Mange Mites

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Brainstorming questions

- Discuss about morphology, classification and pathological roles of arthropods (3min)
- Do you have any information about mites? If you have, say something (2min)
- Have heard what does it mean by mange? (1min)

Learning Objectives

- At the end of this session students will be able to:
  - ✓ characterize the morphology of mites
  - ✓ identify the different types of veterinary important mites
  - ✓ explain factors that influence the occurrence of mites
  - ✓ characterize the effects of mites on animals
  - ✓ diagnose clinical cases of mite infestation
  - ✓ treat and prepare control strategies of mite infestation

Mange mites

- Like ticks, mites **are eight-legged** arthropods belonging to the Acarina
- Unlike ticks, which are **exclusively parasitic**, mites occupy countless terrestrial and aquatic niches with only a tiny minority adopting a **partial** or **completely** parasitic lifestyle.
- Most **parasitic mites** are associated with a **skin disease** called '**mange**', they are called '**mange mites**' to distinguish them from free-living relatives.

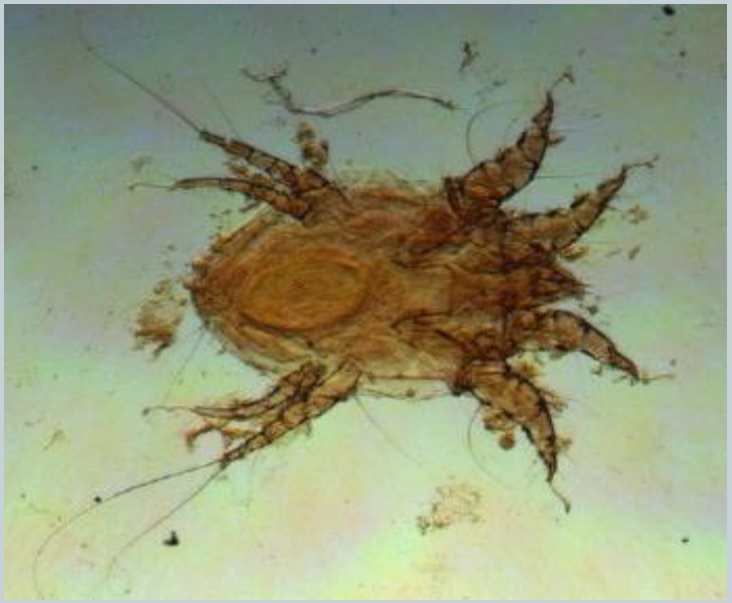
Mange mites

- For clinical consideration, mange mites are more conveniently divided into **two groups** according to their location on the host:

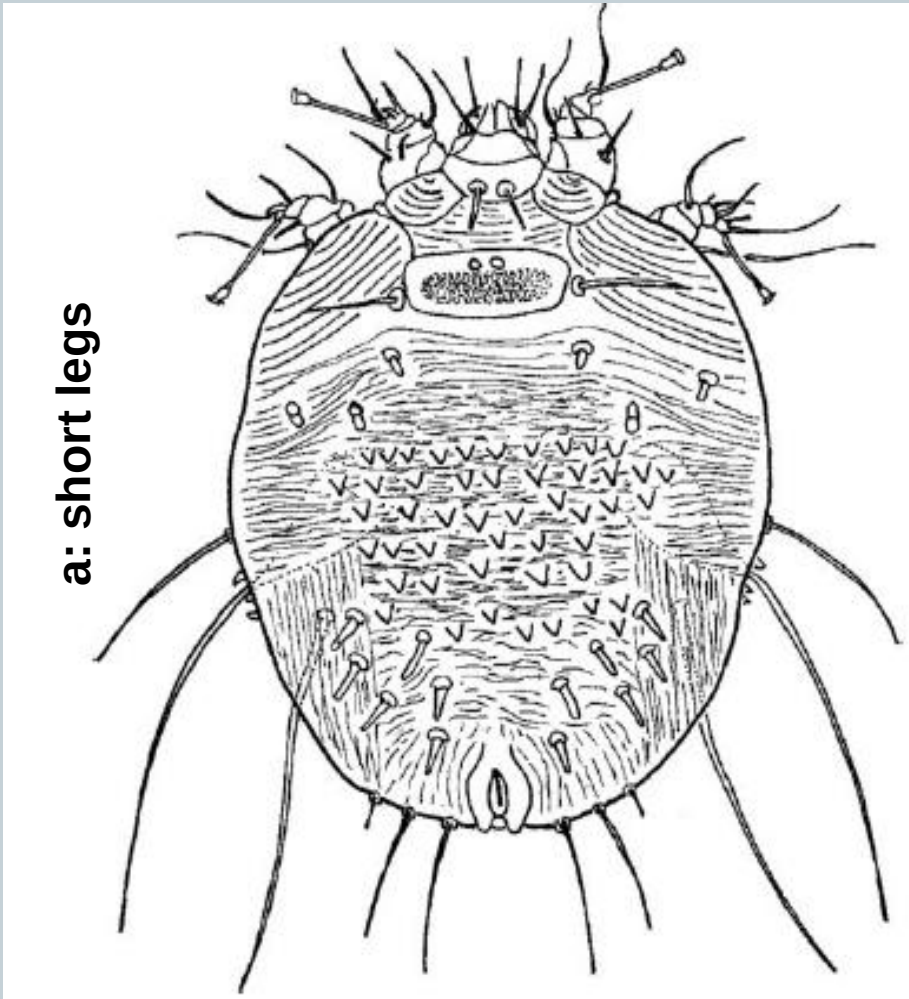
  - ✓ **subsurface** (burrowing) mites

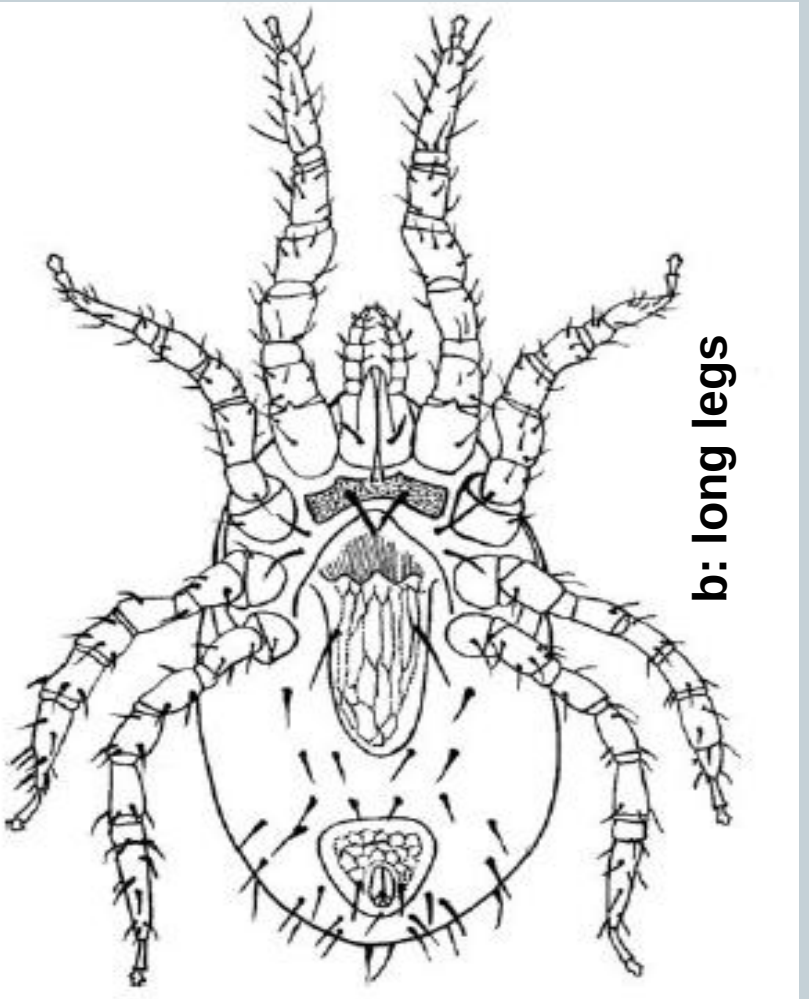
  &

  - ✓ **surface** (nonburrowing) mites



Subsurface mite (a) & Surface mite (b)





Mange mites

- Almost all mange mites complete their **life-cycle** on the host.
- **Transmission** is therefore mainly by **direct contact** between hosts.
- Mites progress from a **six-legged larva** through **one** to **three nymphal stages** to the adult.
- Females lay only **one large egg** at a time but, as **generation** times are relatively **short**, **large infestations** can build up quickly.

Ticks and mange mites compared

- Ticks and mange mites are both **eight-legged wingless** arthropods.
- They both belong to the **Acarina** and so have many **similarities** but there are also fundamental differences, including:

Ticks and mange mites compared

	Ticks	Mange mites
Size	Large (~0.5 cm)	Small (~0.5 mm)
Time on host	Only to feed; most of life spent on ground	Most spend entire life on host
Eggs laid	In clusters on ground	Singly on host
Duration of life-cycle	Often protracted (months or years)	Short (days or weeks)
Host to host transmission	Questing ticks on vegetation etc.	Direct physical contact
Disease transmission	Vectors of many pathogenic organisms	Vectors for very few pathogens

Mange mites

- Mites causing **mange** of animals of veterinary importance usually belong to different families:
  - ✓ **Sarcoptidae**: burrowing
  - ✓ Knemidocoptidae: burrowing
  - ✓ **Psoroptidae**: non-burrowing
  - ✓ **Chorioptidae**: non-burrowing
  - ✓ **Demodicidae**: burrowing

have similarity

have similarity

Mange mites

- Mites could be
  - ✓ **Sarcoptiform** (burrowing and non-burrowing):

    Sarcoptes, *Psoroptes*, *Chorioptes* and *Knemidocoptes*
  - ✓ **Non- sarcoptiform**: *Demodex*

General characteristics

- ✓ **Obligate** and permanent parasite belonging to order Acarines
- ✓ The disease is called **mange** or **scabies** or acariasis
- ✓ Unlike ticks, the **entire life cycle** (egg-L-N-A) takes place on the live host
- ✓ Transmission is by **direct** contact

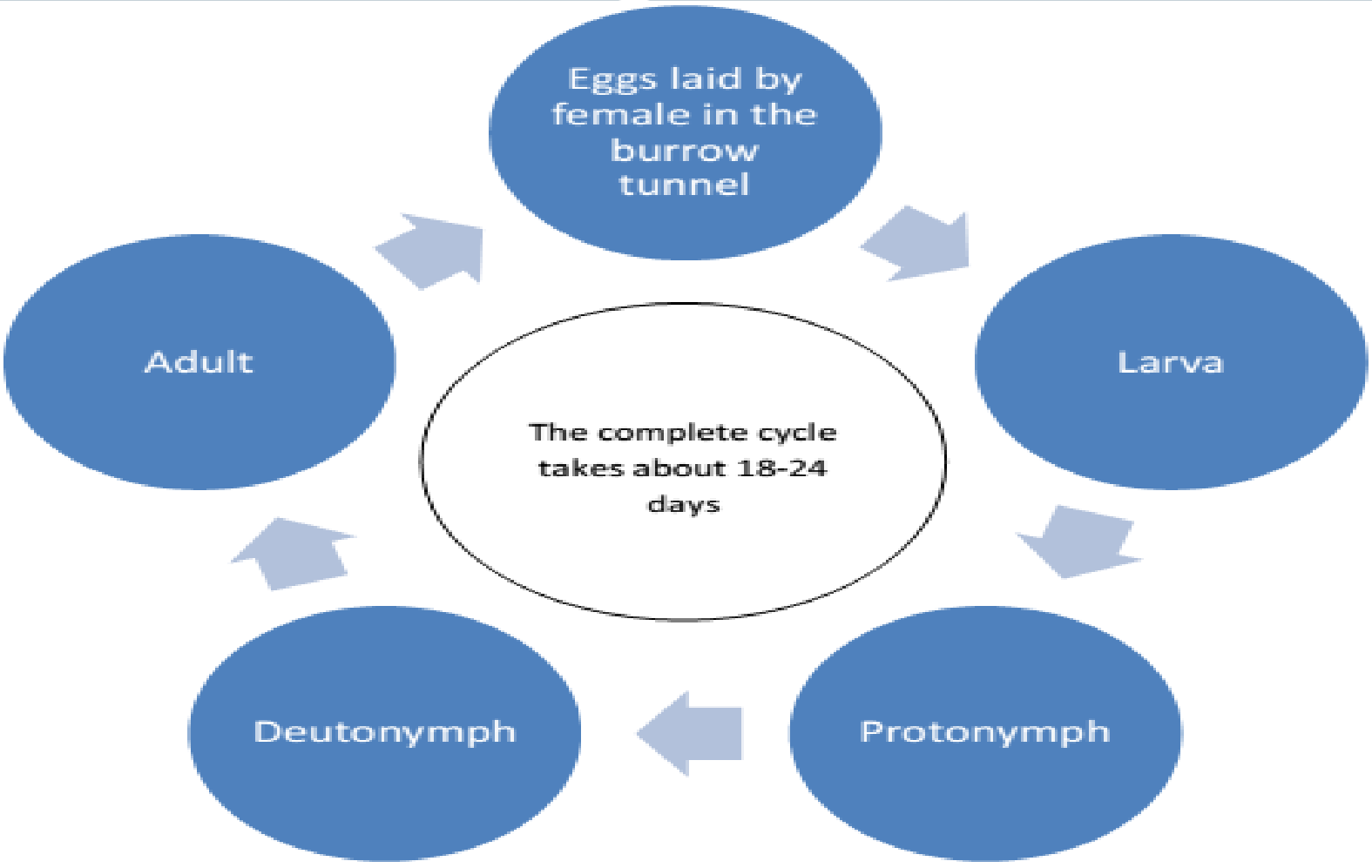
General characteristics

- ✓ Burrowing mites **localize deep** in the dermis in contrast to non-burrowing, which **feed superficially**
- ✓ Affect wide range of animal hosts and human
- ✓ The entire life cycle is **spent on the host**: egg-larva-protonymph- deutnymph- tritonymph-adult stage: simple metamorphosis

General life cycle of mange mites

- **Larvae**: six legged; nymph and adult: eight legged
- Infection is transmitted by **direct contact**
- Predisposing factors to clinical disease includes:
  - **age, poor condition, inter current infection, poor nutrition, breed**

Life cycle of mite: on host



Diagnosis of mange mites

- **History and clinical examination**
  - ✓ seasonal occurrence, sign of wet and discoloured wool, debility, and intense pruritis with easily elicited nibbling reflex (*Psoroptes*)

Diagnosis of mange mites

- **Laboratory diagnosis**
  - ✓ Parasitological examination
  - ✓ Skin scrapping examinations: as deep as to reach follicles and glands, materials should be scraped from the edge of a lesion, placed in warm 10% KOH, and examined microscopically
  - ✓ Collections of free living mite by spreading to sun for some minute

Diagnosis of mange mites

- **Histopathology**: skin biopsy
- **Serology**: early detection of *Psoroptic* antibody using extracted antigens (under trial) (Wall and Shearer, 1997)

Epidemiology of mange mites

- Transmission: through contact
- Transmission from the **dam to the young** and from the **male to female breeding** animals is common
- Infection of a **hitherto mange free herd** occurs usually as a result of **buying in mite-carrying stock**, which often show no clinical symptoms of mange
- Introduction of mite carrier animals

Epidemiology of mange mites

- **Sheds**, **boxes** and **pastures fencing** must considered as source of reinfection because mange mites are able to survive outside the host.
- The disease affects **all age groups** and runs a more **chronic course** in adults than younger animals; young animals are more susceptible (Radostitis et al., 2009)

Factors attributing spread of mange mites

- **Increased livestock trade** and **movement of livestock** across-national borders
- Absence of **veterinary regulations**
- Poor management /husbandry and poor condition
- Overcrowding, concurrent infection, immunosuppression
- Season of the year: cold and wet weather suitable, temperature and humidity

Factors attributing spread of mange mites

- **Concentration** of animals of different origins in **fattening units** or **watering points**
- Irregular ectoparasite **control measures**
- Improper application of acaricides by non-professionals (Radostitis et al. 2009)

Economic impact of mange mites

- **Direct economic loss** through:
  - ✓ mortality and poor growth
  - ✓ reduced reproduction
  - ✓ **skin/hide** downgrading or rejecting at the tannery: 33% of sheep and 21% of goat skin have rejected

Economic impact of mange mites

- **Direct economic loss** through:
  - ✓ **reduced foreign currency**: rejections 20-24% of purchased skins from sheep and goat, has resulted in a loss of US $6.9 million/year (Kassa, 1998; Zeleke, 1998)
  - ✓ control, treatment and replacement cost
- **Indirect effect**: pathogen transmission and secondary complication

Pathogenic effects of mange mites

- **Direct epidermal** damage leading to **inflammation**; this results in **skin erythema**, **pruritus/itching**, **scale formation**, **lichenification** (thickening) and **crust (inflammatory exudate) formation**.
- Production of cutaneous **hypersensitivity** (especially **type I hypersensitivity**).
- Loss of blood or other tissue fluids
- Mechanical or biological transmission of pathogens

Discussion

- Discuss about the morphology of mange mite
- Discuss the life cycle of mange mites
- Discuss the pathological and economic effects of mange mites
- Discuss the factors that influence mange mite occurrence
- Discuss how can we diagnose mange mite infection?

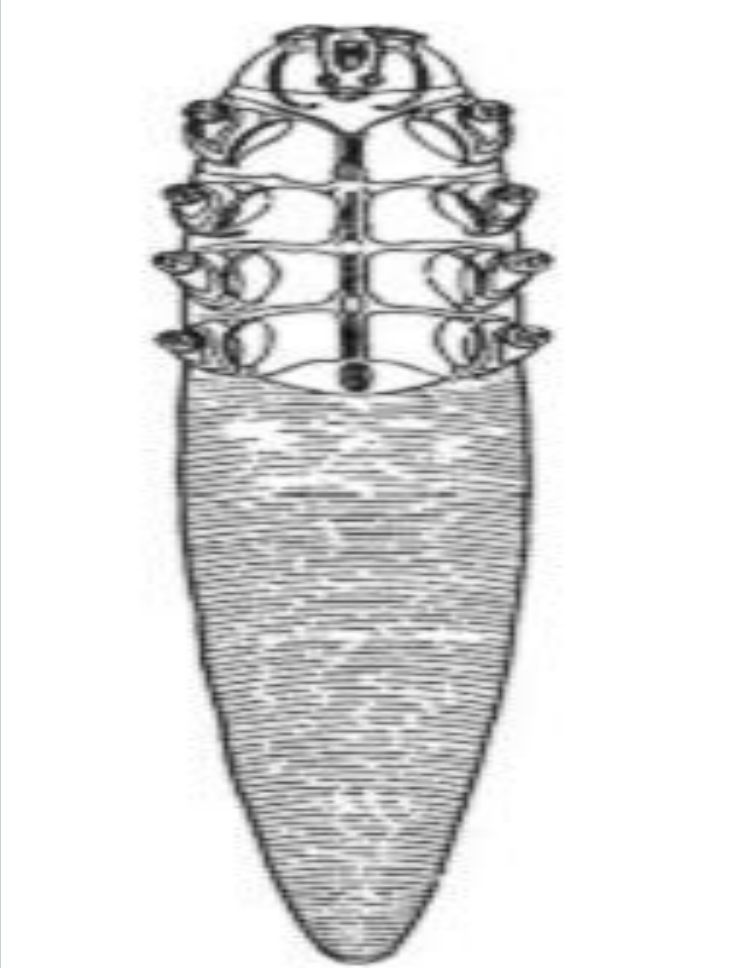
Family: Demodicidae

- Genus: ***Demodex*:**
  - ✓ very **host specific**
  - ✓ is a **burrowing mite,** which lives in the **hair follicles and sebaceous glands** of various mammals causing **demodectic or follicular mange**
  - ✓ The parasite has an **elongate tapering** body: **cigar shape**, 0.25mm long, with **four pairs** of stumpy legs

Family: Demodicidae

- Genus: ***Demodex***
  - ✓ The mouth parts **consist of paired palps** and **chelicerae** and an **unpaired hypostome**.
  - ✓ The **penis** protrudes on the **dorsal side** of the **male thorax** and the vulva is **ventral in female**
  - ✓ The eggs are **spindle-shaped**

Morphology of *Demodex* species & its egg



Family: Demodicidae

- Genus: ***Demodex***
  - ✓ **Hosts**: all domestic mammals and man
  - ✓ **Distribution**: worldwide
  - ✓ **Location**: hair follicles and sebaceous glands
  - ✓ **Species**: *Demodex phylloides*, *D. folliculorum*, *D. bovis*, *D. canis*, *D. equi* e.t.c.

Life cycle

- ✓ The life cycle is completed in **18-24** days. **Males** occur **at** or **near** the **skin surface** where as **fertilized female** oviposits 20-24 eggs in the hair follicle.
- ✓ **Transmission**: direct contact
- ✓ *Demodex* not cause **itching** unlike other mites

Family: Demodicidae

Genus: *Demodex*				
Species	Host	Location	Morphology	Symptoms/pathogenesis
D. folliculorum	Man	Hair follicle and sebaceous gland	- Elongated, tapering body - 0.2mm long - 4pairs of stumpy legs anteriorly	- **Squamous demodicosis** is less serious & is a **dry reaction** with **erythema** and **alopecia**, **desquamation** and skin **thickening** - **Pustular /follicular demodicosis** is the severe form and follows **bacterial** invasion. Skin become **thickened** and **wrinkled** (**folding**) - It is thought that certain bitches carry a **genetically** transmitted factor which results in **immunodeficiency** in their offspring - *Demodex* itself thought to cause a **cell mediated immunodeficiency.** This defects disappear when mites have been disappeared.
D. bovis	Cattle			
D. canis	Dog			
D. equi	Horse			
D. phylloides	Pig			

Clinical demodicosis in goats

Clinical demodectic mange in cattle

Pathogenesis

- In early infection, there is a slight **loss of hair** on the **face** and **forelimbs**, followed by **thickening** of the skin, and the mange may progress no further than the incontact areas; many of these **localized mild infections** resolve spontaneously without treatment.
- On the other hand, **lesions** may spread over the entire body, and this **generalized demodicosis** may take one of two forms: **squamous** and **follicular** demodicosis

Pathogenesis

- **Squamous/localized demodicosis** is the less serious. It is a **dry reaction** with little erythema, but widespread **alopecia**, **desquamation** and **thickening** of the skin.
- In all types of demodectic mange or follicular mange **no pruritus**

Pathogenesis

- ✓ **Pustular/generalized/follicular demodicosis: " red mange"**: is the severe form, and follows **bacterial invasion** of the lesions, often by *Staphylococci*. The skin becomes **wrinkled** and **thickened**, with many small pustules from which **serum, pus** and **blood oozes**.
- ✓ Affected dogs have an **offensive odour.**

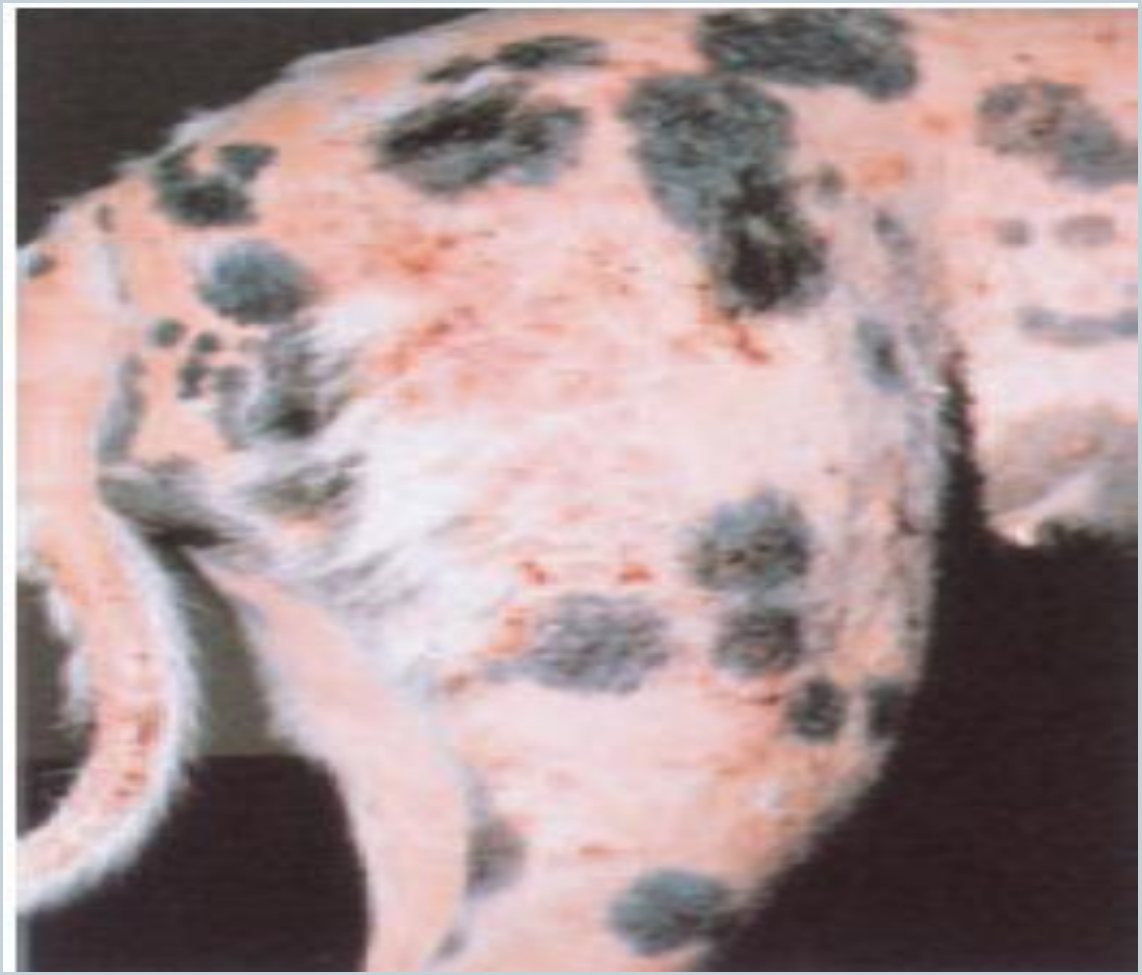
Pathogenesis

- ✓ This affects all domestic mammals and man infecting the **hair follicles** and **sebaceous glands**, sometimes such deeper in the dermis and less accessible for **acaricides**
- ✓ No visible **itching**
- ✓ Demodicosis can be associated with **reduced cell-mediated immunity (T-lymphocyte) or immunosuppression secondary** to other diseases

Predisposing factors

- ✓ Genetic level, age, short hair
- ✓ Poor nutrition
- ✓ Hormones and neoplasia
- ✓ Concurrent infection
- ✓ Use of immunosuppressant for other conditions
- ✓ Undue use of **alkaline soap or shampoo**
- ✓ Immune factors: appear to play a large part in its occurrence and severity

Red mange



Diagnosis & Treatment

- ✓ It is made on the basis of clinical features
- ✓ For confirmatory diagnosis, use deep **skin scrapings** and in contents of **pustules** and **abscesses**, scrapings must be deep enough to assure sampling of the hair follicle
- ✓ **Rx**: use systemic treatment (antibiotics) and acaricides or ivermectin or topical application (amitraz, malathion or trichlorofon)

Significances

- Hide damage and economic losses (in cattle)
- Treatment cost
- Zoonotic impact??
- Production losses

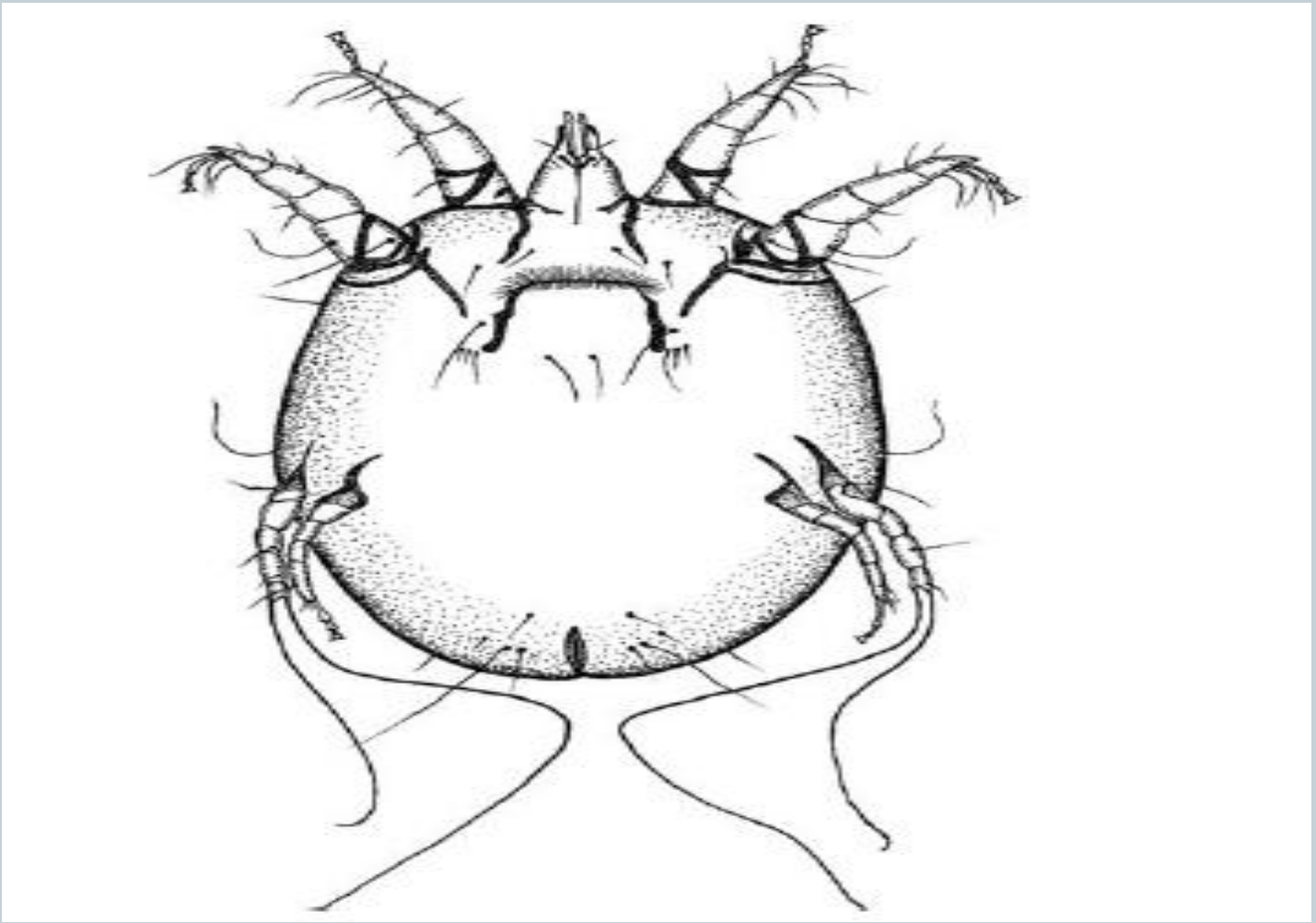
Family: Psoroptidae

- Are **oval-bodied**, **non-burrowing** mites: skin surface mite
- Feed **superficially** and do not burrow into the skin
- have **pointed/piercing** and **chewing** mouthparts
- Some feed on **skin scales** while others **suck tissue fluids**
- **Size**: larger than burrowing mites
- Their **legs** are longer than those of the burrowing mites
- All **pairs** of the legs are **projecting beyond** the body margin

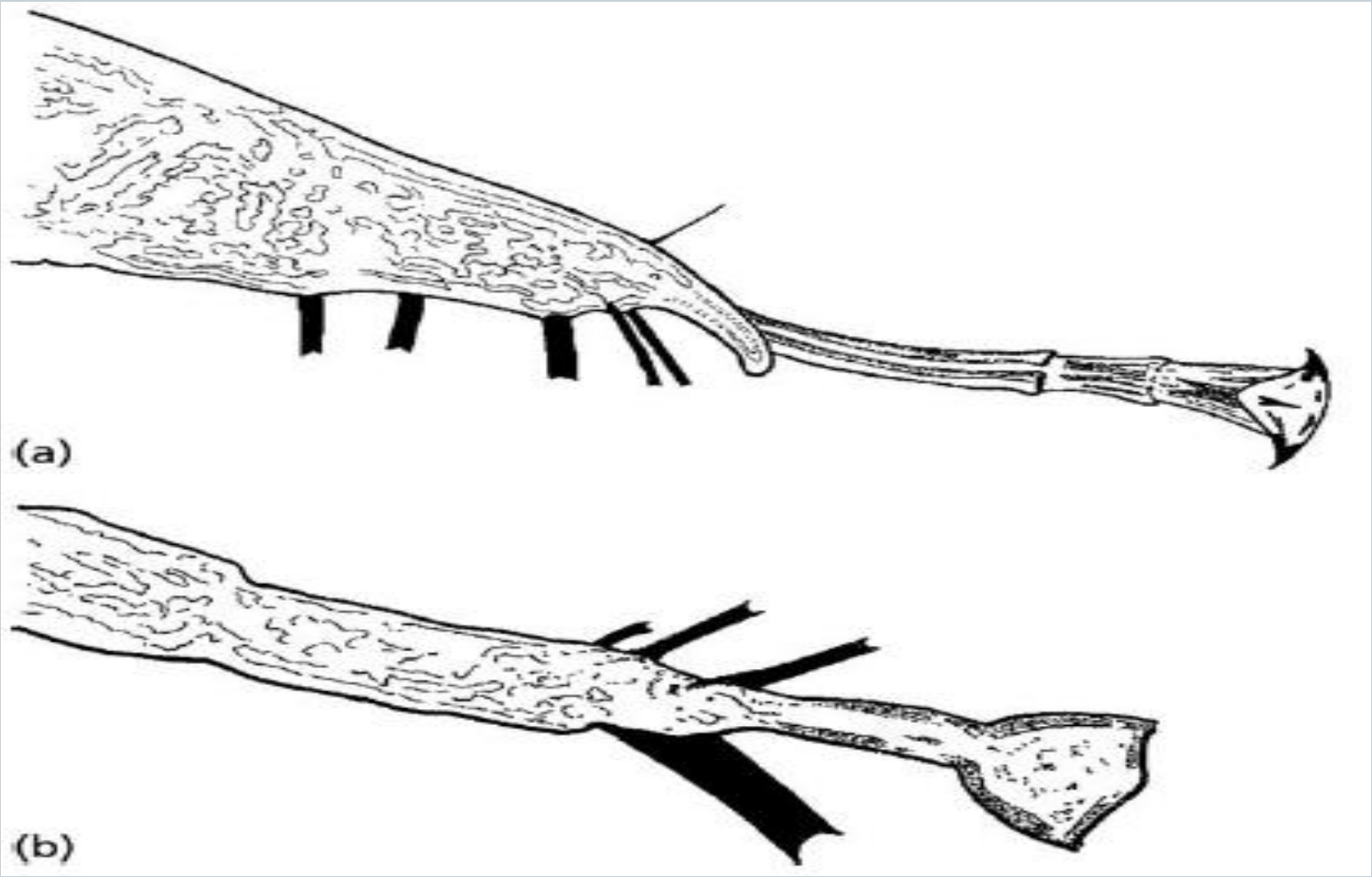
Family: Psoroptidae

- Have **funnel-shaped** sucker attached to the t**hree-jointed pretarsi/pedicles** on **1st**, **2nd** and **4th** pairs of legs
- The pretarsi is **long, jointed** unlike in the other mites: important for diagnosis
- The parasite on the skin surface layer causes the **formation of thick, heavy scabs** rather than **thickening of the skin**
- includes three genera of veterinary importance: ***Psoroptes***, ***Chorioptes*** and *Otodectes*

Psoroptic mite: legs projected beyond the body margin



Psoroptes (a) and *Chorioptes* (b)



Family: Psoroptidae

- ✓ The mites prefer **wooly and hair** covered areas (*Psoroptes*)
- ✓ Sever lesions during **winter**, **sever itching** which disappears in summer
- ✓ **Chorioptic mange**: are also non-burrowing and very limited to **lower hind limb** and **tail**, sever irritation, restlessness and scab formation are common
- ✓ **Life cycle**: the female lives 30-40 days; lays up to 90 or more eggs

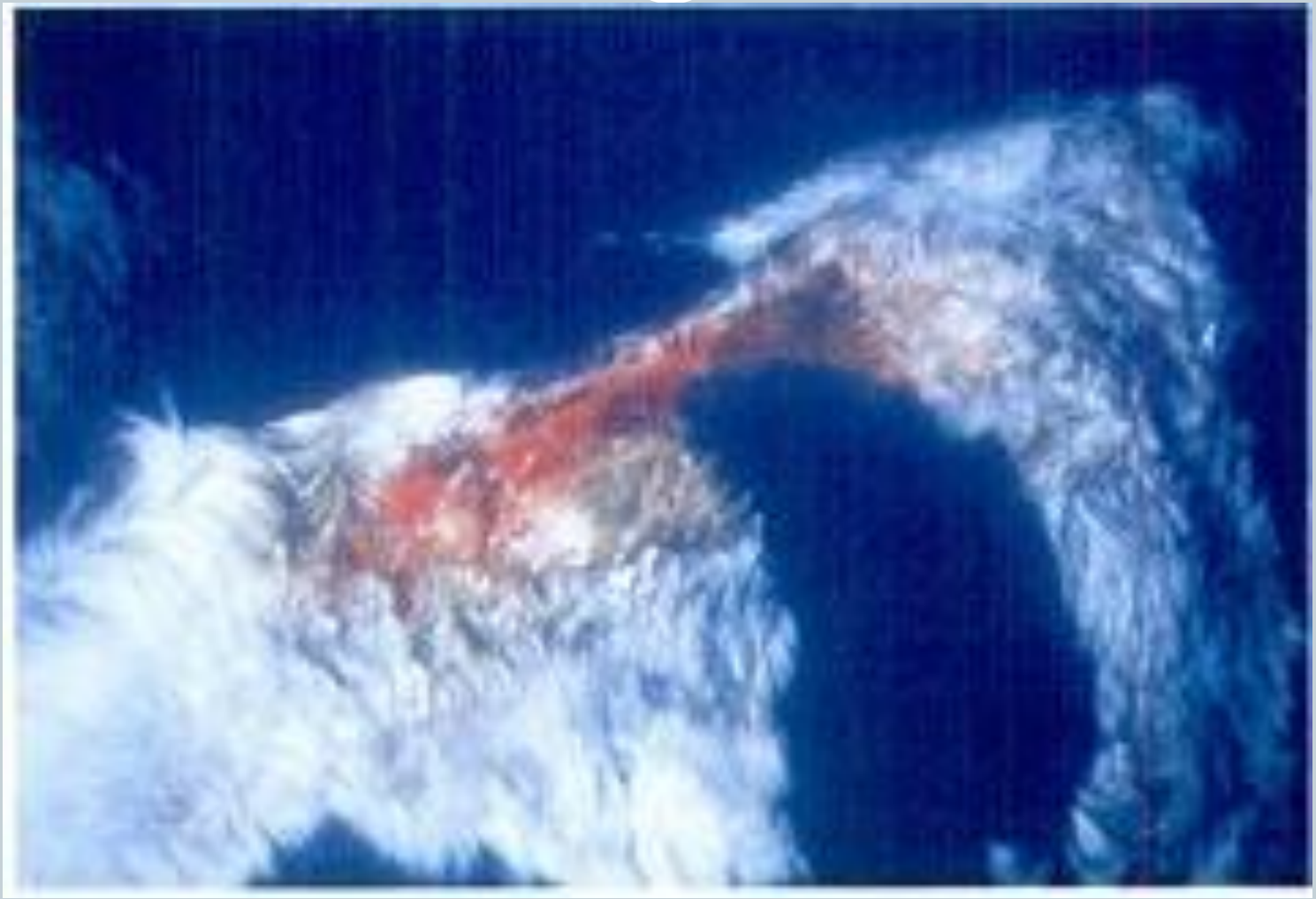
Long and jointed pedicle of psoroptic mite

Ear-mite *Otodectes*

Family: Psoroptidae

Genus	Species	Host	Location	Morphology	Symptoms/Pathogenesis
Psoroptes	*P. ovis*	Sheep & cattle	- Superficially on the skin	Oval, 0.75mm with piercing 7 chewing mouth parts	- Intense itching, rubbing, restlessness, weight loss, case feeding
	P. equi	Equines			
	P. cuniculi	Rabbit & equines			
Chorioptes	*C. bovis*	Cattle, sheep, goat, equines	- Superficially on the skin - Chewing & feeding on scales and skin debris	Oval, 0.75mm with piercing & chewing mouth parts	- In cattle: scratching & rubbing. Affected area neck, udder, leg, tail root - In horse: itchy leg - In sheep: **wrinkling** and **thickening** of skin - In Newzeeland testicular atrophy observed
Otodectes	*O. cynotis*	Dog and cat	- Superficially on the skin	"	- In dog: Otitis externa, black waxy deposits in ear canal resulting head shaking and ear scratching cause **Haematoma**

Psoroptes species infestation in cattle



Clinical Psoroptic mange in sheep

Pathogenic impact

- The parasite is highly **contagious** and can cause **great distress to its host**
- The parasite with its **pointed mouthparts** abrades the skin to generate a **liquid diet**: **skin damage**
- **Micro wounds** become contaminated with **mite faeces: antigen,** which provoke an **intense inflammatory response/hypersensitivity** and a **copious serous exudate**
- **Pruritus** induces rubbing, scratching & self-inflicted damage

Epidemiological factors

- ✓ Season of the year
- ✓ Susceptible host
- ✓ Condition, age and nutritional status of the animals
- ✓ Population density
- ✓ Feature of the animals: wooly or hairy animal

Diagnosis & Treatment

- ✓ **Dx:** based on seasonal occurrence, clinical signs: wet, discoloured area, debility, intense pruritus & scab formation
- ✓ **Rx:** application of acaricides: topical organophosphates(malathion, coumaphous, crotoxyphos, trichlorofon) and ivermectin, amitraz, thiabendazole, permethrin, Belamectin.

Family: Sarcoptidae

- ✓ **Burrowing** mites: are parasitic throughout their lives
- ✓ Small, round mite with prominent dorsal pegs and spines
- ✓ **Pulvillus** is originated on a **stalk**-like or **unsegmented** pretarsus on **1st** and **2nd** pairs of legs
- ✓ Have **circular bodies** with the ventral surface some what flattened

Family: Sarcoptidae

- ✓ They have **short legs** and **dorsally** the anterior legs only just project beyond the edge of the body and the **posterior two pairs of legs** do not extend beyond the body margin at all.
- ✓ **Sarcoptic mange** causes pruritic **dermatosis**: cutaneous reaction or hypersensitivity reaction because of **faecal antigen**

Sarcoptes scabiei with long unsegmented pretarsi on front legs and characteristic triangular spines.

Genera of veterinary importance

- ***Sarcoptes***: cause **scabies** in man and **sarcoptic** mange in animals
- ***Notoedres***: cause notoedric mange in cats, rabbits and rats
- ***Knemidocoptes***: cause of scaly leg, depluming itch (in poultry)

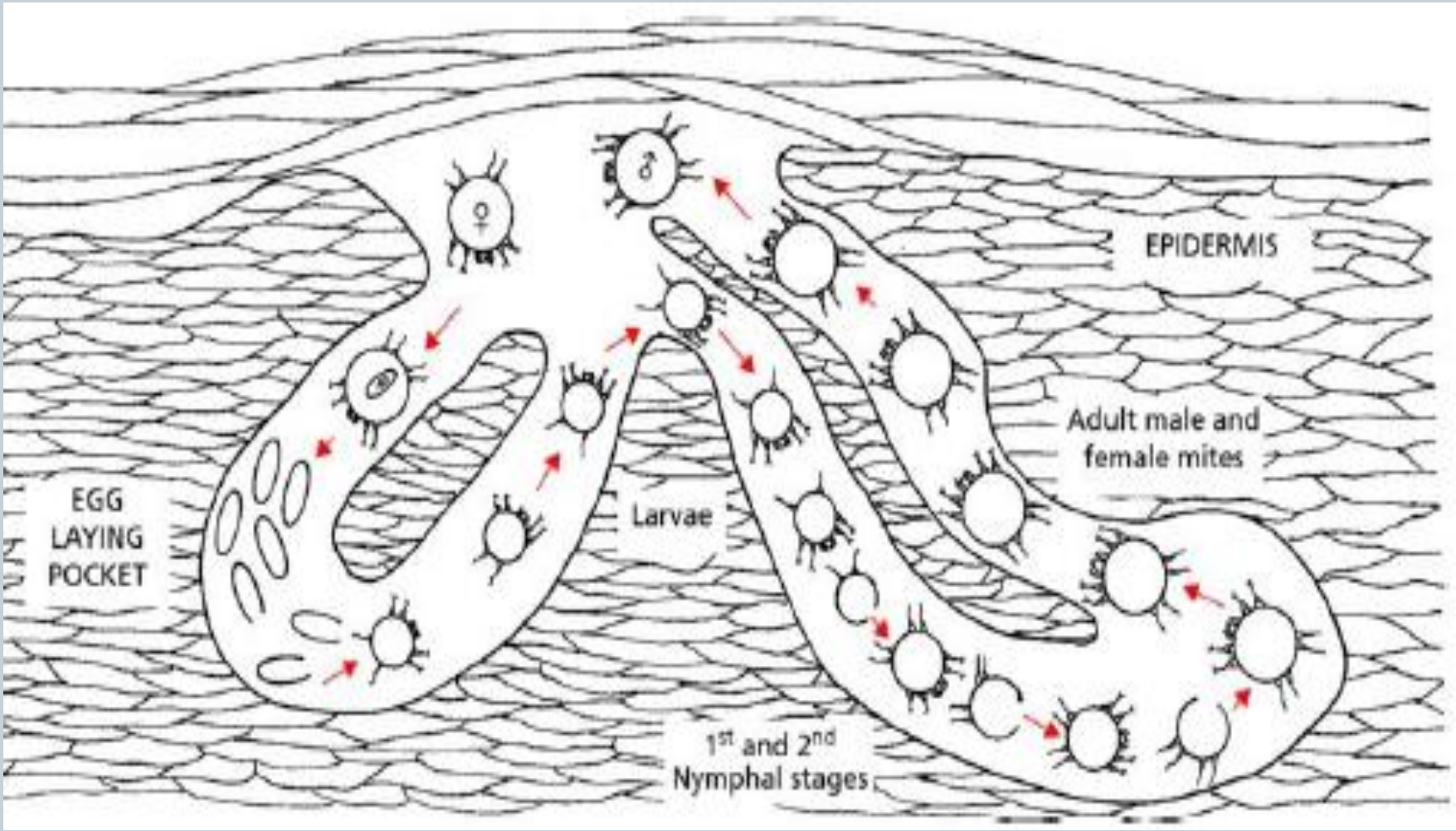
Genera of veterinary importance

- ✓ Cause **scabies** of man and **sarcoptic** mange of sheep, goats, cattle, pigs, equine, dogs, foxes, rabbit and other animals (=Sarcoptes)
- ✓ Start at **hairless areas** such as head, ear, thigh and latter generalized.
- ✓ **Itching**, loss of hair, emaciation and reduced production
- ✓ High morbidity and mortality reported in Ethiopia: during drought period

Life cycle

- ✓ The entire **life cycle** takes place on the host and can take: 14-21 days
- ✓ During egg laying period, **fertilized female mite** creates **tunnel** (egg-laying pocket) or burrow deep into skin using its teeth (called **chelicerae**). She will burrow up to 2-3cm
- ✓ A female lays 3 or 4 eggs each day, producing 40 to 50 eggs during her lifetime.

Life cycle of *Sarcoptes*



Life cycle

- ✓ **Eggs hatch** in four or five days, releasing larvae that will complete their development as either a male or female.
- Females remain in the existing tunnels or burrow side channels where they mate.
- **Fertilized** females continue producing **new tunnels** in which to deposit their eggs while the **males** die shortly after **copulation**.

Epidemiology

- Infection is usually spread by **direct contact** between animals.
- **Straw bedding** and other objects that come into contact with infected animals can become contaminated with mites and can spread infection.
- **Infestations** are generally more common when animals are **housed for winter** and spread more slowly during **summer** months when cattle are on pasture.

Family: Sarcoptidae

Genus	Species	Host	Location	Morphology	Symptom/Pathogenesis
Sarcoptes	*Sarcoptes scabie*	All domestic animals and man	Hair follicle and sebaceous glands	Round in outline, 0.4mm in diameter with short legs	- Produce marked irritation, causes itching, scratching resulting in inflammation of skin - Skin-thickened and wrinkled, alopecia - Secondary infections
Notoedres	*C. bovis*	Cattle, sheep, goat, equines	Face and head	Resembles Sarcoptes, circular outline, short legs	- Thickened and leathery skin
Cnemidocoptes	*C. mutans*	Poultry	Leg	"	- Lameness, scaly leg
	C. gallinae	Poultry	Back, wing	"	- Depluming itch on back and wings

Clinical Sarcoptic mange in cattle

Pathogenesis

- The **feeding** and **burrowing** activities of mites, with **antigenic** substances in **their saliva** and **faeces**, induce an **intense irritation: erythema** with papule formation → **scale** and **crust** formation with **alopecia**
- Affected animals rub against posts, trees, and feeder bunks to relieve the irritation. This rubbing can result in **localized** or widespread **hair loss.**
- When infected animal rub to the point of **bleeding**, the injury to the skin produces a fluid called **exudate.**

Pathogenesis

- The exudate **hardens** and forms a **crust**, which produces the condition known as **scab** or **scabies**. When this situation occurs:
  - ✓ scabs can appear on the **inner surface** of the thighs, the underside of the **neck** and **brisket** as well as around the root of the tail
  - ✓ Lesions can become widespread in advanced cases **skin thickens** and takes on an **elephant skin appearance**

Pathogenesis

- The **speed** at which an infestation spreads over an animal depends on several factors:
  - ✓ number of mites transmitted
  - ✓ site of the infestation
  - ✓ susceptibility of the host
- Visible lesions on cattle heavily exposed to mites may appear in 10 to 14 days.

Diagnosis & Treatment

- ✓ A diagnosis can be confirmed by **microscopic examination** of **deep skin scrapings** taken at the edge of a scaly area.
- ✓ The scraping should be made deep enough to cause **bleeding** of the skin.
- ✓ **Repeated examination** may need to be conducted before an infection can be confirmed

Diagnosis & Treatment

- ✓ Topical treatment with organophosphates: diazinon, coumaphous, malathion, phosmet

Control strategies

- Several strategies are available that can be used to protect domestic animals from getting scabies:
  - ✓ **clean stalls** used to house infected animals, and add fresh bedding before reusing stalls for new animals
  - ✓ **disinfect grooming tools** and other instruments used on infected animals

Control strategies

- **isolate infected animals** from the rest of the herd, and then treat them
- **examine replacement animals** for mites before putting them with the rest of the herd avoid overcrowding
- **ensure animals are well-nourished**; cattle in poor condition are more susceptible to infection than healthy, well-fed animals

Knemidocoptes

- Affects birds
- Cause diseases: scaly leg and depluming itch in poultry

- **Reading Assignment**

Family: Chorioptidae

- ✓ Cause **chorioptic** mange (tail, leg or scrotum mange) which attacks cattle, horse, goats and sheep are now considered to be one species; *Chorioptes bovis*
- ✓ **Chorioptes** does not survive off the host for more than a few days

Family: Chorioptidae

- ✓ In goats, **lesions** of chorioptic mange are usually confined to **lower parts of the leg** and **crusty lesions** may be found behind **fetlock** of all four limbs.
- ✓ In sheep, it affects the **scrotum** and may cause **decrease in fertility**

Mange mites of small ruminants in Ethiopia

- ✓ Different species of mange mites had been recorded from different parts of the country with prevalence rate ranging from 0-43.1%
- ✓ Among mange mites affecting sheep and goats, ***Sarcoptes*** is the most prevalent species
- ✓ According to Asnake (2008), ***Psoroptes*** is a parasite of highland while ***Sarcoptes*** is common in the lowlands

Prevalence of mange mite infestation in different areas of Ethiopia

Location	Prevalence (%)		Source
	Sheep	Goats	
Addis Ababa	32.7	na	Nigatu, 1992
Oromia Region (Debre-Zeit and Nazareth	2.69	3.96	Haffez, 2001
Dire Dawa	0.73	6.8	Zelalem, 1994
	11	10.7	Abeba, 2010
Wolayta	0	6.87	Chalachew, 2001
Sidama	2.07	4.27	Teshome
Mekele	1.5	na	Habte, 1994
Mekele and Shire	30.2	31.8	Kedir, 2002
Amhara and Afar border	1.3	12.5	Mulugeta, 2008
Amhara region (Eastern part)	0.4	6.6	Tefera and Abebe, 2007a

Diagnosis, treatment and control of mange

- **Diagnosis**: made by direct examination of scraped material or following digestion using warm **10% potassium or sodium hydroxide** (used to dissolve the keratin layer) under stereomicroscope.
- Morphology of the parasite needed
  - **Sarcoptes**: **3rd** and **4th** pair legs do not project outside the body margin

Diagnosis, treatment and control of mange

- ***Psoroptes***: all legs project, conical/pointed mouth parts, 1st, 2nd and 4th pair legs have jointed pretarsi
- ***Chorioptes***: similar to *Psoroptes*, but pedicles are **unsegmented** and with round mouth parts
- ***Demodex***: elongate, cigar shaped (obtained from nodular pus)

Diagnosis, treatment and control of mange

- **Treatment:**
  - ✓ Benzyl Benzoate as emulsion
  - ✓ Organophosphate/ carbamate compound (0.05%)
  - ✓ Ivermectin injection/pour on (0.5ml/25kg body weight) is very much effective

✓ **Control**: supportive nutrition, good hygiene and all infected premises should be cleaned out by organophosphorous/ carbamate

Microscopic characteristics of some mange, itch, and scab mites

Genus	Leg Characteristics		Anus
	Egg-Laying Female	Male	
Sarcoptes	Suckers on long, unsegmented stalks on pairs 1, 2; pointed scales on dorsum	Suckers on long unsegmented stalks on pairs 1, 2, 4; few pointed scales on dorsum	Terminal
Notoedres	Suckers as above; many prominent rounded scales on dorsum	Suckers as above; few rounded scales on dorsum	Dorsal
Knemidokoptes	No suckers	Suckers on unsegmented stalks on pairs 1, 2, 3, 4	Terminal
Psoroptes	Suckers on long, segmented stalks on pairs 1, 2, 4	Suckers on long, segmented stalks on pairs 1, 2, 3	Terminal
Chorioptes	Suckers on short, unsegmented stalks on pairs 1, 2, 4	Suckers on short, unsegmented stalks on pairs 1, 2, 3, 4; pair 4 rudimentary	Terminal
Otodectes	Suckers on short, unsegmented stalks on pairs 1, 2; pair 4 rudimentary	Suckers on short, unsegmented stalks on pairs 1, 2, 3, 4	Terminal
Trixacarus	Suckers on long, unsegmented stalks on pairs 1, 2		Dorsal

Additional references

- Soulby, E. Sh. (1974): parasitic zoonosis clinical and experimental studies: Sf. 740. S-60.
- Kahin, M. (2007):The Merck veterinary manual
- Hoy, Marajorie, A. (2003): Insect molecular genetics: Sf.765. H-6.
- Shapiro, Leland, S. (2004): Pathology and parasitology of veterinary technicians. Sf. 769. J-82.
- Hendrix, Charless. M. (1998): Diagnostic veterinary parasitology. Sf 810. H-46.
- Lamann Gregory, V.(1987): Veterinary parasitology. SF.810. L-36.
- Sloss, Margaret, W. (1994): Veterinary clinical parasitology. Sf810. S-58.
- Urguhort, G.M. (1996): Veterinary parasitology. Sf810. U-77.
- Tylor,M.A. (2007): Veterinary parasitology. Sf.810. T-425.
- Zajec, Anne.M.(2006): Veterinary clinical parasitology. Sf. 810.Z-35.
- Maximav, V.I.(1982): A series of parasitological studies of the helminthes, arthropods and protozoa . Sf.810. M-39.
- Lefebvre. (2010):Infectious and parasitic disease of livestock one and two. Sf. 996, I. 54.

I THANK YOU VERY MUCH

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