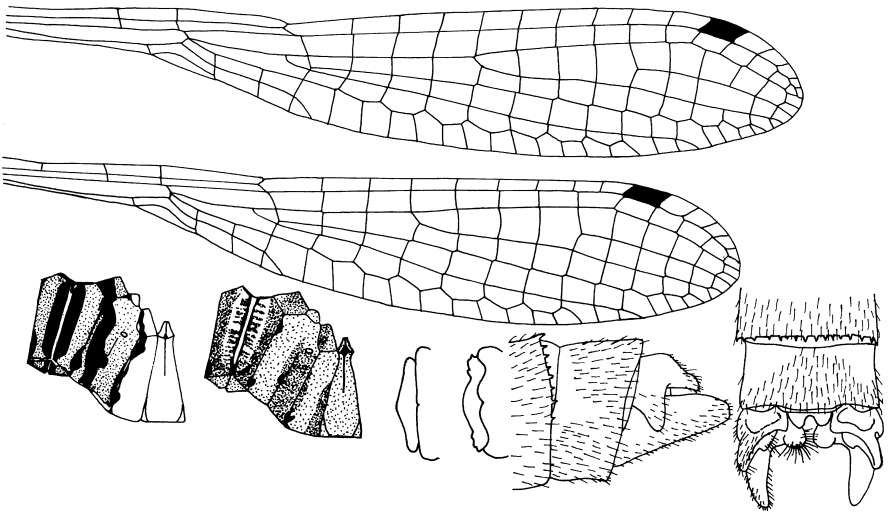


Fig. 3.1.703 *Neoneura joana:* fore and hind wing (above) and (lower row, left to right): diagram of the color pattern on the synthoraces of a male and a female, posterior lobe of the male and the female prothorax in dorsal view, and the apex of the male abdomen in lateral and dorsal view. Based on Williamson (1917b).

4. The hind wing of the male is 23 to 24 mm long, and the male abdomen is at least 33 mm long. The apex of vein Cu_1 is three cells beyond the nodus (**Fig. 3.1.704**). Length of male: c. 44 mm. The abdomen of the male is black, and the general coloration is dark. The female has not been described.
.....*Neoneura jurzitzai* Garrison, 1999 (Santa Catarina).

- The hind wing of the male is shorter than 21 mm, and the male abdomen is shorter than 33 mm. Vein Cu_1 ends opposite the cell beyond the nodus or within one cell of the level of the nodus (**Fig. 3.1.705**). 5

5. The superior anal appendages have dorsal and ventral branches that converge and are almost in contact at their apices, as best seen in lateral view, so the appendage has no decumbent process (**Fig. 3.1.705**). Length of abdomen: c. 26 to 26.5 mm. Hind wing length: c. 20 mm. Length of pterostigma: c. 0.8 mm. The head is yellow on its anterior surface; the postclypeus is dark with a pale spot at each side. The frons is reddish brown with black markings, and a curved

black marking runs between the compound eyes. The thorax is mainly reddish brown with black markings and a yellow mid-dorsal carina. The abdomen is mainly red with brown markings on the lateral surfaces of the first and second segments and a brown ventrolateral stripe along the middle segments. The anal appendages are dark brown with a pale lateral area on the ventral branch of the superior appendage and a reddish apex on the inferior appendages. The female has not been described.
.....*Neoneura anaclara* Machado, 2005 (Paraná).

- Each superior anal appendage has a decumbent process, so the dorsal and ventral processes are well separated from each other at their apices (**Fig. 3.1.706**). 6

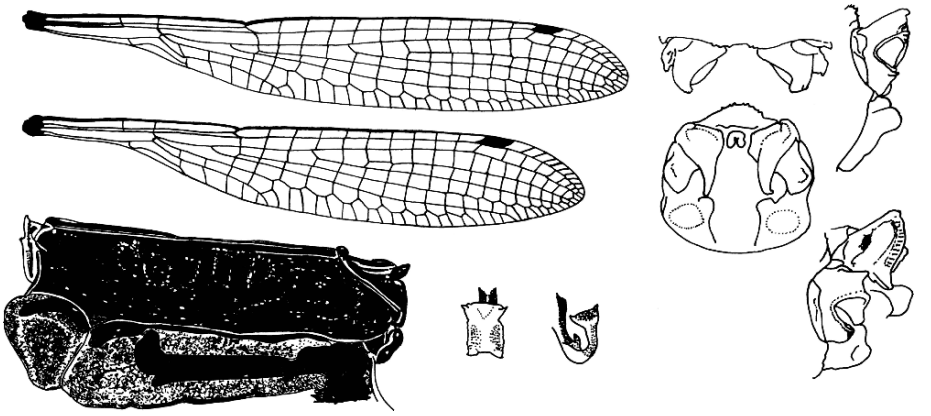


Fig. 3.1.704 *Neoneura jurzitzai* male: fore and hind wing (upper left); thorax in lateral view (lower left); penis in dorsal and lateral view (lower center, left and right, respectively); apex of the abdomen in dorsal (upper right center), lateral (upper right), posterior (middle right center), and oblique posterior view (lower right). Based on Garrison (1999).

6. The upper branch of the superior anal appendage of the male has a decumbent tooth on the ventral margin that appears small in oblique posterior view, and it has no broad lobe on the basal or apical part (**Fig. 3.1.706**). 7

- There is a broad lobe at the basal or apical part of the superior anal appendage of the male, or its upper branch is long or narrow in oblique posterior view and has a decumbent tooth that is obtuse on its ventral margin (**Fig. 3.1.707**). 8

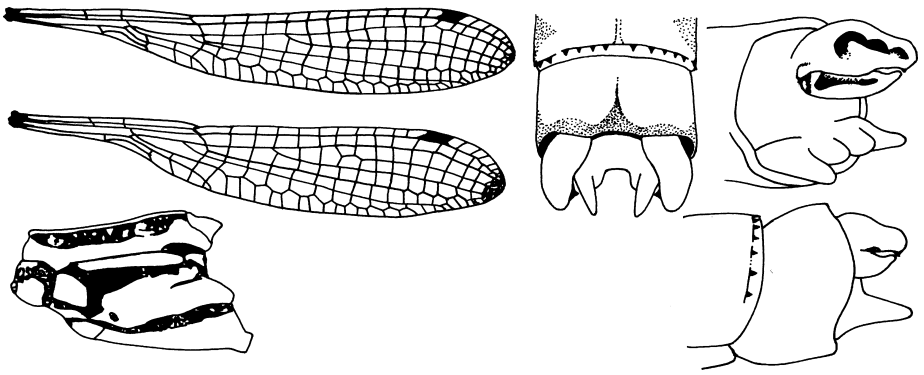


Fig. 3.1.705 *Neoneura anaclara* male: fore and hind wing (upper left), synthorax in lateral view (lower left), apex of the abdomen in dorsal (right center), posterolateral (upper right), and lateral view (lower right). Based on Machado (2005b).

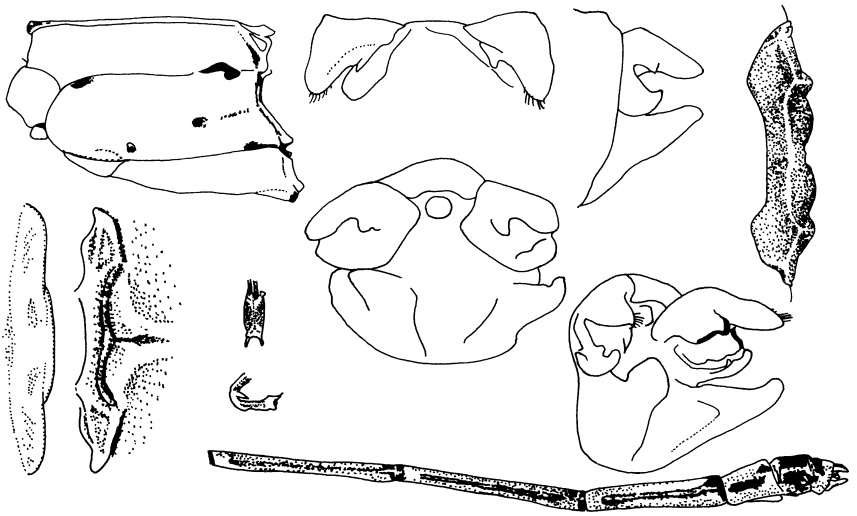


Fig. 3.1.706 *Neoneura rufithorax* (above, left to right): male synthorax in lateral view, appendages at the apex of the male abdomen in dorsal and lateral view, prothorax of a female in dorsal view, and (middle row, left to right): posterior lobe of the prothorax and mesostigmal plate of a male, penis in ventral (above) and lateral view (below), and apex of the male abdomen in posterior and oblique posterior view, and (lower center to right) apical abdominal segments of a male in lateral view. Based on Garrison (1999).

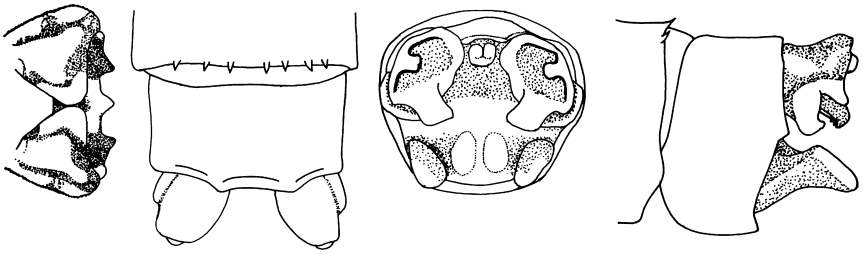


Fig. 3.1.707 *Neoneura moorei* (left to right): posterior lobe of a female prothorax and apex of the male abdomen in dorsal, posterior, and lateral view. Based on Machado (2003).

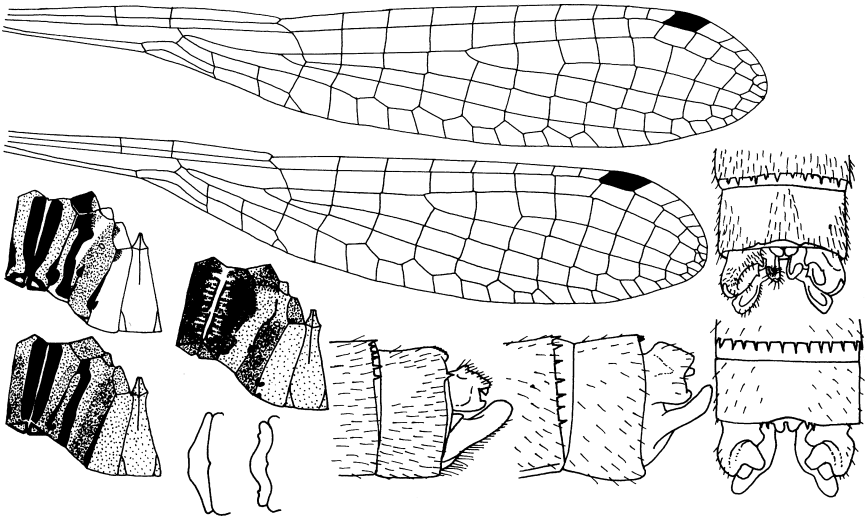


Fig. 3.1.708 *Neoneura bilinearis:* fore and hind wing (above), diagram of the color pattern on the synthoraces of two different males (middle and lower left) and a female (right of the male thoraces), posterior lobe of the a male and female prothorax in dorsal view (lower left center, left and right, respectively), and the apices of the abdomens of two different males in dorsal (middle and lower right) and lateral view (lower center and right center). Based on Williamson (1917b).

7. There are well-defined dark markings on the epicranium and thorax of the male. There are two small teeth on the ventral side of the dorsal branch of each superior anal appendage, which ends in a short, bluntly rounded tip (**Fig. 3.1.708**).
.....*Neoneura bilinearis* Selys, 1860
(Colombia, Peru, Venezuela, Guyana, French Guiana, Bolivia, Pará, Espirito Santo, São Paulo).

- The entire epicranium of the male is pale in color, and the thorax is mainly light brown with traces of dark spots along the lateral and the vestigial second lateral suture. There is one small tooth on the ventral side of the dorsal branch of each superior anal appendage, which ends in a long, acutely pointed tip (**Fig. 3.1.706**).
.....*Neoneura rufithorax* Selys, 1886
(Peru, Pará, Amazonas, Territory of Acre).

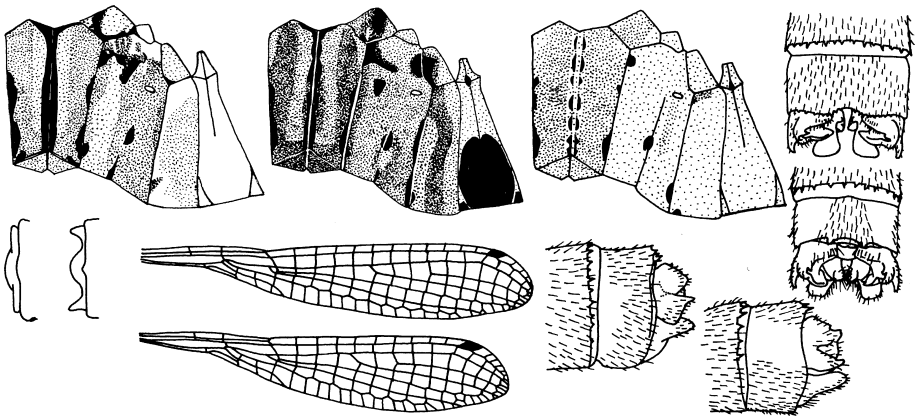


Fig. 3.1.709 *Neoneura esthera:* diagram of the color pattern on the synthorax of a male (upper left) and two individuals of unknown sex (upper center), posterior lobe of the prothorax of a male and a female (lower left, left and right, respectively), fore and hind wing (lower left center), and the apices of the abdomens of two male specimens in dorsal (upper and middle right) and lateral view (lower right center and right). Based on Williamson (1917b).

8. The superior anal appendage of the male has prominent processes on the ventral margin both near the base and near the apex of the appendage (**Fig. 3.1.707**). 9
- On the ventral side of the superior anal appendage, there is a tooth or lobe only at the base or near the apex, but not at both locations (**Fig. 3.1.709**). 10
9. The inferior anal appendage broadens at the apex, which is directed ventroposteriad. The posterior lobe of the female prothorax has acutely pointed, triangular median and lateral extensions, which reach posteriad approximately the same distance; the median triangle is yellowish green, and the lateral ones are black (**Fig. 3.1.707**). Length of abdomen: 23 to 28 mm. Hind wing length: 16 to 18.5 mm.
.....*Neoneura moorei* Machado, 2003
(Rondônia).

- The inferior anal appendages taper gradually to an apex directed posteriad. The posterior lobe of the female prothorax has broadly rounded lateral extensions, which reach much farther posteriad than the small median extension (**Fig. 3.1.710**). Length of abdomen: 23.5 to 26.5 mm. Hind wing length: 14.5 to 17 mm. Length of pterostigma in the fore-wing: 0.6 to 0.8 mm. Color: mainly light green with black and yellow markings on the head and thorax of the male and greenish gray with brown markings on those parts of the female. The male abdomen is bluish green with narrow black longitudinal markings and black lateral stripes, becoming greenish gray or grayish yellow on the seventh and eighth segments and black on part of the ninth and all of the tenth segments. The female abdomen is yellowish gray with obscure markings dorsally. The abdomens of both the males and females are black ventrally.
.....*Neoneura lucas* Machado, 2002
(Mato Grosso).

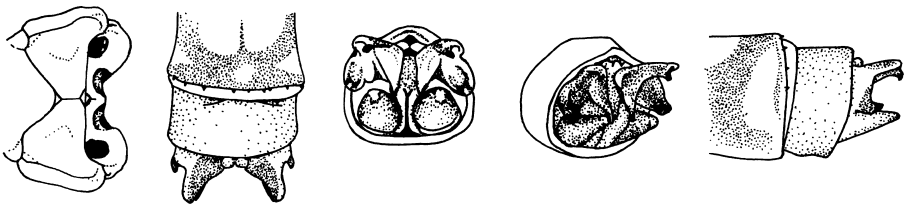


Fig. 3.1.710 *Neoneura lucas* (left to right): prothorax of a female in dorsal view and the apex of the male abdomen in dorsal, posterior, posterolateral, and lateral view. Based on Machado (2002b).

10. On the apical portion of the upper branch of each superior anal appendage of the male, there is a tooth or lobe, making the apex broadly spatulate or truncate to concave (**Fig. 3.1.709**).
.....*Neoneura esthera* Williamson, 1917
(Central America, Trinidad, Colombia, Venezuela). In addition to this species, several Central American and Caribbean species share these characteristics.
- At or near the base of the upper branch of each superior anal appendage of the male, there is a prominent appendage on the ventral margin in the form of a decumbent, inverted triangle or a narrow, parallel-sided tooth (**Fig. 3.1.711**). ..11
11. Viewed from the posterior, the orientation of the decumbent tooth on the dorsal branch of each superior anal appendage is vertical (**Fig. 3.1.711**).
.....*Neoneura fulvicollis* Selys, 1886
(Venezuela, Argentina, Pará, São Paulo, Mato Grosso).
- Viewed from the posterior, the orientation of the decumbent tooth on the dorsal branch of each superior anal appendage of the male is diagonal and divergent from the other at its dorsal end (**Fig. 3.1.712**). 12

Fig. 3.1.711 *Neoneura fulvicollis* (left to right): prothorax of a female in dorsal view, apex of the abdomen of a male in oblique posterior and lateral view, lateral view of the anal appendages of a different specimen, superior anal appendage in oblique posterior view (above) and the apex of the male abdomen in posterior view (below). Based on Garrison (1999).

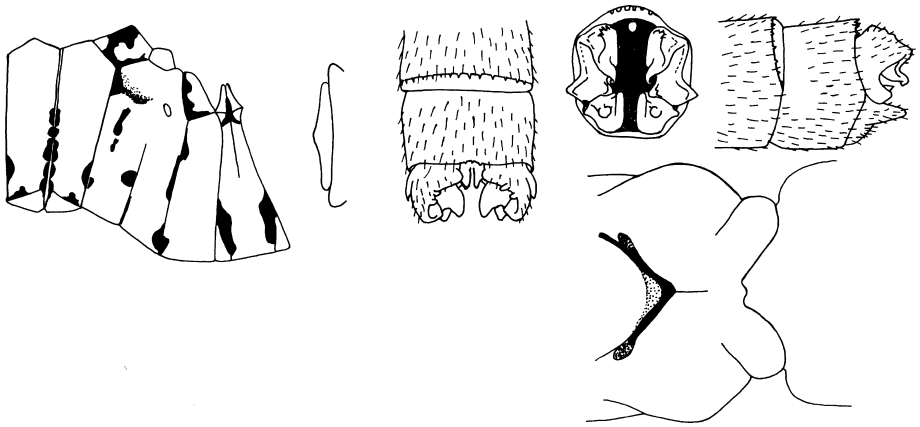


Fig. 3.1.712 *Neoneura sylvatica* (above, left to right): diagram of the color pattern on the male synthorax, outline of the hind lobe of the male prothorax; apex of the male abdomen in dorsal, posterior, and lateral view, and (below right): dorsal view of the middle and posterior lobes of the prothorax of a female. Based on Williamson (1917b) and Rácenis (1955b).

12. Viewed obliquely from the posterior, a vertical carina is evident on the apical 3/10 of the dorsal branch of each superior anal appendage of the male (**Fig. 3.1.712**). 13
- The surface of the apical 3/10 of the dorsal branch of each superior anal appendage of the male is flat or concave without a trace of a vertical ridge (**Fig. 3.1.713**). 14

13. The abdomen of the male is 25 to 27.5 mm, with the first, second, and part of the third segments sky blue, and the rest of the abdomen red. The head and thorax of the male are also sky blue, with irregular markings along the mid-dorsal carina of the thorax (**Fig. 3.1.712**).
.....*Neoneura sylvatica* Hagen in Selys, 1886 (Venezuela, Argentina, Bolivia, Bahia, Minas Gerais, Rio de Janeiro, São Paulo, Rondônia, Mato Grosso).
- The abdomen of the male is 26 to 29.5 mm and entirely red. The thorax of the male is fulvous or slate gray with extensive markings forming solid spots or coalescing bars across half or more of the mesepisternum (**Fig. 3.1.714**).
.....*Neoneura ethela* Williamson, 1917 (Bolivia, Paraguay, Argentina, Rio Grande do Sul).

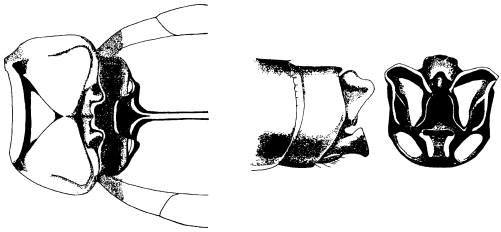


Fig. 3.1.713 *Neoneura schreiberi* (left to right): prothorax and anterior part of the synthorax of a female in dorsal view and the apex of the abdomen of a male in lateral and posterior view. Based on Machado (1975).

14. The apex of the inferior anal appendage is truncate (**Fig. 3.1.713**).
.....*Neoneura schreiberi* Machado, 1975 (Amapá).
- The inferior anal appendage is acute at the apex (**Fig. 3.1.715**). 15
15. On the dorsal branch of each superior anal appendage of the male, the decumbent tooth has the shape of a broad-based, inverted triangle directed ventrad (**Fig. 3.1.686**).
.....*Neoneura rubriventris* Selys, 1860 (Venezuela, Guyana, Ecuador, Peru, Bolivia, Rio Grande do Sul, Rondônia, Pará, Roraima).
- On the dorsal branch of each superior anal appendage of the male, the decumbent tooth has the shape of a lobe directed ventroposteriad or a finger-like process directed ventrad (**Fig. 3.1.715**). 16
16. The abdomen of the male is about 30 mm long. On the dorsal branch of each superior anal appendage of the male, the decumbent tooth has the shape of a lobe directed ventroposteriad (**Fig. 3.1.715**).
.....*Neoneura mariana* Williamson, 1917 (Venezuela, Guyana, French Guiana).

- The abdomen of the male is about 24 mm long. On the dorsal branch of each superior anal appendage of the male, the decumbent tooth has a finger-like shape and is directed ventrad (**Fig. 3.1.716**).
.....*Neoneura myrthea* Williamson, 1917 (Colombia, Venezuela, Guyana, French Guiana, Surinam, Roraima).

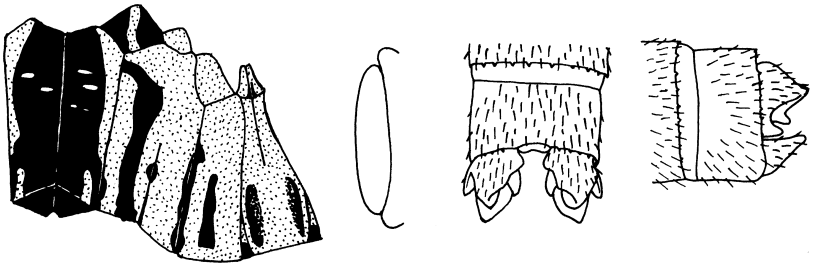


Fig. 3.1.714 *Neoneura ethela* male (left to right): diagram of the color pattern on the synthorax, posterior lobe of the pronotum, and apex of the abdomen in dorsal and lateral view. Based on Williamson (1917b).

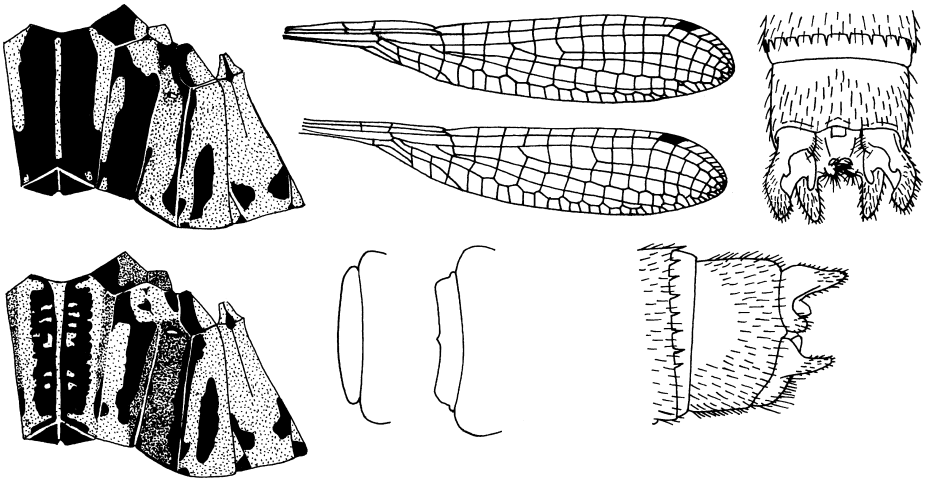


Fig. 3.1.715 *Neoneura mariana:* diagram of the color pattern on the synthorax of a male (upper left) and a female (lower left), fore and hind wing of a male (upper center), posterior lobe of the pronotum of a male and female (lower center, left and right, respectively), and the apex of the male abdomen in dorsal (upper right) and lateral view (lower right). Based on Williamson (1917b).

17. In lateral view, the dorsal branch of each superior anal appendage of the male is no more than ¼ the length of the ventral branch (**Fig. 3.1.702**). 18
- In lateral view, the dorsal branch of each superior anal appendage of the male is at least twice the length of the ventral branch (**Fig. 3.1.717**). 19

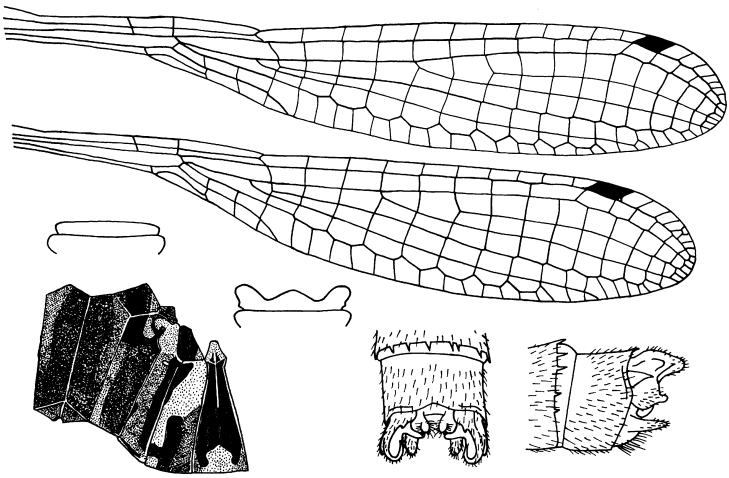


Fig. 3.1.716 *Neoneura myrthea:* fore and hind wing of a male (above), outline of the hind lobe of the prothorax of a male (middle left) and a female (left of center), and (lower row, left to right) diagram of the color patterns on the synthorax of a male, and the apex of the male abdomen in dorsal and lateral view. Based on Williamson (1917b).

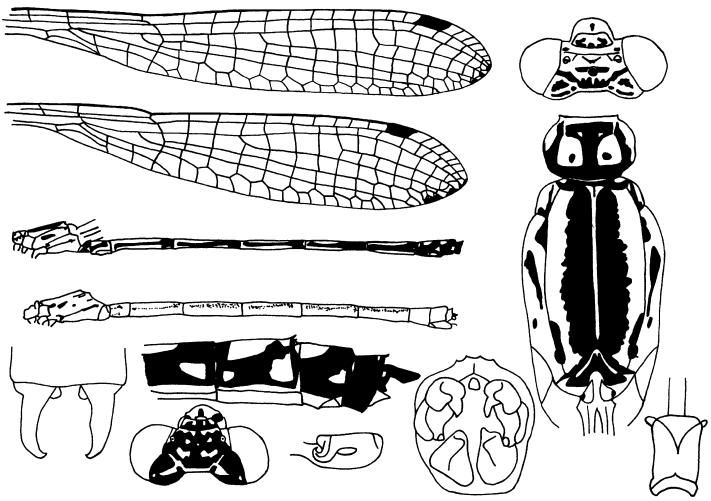


Fig. 3.1.717 *Neoneura waltheri:* fore and hind wing of a female (upper left), head and thorax of a female in dorsal view (upper and middle right, respectively), thorax and abdomen of a male (upper middle left) and female (lower middle left) in lateral view, head of a male (lower left center), enlarged apex of the abdomen of a male in dorsal (lower left), lateral (below abdomen of female), and posterior view (lower right center), and penis in ventral (lower right) and lateral view (lower center). Based on Jurzitza (1981a).

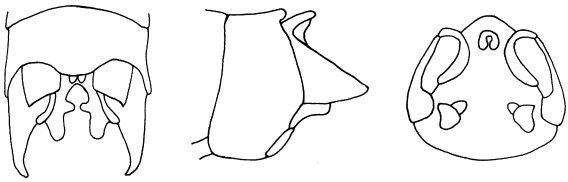


Fig. 3.1.718 *Neoneura gaida* (left to right): apex of the male abdomen in dorsal, lateral, and posterior view. Based on Rácenis (1953b).

18. In posterior view, the superior anal appendages of the male appear very close along their middle margins; the decumbent processes along their ventromedial margins are almost straight or diverge slightly (**Fig. 3.1.702**). .....*Neoneura cristina* Rácenis, 1955 (Venezuela).

- In posterior view, the superior anal appendages of the male are separated by the width of one inferior anal appendage along their middle margins; the decumbent processes along their ventromedial margins converge, and their apices curve to almost touch the middle margins of their external branches (**Fig. 3.1.718**). .....*Neoneura gaida* Rácenis, 1953 (Venezuela, Guyana, French Guiana, Surinam, Pára, Roraima, Rondônia).

19. In lateral view, the ventral branch of each superior anal appendage seems poorly developed, and the dorsal branch is about four times its length (**Fig. 3.1.717**). 20

- In lateral view, the ventral branch of the superior anal appendage appears well developed and is about half as long as the dorsal branch (**Fig. 3.1.719**). 21

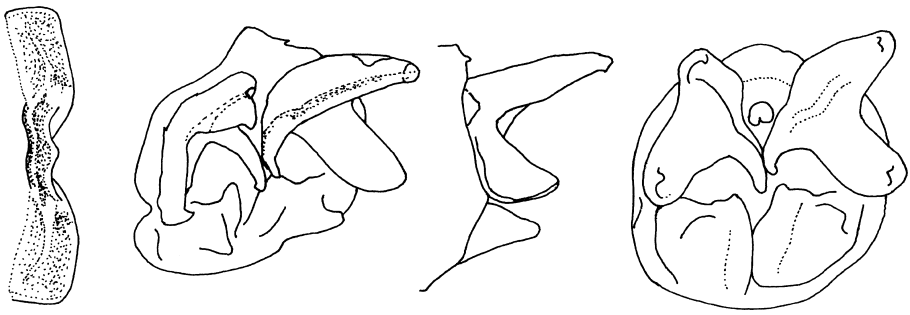


Fig. 3.1.719 *Neoneura luzmarina* (left to right): prothorax of a female in dorsal view and the apex of the male abdomen in oblique posterior, lateral, and posterior view. Based on Garrison (1999).

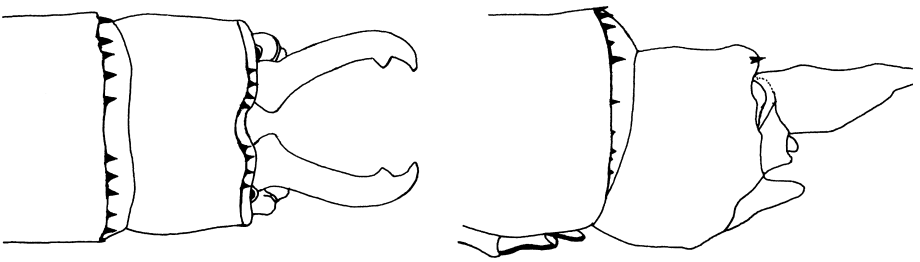


Fig. 3.1.720 *Neoneura desana* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Machado (1989a).

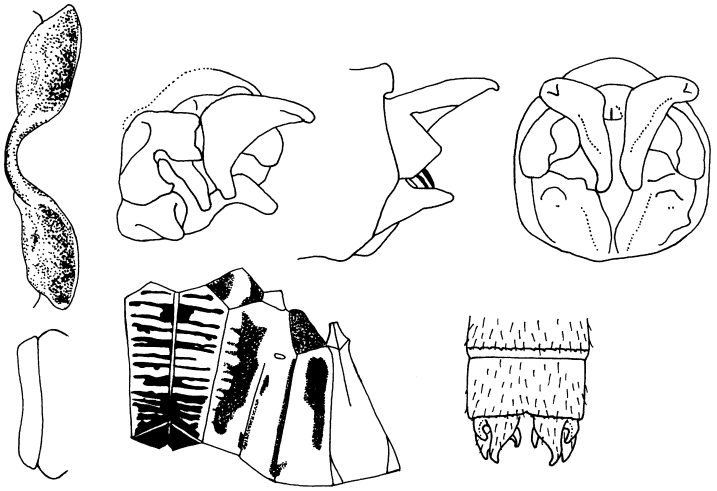


Fig. 3.1.721 *Neoneura denticulata* (above, left to right): posterior lobe of the female prothorax in dorsal view, apex of the abdomen of a male in oblique posterior, lateral, and posterior view; and (below, left and right): posterior lobe of the male prothorax in dorsal view, diagram of the color pattern on the male thorax, and apex of the male abdomen in dorsal view. Based on Williamson (1917b) and Garrison (1999).

20. The color of the male is mainly blue. In lateral view, each male superior anal appendage bends ventrad at mid-length; there is no preapical tooth along its median margin. Two small teeth at the apex of the ventral branch of the male superior anal appendage can be seen in posterior and oblique view (**Fig. 3.1.717**). Length of abdomen: 23 to 26 mm. Hind wing length: 17 to 19 mm. .....*Neoneura waltheri* Selys, 1886
(Argentina, Rio de Janeiro, Paraná).

- The color of the male is mainly red. Each superior anal appendage is straight and has a preapical tooth on its median margin. One small tooth at the apex of its ventral branch can be seen in posterior an oblique views (**Fig. 3.1.720**).
.....*Neoneura desana* Machado, 1989 (Venezuela, Peru, Amazonas).
21. Viewed in oblique posterior view, the ventral branch of each superior anal appendage of the male is about three times as long as wide and has a preapical tooth on the median margin (**Fig. 3.1.719**). Total length including appendages: 26 to 29.5 mm. Abdomen length including appendages: 19.5 to 22.5 mm. Hind wing length: c. 15.5 mm.
.....*Neoneura luzmarina* De Marmels, 1989 (Venezuela, Amazonas, Pará).
- Viewed in oblique posterior view, the ventral branch of each male superior anal appendage is about as long as wide, and the appendage sometimes has one preapical tooth on its median margin (**Fig. 3.1.721**). Total length: c. 33 mm. Hind wing length: c. 19 mm.
.....*Neoneura denticulata* Williamson, 1917 (Ecuador, Peru, Venezuela, Pará, Amazonas, Roraima, Rondônia). Syn: *Neoneura pardalina* Sjöstedt, 1918.

Notes on the two known species of *Neoneura* larvae in South America

Information for the key was provided by Lencioni (2005) and De Marmels (2007a).

1. The color pattern includes prominent dark markings, including two dark bands on each femur and one band on each tibia. The proximal band on the hind femur is very narrow and incomplete. The wing buds extend almost to the posterior margin of the seventh abdominal segment. The gonopophyses of the female extend farther posteriad than the posterior margin of the tenth abdominal segment (**Fig. 3.1.695**).
.....*Neoneura joana* Williamson, 1917 (Venezuela, Guyana, French Guiana, Surinam, Pará, Roraima, Amapá).
- The larva is mainly yellowish with poorly defined dark markings, including one weak subapical dark band on the fore and middle femora. The wing buds extend only to the posterior half of the fourth abdominal segment. The gonopophyses of the female extend barely to the posterior margin of the tenth abdominal segment (**Fig. 3.1.722**).
.....*Neoneura fulvicollis* Selys, 1886 (Venezuela, Argentina, Pará, São Paulo, Mato Grosso).

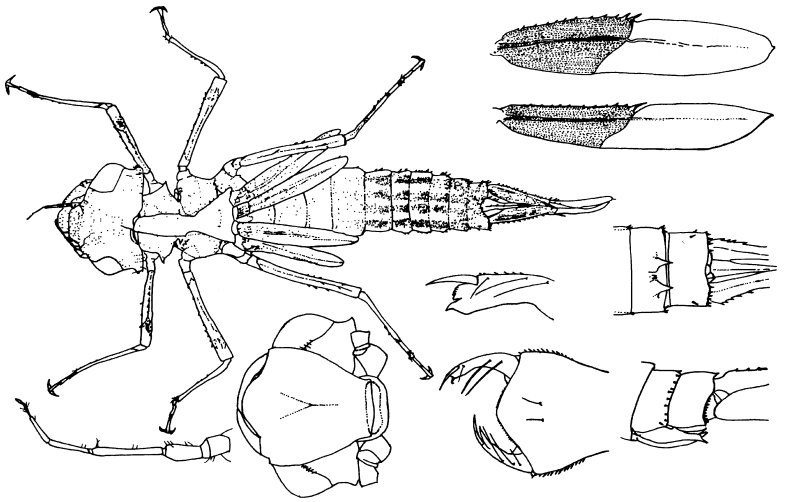


Fig. 3.1.722 *Neoneura fulvicollis* larva: habitus from the exuvia of a female (upper left), antenna of a female (lower left), ventral view of the head of a male (lower left center), labium of a female in dorsal view (lower right center), labial palp of a female in dorsal view (above labium), apex of a male abdomen in ventral view (lower middle right) and a female abdomen in lateral view (lower right), and lateral (upper right) and middle gill lamella (upper middle right). Based on De Marmels (2007a).

Key to the species of adult *Phasmoneura* in South America

Information for the key was provided by Williamson (1916b) and Lencioni (1999).

1. The pterostigmata are trapezoidal. There are three cells between Cu_1 and the posterior margin of the wing from the distal end of the quadrangle to the end of Cu_1 (**Fig. 3.1.687**). Total length: c. 36 mm. Length of abdomen: 31.5 to 33 mm. Hind wing length: c. 19 mm. The dominant color of the male is pale yellow with darker brown markings and black frons, epicranium, apical three abdominal segments, and apical part of the superior anal appendage. The female differs considerably in coloration; the prothorax is light brown laterodorsally and pale lateroventrally, while the synthorax is metallic brown and has green reflections, a black dorsal carina, a brown mesepimeron, and a pale metepisternum and metepimeron. The tenth abdominal segment of the female is brown with black markings.

.....*Phasmoneura janirae* Lencioni, 1999 (Mato Grosso).

- The pterostigmata are approximately in the form of a parallelogram. There are two cells between Cu_1 and the posterior margin of the wing from the distal end of the quadrangle to the end of Cu_1 (**Fig. 3.1.723**).
.....*Phasmoneura exigua* (Selys, 1886) (Guyana, French Guiana, Peru, Amazonas). Syn: *Protoneura exigua* Selys, 1886; *Phasmoneura olmyra* Williamson, 1915.

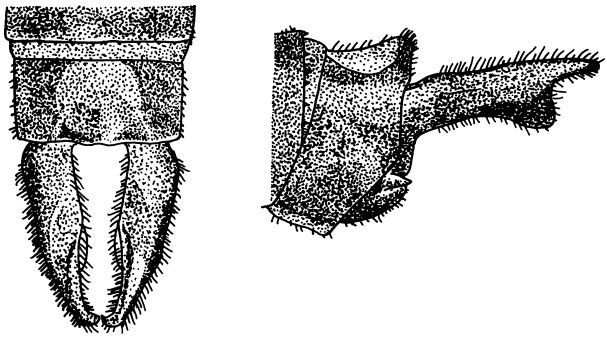


Fig. 3.1.723 *Phasmoneura exigua* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Williamson (1916b), who referred to it as *Phasmoneura olmyra.*

Key to the species of adult *Protoneura* in South America

Information for the key was provided by Eaton and Calvert (1892-1907), Williamson (1915), Gloyd (1939), and Cowley (1941).

1. The inferior anal appendage of the male is more than twice as long as the superior appendages, and its apex is slightly swollen (**Fig. 3.1.724**). The synthorax of the male is mainly reddish or yellowish dorsally and laterally with black markings on the mesepimeron. The synthorax of the female is black dorsally and pale laterally and ventrally, without black on the metepimeron or metepisternum. A better description is needed for this species and especially for the female.
.....*Protoneura paucinervis* Selys, 1886 (Ecuador, Peru, Amazonas?, Territory of Acre).
- The inferior anal appendage is less than twice as long as the superior appendage (**Fig. 3.1.725**). The female either lacks extensive black markings on the dorsum, or it has black markings on the metepimeron or metepisternum. 2
2. The synthorax is entirely pale on the ventral side (**Fig. 3.1.725**). The middle and hind tibiae are black on no more than the apical third. 3
- There are dark markings on the ventral side of the synthorax posterior to the hind coxae. The tibiae and posterior lobe of the male prothorax are uniform dark brown or black (**Fig. 3.1.726**). 5

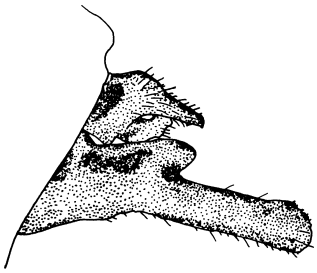


Fig. 3.1.724 Male anal appendages of *Protoneura paucinervis* in lateral view. Based on Lencioni (2005).

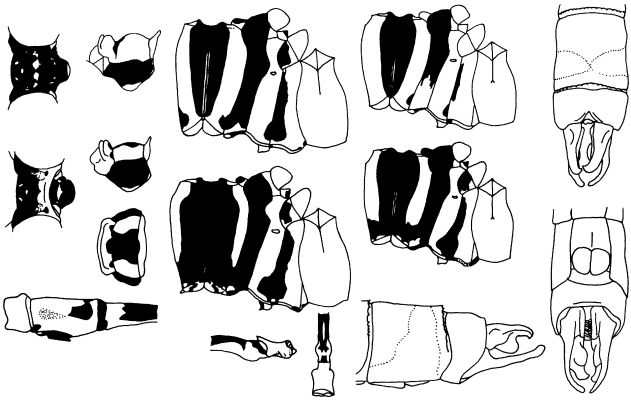


Fig. 3.1.725 *Protoneura woytkowskii:* color pattern on the surfaces of the heads between the eyes of a male and a female in frontodorsal view with the dorsoposterior part of the head to the left (upper left, above and below, respectively); color patterns on the prothoraces of a male and female in lateral view (upper left center, above and below, respectively) and the prothorax of a female in dorsal view (below the lateral views); diagrams of the color patterns on the synthoraces of three different males and one female (upper center and right center, with the female at the lower left of the group); pattern on the first, second, and anterior part of the third abdominal segment of a male (lower left); penis in lateral (lower left center) and dorsal view (lower center); the apex of the male abdomen in dorsal (upper right), ventral (lower right), and lateral view (lower right center). Based on Gloyd (1939).

3. Both the anterior and posterior lobes of the prothorax are nearly entirely pale, although there are black dorsal and lateral markings on the middle lobe. On the male prothorax, the mid-dorsal blackish area on the pronotum occupies less than 1/3 of its width, but that on the female is somewhat wider. There is a pale mid-dorsal stripe on the apical half of the mesepisternum and sometimes for almost

its whole length. The pale antehumeral stripe of the female covers only the basal ¾ of the mesepisternum, and some black markings are present on the female metinfraepisternum. All tibiae have a dusky subbasal band on a pale background and black on no more than the apical third. The ninth abdominal segment of the male has a pale subapical ring equal to or narrower than the black basal marking. On the ninth abdominal segment of the female, the pale lateral marking covers only the lower half of the lateral surface. The superior anal appendages of the male are shorter than the inferior ones. The margin of the third segment of the penis has lateral processes formed at about the mid-length, and there is a belt-like median process that points cephalad (**Fig. 3.1.725**). Length of abdomen without appendages: 27.5 to 37.5 mm. Hind wing length: 16.5 to 21.5 mm.

.....*Protoneura woytkowskii* Gloyd, 1939
(Ecuador, Peru, Bolivia).

- Both the anterior and posterior prothoracic lobes have extensive black dorsal markings, which are usually contiguous with extensive black markings on the middle lobe of the female and less extensive markings on the middle lobe of the male (**Fig. 3.1.727**). 4

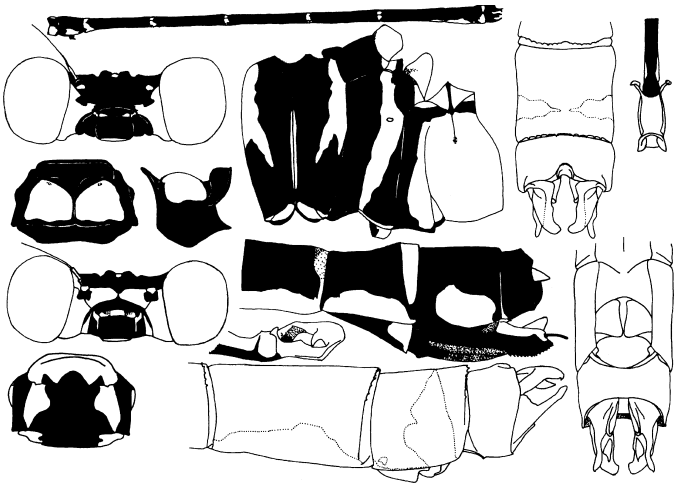


Fig. 3.1.726 *Protoneura klugi:* (left side, top to bottom): lateral view of the abdomen of a male, anterior view of the color pattern on the head of a male, pattern on the prothorax of a male in dorsal (left) and lateral view (right), anterior view of the head of a female, and the prothorax of a female in dorsal view, and (center, top to bottom beneath the abdomen): diagram of the color pattern on the male synthorax, lateral view of the apical segments of the female abdomen with the ovipositor showing the color patter, penis in lateral view, and the apical segments of the male abdomen in lateral view, and (right side, top to bottom): penis in ventral view (right) and apex of the male abdomen in dorsal (left) and ventral view. Based on Cowley (1941).

4. The middle half of the anterior prothoracic lobe is black, and the posterior lobes are black on the middle third of the male and middle half of the female. There is no pale mid-dorsal stripe on the mesepisternum. The pale antehumeral stripe of the female covers the entire length of the mesepisternum, and the female metinfraepisternum is uniformly pale. All tibiae have a dusky subbasal band on a pale background and black on no more than the apical third. The ninth abdominal segment of the male is entirely pale except for a pale subapical ring that is narrow. On the ninth abdominal segment of the female, a pale lateral marking reaches almost as far as the middle of the dorsal surface. The superior anal appendages of the male are longer than the inferior ones. The apex of the third segment of the penis expands laterally (**Fig. 3.1.727**).
.....*Protoneura macintyrei* Kennedy, 1939 (Ecuador).

The anterior, middle, and posterior prothoracic lobes or the male are entirely black dorsally, except for small orange lateral spots and sometimes a larger mid-dorsal spot on the anterior lobe, a pair of orange spots on the middle lobe separated only by a black mid-dorsal line, and an orange mid-dorsal spot on the posterior lobe. Pale markings on the female are generally smaller and pale yellow rather than orange, the markings on the middle prothoracic lobe being minute or absent entirely. The fore-tibia is almost entirely black, while the middle and hind tibiae are black only on the apical third. The eighth through tenth abdominal segments are mainly black with a pair of orange basal spots on the dorsal surface and orange ventrolaterally on the eighth segment of the male, an orange transverse dorsal spot connected to lateral orange coloration on the ninth, and sometimes two small orange spots on the tenth. The second through tenth abdominal segments of the female are black with a narrow transverse yellow ring on the third through seventh segments. This basal ring is interrupted mid-dorsally. Length of abdomen: 28.5 to 35.5 mm. Hind wing length: 17.5 to 20.5 mm. Vein Cu_1 ends at or proximal to the end of the cross vein that extends posteriad from the nodus. The width of each wing is about 1/7 its length. The distance from the base to the nodus is about 1/3 of the wing length and is as long as the distance from the nodus to a point between the fifth and sixth postnodal cross vein. The length of the first costal space at the base of the wing is only slightly longer than that of the third (**Fig. 3.1.688**).
.....*Protoneura amatoria* Calvert, 1907 (Central America, Trinidad, Ecuador, Peru, Venezuela, Roraima).

5. The anterior lobe of the female prothorax is mainly pale with three rounded basal spots, which may be confluent. In the male, there is a pale mid-dorsal stripe on the mesepisternum covering 70% to 80% of its length and a pale antehumeral stripe covering 50% to 70% of the width of the mesepisternum and bordering on the basal 50% to 70% of the humeral suture. The antehumeral stripe of the female is wider than the pale mid-dorsal stripe and widely separated from the small pale posthumeral spot; it is 50% to 70% the length and 20% to 25% of the width of the mesepisternum. The male superior anal appendage is only slightly shorter than the tenth abdominal segment (**Fig. 3.1.726**). 6

- The middle half of the anterior lobe of the female prothorax is black. In the male, there is no pale mid-dorsal stripe on the mesepisternum, and the pale antehumeral stripe is almost equal in width to the mesepisternum and borders on the basal 25% to 70% of the humeral suture. In the middle, it varies from less than half to almost as long as the mesepisternum. In the female, the antehumeral stripe is very narrow, not wider than the pale mid-dorsal stripe, and it joins the small pale posthumeral spot. It is about 75% of the length of the mesepisternum. The superior anal appendage of the male is only slightly longer than the length of the tenth abdominal segment (**Fig. 3.1.728**). 7

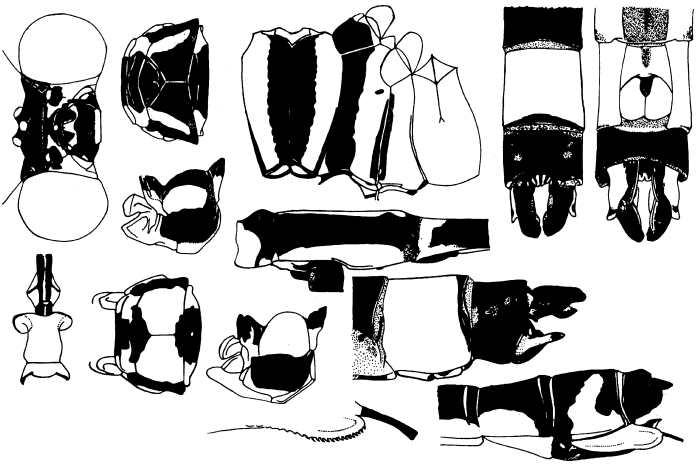


Fig. 3.1.727 *Protoneura macintyrei* (upper row, left to right): head of a female in dorsal view; prothorax of a female in dorsal (above) and lateral view (below); diagram of the color pattern of the synthorax (above); first, second, and anterior part of the third abdominal segments of a male below; apex of the male abdomen in dorsal and ventral view; and (below, left to right): penis in ventral view; prothorax of a male in dorsal and lateral view (above); ventral margin and apex of the ovipositor (below); and the apex of a male (above) and a female abdomen in lateral view (below). Based on Kennedy (1939c).

6. In the male, the pale antehumeral stripes are about 1/3 the width of the mesepisternum, and the pale metepisternal stripe extends as far as the mesinfraepisternum. The antealar sinus is mostly pale. There are large pale lateroventral marking on the ninth abdominal segment of the male that extend dorsally far enough to almost join along the midline. The superior and inferior anal appendages of the male are almost equal in length. The penis has lateral processes at the apex of the third segment (**Fig. 3.1.726**). In the female, the mid-frontal spots and markings on the genae are confluent, and the antealar sinus is pale with a finger-like black lateroapical marking. The middle half of the posterior lobe of the prothorax is black. There is a pale mid-dorsal stripe on the

apical 2/3 of the mesepisternum. In the female, the pale antehumeral stripes are about 1/2 the width of the mesepisternum,
.....*Protoneura klugi* Cowley, 1941 (Ecuador, Peru).

- In both sexes, the pale antehumeral stripes are about 2/3 the width of the mesepisternum. The pale metepisternal stripe of the male fails to reach the mesinfraepisternum. The antealar sinuses of both sexes are almost completely black. The ninth abdominal segment of the male has only narrow pale markings. The superior anal appendages of the male exceed the inferior appendages in length. The penis has small lateral lobes at the mid-length of the third segment (**Fig. 3.1.729**). In the female, the mid-frontal spots are separated from the pale markings on the genae. The posterior lobe of the female prothorax is nearly uniformly pale, and there is a pale mid-dorsal stripe on the apical 8/9 of the mesepisternum. Length of male abdomen without appendages: 33 to 35.5 mm: female: 29 to 30.5 mm. Hind wing length of male: 17.5 to 18.5 mm; female: 18.5 to 19.5 mm.
.....*Protoneura scintilla* Gloyd, 1939 (Ecuador, Rondônia).

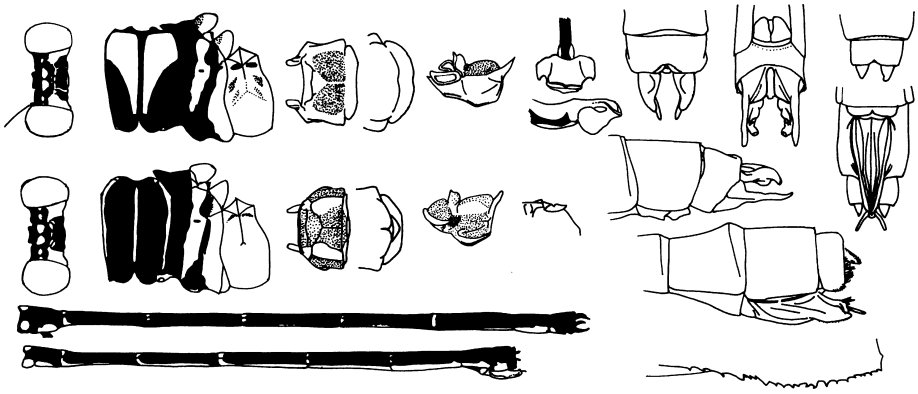


Fig. 3.1.728 *Protoneura tenuis:* (upper row, left to right): head of a male in dorsal view; diagram of the color pattern on the synthorax of a male; prothorax of a male in dorsal, anterodorsal, and lateral view; penis in ventral (above) and lateral view (below), apex of the male abdomen in dorsal, ventral (above), and lateral view (below), and apex of the female abdomen in dorsal (above) and ventral view (below); and (middle row, left to right): head of a female in dorsal view; diagram of the color pattern on the synthorax of a female; prothorax of a female in dorsal, anterodorsal, and lateral view; female mesostigmal plate; apex of the abdomen of a female in lateral view above an enlarged lateral profile of the ventral margin of the outer valve of the ovipositor; and lateral views of a male and a female abdomen (lower left, above and below, respectively). Based on Cowley (1941) and Lencioni (2005).

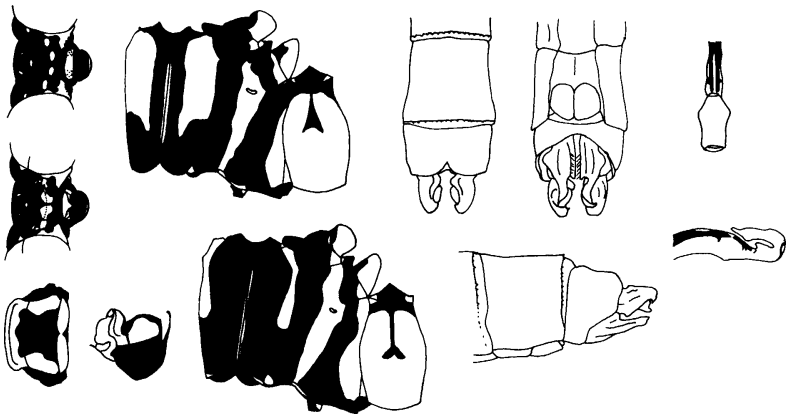


Fig. 3.1.729 *Protoneura scintilla:* color pattern on the surfaces of the heads between the eyes of a male and a female in frontodorsal view with the dorsal part of the head to the left (upper left, above and below, respectively); color pattern on the prothorax of a female in dorsal and lateral view (lower left, left and right, respectively); diagram of the color pattern on the synthoraces of a male and female (left center, above and below, respectively); apex of the abdomen of a male in dorsal (upper center), ventral (upper right center), and lateral view (lower right center); penis in dorsal (upper right) and lateral view (lower right). Based on Gloyd (1939).

7. In the male, the pale antehumeral stripe borders on the basal 1/3 to 2/3 of the humeral suture, and in the middle, it is 1/2 the length of the mesepisternum; it is usually extended along the humeral suture. On the superior anal appendage, the ventral lamina is more visible in lateral than in dorsal or ventral view. In the female, the posterior margin of the mesostigmal lamina is not sharply elevated above the level of the thorax. The ventral margin of the outer valve of the ovipositor is lined with more than 20 relatively small denticles (**Fig. 3.1.728**). The pale metepisternal stripe reaches the mesinfraepisternum and is only narrowly separated from the apical carina or reaches it only along a short line of contact; it is wider than the black stripe along the metapleural suture below it.
.....*Protoneura tenuis* Selys, 1860
(Trinidad, Venezuela, Peru, Pará, Rôndonia).

- In the male, the pale antehumeral stripe borders on the basal 1/4 of the humeral suture, and in the middle, it is less than 1/2 to about 2/3 the length of the mesepisternum and is never extended along the humeral suture. On the superior anal appendage, the ventral lamina is less visible in lateral than in dorsal or ventral view (**Fig. 3.1.730**). In the female, the posterior margin of the mesostigmal lamina is sharply elevated above the level of the thorax. The pale metepisternal stripe is widely separated from the mesinfraepisternum ventral to

it and from the apical carina dorsal to it; it is not wider than the black stripe along the metapleural suture below it. Vein Cu_1 ends distal the end of the cross vein that extends posteriad from the nodus. The width of each wing is only about 1/8 its length. The distance from the base to the nodus is more than 1/3 of the wing length and is as long as the distance from the nodus to a point beyond the sixth postnodal cross vein. The first costal space at the base of the wing is almost equal to the next two combined.
.....*Protoneura calverti* Williamson, 1915
(Trinidad, Venezuela, Guyana, French Guiana).

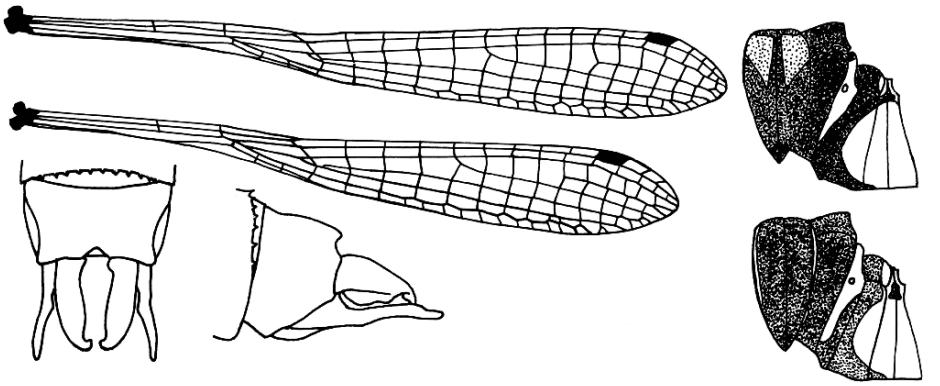


Fig. 3.1.730 *Protoneura calverti:* fore and hind wing of a male (upper left), lateral view of the color pattern on the thorax of a male (upper right) and female (lower right), and the apex of the abdomen of a male in dorsal (lower left) and lateral view (lower left center). Based on Williamson (1915).

Key to the species of adult *Epipleoneura* in South America

Information for the key was provided by Williamson (1915), Fraser (1946a), Santos (1957c,d, 1964), Rácenis (1960), Machado (1964, 1985d, 2005a), and De Marmels (1989a). Females of all species have not been described, so the key will be reliable only for male specimens.

1. The thorax of the male is mainly black with some violet or green and bronze iridescence, sometimes with some yellow laterally, at least on the metepimeron or sternum (**Fig. 3.1.731**). 2
- The thorax of the male is not mainly or extensively black (**Fig. 3.1.732**). If it is difficult to distinguish a dark green metallic thorax from a black one with green iridescence, check both possibilities in the key. 8

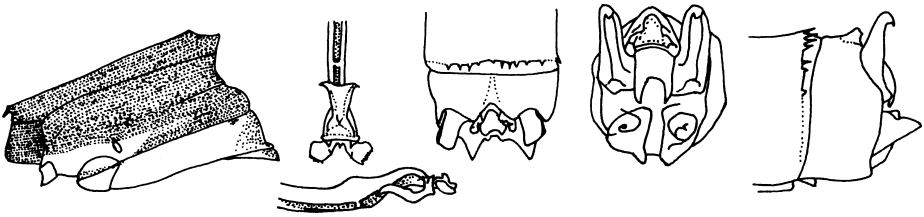


Fig. 3.1.731 *Epipleoneura ocuene* male (left to right): color pattern on the lateral surface of the synthorax, penis in ventral (above) and lateral view (below), and apex of the abdomen in dorsal, posterior, and lateral view. Based on De Marmels (1989a).

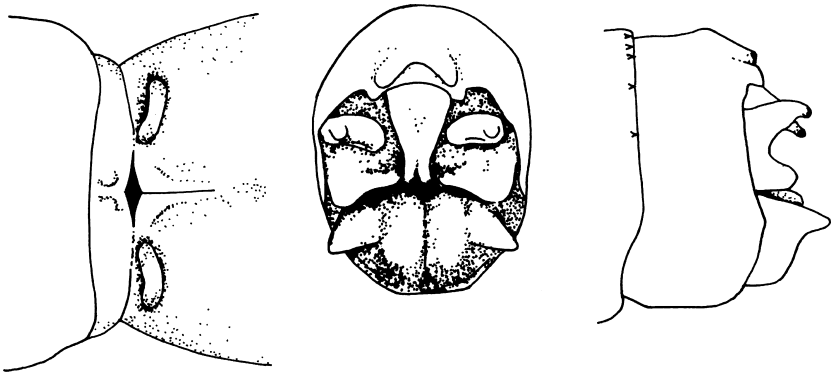


Fig. 3.1.732 *Epipleoneura janirae* (left to right): posterior lobe of the prothorax of a female in dorsal view and the apex of the male abdomen in posterior and lateral view. Based on Machado (2005a).

2. The thorax is mainly black with some violet iridescence and a metepimeron that is yellow with a brownish spot ventral to the hind wing root (**Fig. 3.1.731**). Total length of male, including appendages: 34 to 36.5 mm. Length of male abdomen with appendages: c. 31 mm. Hind wing length of male: c. 18 mm. The female has not been described.
.....*Epipleoneura ocuene* De Marmels, 1989 (Venezuela).
- The male thorax is black dorsally with a green or green and bronze iridescence and sometimes yellow lateral or ventral markings and sometimes grayish violet on the metepimeron (**Fig. 3.1.733**). 3
3. The femora of the male are brown, and the tibiae are white on the dorsal surface and pale brown ventrally. The tarsi are pale. The male thorax is mainly black with green reflections dorsally. The third through eighth segments of the male abdomen are mainly dark brown dorsally and paler laterally; the other

segments are black (**Fig. 3.1.733**). Total length with appendages: c. 32.5 mm. Length of male abdomen with appendages: c. 27.5 mm. Hind wing length of male: c. 16.5 mm. The female has not been described.
.....*Epipleoneura solitaria* De Marmels, 1989 (Venezuela).
- The legs of the male are mainly black and yellow, and the synthorax usually has extensive yellowish lateral markings (**Fig. 3.1.734**). 4

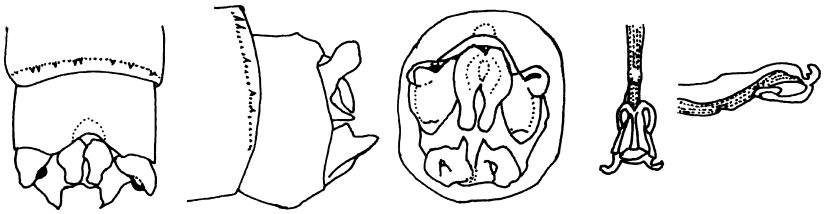


Fig. 3.1.733 *Epipleoneura solitaria* male (left to right): apex of the abdomen in dorsal, lateral, and posterior view; penis in ventral and lateral view. Based on De Marmels (1989a).

4. The legs are yellow except for the articulations, spines, and apices of the tarsal claws. The abdomen is blackish dorsally with yellow basal rings on the third through seventh segments and dark yellow laterally on some of the segments. There are yellowish markings on the metepisternum, metepimeron, and sternum. The apices of the superior anal appendages are narrow and hooked ventrad (**Fig. 3.1.734**). The female has a thorax that is mainly metallic green. Length of male abdomen with appendages: 29 to 31 mm; female: 27 to 27.5 mm. Hind wing length of male: 17 to 19 mm; female: 18.5 to 20.5 mm. .....*Epipleoneura fernandezi* Rácenis, 1960 (Venezuela).
- The femora are black, and the rest of the legs are yellow or somewhat paler with black spines, or they are pale with black at the apical ends of the femora and tibiae, or they are yellow with a black line along the inner surface of each tibia (**Fig. 3.1.735**). 5

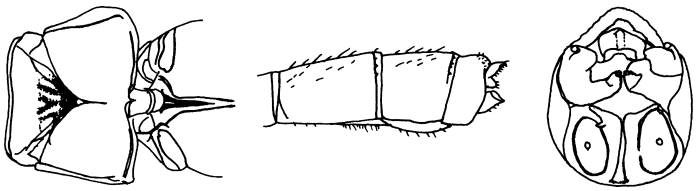


Fig. 3.1.734 *Epipleoneura fernandezi*: prothorax and anterior part of the synthorax of a female in dorsal view (left) and apex of the male abdomen in lateral (center) and posterior view (right). Based on Rácenis (1960).

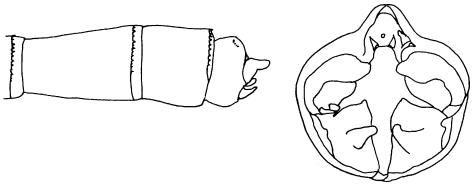


Fig. 3.1.735 *Epipleoneura spatulata* male: the apex of the abdomen in lateral (left) and posterior view (right). Based on Rácenis (1960).

5. The abdomen is blackish dorsally without any pale basal rings. The apices of the superior anal appendages are robust and directed posteriad (**Fig. 3.1.735**). Length of male abdomen: 24 to 29 mm. Hind wing length of male: 15.5 to 17.5 mm.
.....*Epipleoneura spatulata* Rácenis, 1960 (Venezuela, French Guiana, Surinam).
- The fourth through sixth segments of the male abdomen have pale basal rings. The rest of the fifth through seventh are black dorsally, while the third and fourth may be either black or brilliant green posterior to the pale rings. The superior anal appendage of the male has a thick, rounded ventral process (**Fig. 3.1.736**). 6

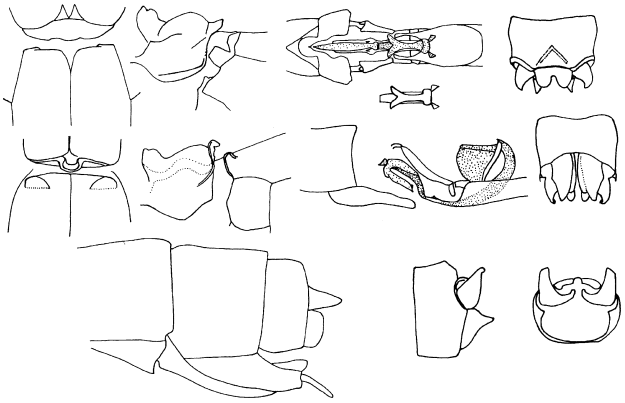


Fig. 3.1.736 *Epipleoneura venezuelensis* (upper row, left to right): posterior part of the prothorax and anterior part of the synthorax of a male in dorsal and lateral view, male genital organs on the second abdominal segment above the penis in ventral view, and the apex of the male abdomen in dorsal view, and (middle row, left to right): posterior part of the prothorax and anterior part of the pterothorax of a female in dorsal and lateral view, the penis in lateral view, and the apex of the male abdomen in ventral view, and (lower row, left to right): the apex of the abdomen of a female in lateral view, and the apex of the abdomen of a male in lateral and posterior view. Based on Santos (1957c).

6. The supra-anal lamina is forked at about its midlength, as seen in posterior view, forming two narrow diverging branches. There is a process on the basoventral lobe of the superior anal appendage that has a strong tubercle at the apex (**Fig. 3.1.737**). Length of male abdomen: 25 to 26.5 mm; female: c. 24.5 mm. Hind wing length of male: 15.5 to 17 mm; female: c. 17 mm. The dorsal surfaces of the male head, thorax, and abdomen are black with a metallic sheen and yellow markings on the face and pale basal markings on the fourth through sixth abdominal segments. On much of the surface of the female head and thorax, metallic green replaces the black in the male, and yellow markings are more extensive. The female abdomen is black dorsally with pale basal rings on the third through sixth segments and dark yellow laterally.
.....*Epipleoneura machadoi* Rácenis, 1960 (Minas Gerais, Espirito Santo).
- The branches of the supra-anal appendage are not narrow and diverge slightly, if at all (**Fig. 3.1.736**). 7

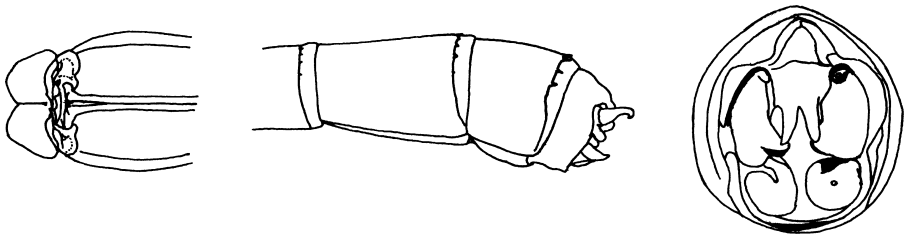


Fig. 3.1.737 *Epipleoneura machadoi*: thorax of a female in dorsal view (left), apex of the male abdomen in lateral (center) and posterior view (right). Based on Rácenis (1960).

7. The superior anal appendage of the male has a thick, rounded ventral basal process and a somewhat conical dorsal branch directed dorsad but hooking sharply ventrad at the acutely pointed apex. The supra-anal lamina between the superior anal appendages is deeply and broadly incised along the midline to form two rounded lobes (**Fig. 3.1.736**). The first four abdominal segments of the male are bright metallic green dorsally, while the fifth through tenth are black. The third through seventh have paler basal rings. The femora are black, while the tibiae are yellow, with a black line along the inner surface. Length of the male abdomen: c. 25 mm. Hind wing length of the male: c. 15 mm. The female has not been described.
.....*Epipleoneura venezuelensis* Rácenis, 1955 (Venezuela, Rondônia).
- The superior anal appendage of the male has a thick, rounded ventral basal process and a somewhat conical dorsal branch directed dorsoposteriad but curving slightly posteriad at the bluntly rounded apex. The wide supra-anal lamina between the superior anal appendages has a triangular process extending

posteriad at the midline (**Fig. 3.1.738**). The first two basal abdominal segments of the male are metallic green dorsally and pruinose black laterally, while the rest of the segments are metallic black with lighter basal rings on the third through seventh segments. The femora are black, while the tibiae are somewhat paler, with a black line along the inner surface. The thorax of the male is dark metallic, except for the yellow sternum, while that of the female has lateral yellow markings on the synthorax. Length of abdomen: 25 to 28 mm. Hind wing length: 16 to 18 mm.

.....*Epipleoneura metallica* Rácenis, 1955 (Venezuela, Mato Grosso).

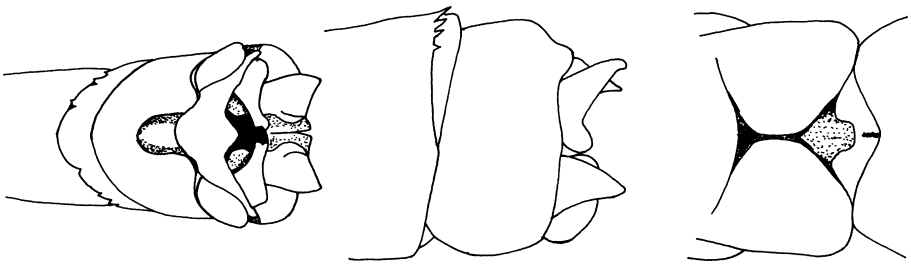


Fig. 3.1.738 *Epipleoneura metallica* (left to right): apex of the male abdomen in dorsal and lateral view and the middle and posterior lobes of the female prothorax in dorsal view. Based on Rácenis (1955b).

8. The prothorax is brownish yellow with poorly defined metallic green areas, while the synthorax is yellowish brown with a metallic green stripe on the middle half of the mesepisternum. The ventral parts of the thorax are brownish yellow and yellowish. Black markings are limited to spots at the base of each wing. The two basal abdominal segments are dark brown dorsally with greenish or coppery reflections and brownish yellow laterally. The third through seventh segments have yellow basal rings and brownish yellow apical areas. The eighth through tenth segments are brown dorsally and brownish yellow laterally. The supra-anal lamina formed by the junction of the superior anal appendages tapers toward the apex but forks subapically to form two divergent branches (**Fig. 3.1.732**). Length of abdomen: 28 to 28.5 mm. Fore-wing length: 18 to 18.5 mm. Hind wing length: 18.5 to 19 mm. Length of pterostigma: c. 0.7 mm. The head is mainly yellow on the anterior surface with an olive postclypeus. The frons is metallic green on the posterior surface, and the dorsal part of the head is greenish gray. The occipital part of the head is black.

.....*Epipleoneura janirae* Machado, 2005 (Pará).

- The thorax is mainly metallic green, metallic red, or both, or it is lighter with black markings more extensive than spots near the wing roots. 9

9. The superior anal appendages of the male join to form a wide supra-anal lamina, which is produced in the center to form a process strongly constricted at its midlength with a posterior margin that is straight and relatively wide in dorsal view (**Fig. 3.1.739**). The prothorax of the male is either black or dark green dorsally and flesh-colored ventrolaterally. Its posterior lobe is convex and not elevated. The synthorax is dark metallic green with a narrow brown humeral line, brown on the metepimeron, and pale ventrally. The male abdomen is black dorsally and laterally with green reflections of the basal segments, obscure brown basal rings on the fourth through seventh segments, and dull yellowish brown apical rings on the seventh and eighth. The male abdomen is yellowish brown ventrally. Length of male abdomen: 28.5 to 30 mm. Hind wing length of male: 17 to 18 mm. The female has not been described.
.....*Epipleoneura capilliformis* (Selys, 1886)
(Guyana, Pará, Mato Grosso). Syn: *Protoneura capilliformis* Selys, 1886; *Epipleoneura incusa* Williamson, 1915.
- If a supra-anal lamina is evident between the superior anal appendages of the male, it is narrow and spine-like or forked horizontally or vertically or otherwise forms processes directed posteriad so that the posterior margin is not straight (**Fig. 3.1.740**). 10

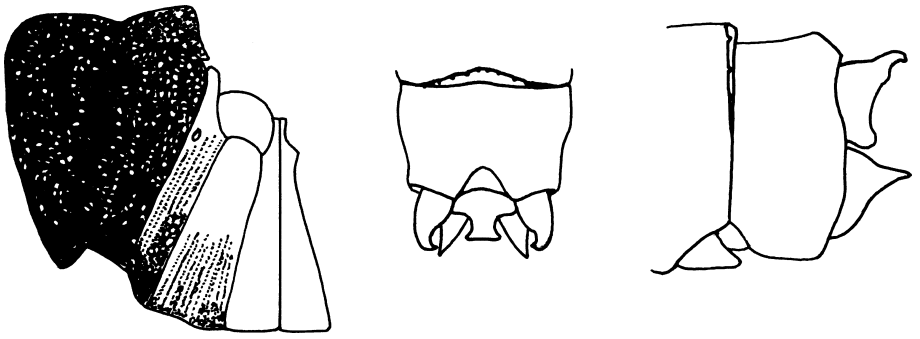


Fig. 3.1.739 *Epipleoneura capilliformis* male (left to right): diagram of the color pattern on the synthorax and apex of the male abdomen in dorsal and lateral view. Based on Williamson (1915).

10. The prothorax is black with green iridescence dorsally and pale laterally and ventrally. The synthorax is pale except for the entirely black mesepisternum and mesepimeron and a black groove between the middle coxae. The shiny black markings have green or coppery reflections. The supra-anal lamina consists of two tapering lobes fitted tightly together appearing to form a single spine (**Fig. 3.1.740**). Total length of male: 33 to 35 mm. Length of male abdomen: c. 28 mm. Hind wing length of male: c. 17 mm. The female has not been described.
.....*Epipleoneura uncinata* De Marmels, 1989
(Venezuela).

- The main color of the male thorax is metallic green, metallic red, or a mixture of both with dark brown or yellow sometimes on the lateral or posterior surface, or it is pale brown with a green mid-dorsal stripe (**Fig. 3.1.741**). 11

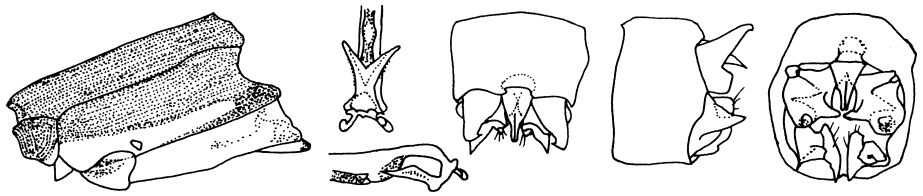


Fig. 3.1.740 *Epipleoneura uncinata* male (left to right): color pattern on the lateral surface of the synthorax, penis in ventral (above) and lateral view (below), and the apex of the abdomen in dorsal, lateral, and posterior view. Based on De Marmels (1989a).

11. The main color of the male thorax is metallic green, metallic red, or a mixture of both; it is yellow or brown or both laterally, most evident in the female (**Fig. 3.1.741**). 12
- The thorax is brownish yellow with a green longitudinal stripe, at least in the male. 23

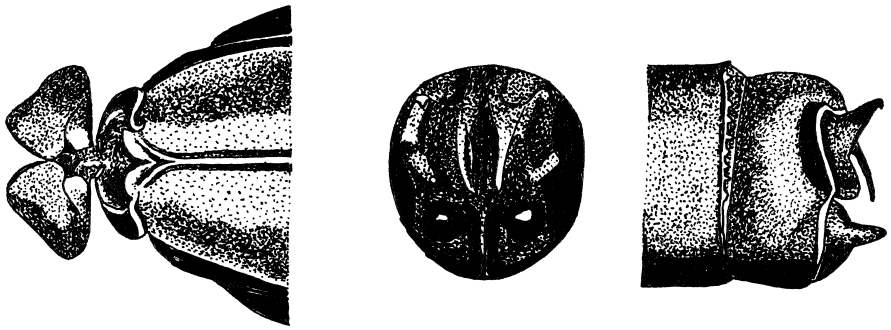


Fig. 3.1.741 *Epipleoneura pereirai* (left to right): prothorax and anterior part of the synthorax of a female in dorsal view and the apex of the abdomen of a male in posterior and lateral view. Based on Machado (1964).

12. There is no lamella that is forked either vertically or horizontally between the superior anal appendages (**Fig. 3.1.742**). 13
- The superior anal appendages form a lamella between them that is forked either in the vertical or horizontal plane (**Fig. 3.1.741**). 14

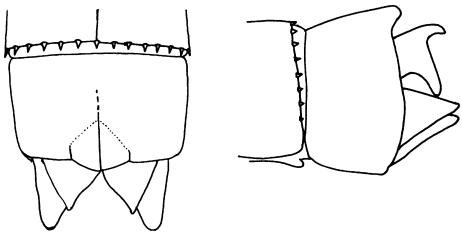


Fig. 3.1.742 *Epipleoneura peruviensis* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Fraser (1946a).

13. In dorsal view, the superior anal appendages appear short, close together, and conical, but in lateral view, a long process on each is evident (**Fig. 3.1.742**). The abdomen is brownish black with coppery reflections and vague pale basal rings on the third through seventh appendages. Abdomen length of the one male specimen described: 29 mm. Hind wing length: 19 mm. The female has not been described.
.....*Epipleoneura peruviensis* (Fraser, 1946) (Ecuador, Peru). Syn: *Protoneura peruviensis* Fraser, 1946.
- The superior anal appendages appear widely separated in dorsal view (**Fig. 3.1.690**). The head and thorax of the male are dark metallic green dorsally, brown or bronzed laterally, and paler brown ventrally. The abdomen of the male is black with slightly paler basal rings on the fourth through seventh segments and black appendages. Length of abdomen: 26.5 to 27 mm. Hind wing length: 17 to 17.5 mm.
.....*Epipleoneura fuscaenea* Williamson, 1915 (Venezuela, Guyana, Surinam).

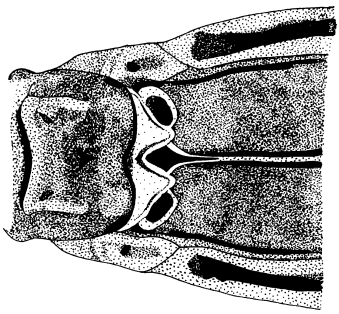


Fig. 3.1.743 Prothorax and anterior part of the synthorax of a female *Epipleoneura humeralis* in dorsal view. Based on Machado (1984).

14. The very short superior anal appendages of the male join to form a lamella that has a vertical fork visible in lateral view, with a longer dorsal branch bearing a subapical spine. The female has a deep V-shaped excavation in the middle of the posterior lobe of the prothorax, which is delimited by lobules that are appear flat apically in profile (**Fig. 3.1.743**). There are 11 or 12 postnodal cross veins in the fore-wing and 9 in the hind wing. Total length: 34 to 35 mm. Length of abdomen without appendages: 28 to 31 mm. Fore-wing length: c. 21 mm. Hind wing length: 19 to 20 mm. Pterostigma: c. 0.7 mm.
.....*Epipleoneura humeralis* (Selys, 1886) (Amazonas). Syn: *Protoneura humeralis* Selys, 1886.

- The dorsal process of the supra-anal lamina formed by the superior anal appendages does not bear a strong subapical spine and does not appear forked in lateral view, although it may be clearly forked in the horizontal plane forming branches that are clearly visible in dorsal view. The posterior lobe of the female prothorax does not have a deep V-shaped incision, or it is delimited by lobules that are convex in profile (**Fig. 3.1.741**). 15

15. The supra-anal lamina formed between the superior anal appendages is semi-elliptical with a constriction along the midline, apparent as a slight apical indentation in dorsal view (**Fig. 3.1.744**). The thorax of the male is metallic reddish with greenish reflections dorsally and yellow laterally and ventrally. The proximal segments of the male abdomen are dark chestnut brown with yellow on the lateral surfaces of the first and second segments, yellow crescents at the bases of the third through seventh, and lateral stripes on the third through eighth. The seventh through tenth segments are metallic black. Length of male abdomen: 28 to 30 mm. Hind wing length of male: 15 to 16 mm. The posterior part of the head is black, and the anterior part is various shades of red with yellow on the labia, anterior part of the labrum, anteclypeus, and genae. The female has not been described.
.....*Epipleoneura tariana* Machado, 1985 (Venezuela, Amazonas).

- The supra-anal appendage is clearly forked forming well-defined branches (**Fig. 3.1.741**). 16

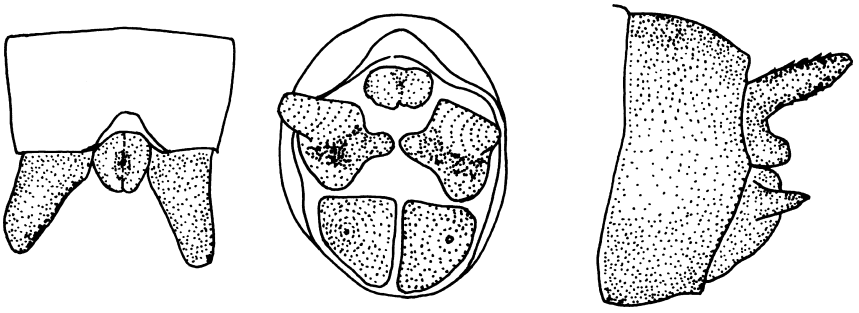


Fig. 3.1.744 *Epipleoneura tariana* male (left to right): apex of the abdomen in dorsal, posterior, and lateral view. Based on Lencioni (2005).

16. In the male, there is a fork with slightly convergent branches in the supra-anal lamina. In the female, there are no small sublateral lobules on the posterior lobe of the prothorax (**Fig. 3.1.741**). The main color of the thorax is metallic green. 17
- In the male, there is a fork with divergent or parallel branches in the supra-anal lamina (**Fig. 3.1.745**). 18

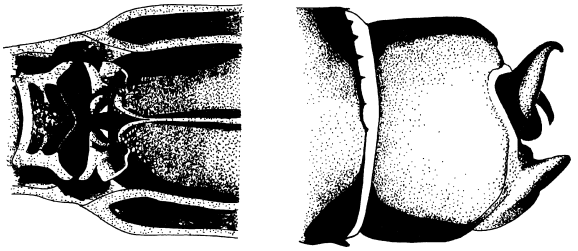


Fig. 3.1.745 *Epipleoneura westfalli:* prothorax and anterior part of synthorax in anterodorsal view (left) and apex of the male abdomen in lateral view (right). Based on Machado (1956).

17. The branches of the lamina are long, curve ventrad, and converge toward the apices. They are clearly visible in lateral view, reaching the ventral margin of the superior appendage. The main color or the thorax is metallic green, with yellow laterally and a black mark in the center in the female synthorax; the thorax is darker green laterally in the male (**Fig. 3.1.741**). Length of abdomen of male: 28.5 to 30 mm; female: 26 to 27.5 mm. Fore-wing length of male: 18 to 20 mm; female: 19.5 mm. Hind wing length of male: c. 17.5 to 19 mm; female: c. 18.5 mm. The first abdominal segment of the male is black with green reflections dorsally and yellow ventrally. The second segment is metallic green dorsally and brown laterally. The third through tenth segments are black dorsally, brown dorsolaterally, and yellow ventrolaterally. Ventrally, the fourth through seventh segments are black, and the eighth through tenth, brown. There is a small, yellow lateral spot on the lateral surfaces of the fourth through seventh segments.
.....*Epipleoneura pereirai* Machado, 1964 (Amapá, Pará).
- The branches of the lamina are short and blocked from view by the superior appendages when viewed laterally. The thorax of both males and females is dark metallic green dorsally with a short, narrow, brown humeral stripe and transitioning into pale brown, almost flesh-colored, laterally. The abdomen of the male is mainly dark with green reflections dorsally but with obscure brown basal rings on the third through seventh segments, a pale apical ring on the seventh, and an apical third of the ninth, which is brown in preserved specimens but which may be blue in living specimens. The ventral side of the abdomen is obscure yellowish brown. The abdomen of the female is similar, but pale areas

are more extensive, including apical pale rings on both the seventh and eighth segments. The ovipositor extends beyond the posterior margin of the tenth abdominal segment, and its palps extend as far posteriad as the anal appendages, which are black in both sexes (**Fig. 3.1.746**). Length of male abdomen: 29 to 31 mm; female: c. 26.5 mm. Hind wing length of male: 18 to 19 mm; female: c. 18 mm.
.....*Epipleoneura lamina* Williamson, 1915 (Peru, Venezuela, Guyana). Syn: *Protoneura protostictoides* Fraser, 1946.

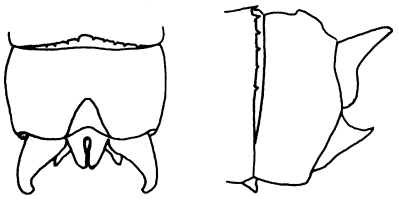


Fig. 3.1.746 Apex of the male abdomen of *Epipleoneura lamina* in dorsal (left) and lateral view (right). Based on Williamson (1915).

18. The branches of the forked supra-anal lamina of the male curve strongly ventrad, and each ends in an acute point, clearly visible in lateral view (**Fig. 3.1.745**). 19
- The branches on the fork of the supra-anal lamina are thick and broadly rounded at their apices or widely spaced and not curved ventrad far enough to be observed in lateral view. The superior anal appendage is also rounded at the apex and does not end in a hook; it bears at least a small knob directed posteriad on its basoventral lobe. In the known females, there are two sublateral lobules on the posterior lobe of the prothorax, which may be small or prominent and directed dorsad (**Fig. 3.1.747**). 20

19. The superior anal appendage curves strongly dorsal and ends in a hook; its process on the basoventral lobe bears only a small chitinized tubercle at the apex. There are two sublateral lobules on the posterior lobe of the prothorax, which are prominent and directed dorsad (**Fig. 3.1.745**). Length of male abdomen: 26 to 28 mm; female: c. 25.5 mm. Fore-wing length of male: 17 to 18 mm; female: c. 18 mm. Hind wing length of male: 16 to 17 mm; female: c. 17 mm.
.....*Epipleoneura westfalli* Machado, 1986 (Rondônia).
- The superior anal appendages extend posteriad and curve inward near the apex to point toward each other. They appear truncate at the apex with a slight apical notch, evident in lateral view. In dorsal view, the branches of the supra-anal lamina appear parallel and close together (**Fig. 3.1.748**).
.....*Epipleoneura manauensis* Santos, 1964 (Venezuela, Amazonas).

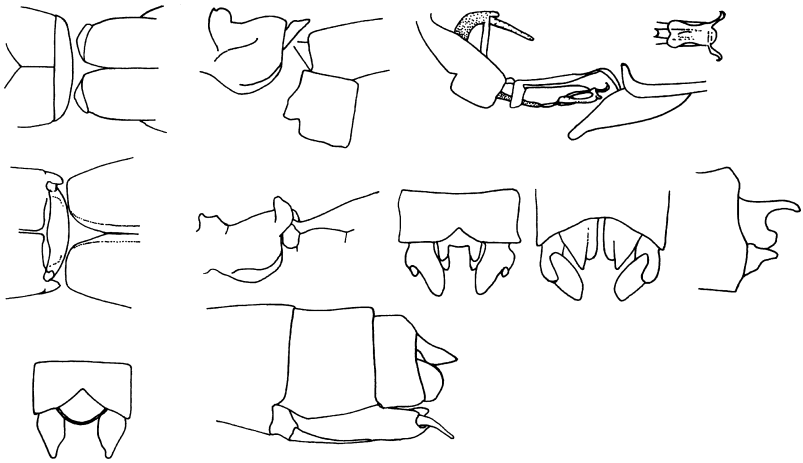


Fig. 3.1.747 *Epipleoneura williamsoni* (upper row, left to right), posterior part of the prothorax and anterior part of the synthorax of a male in dorsal and lateral view; penis in lateral view and its apex in ventral view (above); and (middle row, left to right): posterior part of the prothorax and anterior part of the synthorax of a female in dorsal and lateral view; apex of the male abdomen in dorsal, ventral, and lateral view; and (below): apex of the female abdomen in dorsal (left) and lateral view (right). Based on Santos (1957d).

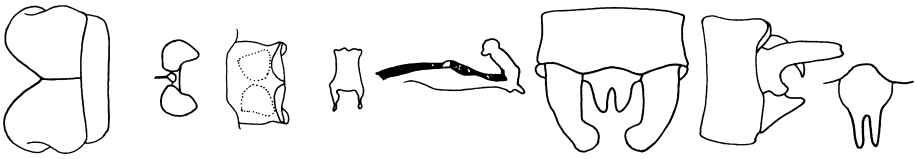


Fig. 3.1.748 *Epipleoneura manauensis* (left to right): posterior lobe of the prothorax of a male in dorsal and posterior view, prothorax of a female in dorsal view, apex of the penis in ventral and lateral view, apex of the abdomen of a male in dorsal and lateral view, and the supra-anal lamina of a male. Based on Santos (1964).

20. The basoventral lobe on the superior anal appendage reaches as far or almost as far posteriad as the inferior anal appendage, and it is broadly rounded at its apex (**Fig. 3.1.747**). 21

- The basoventral lobe on the superior anal appendage is little more than a raised knob, which does not reach nearly as far posteriad as the inferior anal appendage. The supra-anal lamina forks near its mid-length into two processes that run nearly parallel to their apices (**Fig. 3.1.749**). The thorax is mainly metallic reddish dorsally and largely yellow laterally. The abdomen is mainly black with metallic reflections and yellow lateral stripes on the two proximal segments and yellow lateral stripes on the third through eighth. There is a yellow basal crescent on the dorsal surfaces of the third through seventh segments. 22

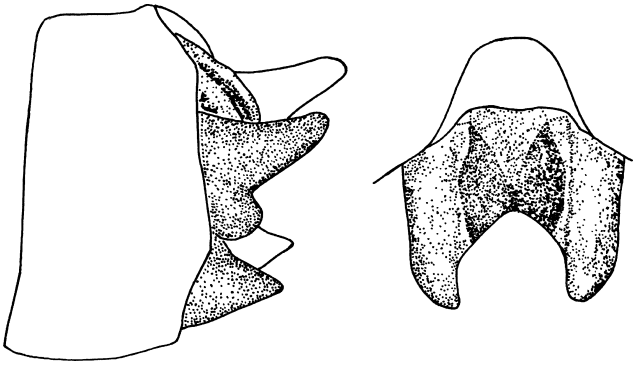


Fig. 3.1.749 *Epipleoneura waiwaiana* male: apex of the abdomen in lateral view (left) and supra-anal plate in posterior view (right). Based on Machado (1985d) and Lencioni (2005).

21. The basoventral lobe on the superior anal appendage curves posteriad at its apex. In dorsal view, two nearly parallel lateral processes are directed posteriad from the supra-anal lamina, which has a nearly straight posterior margin between them longer than the length of each process. At the base of the apical segment of the penis, there is a pair of flagellate processes (**Fig. 3.1.747**). In lateral view, the ovipositor extends slightly posterior to the margin of the tenth abdominal segment. The main colors are metallic green and yellow.
.....*Epipleoneura williamsoni* Santos, 1957 (Bahia, São Paulo).

- The basoventral lobe on the superior anal appendage is broad with its margin extending slightly beyond the inferior appendage but showing no tendency to curve posteriad. In dorsal view, two lateral processes of the supra-anal lamina are widely spaced and divergent toward their apices, there is a slightly convex emargination between them, which is somewhat longer than the length of each process. At the base of the apical segment of the penis, there are no flagelliform processes (**Fig. 3.1.750**). The female has not been described.
.....*Epipleoneura haroldoi* Santos, 1964 (Venezuela, French Guiana, Amazonas).

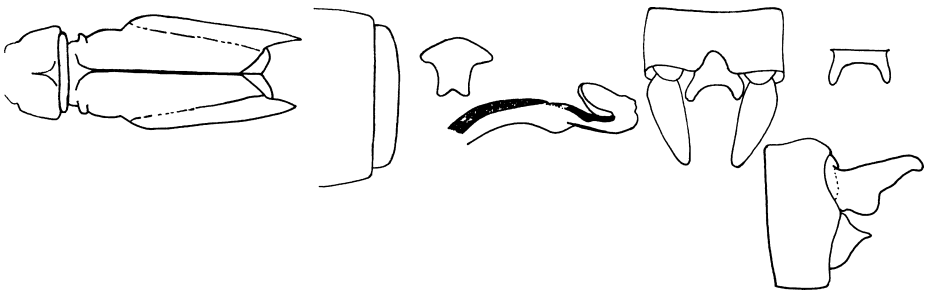


Fig. 3.1.750 *Epipleoneura haroldoi* (left to right): dorsal view of the thorax of a female, posterior lobe of the prothorax of a male, apex of the penis in ventral and lateral view, apex of the abdomen of a male in dorsal and lateral view (below), and the supra-anal lamina (above). Based on Santos (1964).

22. The apical processes of the supra-anal lamina are separated at their apices by a distance equal to or greater than the distance from the base of the excavation between them to the apex of a process (**Fig. 3.1.749**). The dorsal surface of the thorax is reddish metallic as far as the blackish humeral suture. The lateral surfaces ventral to the darkened sutural stripe are almost entirely yellowish. The first abdominal segment is reddish metallic on the dorsal surface, while the second segment is greenish metallic dorsally. The appendices and supra-anal lamina are blackish. Length of male abdomen: c. 30 mm. Hind wing length of male: c. 18 mm. The female has not been described.
.....*Epipleoneura waiwaiana* Machado, 1985 (Venezuela, Pará).

- The apical processes of the supra-anal lamina are separated at their apices by a distance less than 2/3 of the distance from the base of the excavation between them to the apex of a process (**Fig. 3.1.751**). The dorsal color of the thorax varies greatly from individual to individual. It is usually metallic red with or without greenish reflections and with large yellow areas on the lateral and ventral surfaces. The ninth and tenth abdominal segments have large chestnut brown areas. Length of male abdomen: 27 to 28.5 mm. Hind wing length of male: 16.5 to 17 mm. The dorsal and ventral parts of the head are black with metallic reflections on the dorsal part. The anterior surface is brightly marked with yellow on the labia, a white stripe across the anterior border of the labrum, dark red at the base of the mandibles, and red with a greenish yellow stripe on the anteclypeus. The genae and anterior part of the frons are yellowish green, and yellow spots are present near the antennae. The female has not been described.
.....*Epipleoneura kaxuriana* Machado, 1985 (Pará, Amazonas, Rondônia).

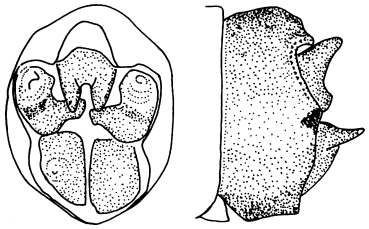


Fig. 3.1.751 Apex of the male abdomen of *Epipleoneura kaxuriana* in posterior (left) and lateral view (right). Based on Lencioni (2005).

23. A well-developed basal lobe on the ventral side of the superior anal appendage is present (**Fig. 3.1.752**). Length of male abdomen: c. 27 mm. Hind wing length of male: c. 16 mm. The female has not been described. The head is black dorsally with extensive yellow markings on the face, including on the labrum, labia, anteclypeus, and postclypeus. The thorax is metallic green, and the abdomen is blackish dorsally with pale basal rings on the third through seventh segments.
.....*Epipleoneura pallida* Rácenis, 1960 (Venezuela).
- There is no basal lobe on the superior anal appendage (**Fig. 3.1.753**). Length of male abdomen: c. 31 mm. Fore-wing length of male: c. 19.5 mm. Hind wing length of male: c. 18.5 mm. The prothorax is yellowish brown with a green mid-dorsal stripe, and the synthorax has a green mid-dorsal stripe bordered by a yellowish brown and then a light blue stripe. The first abdominal segment of the male is pale blue dorsally and yellow ventrally. The second segment and basal 1/5 of the third are green dorsally and light blue laterally. The rest of the third segment and the fourth through eighth are black with blue metallic reflections dorsally and laterally; the fourth through seventh segments have light blue marginal stripes and ventral markings. The ninth and tenth segments are black with an obscure ring around the basal 1/4 of the tenth. The female has not been described.
.....*Epipleoneura albuquerquei* Machado, 1964 (Pará).

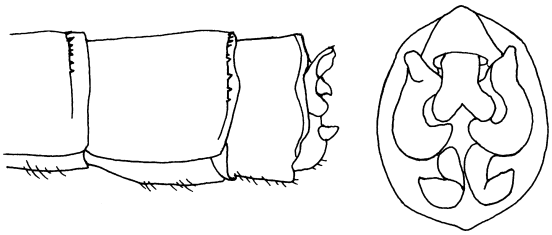


Fig. 3.1.752 *Epipleoneura pallida* male: the apex of the abdomen in lateral (left) and posterior view (right). Based on Rácenis (1960).

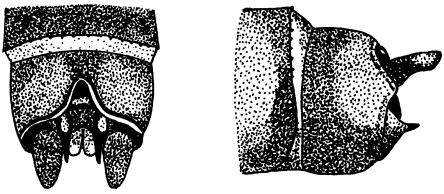


Fig. 3.1.753 *Epipleoneura albuquerquei* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Machado (1964).

Key to the species of adult *Psaironeura* in South America

Information for the key was provided by De Marmels (1989a) and Esquivel (1993).

1. The superior anal appendage is robust and as long as the tenth abdominal segment, and it has a broad, rounded ventral process (**Fig. 3.1.692**). The female has an ovipositor extending approximately as far posteriad as the anal appendages. The abdomen of the male is mainly black, while that of the female is light brown on the anterior segments, transitioning to dark brown toward the apex.
.....*Psaironeura remissa* (Calvert, 1903)
(Central America, Colombia, Venezuela, French Guiana, Brazil). Syn: *Protoneura remissa* Calvert, 1903. A somewhat similar species known only from Costa Rica, *Psaironeura selvatica* Esquivel, 1993, can be distinguished by the bright red color of the male labrum and clypeus, which is brown in *P. remissa*, and the ovipositor, which extends well beyond the apices of the anal appendages.
- The superior anal appendages are narrow, evenly curved, and forcipate in dorsal view (**Fig. 3.1.754**). 2
2. In dorsal view, the internal tooth on the superior anal appendage is inserted subapically (**Fig. 3.1.754**). Total length, including appendages: 31.5 to 32.5 mm. Length of abdomen with appendages: 26.5 to 28 mm. Hind wing length: c. 17 mm.
.....*Psaironeura bifurcata* (Sjöstedt, 1918)
(Venezuela, Amazonas). Syn: *Protoneura bifurcata* Sjöstedt, 1918; *Psaironeura machadoi* De Marmels, 1889.
- In dorsal view, the internal tooth on the superior anal appendages is inserted at the apex, separated from the outer corner of the apex by a shallow emargination (**Fig. 3.1.755**).
.....*Psaironeura tenuissima* (Selys, 1886)
(Ecuador, Peru, Guyana, Pará, Amazonas, Rondônia). Syn: *Psaironeura cerasina* Williamson, 1915.

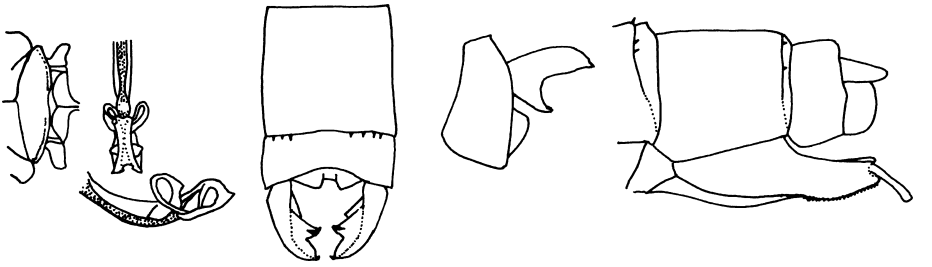


Fig. 3.1.754 *Psaironeura bifurcata* (left to right): posterior lobe of the pronotum, penis in ventral (above) and lateral view (below), apex of the male abdomen in dorsal and lateral view, and apex of the female abdomen in lateral view. Based on De Marmels (1989a), illustrated as *Psaironeura machadoi.*

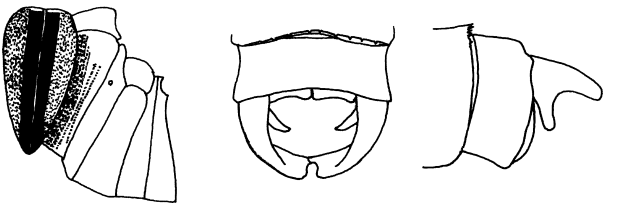


Fig. 3.1.755 *Psaironeura tenuissima* male (left to right): diagram of the color pattern on the synthorax and the apex of the abdomen in dorsal and lateral view. Based on Williamson (1915), shown under the synonym, *Psaironeura cerasina*.

Key to the species of adult male *Forcepsioneura* in South America

Information for the key was provided by Santos (1970e), Lencioni (1999, 2005) and Machado (2001, 2004, 2005c). The key is reliable only for males because few females have been described.

1. Posterolateral tubercles on the median prothoracic lobe are poorly developed or absent (**Fig. 3.1.756**). The posterior surface of the head is black. 2
 - The posterolateral tubercles on the median prothoracic lobe are prominent (**Fig. 3.1.757**). 4
2. In lateral view, the superior anal appendage of the male is inclined dorsad less than 30° from the plane of the dorsal surface of the ninth abdominal segment; its ventral branch is barely, if at all, developed. No tubercles are present on the posterolateral corners of the median lobe of the prothorax. The apex of the ventromedial process on the superior anal appendage lacks teeth and is not visible in lateral view (**Fig. 3.1.758**). Mature males develop pruinescence on the ninth abdominal segment but not on the thorax. Length of male abdomen with appendages: 35.5 to 36 mm. Hind wing length: 21.5 to 22 mm. Color, metallic

green and dark brown with light brown and yellow markings. The female has not been described.
.....*Forcepsioneura juruaensis* (Machado, 2004) (Acre). Syn: *Amazoneura juruaensis* Machado, 2004.
- In lateral view, the superior anal appendage of the male is inclined dorsad more than 30° from the plane of the dorsal surface of the ninth abdominal segment; its ventral branch is fairly well developed and can be seen well, at least in dorsal view (**Fig. 3.1.756**). A tubercle is present on each posterolateral corner of the median lobe of the prothorax, but it is poorly developed. 3

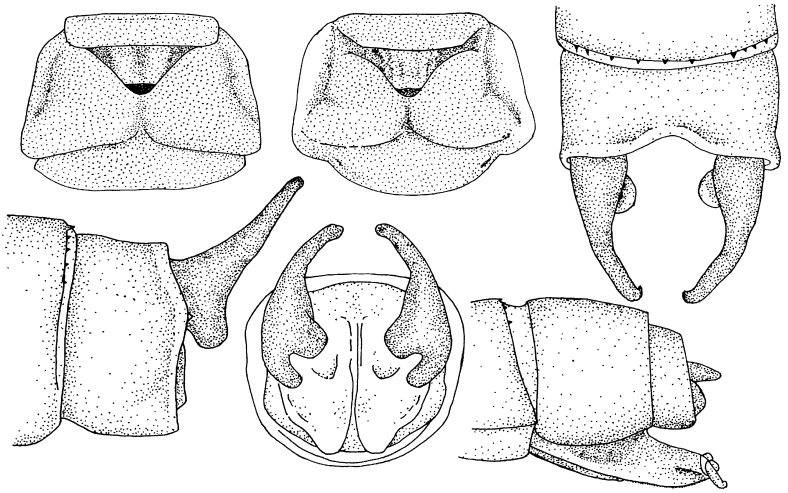


Fig. 3.1.756 *Forcepsioneura westfalli* (upper row, left to right): dorsal view of the prothorax of a male and a female, apex of the abdomen of a male in dorsal view, and (lower row, left to right): apex of the abdomen of a male in lateral and posterior view and the apex of a female abdomen in lateral view. Based on Machado (2001).

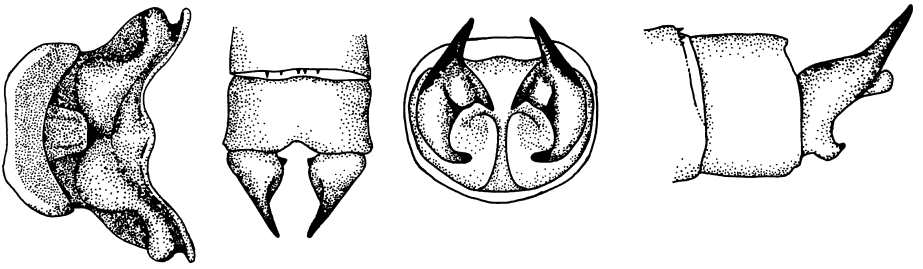


Fig. 3.1.757 *Forcepsioneura grossiorum* male (left to right): prothorax in dorsal view and the apex of the abdomen in dorsal, posterior, and lateral view. Based on Machado (2005c).

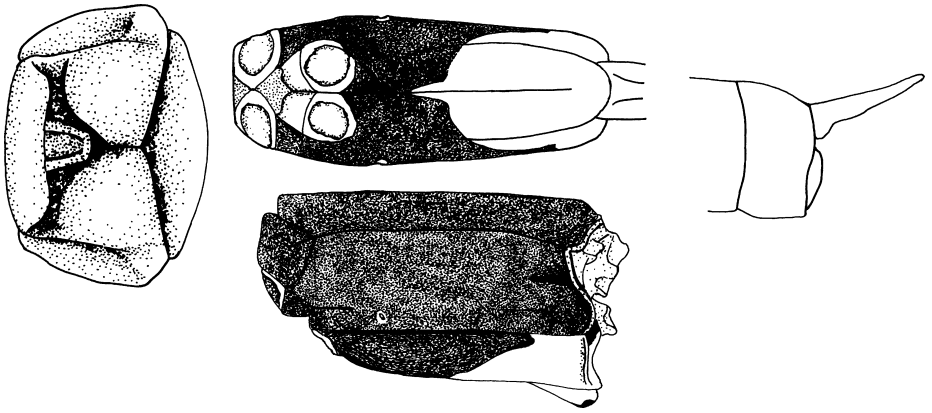
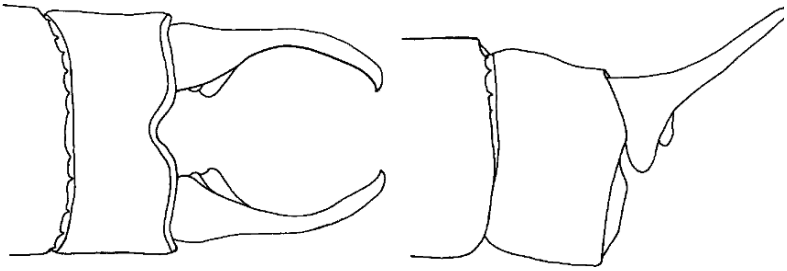


Fig. 3.1.758 *Forcepsioneura juruaensis* male: dorsal view of the prothorax (left), synthorax in ventral (upper center) and lateral view (lower center), and apex of the abdomen in lateral view (right). Based on Machado (2004).

3. In lateral view, the apex of the ventromedial process on the superior anal appendage cannot be seen (**Fig. 3.1.756**), and in dorsal view, the appendage appears rounded with a smooth rim. Length of abdomen: 33 to 35.5 mm. Hind wing length: 21 to 23 mm. Color, metallic green and dark brown with light brown and yellow markings. Mature males develop pruinescence on the ninth abdominal segment but not on the thorax.
.....*Forcepsioneura westfalli* Machado, 2001 (Ecuador). Syn: *Amazoneura westfalli* (Machado, 2001).

- In lateral view, the apex of the ventromedial process can be seen on the superior anal appendage (**Fig. 3.1.759**), and in dorsal view, the appendage appears triangular and bears two tiny teeth. Mature males develop pruinescence on the prothorax and synthorax but not on the ninth abdominal segment. Length of male abdomen including appendages: c. 37 mm. Fore-wing length of male: c. 22 to 23 mm. Hind wing length of male: c. 21 to 22 mm. The general color of the head and thorax is dark metallic green with some yellowish markings on the head and bluish markings on the thorax. The abdomen is mainly dark brown with the first segment mainly yellow, the second through eighth segments with a metallic bluish tinge, and the tenth with a yellow dorsal spot at the midlength of the segment.
.....*Forcepsioneura ephippigera* (Selys, 1886) (Ecuador, Peru, Amazonas). Syn: *Protoneura ephippigera* Selys, 1886; *Phasmoneura ephippigera* Selys, (1886); *Amazoneura ephippigera* (Selys, 1886).



Fig, 3.1.759 *Forcepsioneura ephippigera* male: apex of the abdomen of a male in dorsal (left) and lateral view (right). Based on Machado (1985d).

4. The superior anal appendage has a ventral branch that does not reach the level of the ventral part of the tenth abdominal segment, either because it is too short or because it is curved inward so sharply that it diverges away from the ventral margin of the tenth segment at its apex, as best seen in posterior view (**Fig. 3.1.757**). 5
- The superior anal appendage has a long ventral branch that reaches or almost reaches the level of the ventral part of the tenth abdominal segment (**Fig. 3.1.760**). The posterior surface of the head is pale in color. 6

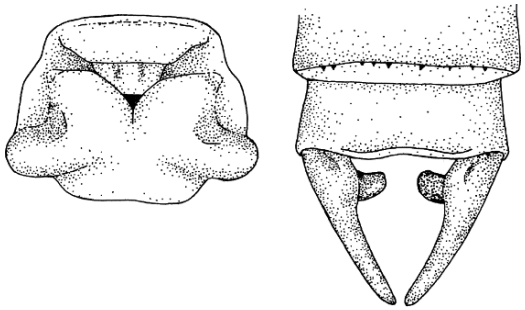


Fig. 3.1.760 *Forcepsioneura sancta* male: dorsal view of the prothorax (left) and the apex of the male abdomen in dorsal view (right). Based on Machado (2001).

5. The posterior prothoracic lobe of the male has a prominent projection along the midline, is deeply concave lateral to this projection, and has lateral extensions that widen from the deepest point of the concavity. The ventral process on each superior anal appendage of the male is relatively long but curves sharply inward before reaching the level of the ventral margin of the tenth abdominal segment (**Fig. 3.1.757**). Length of male abdomen including appendages: c. 37 mm. Hind wing length of male: c. 23 mm. Length of pterostigma: c. 0.8 mm. The head and prothorax are mainly black and yellow

with a few brown markings, while the synthorax and abdomen are mainly bright metallic green with yellow ventrolateral areas and basal rings and with small brownish markings. The female has not been described.
.....*Forcepsioneura grossiorum* Machado, 2005 (Rio de Janeiro).

- The posterior prothoracic lobe of the male does not have a deeply concave margin lateral to a prominent median projection, and it narrows continually to its lateral corners. The posterior margin of the posterior prothoracic lobe of the female is shallowly convex in the middle. The ventral process on each superior anal appendage of the male is short, curves inward just proximal to its apex, and ends far short of the level of the ventral margin of the tenth anal appendage (**Fig. 3.1.761**). The posterior surface of the head is pale.
.....*Forcepsioneura lucia* (Machado, 2000) (Minas Gerais, Espirito Santo).

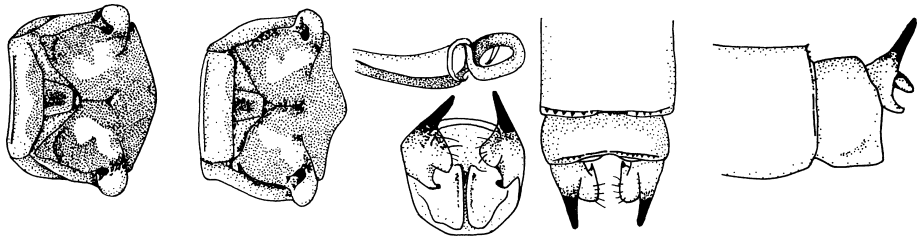


Fig. 3.1.761 *Forcepsioneura lucia* (left to right): prothoraces of two different specimens in dorsal view, penis (above), and apex of the male abdomen in posterior (below), dorsal, and lateral view. Based on Machado (2000).

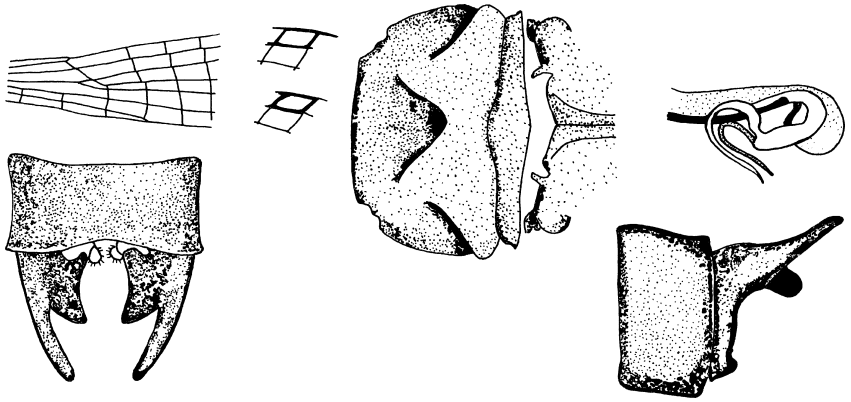


Fig. 3.1.762 *Forcepsioneura itatiaiae:* the base of the hind wing (upper left) and the fore and hind pterostigmata of a male (upper left center), prothorax in dorsal view (upper center), penis in lateral view (upper right), and apex of a male abdomen in dorsal (lower left) and lateral view (lower right). Based on Lencioni (1999).

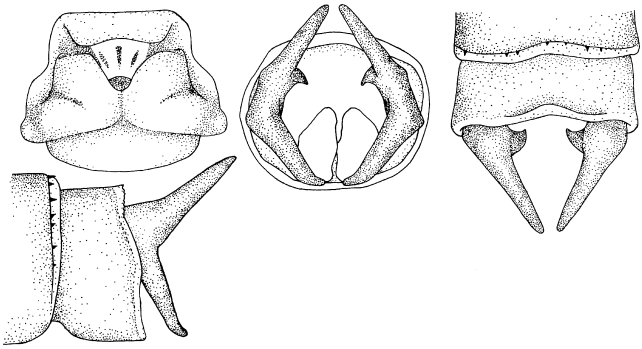


Fig. 3.1.763 *Forcepsioneura haerteli* male: dorsal view of the prothorax (upper left) and the apex of the male abdomen in posterior (center), dorsal (right), and lateral view (lower left). Based on Machado (2001).

6. In lateral view, the ventromedial process of the superior anal appendage can be seen (**Fig. 3.1.761**). 7
- In lateral view, the ventromedial process of the superior anal appendage cannot be seen (**Fig. 3.1.759**). 8

7. Inferior anal appendages are absent. There is a central concavity on the posterior lobe of the prothorax (**Fig. 3.1.693**). Total length of male, including anal appendages: c. 34 mm. Abdomen length of male: c. 29 mm. Fore-wing length of male: c. 19 mm. Hind wing length of male: c. 16 mm. The female has not been described.
.....*Forcepsioneura garrisoni* Lencioni, 1999 (São Paulo).
- Inferior anal appendages are present. The posterior lobe of the prothorax is convex (**Fig. 3.1.761**). Length of abdomen: 35 to 38 mm. Hind wing length: 23 to 27 mm. The color is mainly metallic gray with green reflections, especially on the thorax. The male is more brightly colored than the female.
.....*Forcepsioneura itatiaiae* (Santos, 1970) (Rio de Janeiro). Syn: *Phasmoneura itatiaiae* Santos, 1970.

8. In dorsal view, the ventromedial process on the superior anal appendage is nearly rectangular but rounded at the apex. The posterior lobe of the prothorax is slightly concave or nearly straight (**Fig. 3.1.759**). Length of abdomen: 24.5 to 32 mm. Hind wing length: 16.5 to 20 mm.
.....*Forcepsioneura sancta* (Hagen in Selys, 1860) (Colombia?, French Guiana?, Minas Gerais, Rio de Janeiro, São Paulo). Syn: *Protoneura sancta* (Hagen in Selys, 1860; *Phasmoneura ciganae* Santos, 1968.
- In dorsal view, the ventromedial process on the superior anal appendage of the male is nearly triangular with a minute, black apex. The posterior lobe of the male prothorax is slightly convex (**Fig. 3.1.762**). Length of abdomen of male:

34 to 37 mm. Hind wing length of male: 20.5 to 22.5 mm. Color of male: yellow and shiny black on the head, reddish brown with black markings and metallic green stripes on the thorax, and metallic green dorsally with yellow markings laterally and ventrally on the abdomen. The female has not been described. .....*Forcepsioneura haerteli* Machado, 2001 (Santa Catarina).

Erratum Section 3, Part 1 Zygoptera, page 45–48

3.1.7 Key to the families of Zygoptera in South America

Adults

Information for the key was taken from Munz (1919) and Brues *et al.* (1954).

1. There are five or more antenodal cross veins in each wing, and the wings are not distinctly petiolate. The arculus is nearer to the base of the wing than to the nodus (**Fig. 3.1.12**). 2
- There are two to four antenodal cross veins in each wing, and the wings are distinctly petiolate. Vein R_{2+3} is nearly always fused with R_1 for a short distance beyond its origin (**Fig. 3.1.13**). 4

2. An arculus is absent. Usually, only the distal primary antenodal cross vein is present (**Fig. 3.1.14**).
.....Polythoridae..p. 60
- An arculus is present (**Fig. 3.1.12**). 3

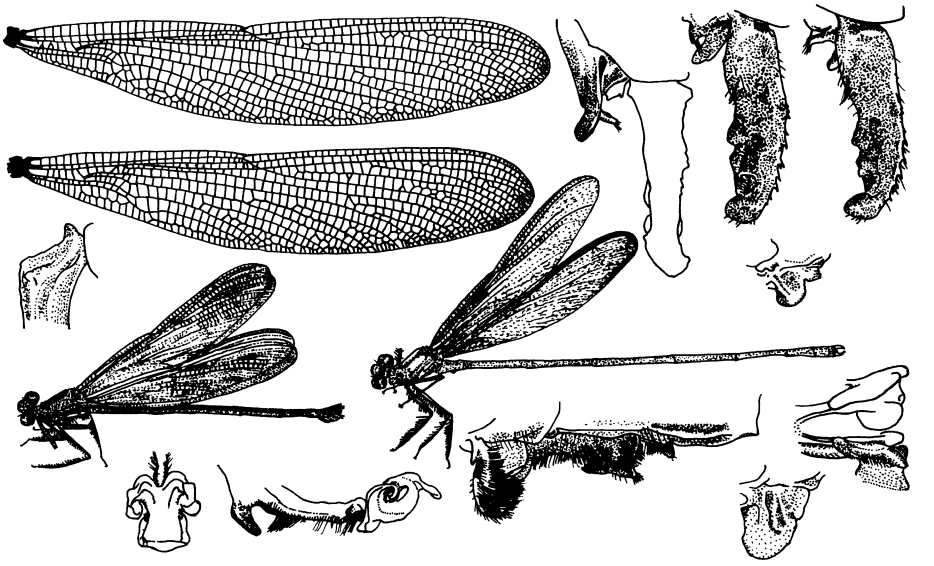


Fig. 3.1.12 *Bryoplathanon globifer:* fore and hind wing of a male (upper left), habitus of a female (lower middle left) and male (lower middle right), left female intersternite (upper middle left), setose tubercle on the first and visible genitalia on the second abdominal segment of a male in lateral view (lower right center), male anterior hamules in ventral view (lower right), and the setose tubercle of a male with the setae removed (below and left of the hamules) and a female (upper middle right), penis in ventral and lateral view (lower left center, left and right, respectively), and male anal appendages in lateral, mediodorsal, and dorsal view (upper right, left to right). Based on Garrison (2006).

3. Both primary antenodal veins are absent (**Fig. 3.1.12**).
.....Calopterygidae..p. 103
- Both primary antenodal veins are present. The discoidal cells are well separated from R_1. Vein R_{2+3} is sometimes arched toward R_1 shortly beyond its origin. Secondary antenodal cross veins are numerous (**Fig. 3.1.15**). The femur of the middle leg, directed posteriad, extends beyond the second abdominal segment, and the legs lack spurs.
.....Heliocharitidae..p. 164
This family is also called Dicteriastidae or Dicteriadidae.

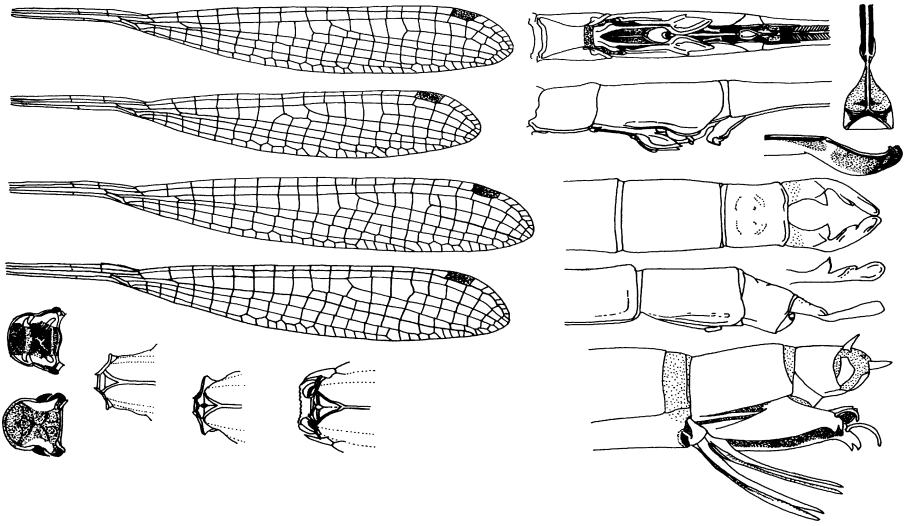


Fig. 3.1.13 *Perissolestes castor:* fore and hind wing of a male (upper left) and a female (middle left); dorsal view of the prothorax of a male and a female (lower left, above and below, respectively); mesostigmal laminae of a male in posterior view, a female in posterior view, and a female in dorsal view (lower left center, left to right); the genitalia on the second abdominal segment in ventral and lateral view (upper right center, above and below, respectively); apex of the penis in ventral and lateral view (upper right, above and below, respectively); and (middle to lower right): the apical segments of the male abdomen in dorsal and lateral view with the superior anal appendage in oblique view between them and the apex of the female abdomen with the ovipositor expanded after treatment in potassium hydroxide. Based on Kennedy (1937).

4. The distal corner of the quadrangle contacts the posterior margin of the wing. Vein Cu_2 arches sharply anteriad where it arises near the quadrangle (**Fig. 3.1.13**).
.....Perilestidae..p. 165

- The distal corner of the quadrangle does not reach the margin of the wing, and vein Cu_2 does not arch sharply anteriad at its origin (**Fig. 3.1.16**). 5

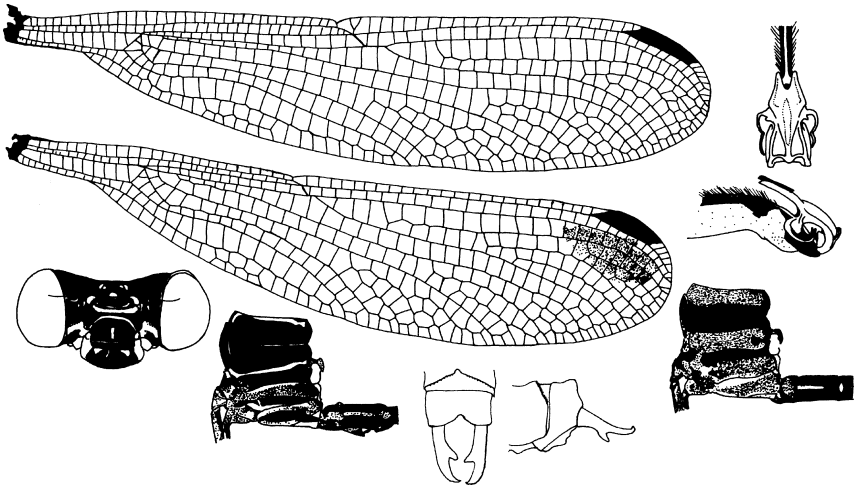


Fig. 3.1.14 *Miocora peraltica*: fore and hind wing of a male (upper left); head of a male in anterior view (lower left); diagram of the thoracic color pattern diagrammatically displayed in one plane with the lateral surface below and dorsal surface above, showing the female (lower left center) and male (lower right); penis in ventral (upper right) and lateral view (middle right), and apex of the male abdomen in dorsal (lower center) and lateral view (lower right center). Based on Calvert (1917) and Kennedy (1940).

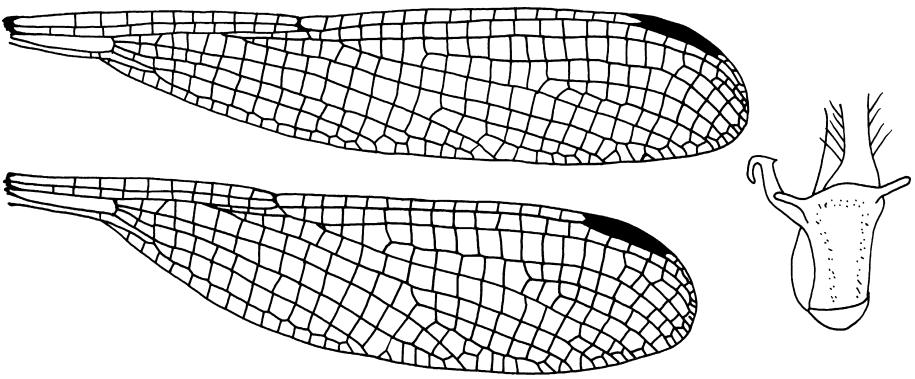


Fig. 3.1.15 The fore and hind wing of *Dicterias atrosanguinea* (left) and its penis (right). Based on Needham (1933), who labeled his drawing of the wing *D. procera,* and Dunkle (1991a).

5. R_{4+5} and R_3 both arise far proximal to the level of the subnodus. IR_3 is usually at least half way between the arculus and the subnodus and usually nearer the arculus. CuP and A_1 are complete. Supplemental sectors connect IR_3, R_{4+5}, and MA (**Fig. 3.1.17**). 6
- R_{4+5} and IR_3 arise nearer to the subnodus than the arculus. At most, R_{4+5} arises halfway between the arculus and the subnodus (**Fig. 3.1.18**). 7

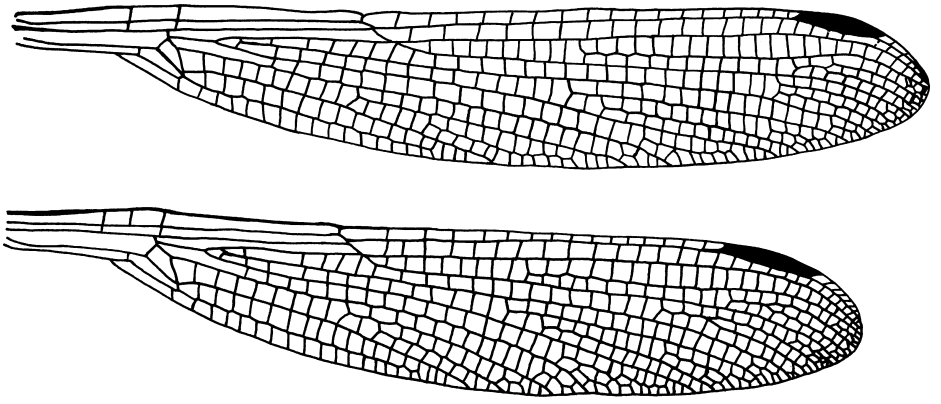


Fig. 3.1.16 The fore and hind wing of a female *Rimanella arcana.* Based on Needham (1933).

6. Vein R_3 of the only South American species arises at the subnodus. The total length of the only South American species is c. 41 mm; its hind wing and abdomen are each c. 30 mm long. The wing is as shown (**Fig. 3.1.16**).
.....Amphipterygidae
There are only two Neotropical species in this family: *Amphipteryx agrioides* Selys, 1853, which is found in Central America and has not yet been identified in South America, and *Rimanella arcana* (Needham, 1933), known from Venezuela, Guyana, Surinam, and Amazonas. The tibial spines are slightly longer than the spaces between them. The general coloration is dull greenish black and brown; the pronotum is dull yellowish brown with a black marking on its posterior lobe. The synthorax is brown with a greenish black mid-dorsal stripe narrowing at its mid-length. Its synonym is *Rima arcana* Needham, 1933.
- Vein R_3 usually arises at least one cell distal to the subnodus (**Fig. 3.1.17**).
.....Lestidae..p. 176
7. The nodus is located very close to the base of the wing at 1/6 to 1/4 of the wing length. The pterostigma is absent or is strangely formed, not chitinized, or formed from several cells and never braced (**Fig. 3.1.18**).
.....Pseudostigmatidae..p. 201
- The nodus is usually located more than 1/4 of the wing length from the base, or, if not, then the pterostigma is not strangely formed. The pterostigma is strongly chitinized or, rarely, hypertrophied (**Fig. 3.1.19**). 8

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