Diagnostic Entomology (VeLT 3103)
Phylum ARTHROPODA

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Outline and earning outcome

- This portion of the course (50%) consists of the following major sections:

  Section I: Class Insecta

  - Order Diptera (flies) of veterinary importance

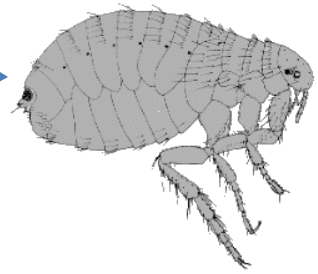
  Section II: Class Insecta

  - **Orders: Phthirapera (lice) and Siphonaptera (Fleas**)

- At the end of each part please make sure that you are able to:
  - Describe the basic morphological features of each parasite
  - Explain how samples are collected, preserved and examined for each group of parasites
  - Differentiate parasites within each group by using morphological features of the parasite

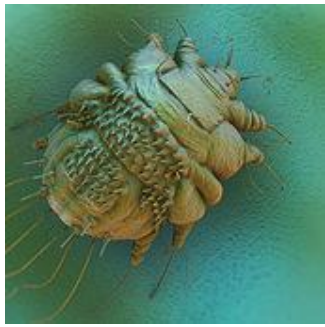
Classification

- Classes of veterinary importance
  - Class Insecta
    - 3 pairs of legs, head, thorax and abdomen are distinct, have a pair of antennae
    - Orders:
      - **Diptera (flies)**
      - **Phthirapera (lice)**
      - **Siphonaptera (Fleas**)



Classification

- Class Arachnida: not included here
  - Adults have 4 pairs of legs, body divided into cephalo-thorax and abdomen, have no antennae
  - Order: Acarina
    - **Ticks**
    - **Mites**



CLASS INSECTA

GENERAL MORPHOLOGY

- Head
  - Has a pair of antennae
  - Has mouth part which varies depending on the feeding habit
    - Chewing, biting, sponging, piercing-sucking
- Thorax
  - Has three segments each with a pair of jointed legs
  - In some, it also has two pairs of wings
    - Those of vet. Importance have only one pair functional wings
    - The second pair is modified to a sensory structure: halters
  - Wings have veins formed by outgrowths of the thoracic tegument and in between the veins are spaces called cells
- Abdomen
  - Contain up to 11 segments
  - The terminal segment is modified to form the genitalia

ORDER DIPTERA

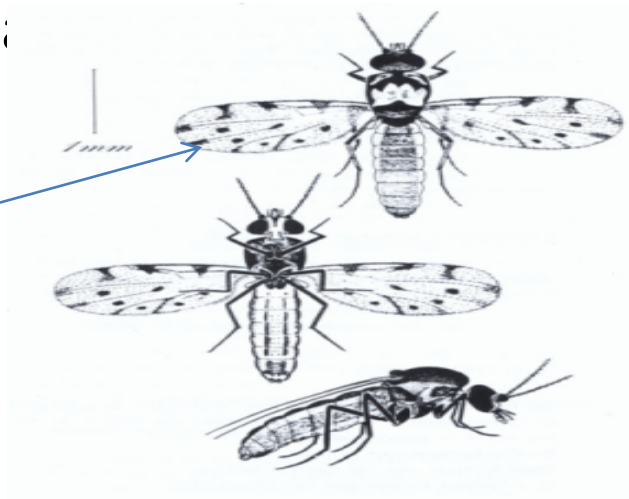
- Some are important as external parasites
- For some, the larvae are parasitic
- Many of them serve as vectors of diseases
- A pair of wings, a pair of halters
- Suborders:
  - The following suborders are grouped under vector flies
    - Nematocera: example-P*hlebotomus*, *Culicoides*
    - Brachycera: example-*Tabanus*
    - Cyclorapha: example-*Stomoxys*,*Musca*, *Glossina*
  - The following suborders are grouped under myiasis agents
    - Oestrus
    - Cephalopina

SUBORDER NEMATOCERA

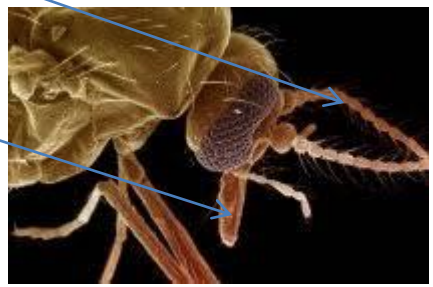
- Small flies with a pair of long jointed antenae, segmented maxillary pulps
- Wings have few cross veins
- Only the females are parasitic with piercing-sucking mouth parts
- Family Ceratopogonidae:

SUBORDER NEMATOCERA:
Family Ceratopogonid

- Genus: *Culicoides-biting midges*
  - Morphology:
    - Very small flies: 1.5-5mm long,
    - wings are mottled
    - Wings are held at rest like a closed pair of scissors
    - legs are relatively short



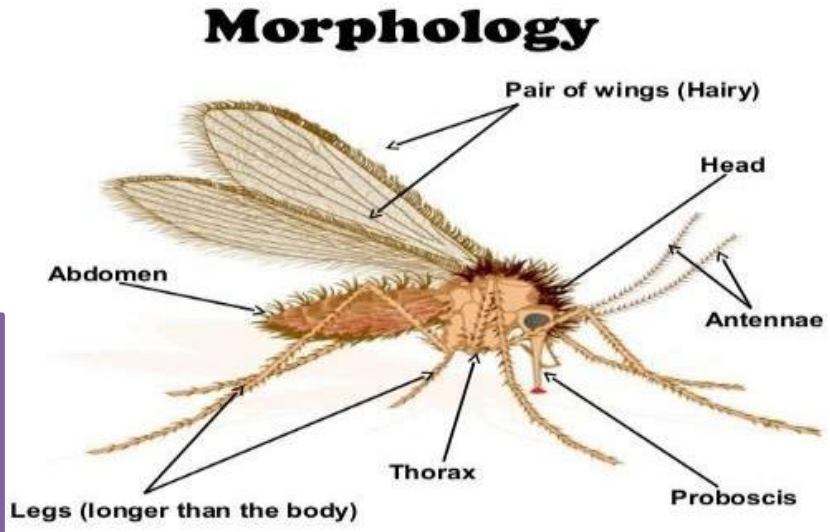
    - Have prominent **Antennae**
    - **Small mouth parts** hang vertically with short piercing proboscis
    - They are usually seen flying in large swarms at dawn or dusk



SUBORDER NEMATOCERA: Family Ceratopogonidae

- Genus: *Culicoides-biting midges*
  - Lifecycle
    - Only females are blood suckers
    - Females lay 100-200 eggs in areas with a specific humidity and abundant organic material
    - 4 larval stages (egg, larva, pupa and imago)that feed on decaying vegetation
  - *Transmit diseases such as*
    - *Bluetongue, African horse sickness: virus*
    - *Onchocercosis: filarial nematodes*

SUBORDER NEMATOCERA:
family Psychodidae



Phlebotomus: sand flies

- Distribution: tropics, subtropics
  - Prefer semi-arid and savannah regions
- Morphology
  - Measure up to 5mm long
  - Have hairy appearance, large black eyes and long legs
  - Wings are covered with hair and held erect over the body at rest
  - Moth parts are short-medium size, hang downwards , adapted for piercing and sucking
  - Long antenae with short hairs
  - Found around breeding sites where suitable resting place is available
  - Resting sites range from forest litters and tree trunks to cracks and crevices of rocks and livestock pens

Life cycle

Up to 100 eggs laid at a time in small cracks or holes in the ground

There are 4 larval instars

Pathogenic significance

Only the female suck blood

Serve as Vectors for *Leishmanosis*

SUBORDER NEMATOCERA
family Culicidae

Mosquitoes: ***Anopheles***, *Culex* and *Aedes*

- Morphology
  - Measure 2-10mm long,
  - Have slender bodies, prominent eyes and long legs
  - Have long narrow wings with scales, held crossed flat over the abdomen at rest
  - Have mouth part with conspicuous, forward projecting elongated proboscis adapted for piercing and sucking
- Anopheles
  - the body of the adult Anopheles mosquito is dark brown to black in color
- Culex
  - is a black mosquito with faint white bands on its proboscis and tarsal joints. It also has white stripes along the legs and dark chevrons on the abdomen
- Aedes
  - they have black and white markings on their bodies and legs. They are active during the day in shaded areas and into the early evening

Anopheles

Suborder Brachycera: family Tabanidae

Closely related in behavior and pathogenic significance

- Tabanus= horse flies
- Haematopota= horse fly
- Chrysops= deer flies
  - host: mammals and birds
  - distribution: world wide
  - Morphology
    - Large robust flies up to 2.5cm long
    - Generally dark coloured, with clear/brownish wings
    - Tabanus: clear or brownish wings
    - Haematopota: grey-brown mottled wings
    - Chrysops: dark bands across the wings
    - Short, stout 3-segmented antanae w/o arista
    - Short mouth part adapted for stashing/sponging, pointing downwards


Tabanus

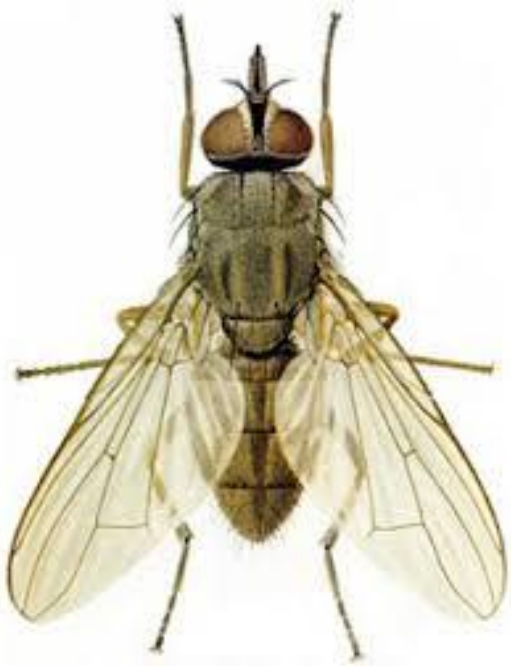

Haematopota


Chrysops

Suborder Cyclorapha
family Muscidae

- Comprises genera such as:
  - *Musca* (house fly, horse face fly)
  - *Haematobia* (horn fly)
  - ***Stomoxys*** (Stable fly)
  - ***Glossina*** (tsetse fly)

Family Muscidae



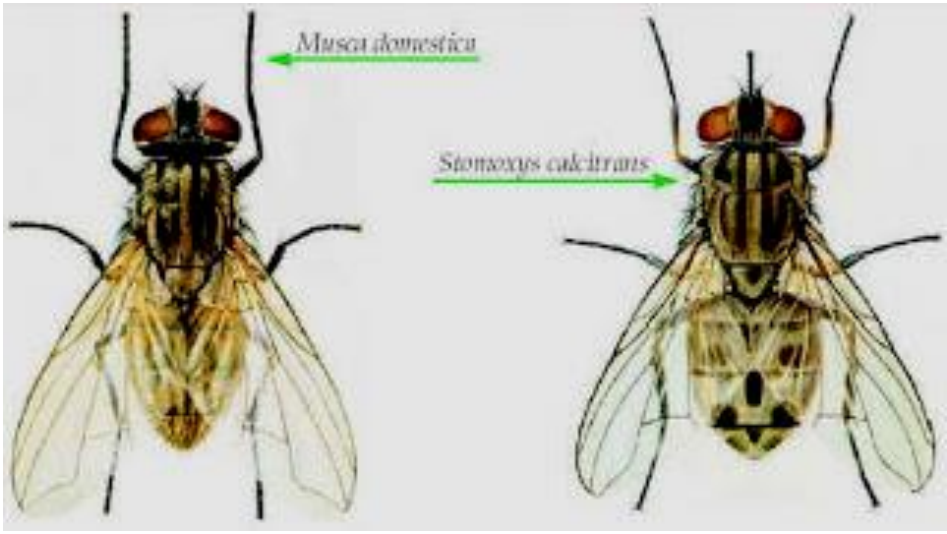
- *Haematobia irritans* (horn fly)
  - Found worldwide
  - Morphology
    - Adults are quite small, approximately half the sizes of a house fly
    - gray in color with large compound eyes and reduced antennae
  - While able to fly, almost never leaves its host, instead staying on the same cow to feed 24 hours a day

Family Muscidae

- *Haematobia irritans* (horn fly)

- The adult horn flies have brownish-gray or black bodies and are shiny, with slightly overlapping wings that are held flat over the abdomen
- The head has small, brownish-red antennae which point downward.
- The thorax has two parallel stripes on the dorsal surface, just behind the head
- Both male and female horn flies have piercing-sucking mouthparts and feed exclusively on blood.

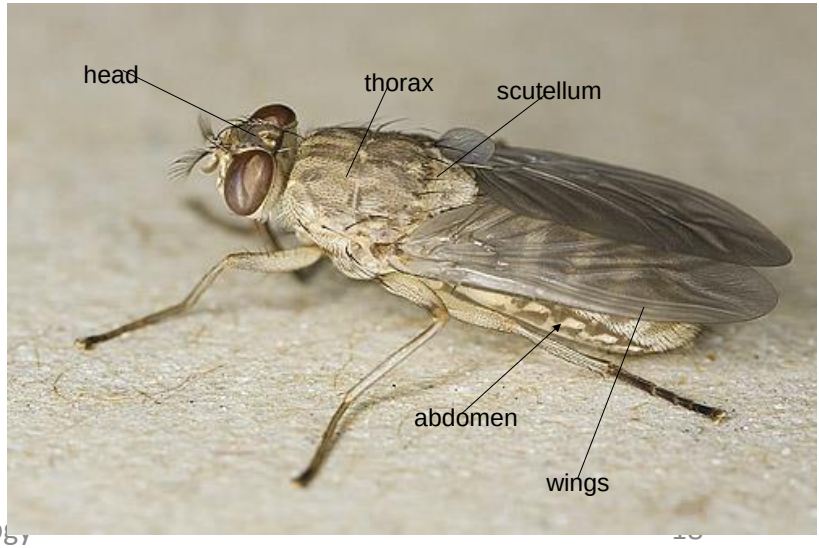
Family Muscidae



- *Stomoxys calcitrans* (Stable fly)
  - Host: most animals and man
  - Distribution: Worldwide
  - Morphology
    - 5-8mm long
    - Resembles the housefly
      - Equivalent size, but grey, with 4 longitudinal dark strips on the thorax
    - Abdomen shorter and broader than Musca, with 3 dark spots on the 2nd & 3rd abdominal segment
    - Proboscis is conspicuous and foreword projecting
    - Abundant around farm buildings and stables in late dry season
    - Prefer strong sunlight
    - Bite mainly out of doors, can follow animals inside to feed

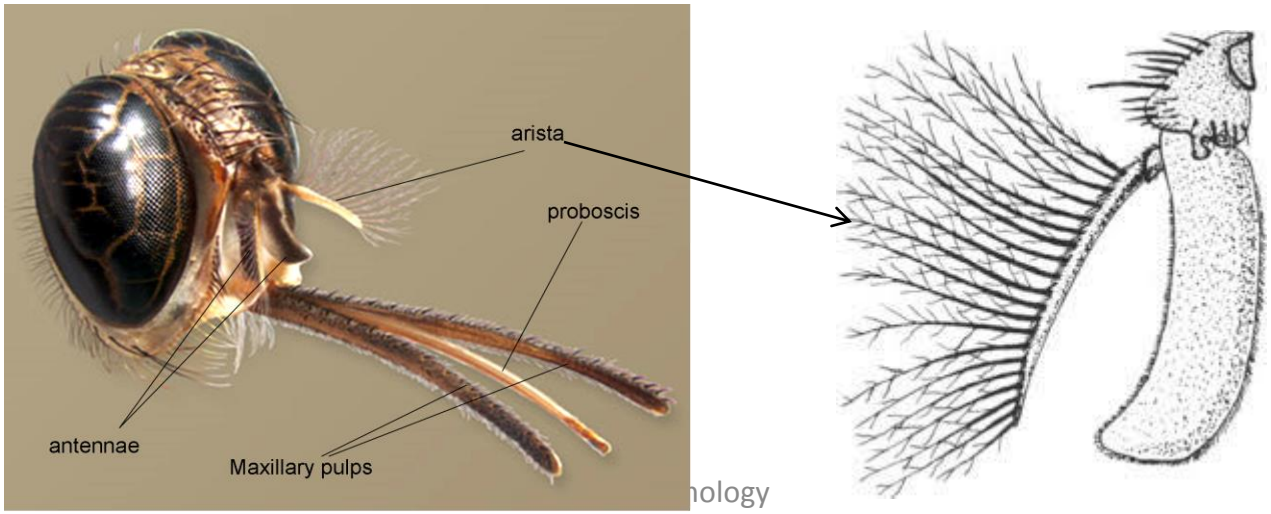
Suborders Cyclorapha
family Muscidae/Glossinidae

- *Glossina* (tsetse fly)
  - Tsetse appears brown or grey-brown; sometimes there is a slight pink or sandy-red tinge.
  - Several species are very dark and usually has darker & lighter patches, which makes them difficult to see when settled on bark, rock or soil
  - Generally, the size of tsetse flies ranging from 6 to 14 mm long, excluding the proboscis
  - tsetse abdomen is enlarged, rounded and red.



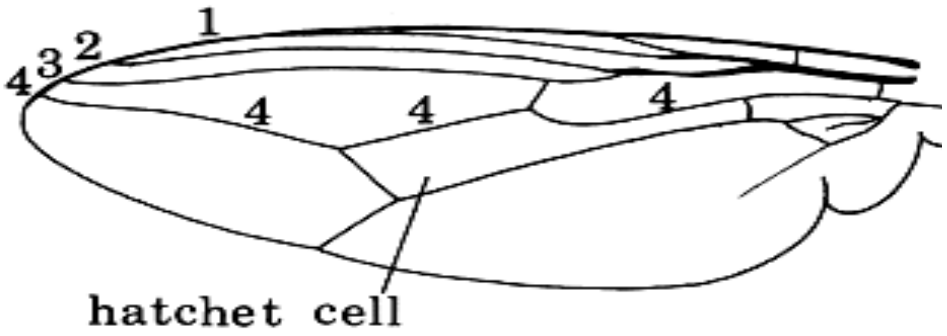
Suborders Cyclorapha
family Muscidae/Glossinidae

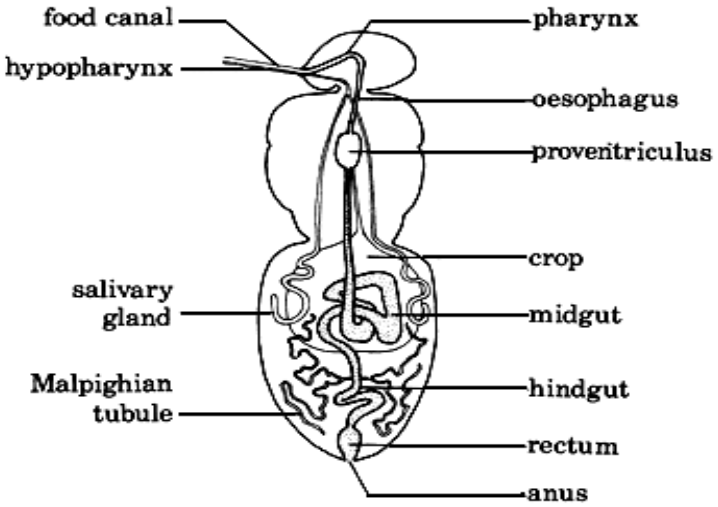
- There are two antennae placed at the front of the head in a depression between the two compound eyes
- Each antenna posses 3 segments, the third being the largest and bears the arista.
- The arista is a long thin structure like an eye lash, but has a row of branched hairs on its upper side and also posses a small holes leading to the olfactory pits.
- Therefore antenna is the organ that serves as a sense of smell.



Suborders Cyclorapha
family Muscidae/Glossinidae

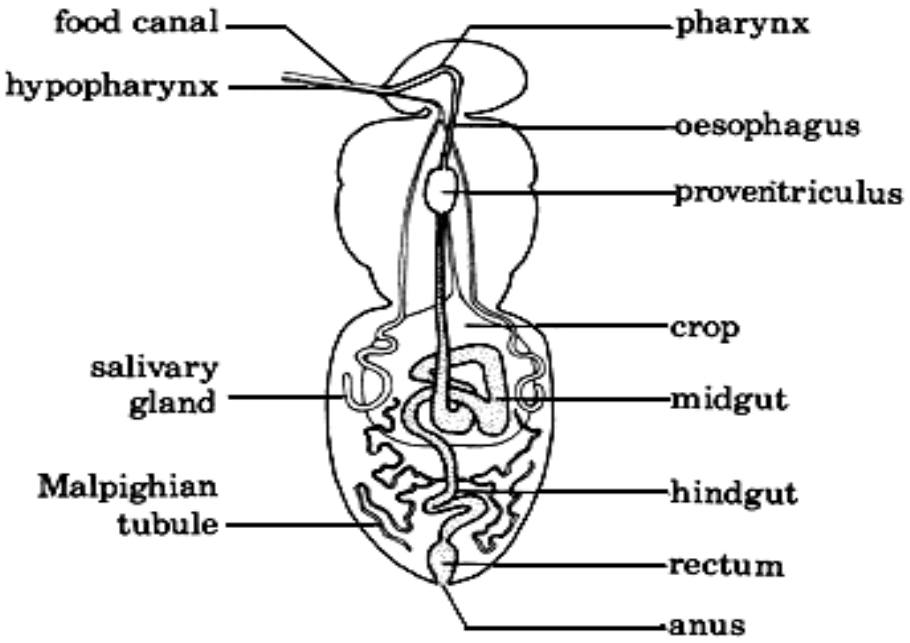
- *Glossina* species can easily be differentiated from other groups of flies by their wing venation and typical wing conformation at rest.
- The “hatchet” cell gives the tsetse a distinct characteristic feature for identification
- At rest, the wings are placed one over the other on the back so, tsetse appears quite slim



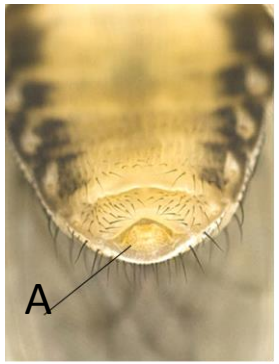


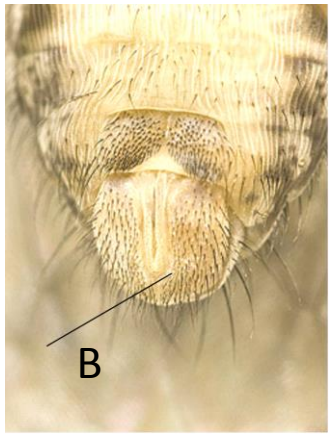
family Muscidae/Glossinidae

- The tsetse fly has two salivary glands the main part of which lies on the digestive tract at the anterior part of the abdomen.
- The gland sends forward to the head a very narrow tube that joins with the one from the other side, before entering the hypopharynx

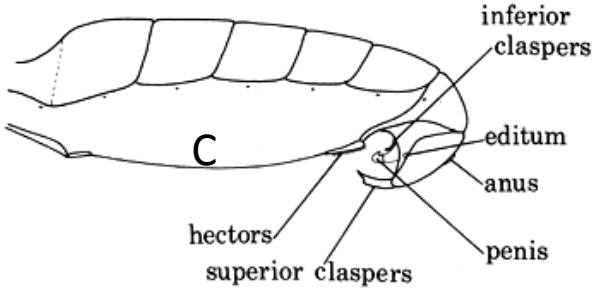


Family Muscidae/Glossinidae





- *Abdomen*
  - In the resting fly, the abdomen is covered over by the wings
  - It has seven visible segments
  - in the male there is, in addition, an extra structure (hypopygium) folded beneath the last two segments (B)
  - The hypopygium is the male genitalia; a rounded structure at the posterior end of the abdomen.
  - At the start of mating, the hypopygium of the male unfolds, uncovering the superior claspers, the inferior claspers and the penis (C)
  - The end of the female abdomen does not have large obvious structures corresponding to the male hypopygium and hectors. But there is a small hole (vulva) through which the larva emerges (A)



Family Muscidae/Glossinidae

Tsetse classification on the basis of genital structures

Group	Male genital structure	Female genital structure
Austenina	• Sharply pointed superior claspers • Claspers are joined medially by a membrane	Have five genital plates (sclerites)
Nemorhina	• Sharply pointed superior claspers • Claspers are not joined medially by a membrane	Have six genital plates
Glossina	• Blunt superior claspers • Claspers are fused distally and joined medially by a membrane	Have two genital plates

MYIASIS AGENTS

Superfamily: Oestroidea

Family: Oestridae, Calliphoridae, Sarcophagidae.

Introduction

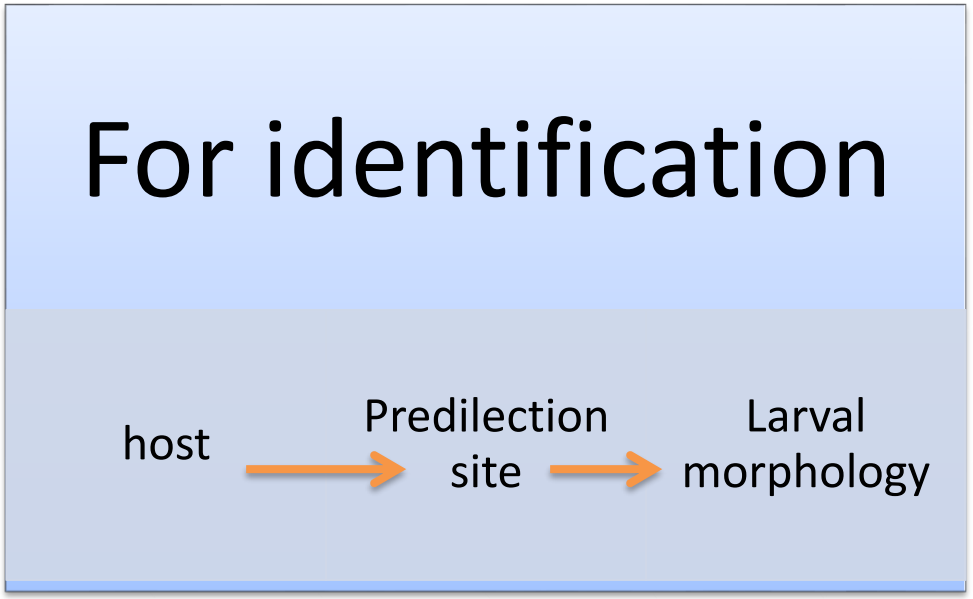
- Myiasis:
  - infestation of the organs or tissues of host animals by the larvae of dipterous flies, usually known as maggots, bots or grubs
- There are two main systems for categorizing myiases:
  - Anatomically, in relation to the location of the infestation on the host
    - **Cutaneous myiasis**
    - **Nasopharyngeal myiasis**
    - **enteric myiasis**
  - Entomologically, according to the level of dependence on the host (host-parasite relationship)
    - **Obligatory**: require a living host to complete its lifecycle
    - **Facultative**: can develop in both living and dead organic matters
    - **Accidental**: invade an inappropriate host, or cause myiasis when fly eggs are accidentally ingested

Introduction

- The larvae of most species of Diptera are extremely difficult to identify, especially at first and second stage larvae
  - Host species,
  - geographical location,
  - type of myiasis

Are may be important clues for identification

- All the flies that act as economically important agents of veterinary myiasis are in the superfamily of:
  - Oestroidea that consists of three major families:
    - Oestridae,
    - Calliphoridae
    - Sarcophagidae



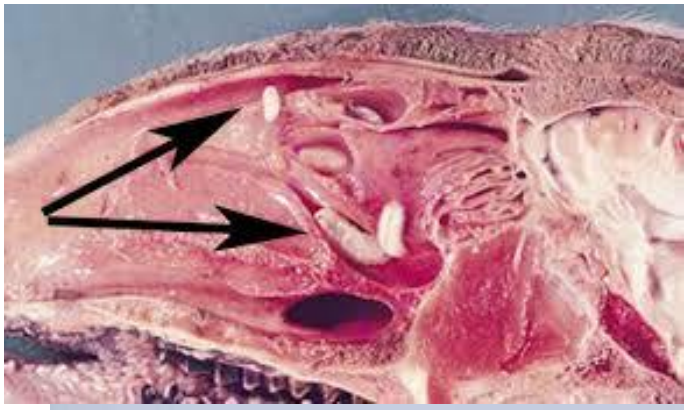
FAMILY OESTRIDAE
Subfamily Oestrinae

Oestrus ovis/ sheep nasal bot

- Distribution: worldwide including Ethiopia
- Adult sheep bot flies (*Oestrus ovis*) do not oviposit, instead, larvae hatch within the female fly (viviparous)
- she deposits up to 25 live first stage larvae at a time, in or on the nostrils of the host

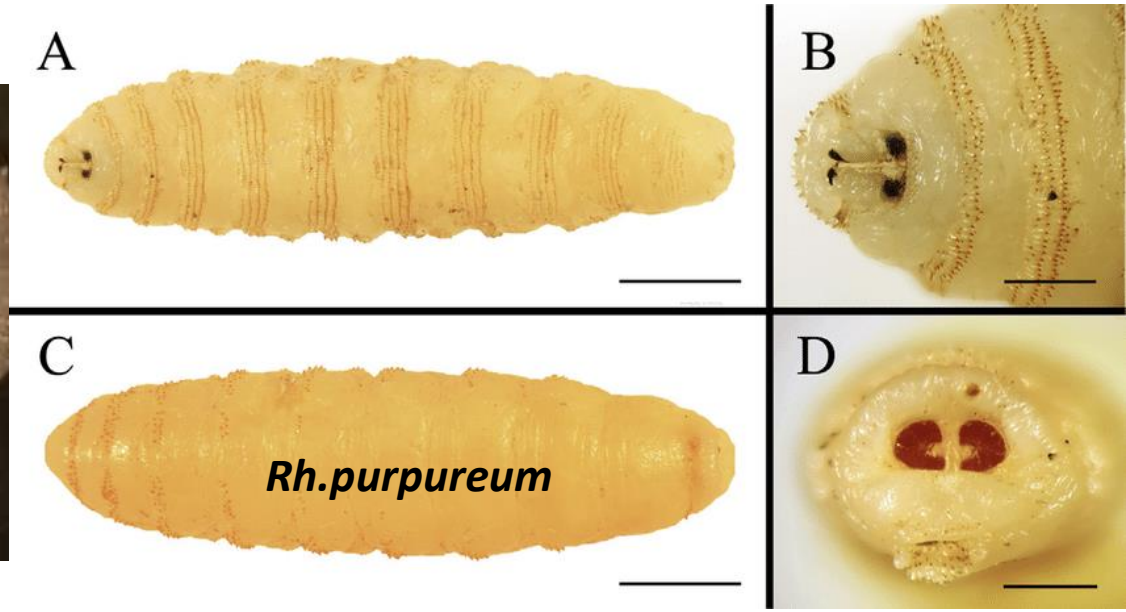
Oestrus ovis

- Larval morphology
  - **First-stage larvae**: measure about 1mm, live in nasal cavity and attach to the mucous membrane
  - **second stage larvae**: measure 4-12 mm and are located in the frontal sinuses
  - **3rd stage larvae**:
    - measure up to 20mm long , located in the frontal sinuses
    - Mature larvae in the nasal passages are white, becoming slightly yellow or brown as they mature, with dark transverse bands on each segment
    - The central surface of each segment bears a raw of small spines
    - When mature, they re-enter the nasal cavity where they are sneezed out



Subfamily Oestrinae

- *Cephalopina titillator: in camels*
- *Rhinoestrus purpureum: in equine*
  - Nasal bots of camels and horses respectively
  - Third stage larvae are present in the nasal and paranasal sinuses, pharynx and larynx



Sub-family Gastrophilinae

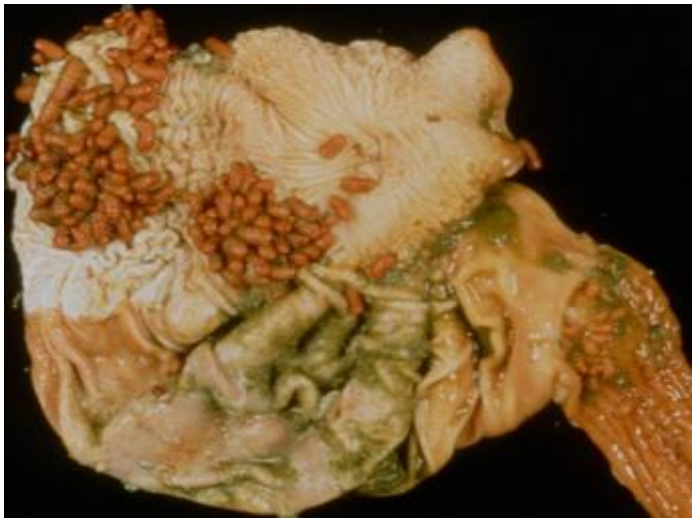
Gastrophilus

- obligate parasites of equines
- adult flies resemble honeybees
- egg deposition:
  - *G. nasalis*: on the hairs of the inter-mandibular space
  - *G. hemorrhoidalis*: on the short hairs that adjoin the lips
  - *G. intestinalis*: on the hairs of the forelegs and shoulders
- After hatching L1 barrow into the epithelium of the tongue, lips and gums
- 2nd stage larvae can be found in the interdental pockets, attached to the root of the tongue or to the wall of the stomach

Sub-family Gastrophilinae

Gastrophilus 3rd stage larvae:

- ***G. nasalis***: yellowish, with one row of spines on each segment, usually found in the first ampulla of the duodenum
- ***G. intestinalis***: red, with two rows of spines on each segment, attach in clusters in the non-glandular part of the stomach
- ***G. hemorrhoidalis***: reddish, with two rows of spines on each segment, found in the duodenum and rectum
- fully mature L3 (mature bots), when the time is appropriate for external development, pass out with feces to pupate in the soil



Family Calliphoridae (blow flies)

Chrysomya bezziana

- Cause traumatic or cutaneous myiasis
- Hosts can be all worm-blooded animals
- Found commonly in skin wounds
- As they feed, the wound is enlarged and deepened, resulting in extensive tissue destruction.
  - First instar larvae are creamy-white and about 1.5 mm in length
  - The L2 and L3 are 4-9 mm and 18 mm in length respectively,
    - each segment carrying a broad, encircling belt of strongly developed spines

Orders

Phthirapera (lice)

Siphonaptera (Fleas)

Introduction

- Ectoparasites
  - **PHTHIRAPTERA** : Lice= cause a disease called **pediculosis**
    - Suborder: Anoplura: sucking lice and
    - Suborder: Mallophaga: biting lice
    - Most are host specific
  - **SIPHONAPTERA**: Fleas

PHTHIRAPTERA : Lice

Biting lice (left), louse nits/eggs (center), sucking lice (right)

PHTHIRAPTERA : Lice

- Lice
  - Are unable to survive away from the host for more than a day or two
  - Their legs terminate in claws
    - Louse of mammals: One claw on each leg
    - Louse of birds: two claw on each leg

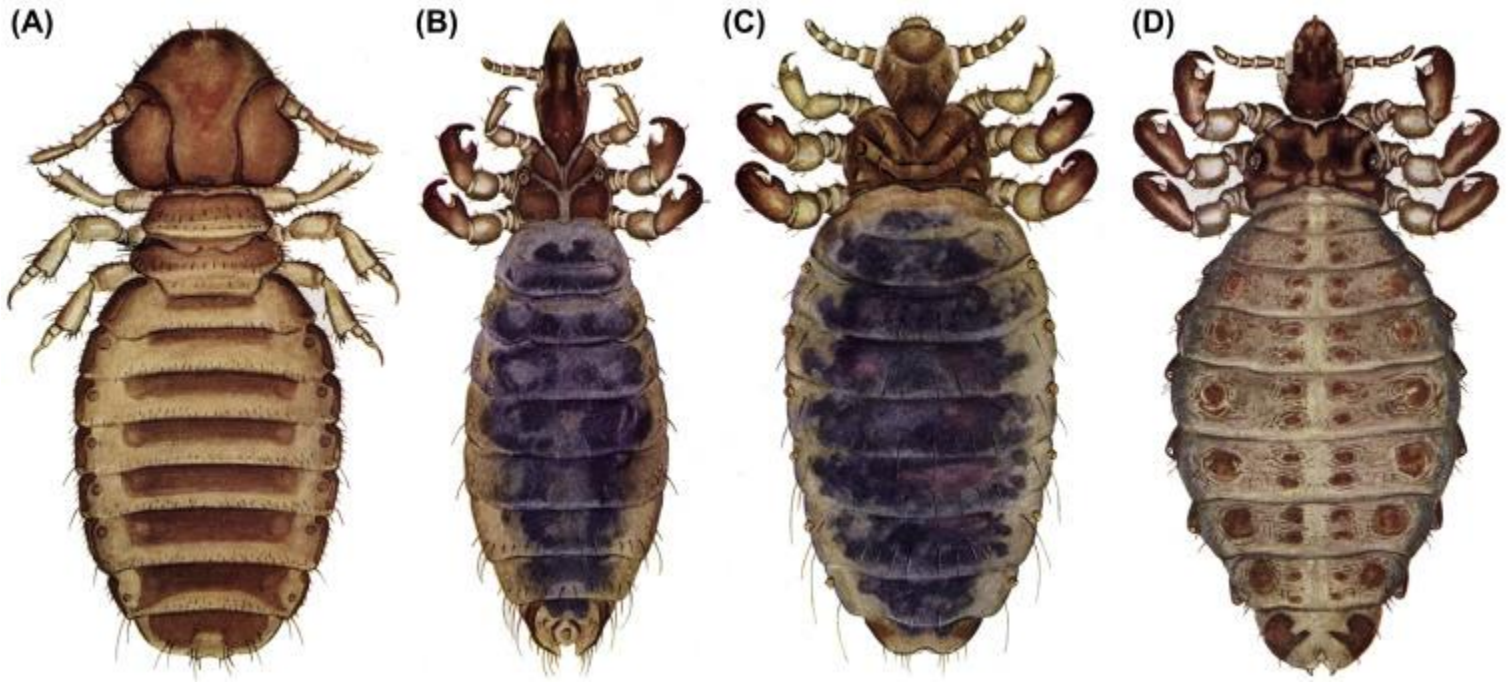
PHTHIRAPTERA : Lice

- Suborder: Anoplura: sucking lice
  - Only in mammals
  - Heavy infestation cause severe anemia
  - Irritation and skin damage
  - Large, up to 5mm, small pointed head, terminal mouth parts
  - Single large claw on each leg

Sucking lice of mammals
Anoplura

Host	Predilection Site	Lice species	Genus description
cattle	Poll, base of horns, ears, around eyes and nostrils	*Haematopinus eurysternus*	Short-nosed, up to 0.5cm in length , Yellowish/greyish-brown with dark strips on each side *H. Eurysternus* forms isolated clusters
	Tail region only	*Haematopinus quadripertusus*	
	Head, neck, dewlap	*Linognathus vituli*	Long-nosed, bluish-black, eggs are dark blue forms isolated clusters
		Solenoptes capillatus	Small/little, blush lice, occur in clusters

Pediculosis in cattle



(A) Cattle biting louse (*Bovicola/Linognathus bovis*)
(B) Long-nosed cattle louse (*Linognathus vituli*)
(C) Little blue cattle louse (*Solenopotes capillatus*)
(D) Short-nosed cattle louse (*Haematopinus eurysternus*)

Sucking lice of mammals
Anoplura

Host	Predilection Site	Lice species	Genus description
Sheep, Goat	Lower region of hind limbs, scrotum, belly	*Linognathus pedalis* (foot louse)	Long-nosed, bluish-black, eggs are dark blue
	Face, ears, chicks, neck	*Linognathus ovillus* (face louse)	
Pig	Skin folds of: neck, jowl, flunks, inside of legs	*Haematopinus suis*	Large grayish-brown
Equine	Hairs of the mane, base of tail, fetlock region, can spread to other parts	*Haematopinus asini*	Large grayish-brown
Dog	Ears, other parts	*Linognathus setosus*	As in cattle

PHTHIRAPTERA : Lice

- Suborder: Mallophaga: biting lice
  - Smaller in size (up to 3mm)
  - Much larger head, ventral mouth part
  - Claws are small: one in mammals, 2 in birds

Biting lice of mammals
Melophaga

Host	Predilection Site	Lice species	Genus description
cattle	Head, forehead, neck, shoulders, back, ramp	*Damalinia bovis/ bovicola bovis*	Reddish/Reddish-brown Highly active
Sheep, Goat	Can be present throughout the body	*Damalinia ovis (body louse)*	
Equine	Hairs of the mane, base of tail, fetlock region, can spread to other parts	*Damalinia equi*	
Dog	Ears, other parts	*Trichodectes canis*	Small/short, broad, yellowish
	Different body parts	*Heterodoxus*	Slender, yellowish
Cat	Under tickly matted neglected fur	*Felicola subrostratus*	Pointed head, ventral mouth parts

Biting lice of birds: Melophaga

Host	Predilection Site	Lice species	Genus description
Chicken/ domestic fowl	Base of the wings and tail feathers	*Lipeurus caponis* (Wing louse)	Grey, slaw moving Found close to the skin surfaces
	Head, neck	*Cuclotogaster (Lipeurus) heterographus* (head louse)	Eggs are laid singly on the feathers,
	Skin of the breast, thigh, anus	*Menacanthus stramineus* (yellow body louse)	Yellow, found closer to skin surfaces
	Shaft/legs	*Menopon gallinae* (Shaft louse)	pale yellow, fast moving , feeds on feathers

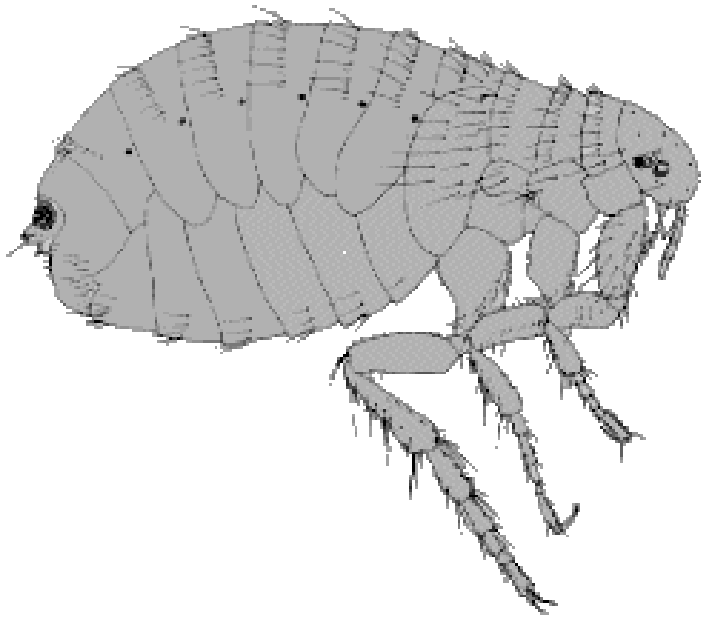
Lipeurus and *Menacanthus* contain the most pathogenic species

Lifecycle of lice

- Similar for the two suborders
- During a life span of about a month the female lays 200-300 eggs/nits, glued to the hair/feathers
- From the egg hatches a nymph
- After 3 molts, the adult
- Takes 2-3 weeks
- Feeding
  - Anoplura: on blood
  - Mallophaga; equipped for biting and chewing, have a wider range of diet
    - On mammals: ingest the outer layers of the hair shafts, dermal scales, blood scabs
    - Bird lice: feed on skin scales and scabs, can digest keratin: eat feathers

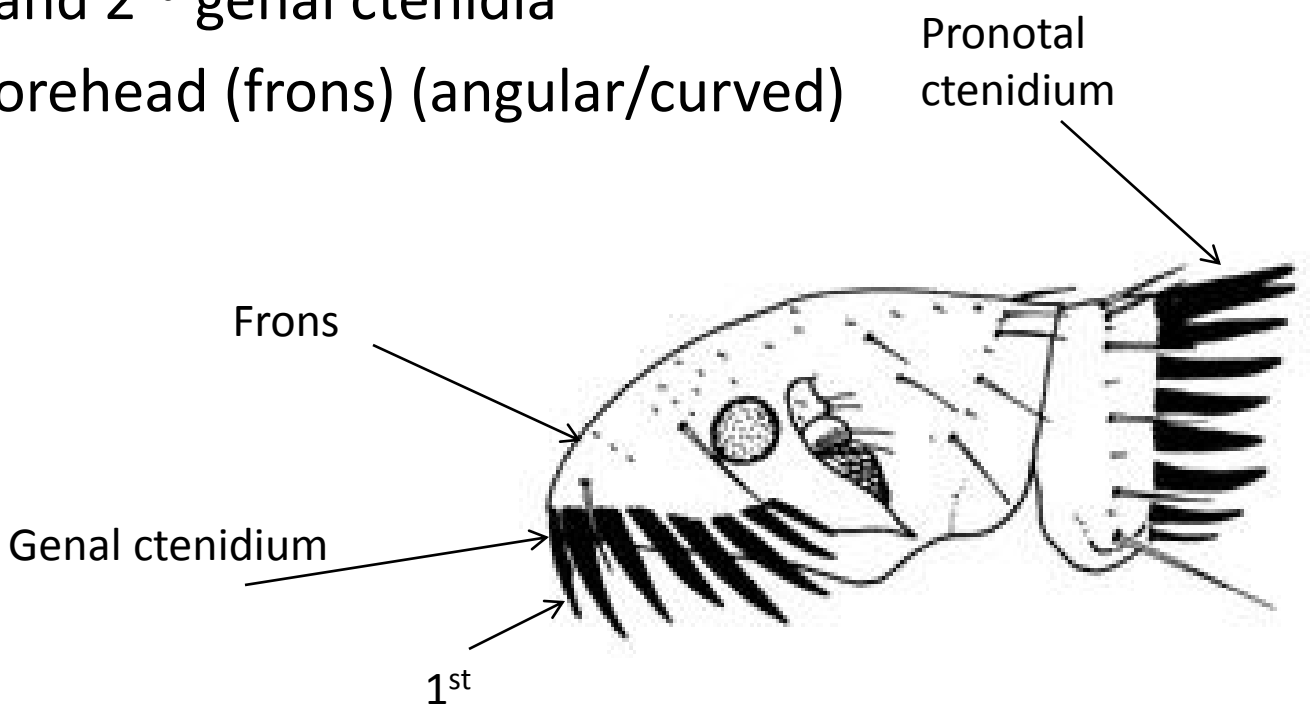
SIPHONAPTERA: Fleas

- Fleas are highly specialized bloodsucking parasites
- Morphology
  - Dark-brown, wingless insects, laterally compressed
  - The head may bear at its posterior or ventral borders rows of dark spines called ctenidia/combs: used for identification



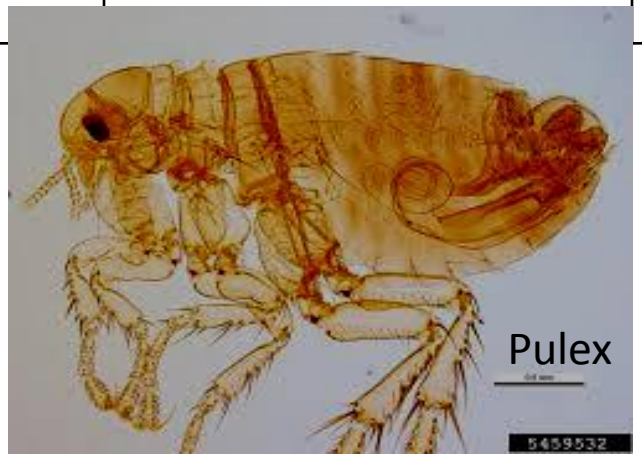
SIPHONAPTERA: Fleas

- Differentiation keys
  - Presence or absence of ctenidia
  - Presentation of ctenidia (horizontal/oblique)
  - Size of 1st and 2nd genal ctenidia
  - Shape of forehead (frons) (angular/curved)

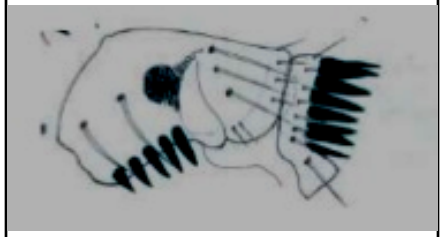


SIPHONAPTERA: Fleas

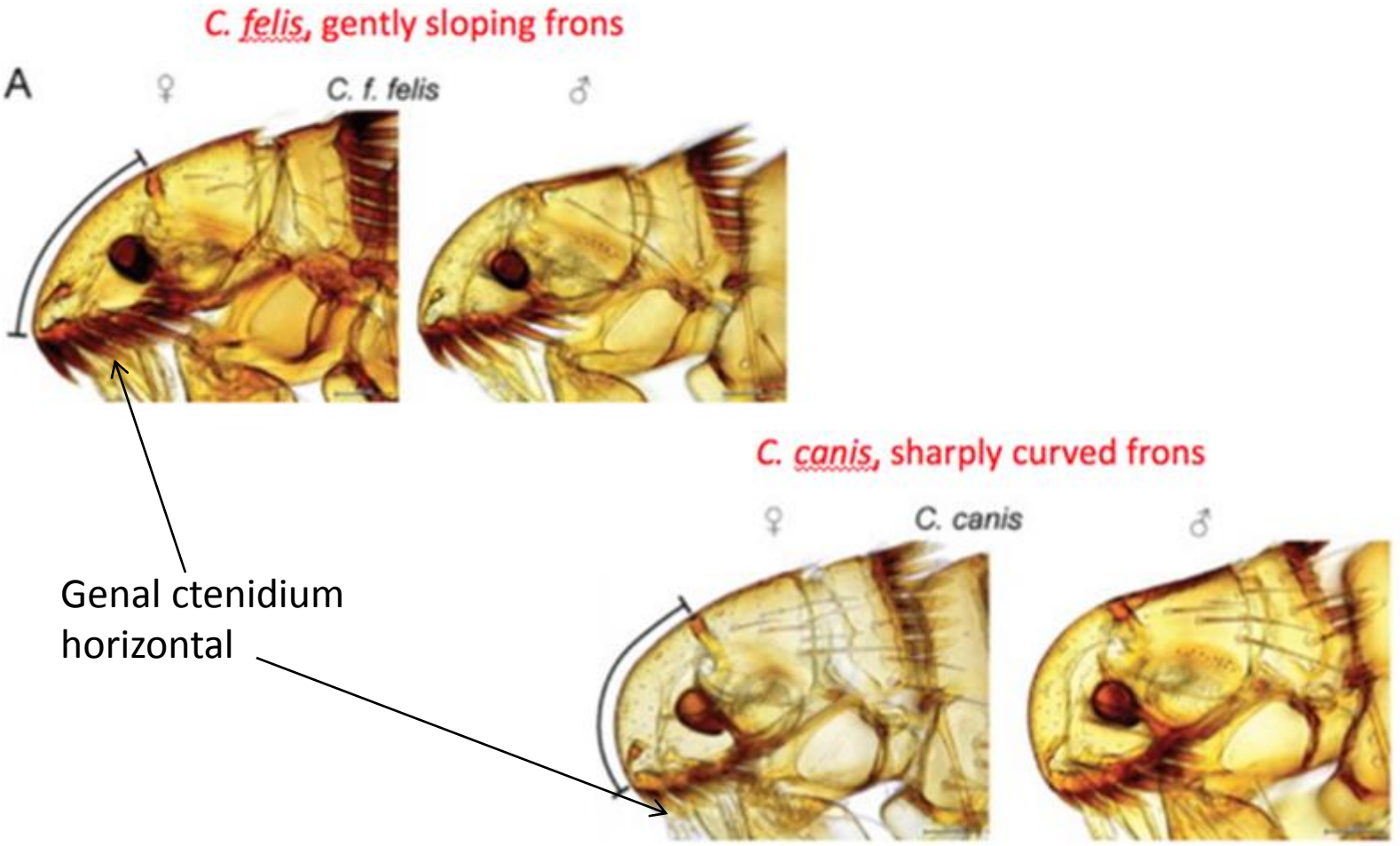
Ctenida	Frons and ctenidia description	fleas
Absent	Frons angled anteriorly	Echidnophaga gallinacea
Absent	Frons rounded anteriorly	Pulex iritans
Ppronotal ctenidium only		Ceratophyllus gallinae
Both genal and pronotal ctenidia	See next slide	Ctenocephalides Spilopsyllus cuniculi



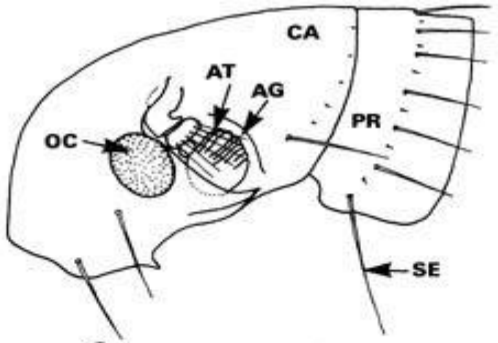
SIPHONAPTERA: Fleas

Ctenida	Frons and ctenidia description	fleas
Both genal and pronotal ctenidia 	Genal ctenidium horizontal, head length less than 2x height , Spine 1 of genal ctenidium shorter than spine 2 Sharply curved frons	Ctenocephalides canis
	Genal ctenidium horizontal, head length =2x height , Spine 1 of genal ctenidium =spine 2 Gently sloping frons	Ctenocephalides felis
Both genal and pronotal ctenidia	Genal ctenidium oblique with 4-6 elements	Spilopsyllus 

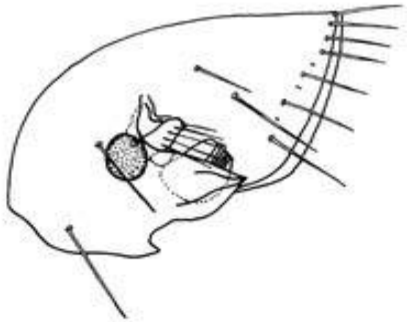
SIPHONAPTERA: Fleas



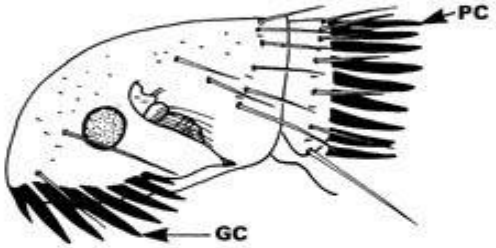
SIPHONAPTERA: Fleas



A PULEX IRRITANS

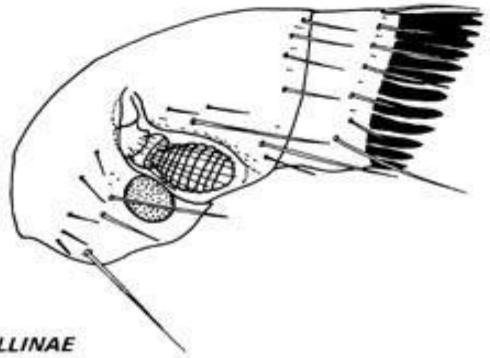


B XENOPSYLLA CHEOPIS



C CTENOCEPHALIDES CANIS

D CTENOCEPHALIDES FELIS



E CERATOPHYLLUS GALLINAE

Life cycle

- Both sexes are blood suckers, only adults are parasitic
- Eggs may be laid on the ground or on the host from which they soon drop off
- Hatching in 2 days-2 wks depending on the temperature
- Larvae have chewing mouth parts
  - Feed on debris and feces of adult fleas
- 2 molts followed by a cocoon (woolly puparium), adult emerges
- Length of cycle: 2 wks to 2 years (temperature)
- Most of the lifecycle is away from the host
- A few genera remain permanently attached to hosts throughout adult life
  - Burrowing/stickfast fleas: females embedded in the skin with posterior part pointing to the surface
- Fleas have their own host preference but can feed on any host

SIPHONAPTERA: Fleas

fleas	Host	Major site
Echidnophaga gallinacea	Birds	Burrows into the skin of the comb and wattles, form nodules
Pulex iritans	Man/dog, cat	Any part
Ceratophyllus gallinae	Birds/man, dog, cat	Any part
Ctenocephalides	Dog, cat/man	Any part
Spilopsyllus cuniculi	Rabbits	Ears

Diagnostic Entomology VeLT 3103 (50%)_ VLT -year 2- week 8-16-by Dr. Bersissa KUmsa

By Bersissa Kumsa (DVM, MSc, PhD)

8-10	**Class Arachinida** - Acarine parasites (Ticks and mange mites) **Ixodidae** (hard ticks) and **Argasidae** (Soft ticks) Pathogenic role of ticks, morphological features Biology of ticks: Intrinsic factors (host tropism) and significance Extrinsic factors: physical, climate etc. Major ticks (hard and soft) species of domestic animals in Ethiopia Argas, Ornithodorus, Amblyomma, Boophilus, Hyalomma, Haemaphysalis, Rhipicephalus. Tick control (long- and short-term objectives). Acaricides, Resistance development, methods of application, recent advances
11-16	**Mange Mites**: Nomenclature, Morphology, life cycle, host range and response, clinical features, pathology, immunity, diagnosis, treatment and control. Sarcoptes, Notoedres, Cnemidocoptes, Otodectes, Demodex, Psoroptes, Chorioptes, Psorergatus, Dermayssus gallinae

Summary of Assessment Methods

Evaluation will be carried out based on continuous assessment (minimum 40%) which comprises:

- ✓ Class attendance and participation through asking questions, answering questions, etc.;
- ✓ Assignments (individual and group assignments);
- ✓ Participation on class exercises including study problems;Quizzes;

Classification of arthropods

Two Veterinary & medically important classes, viz: 1. Class Insecta, 2. Class Arachnida

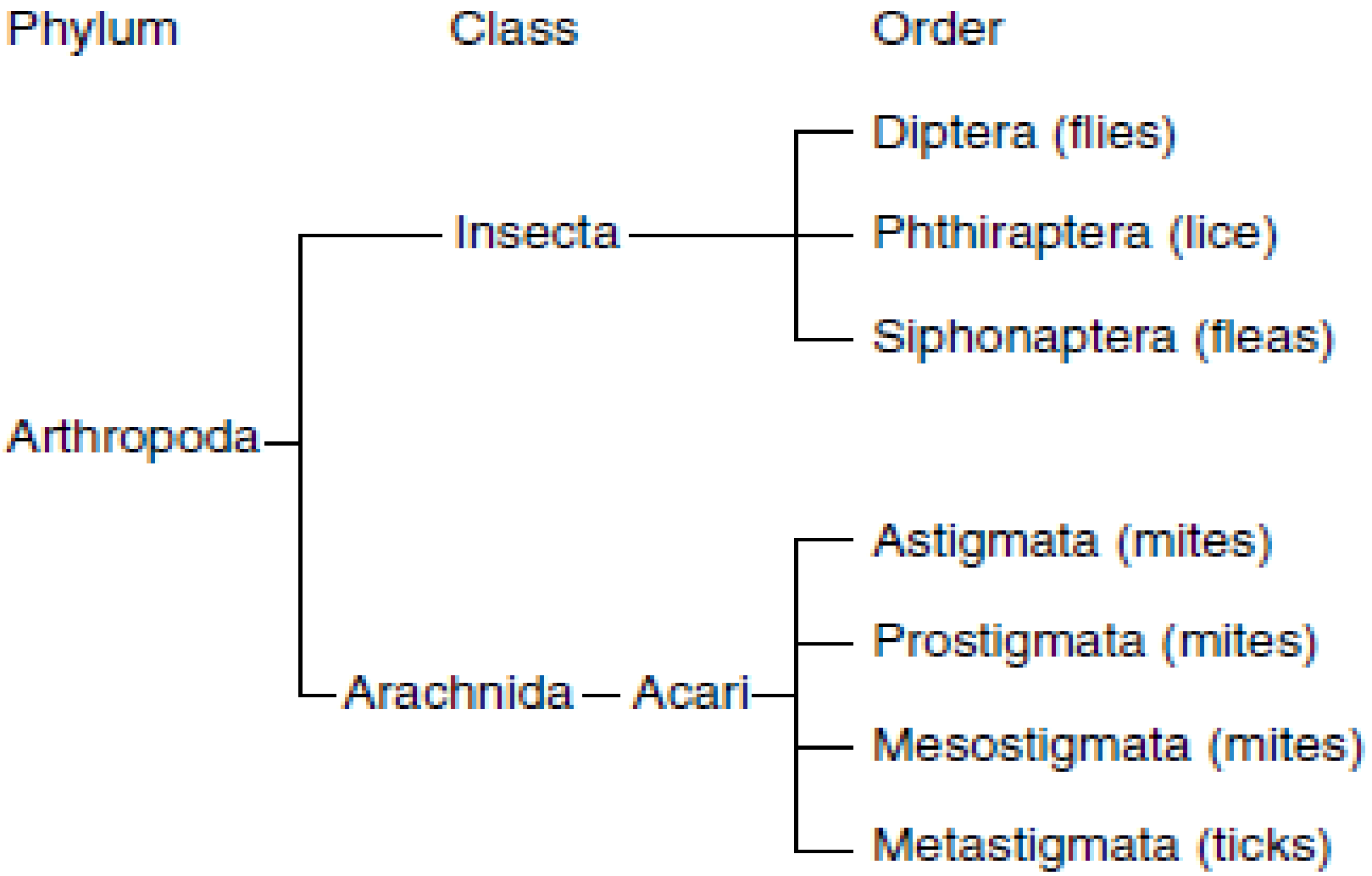


Fig. 1.15 The arthropod orders of verinary importance.

Class Arachnidia, Subclass Acari

- ✓ Has 4 pairs of legs & their body is divided into cephalo-thorax & abdomen
- ✓ Lack antennae unlike the class Insecta.
- ✓ Comprise ticks & mites----------→Acarines of veterinary importance

Mouth parts borne on the **basis capituli** (gnathosoma) that consists:

- ✓ Pair of **chelicerae (unsegmented)** with mobile digits for cutting
- ✓ Pair of sensory **palps (segmented)**
- ✓ Ventromedially has unpaired **hypostome (unsegmented)** with recurved teeth

Class Arachnidia, Subclass Acari

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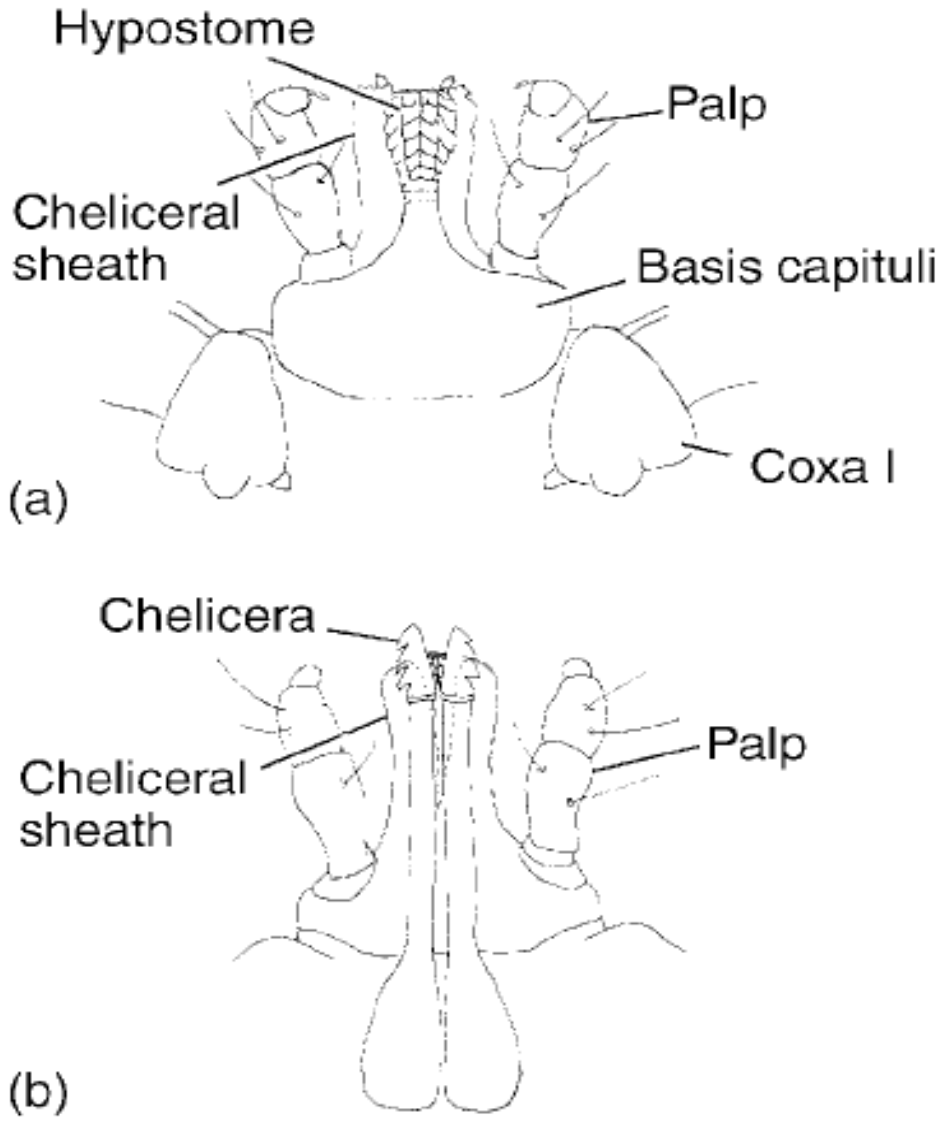


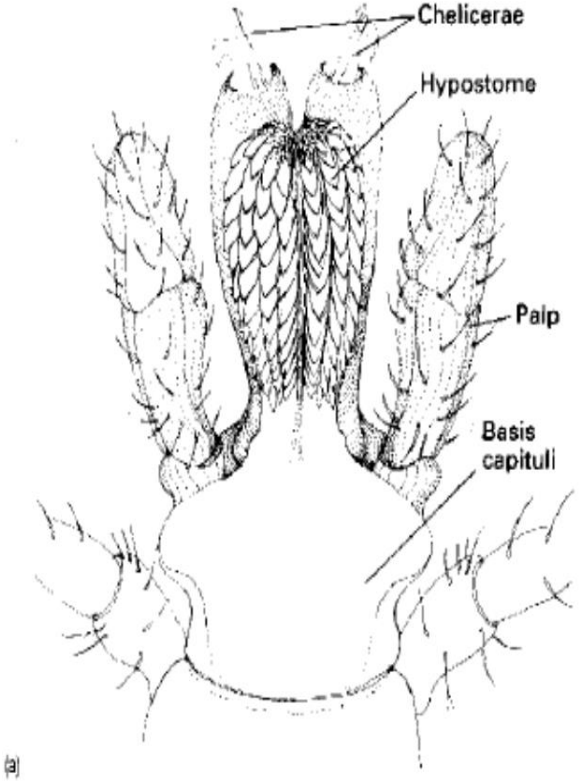


Fig. 3.1 Tick mouthparts: (a) ventral view, showing toothed hypostome; (b) dorsal view, showing the chelicerae behind the cheliceral sheaths.

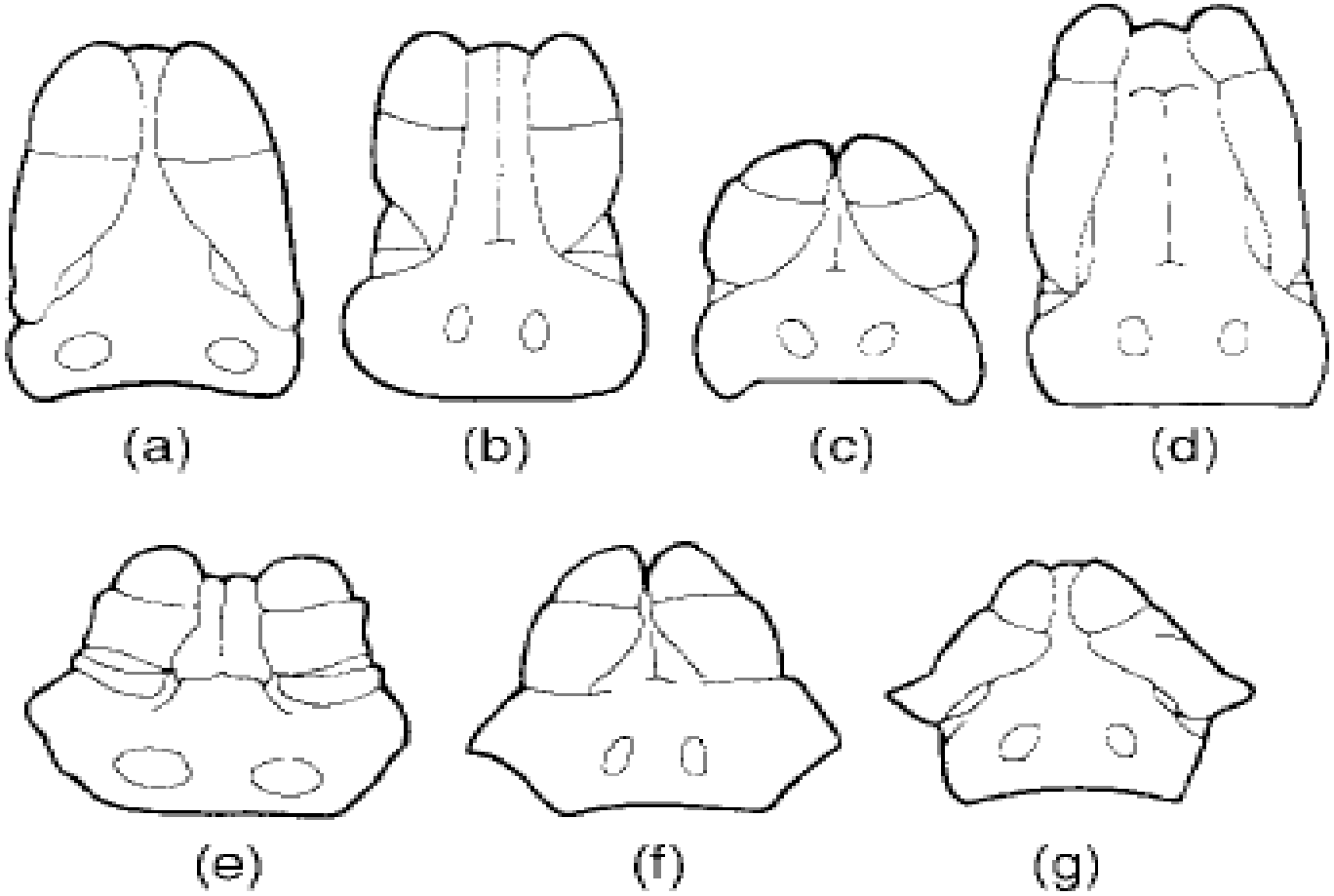


Fig. 3.9 Diagrammatic dorsal view of the gnathosoma of seven genera of ixodid ticks (from Smart, 1943). (a) *Ixodes*, (b) *Hyalomma*, (c) *Dermacentor*, (d) *Amblyomma*, (e) *Boophilus*, (f) *Rhipicephalus* and (g) *Haemaphysalis*.

TICKS

Divided into 3 families, viz:

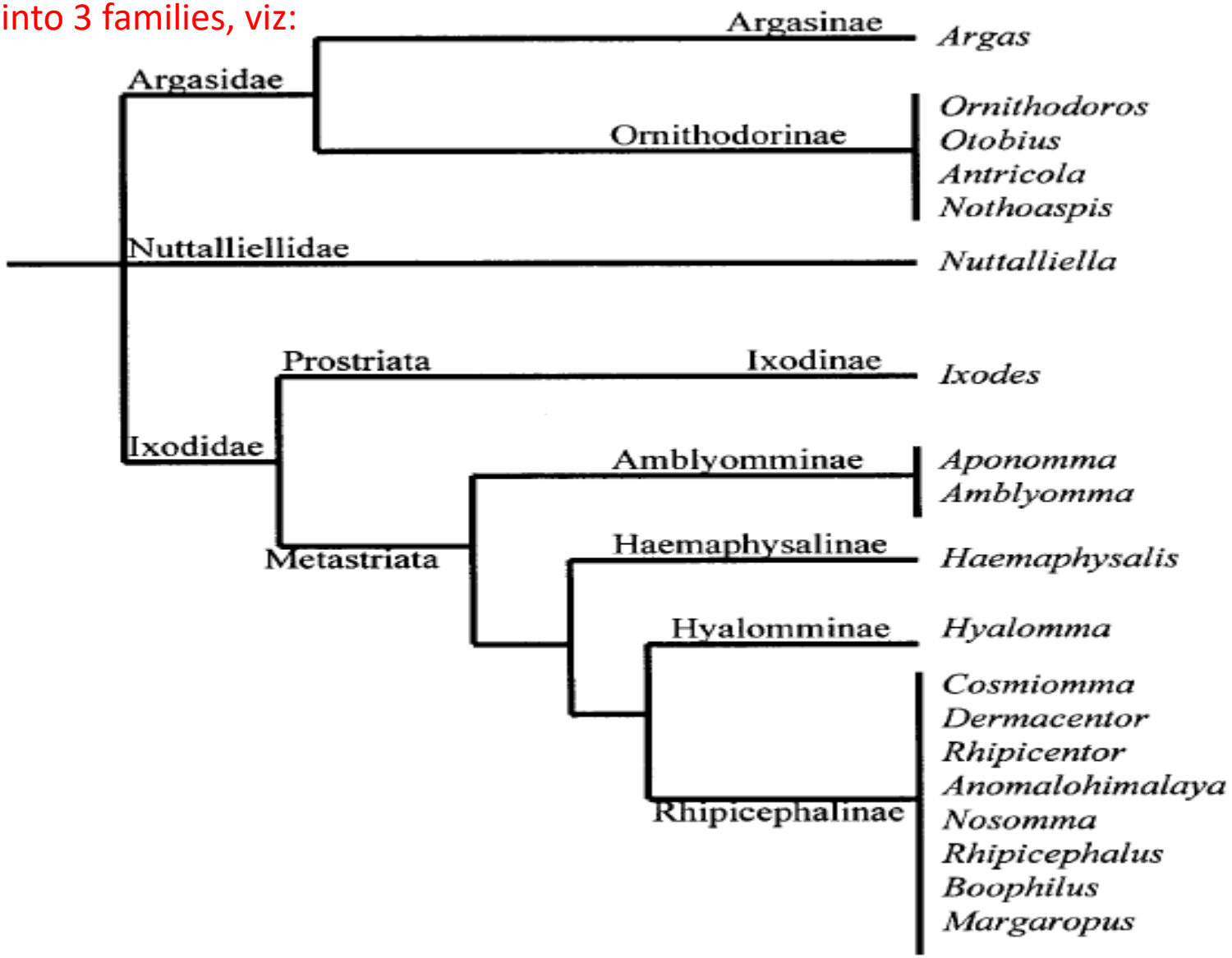
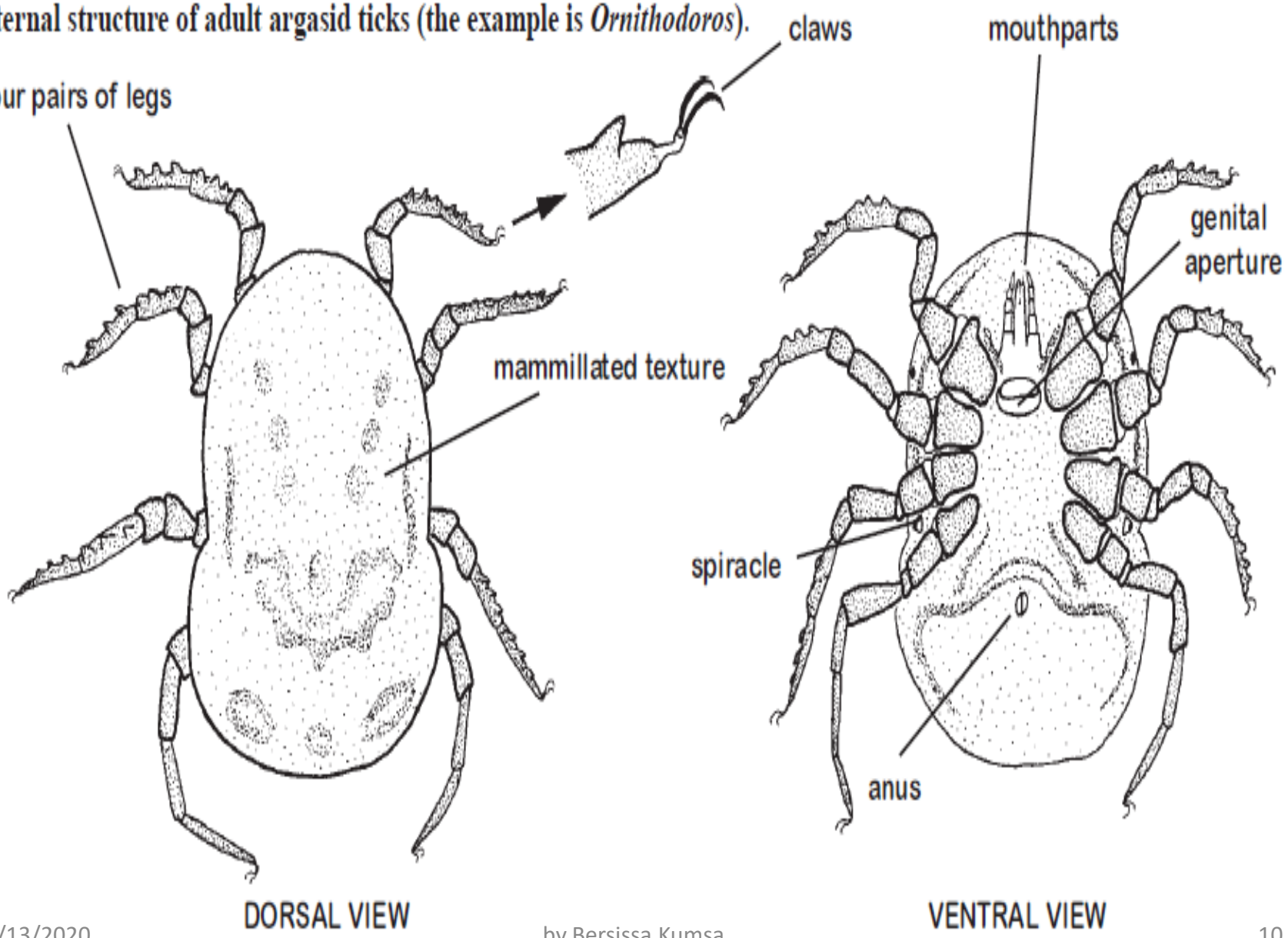


Figure 1. The traditional Hoogstraal classification for ticks

1. Family Argasidae (soft ticks)

- ✓ Lack scutum instead have leathery & unsclerotized body.
- ✓ Mouth part is ventral hence isn't visible from dorsal aspect
- ✓ Stigmata are usually located between coxae III & IV
- ✓ Don't swell much on engorgement, body is often wrinkled & feeds moderately
- ✓ Includes bird ticks & tampans

External structure of adult argasid ticks (the example is *Ornithodoros*).



Soft tick

Hard tick

2. Family Ixodidae

General distinguishing features

- ✓ Chitinous **scutum** (sclerotized dorsal shield or plate) covers the entire dorsal surface of the male.
- ✓ But the scutum covers only a small area about 1/3- 1/8 of the body behind the head in the larva, nymph & female. All stages feed on blood & tissue fluids of animals, females are engorged with blood till legs are useless but males don't increase much in size after feeding.
- ✓ Mouth parts carried on the capitulum are anterior & visible from the dorsal surface
- ✓ Series of grooves on the scutum & body. A raw of notches (uniform rectangular regions) on the posterior border of body called **festoons**.

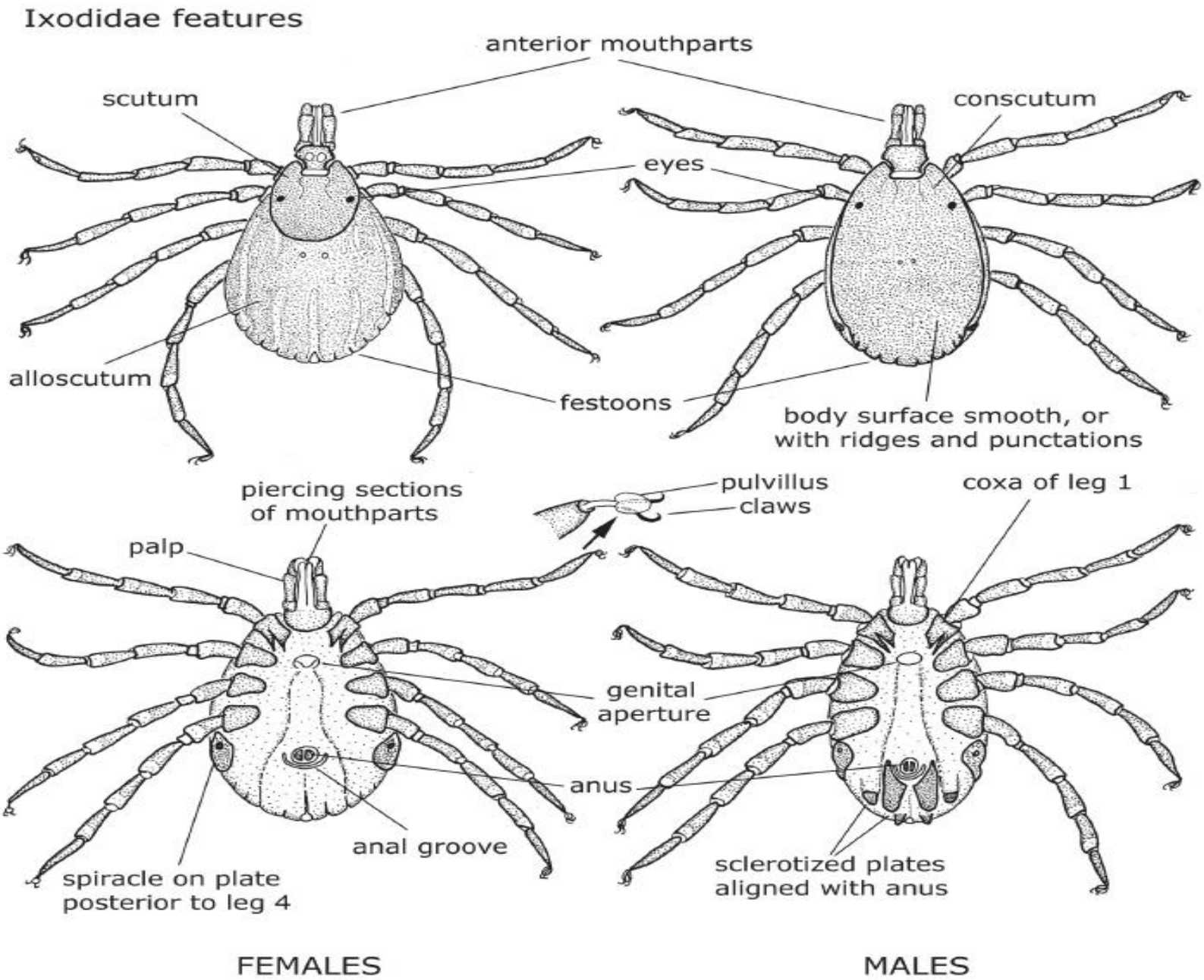
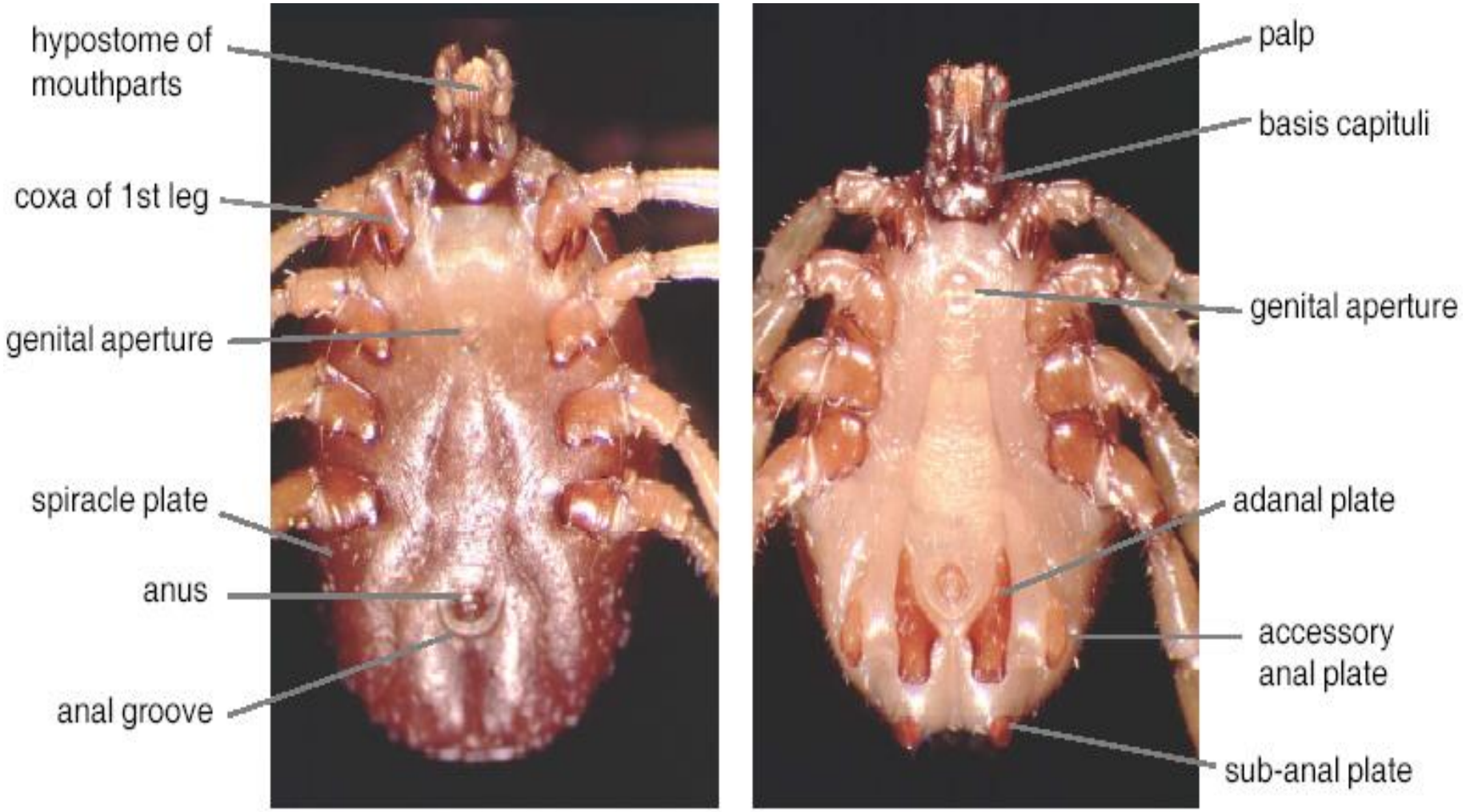


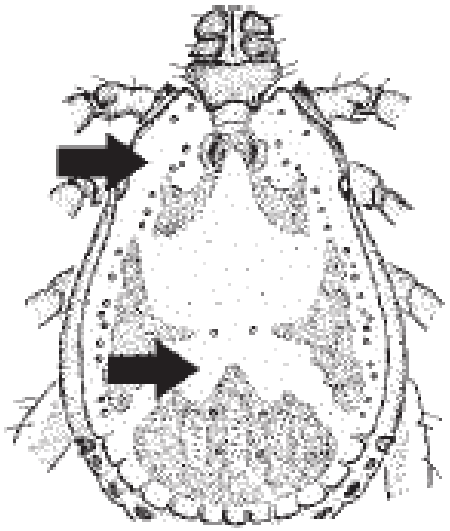
FIGURE 3. Morphological features of hard ticks (family Ixodidae). Example is an adult female and an adult male of the genus *Hyalomma*. Top row is dorsal view, bottom row is ventral view.

External structure of *Hyalomma a. anatolicum*, dorsal view. Female at left, male at right.

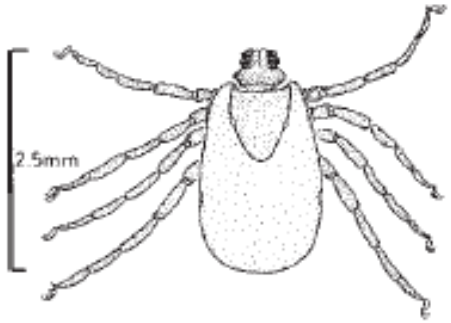


External structure of *Hyalomma a. anatolicum*, ventral view. Female at left, male at right.

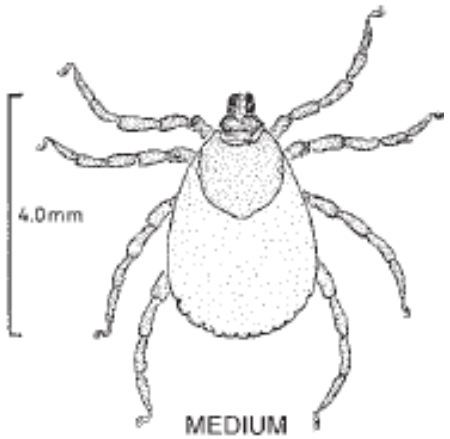
- ✓ Chitinous plates (**ventral shields)** on the ventral surface of males present in some species
- ✓ Genital opening is on the ventral mid-line at the level of 2nd pairs of legs & the anus is located posterior to it. larvae & Nymphs lack genital pore
- ✓ In some genera colored enamel-like areas (pattern of gray & white on a dark background) on the body called "**ornate ticks**" Ex. *Amblyomma* but those ticks without ornation are called "**inornate ticks**". A pair of **stigmata** behind the 4th pair of legs in adults.
- ✓ Eyes are situated on the dorsal surface on the lateral margin of the scutum.
- ✓ Ticks are temporary ectoparasites only for short periods on the host.



WHITE ENAMEL



SMALL



MEDIUM

LARGE

- ✓ According to the number of hosts required to complete the lifecycle (Egg--------→larva (6 legs) -------→nymph (8 legs) -------→adult) Ixodidae ticks are divided into 3 as:
- ✓ **One-host tick**--→larvae to adult development occurs on 1 host Ex. *Boophilus*
- ✓ **Two-host tick**---→larvae-------→nymph occurs on one host. Ex *Hyalomma*.
- ✓ **Three-host tick**---→each stage of development takes place on different hosts. Ex *Amblyomma* spp. During development ticks feeds & molts. Adults copulate on the host females then drop off, lay eggs &die. Number of hosts used for completing life cycle is important for planning control programs & disease epidemiology.

Life cycles of Ixodid ticks

One-host	Two-host	Three-host
Boophilus spp.	*Rhipicephalus evertsi* *Hyalomma anatolicum excavatum* *Hyalomma dentritum dentritum* *Rhipicephalus bursa*	*Hyalomma anatolicum excavatum* *Most species of hard ticks*
Fast: 3 weeks on host + 2 months eggs-larvae		Slow: 6 months to several years
Highly evolved		Least evolved

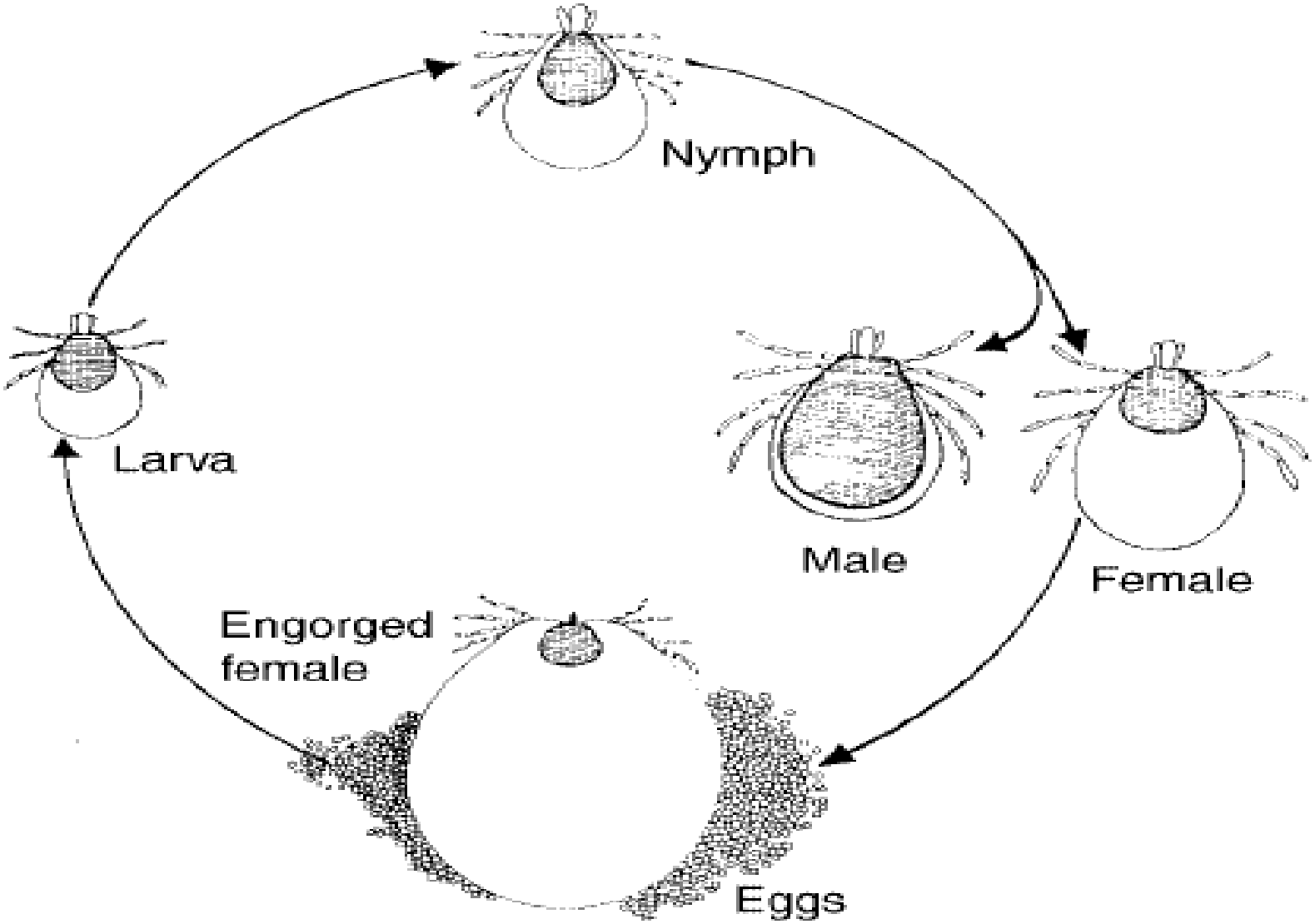


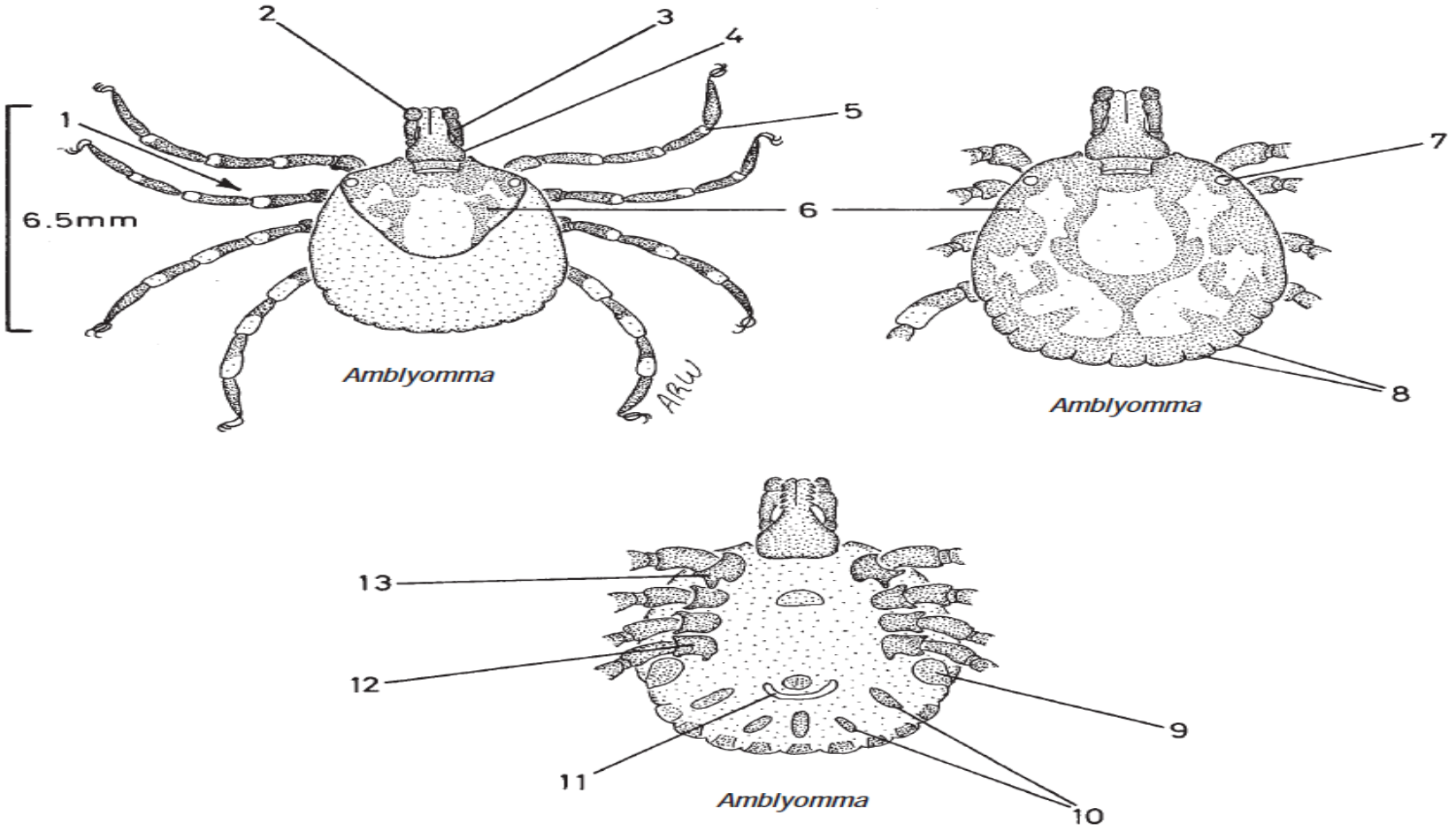
Fig. 3.6 Life-cycle of an ixodid tick (reproduced from Urquhart *et al.*, 1987).

- ✓ Of many genera of Ixodidae ticks occurring worldwide 5 exists in Ethiopia, viz: Genera *Amblyomma*, *Hyalomma*, subgenus *Boophilus*, *Rhipicephalus* & *Haemaphysalis*.

1. **Genus *Abmlyomma***

- ✓ Large, broad & usually ornate. Long palps & hypostome.
- ✓ Legs have bands of color called "bont ticks". Eyes & festoons are present.
- ✓ In males ventral plates are absent. They are three-host ticks. Long mouth cause painful bites. Important species in Ethiopia are: *Am. variegatum* & *Am. coherens*, *Am. gemma* & *Am. lepidum*.
- ✓ *A. variegatum* transmits heart water (Cowdria (Erlhichia) ruminantium).

***Amblyomma* genus, female dorsal at upper left, male dorsal at upper right, male ventral at lower central** (all features apply to both sexes, except where stated).

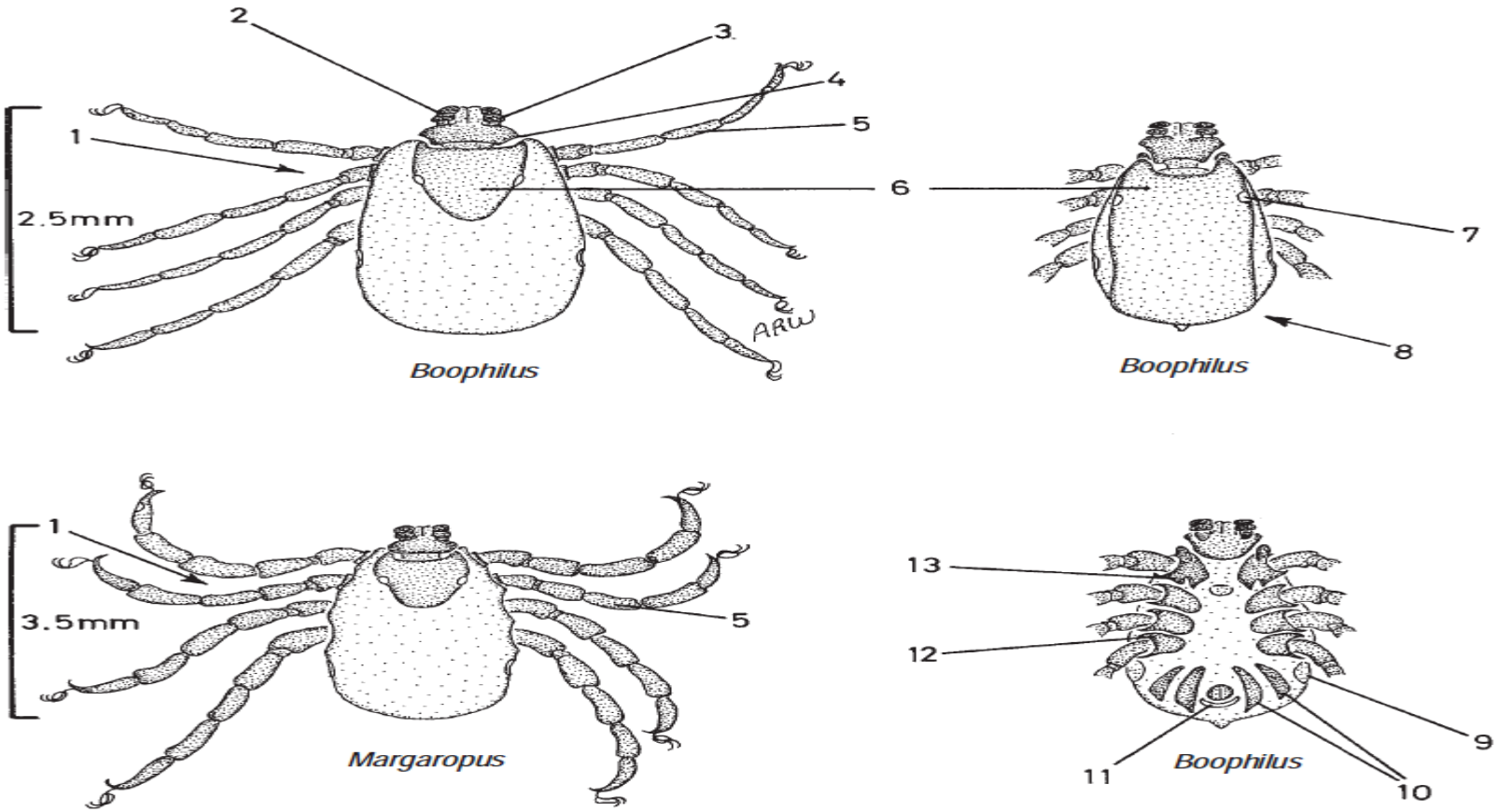


1 Size of unfed ticks is large (6 to 7mm) including mouthparts. Lateral suture is absent. Integument texture has striations.
2 Mouthparts are anterior.
3 Palp articles 2 are longer than articles 1 and 3.
4 Basis capituli has straight lateral margins.
5 Legs usually have pale rings. Legs are slender. Pulvilli are always present.
6 Scutum is present in the female (a conscutum in the male). Enamel (= ornamentation) is present on the scutum and conscutum of many species.
7 Eyes are always present and may be flat or convex (some times difficult to see).
8 Festoons are present in males (and in females but unclear when females are fed).
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates in males are indistinct (in the form of small flat plates posterior to the anus, also the ventral surface of the festoons have plates known as scutes).
11 Anal groove is posterior to the anus.
12 Coxae 4 are of normal size.
13 Coxae 1 have unequal paired spurs.

2. Subgenus *Boophilus*

- ✓ Short palps & hypostome. Have hexagonal basis capituli, Inornate ticks with eyes. Festoons are not present. Anal grooves absent in females & faint in males.
- ✓ Coxe I is bifid. Males have adanal or accessory ventral shields & caudal process.
- ✓ *R(B). decoloratus* is often called blue ticks engorged female has slaty blue & pale yellow legs. Are one host-ticks. Most important vectors of *Babesia* & *A. marginale* in cattle.
- ✓ Important & widely distributed species in Ethiopia is *R(B). decoloratus.*

Boophilus **sub-genus (within *Rhipicephalus* genus), female dorsal at upper left, male dorsal at upper right, male ventral at lower right** (all features apply to both sexes except where stated);
Margaropus **genus, female dorsal at lower left** (only those features differing from *Boophilus* are labelled).

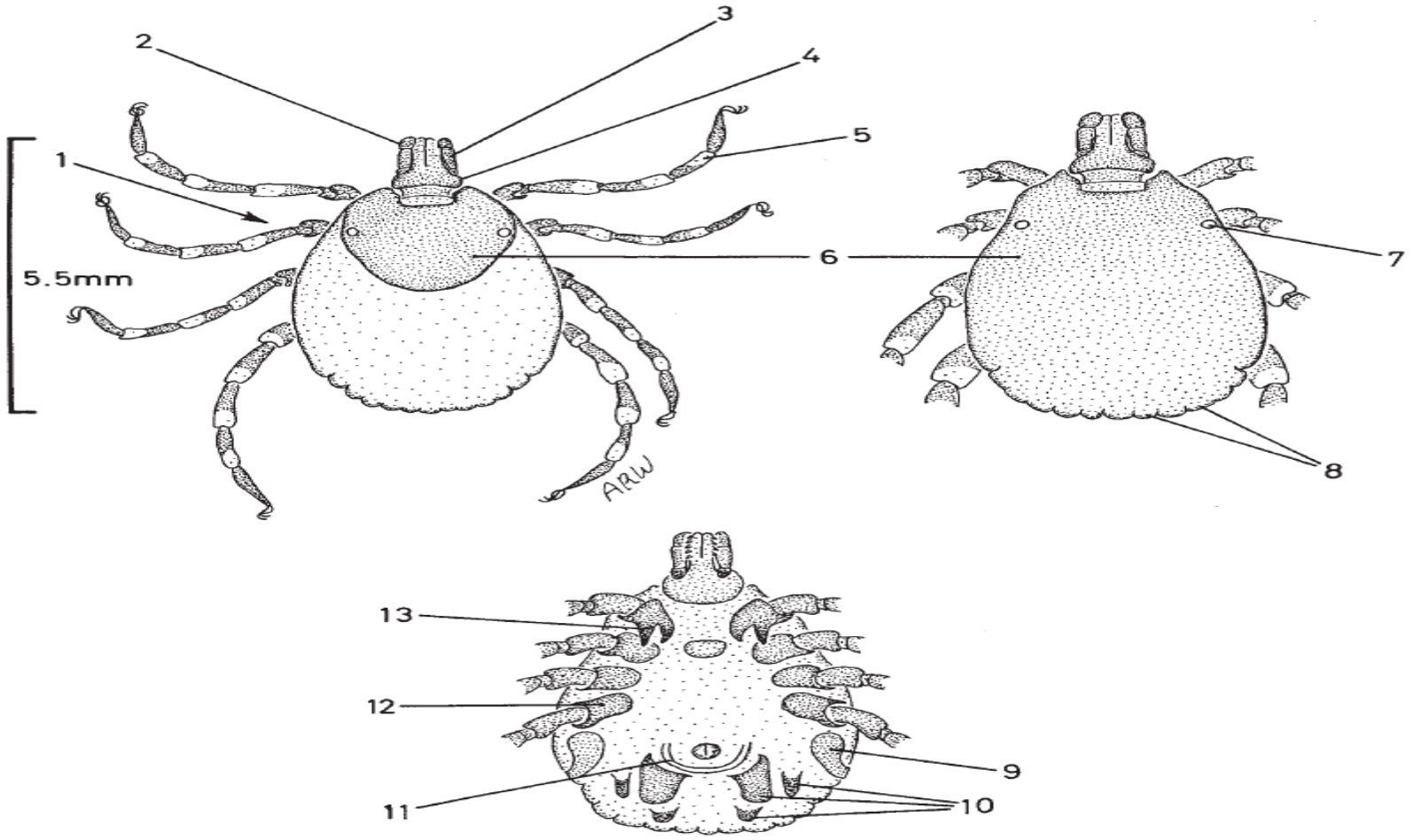


1 Size of unfed ticks is small (2 to 3mm) for *Boophilus*; and 3mm for *Margaropus* including mouthparts. Lateral suture is absent. Integument texture has striations.
2 Mouthparts are anterior.
3 Palp articles are all small.
4 Basis capituli has angular lateral margins.
5 Legs have no pale rings. Legs are slender in *Boophilus* and bulbous in *Margaropus* (they are very bulbous in *Margaropus* males). Pulvilli are always present.
6 Scutum is present in the female (a conscutum in the male). Enamel (= ornamentation) is absent from the scutum and conscutum.
7 Eyes are present but indistinct (very indistinct in the males).
8 Festoons are absent from females and males.
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates are present in males only. In *Margaropus* the adanal plates are distinctly long and sharp.
11 Anal groove is indistinct (it is posterior to the anus if visible).
12 Coxae 4 are of normal size.
13 Coxae 1 have small paired spurs (very small in the fe males).
(Also: genital aperture of females is a small **U** or **V** shape in *Boophilus* but is a wide oval in *Margaropus*.)

Genus *Hyalomma*

- ✓ Similar to *Amblyomma* have long palps & hypostome. Usually inornate but with banded legs (bont-legged ticks) similar to *Amblyomma*. Eyes are present but festoons are sometimes present. Males have a pair of adanal shields & sometimes-accessory shields. And a pair of chitinous protrusions behind the adanal shields.
- ✓ Spiracles comma shaped in males & triangular in females. Usually two-host ticks & some are 3 host ticks. Larvae & nymphs feed on birds & small mammals
- ✓ Adults feed on ruminants & equines. Occur throughout Africa, Asia, ex. *Hy truncatum* occur throughout Africa. Vectors of *Babesia*, *Theiliria* & rickettsial infections.
- ✓ Mainly responsible for tick toxicosis-----→toxin produced causes a sweating sickness in ruminants & pig leading to widespread hyperaemia in mucous membrane & profuse moist eczema.

***Hyalomma* genus, female dorsal at top left, male dorsal at top right, male ventral at bottom central** (all features apply to both sexes except where stated).



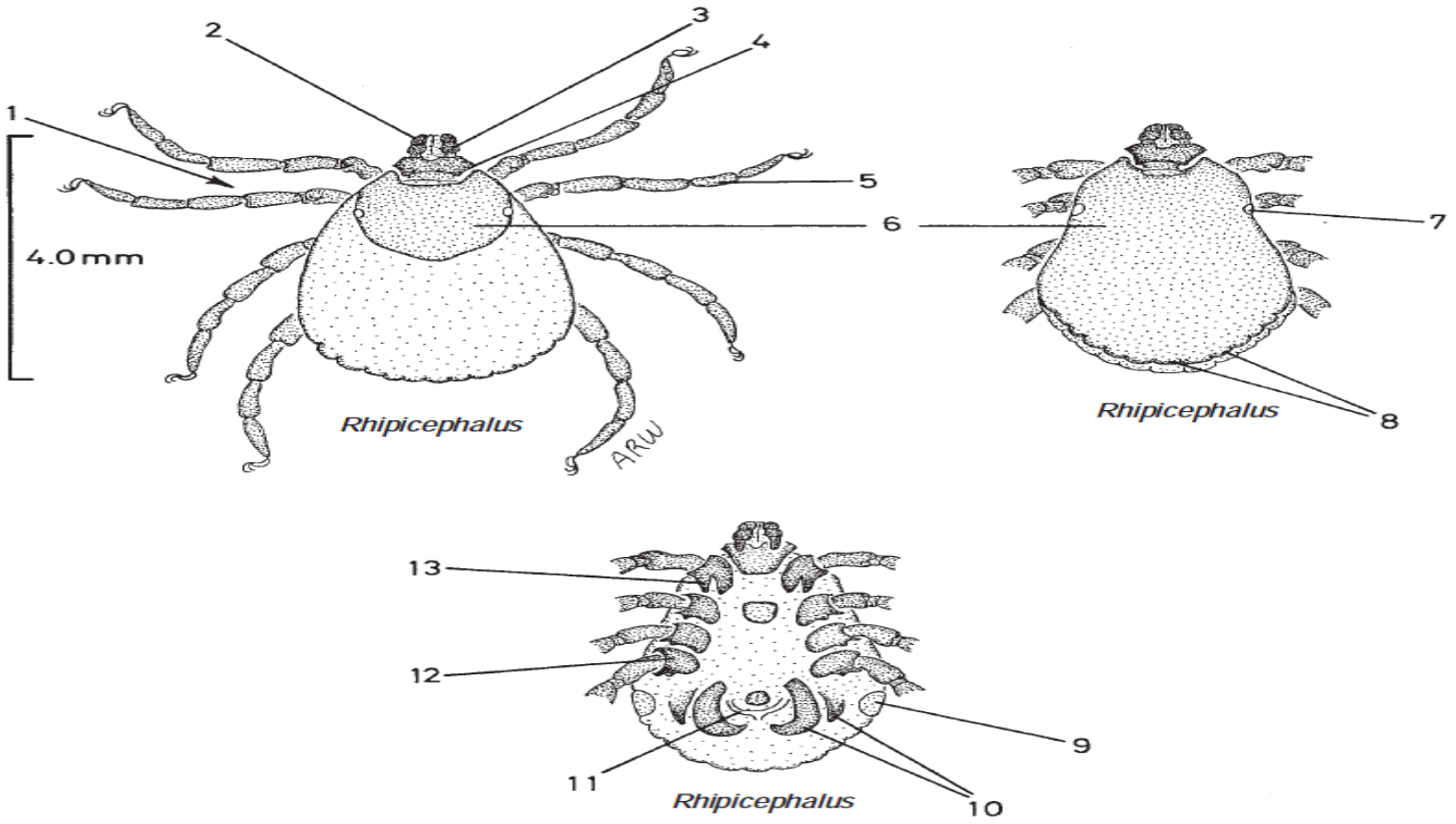
1 Size of unfed ticks is large (5 to 6mm) including mouthparts.Lateral suture is absent. Integument texture has striations.
2 Mouthparts are anterior.
3 Palp articles 2 are longer than articles 1 and 3.
4 Basis capituli has medium angular lateral margins.
5 Legs usually have pale rings. Legs are slender. Pulvilli are always present.
6 Scutum is present in the female (a conscutum is present in the male) and these are coloured brown. Enamel (= ornamentation) is usually absent from the scutum and conscutum (*Hy. lusitanicum* is an exception).
7 Eyes are always very convex.
8 Festoons are present in males (and in females but unclear when females are fed).
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates are present in males only (usually three distinct pairs).
11 Anal groove is posterior to the anus.
12 Coxae 4 are of normal size.
13 Coxae 1 have large and equal paired spurs.

4. Genus *Rhipicephalus*

- Short palps & hypostome with hexagonal **basis capituli** dorsally. Usually inornate
- Have eyes & festoons. Coax I has 2 strong spurs. Males have adanal plates & accessory shields. Frequently have a caudal prolongation when engorged.
- Have both 2 & 3 host ticks Ex. *Rh. appendiculatus* (brown ear ticks)--→ECF in cattle

  Also *B. bigemina* & NSD whereas *Rh. sanguineus* is a three-host tick _ called brown dog or kennel tick. Primary parasite on dogs *B. canis* & *E. canis*. Causes tick paralysis in dogs

***Rhipicephalus* genus, female dorsal at top left, male dorsal at top right, male ventral at bottom central** (all features apply to both sexes except where stated).

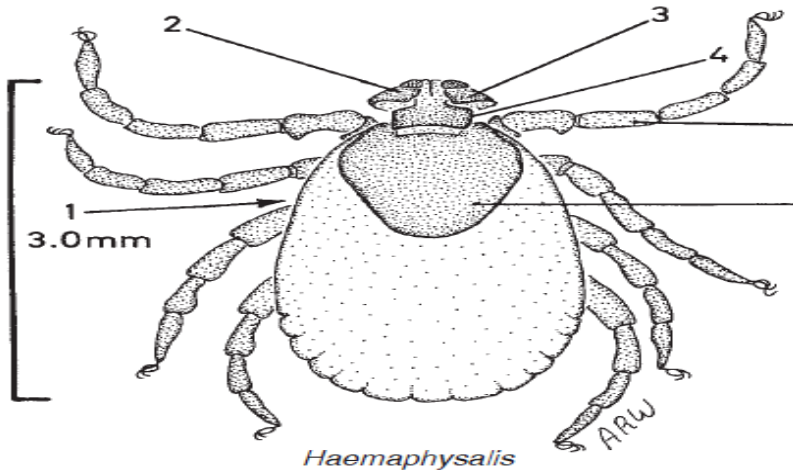


1 Size of unfed ticks is medium (3 to 5mm) including mouthparts. Lateral suture is absent. Integument texture hasstriations.
2 Mouthparts are anterior.
3 Palp articles are all small.
4 Basis capituli has distinctly angular lateral margins (making a hexagonal shape of the entire basis capituli).
5 Legs have no pale rings (with one exception - *Rh. evertsi mimeticus*). Legs are slender. Pulvilli are always present.
6 Scutum is present in the female (a conscutum in the male). Enamel (= ornamentation) is usually absent from the scutum or conscutum but there are four species with enamel.
7 Eyes are present and flat to slightly convex (but in *Rh. e. evertsi* the eyes are very convex or highly bulging).
8 Festoons are present in males (and in females but unclear when females are fed).
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates are present in males only (usually as two pairs of plates).
11 Anal groove is posterior to the anus.
12 Coxae 4 are of normal size.
13 Coxae 1 have large and equal paired spurs.

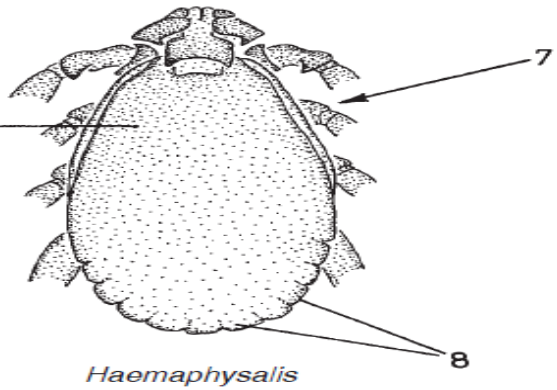
5. Genus *Haemaphysalis*

- ✓ Usually of small size inornate ticks. They have festoons but don't have eyes.
- ✓ Sensory palps are short & conical as the 2nd palpal segment is broad extending beyond the margins of the basis capituli (the 2nd articles have conspicuous lateral projections)
- ✓ Males don't have ventral shields & anal groove contours the anus posteriorly. They are three host ticks.
- ✓ *Ha. punctata* _ *B. major*, non-pathogenic theileria, *B. motasi* & benign *Theileria ovis*. *H. leachi* (yellow dog tick) _ common in Africa & Asia & transmits *B. canis*

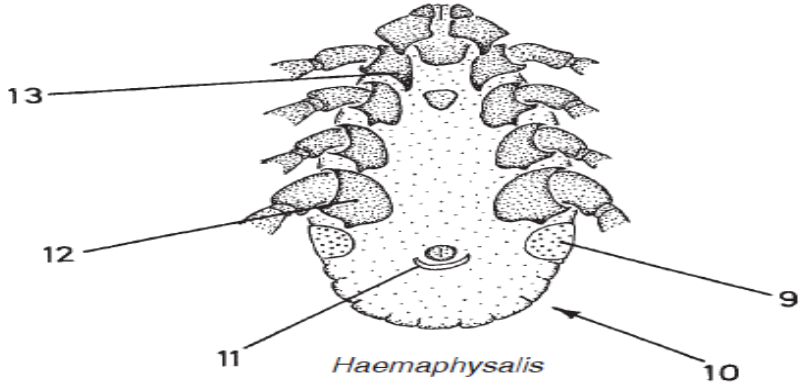
***Haemaphysalis* genus, female dorsal at upper left, male dorsal at upper right, male ventral at lower central** (all features apply to both sexes except where stated).



Haemaphysalis



Haemaphysalis



Haemaphysalis

1 Size of unfed ticks is small (3mm) including mouthparts. Lateral suture is absent. Integument texture has striations.
2 Mouthparts are anterior.
3 Palp articles 2 are usually broad (only in some species do they form a distinct conical shape as shown).
4 Basis capituli has straight lateral margins.
5 Legs have no pale rings. Legs are slender. Pulvilli are always present.
6 Scutum is present in the female (a conscutum in the male). Enamel (= ornamentation) is absent from the scutum and conscutum.
7 Eyes are always absent.
8 Festoons are present in males (and in females but unclear when females are fed).
9 Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracle plates.
10 Ventral plates are absent from males.
11 Anal groove is posterior to the anus.
12 Coxae 4 are of normal size.
13 Coxae 1 have unequal paired spurs (only a single internal spur is present).

Mites

✓merely smaller than ticks & have same body plan

✓parasitic or free living

✓Some of the free living are IH of **Anoplocephala Cestodes**

✓Most parasitic species spend their entire life cycles on the host causing a general condition called Mange.

✓Hence once infection is established pathogenic population can build up on an animal

✓broadly divided into two, viz: 1. **Burrowing Mites**

2. **Non- Burrowing Mites**

The mites causing mange of animals of veterinary importance usually belong burrowing & non burrowing:

- ✓ *Sarcoptes*----------family Sarcoptidae
- ✓ *Notoedres*----------family Sarcoptidae
- ✓ *Knemidocoptes*------family Sarcoptidae
- ✓ Demodex----------family Demodicidae

Burrowing mites

- ✓ *Psoroptes*---------- family Psoroptidae
- ✓ Chorioptes---------- family Psoroptidae
- ✓ Otodectes---------- family Psoroptidae
- ✓ *Psorergates*----------family Cheyletidae
- ✓ *Cheyletiella*----------family Cheyletidae
- ✓ *Dermanyssus* ----------family Dermanyssidae
- ✓ *Ornithonyssus* ----------family Dermanyssidae
- ✓ *Pneumonyssus* ----------family Dermanyssidae

Non-Burrowing mites

Family Sarcoptidae

circular outline.

Very short legs & 3rd & 4th pairs of legs don't project beyond the body margin.

Long unsegmented pedicle with a sucker on end of some legs.

Genera of veterinary Importance-

- ✓ *Sarcoptes*
- ✓ *Notoedres*
- ✓ *Cnemidocoptes*
- ✓ Cause scabies of man and sarcoptic mange of sheep, goats, cattle, pigs, equine dogs, foxes rabbit & other animals

Life-Cycle:

Entire life-cycle – 17-21 days. The female burrows in to the skin and lays 40-50 eggs.

1. Genus Sarcoptes

- ✓ Only one genus called *S. scabiei* that evolved to become a varity in different animal species. Ex. *S. var. canis* in dog, *S. var. suis*, *S. var. felis*, *S. var. bovis*, *S. var. equi*, *S. var. ovis.*
- ✓ Host specific strains evolved by biological adaptation.
- ✓ Causes mange in humans & animals.
- ✓ In man is generally called scabies & Sarcoptic mange in animals.

Host: all domestic mammals & man

Morphology

Is round in outline with caudal anus

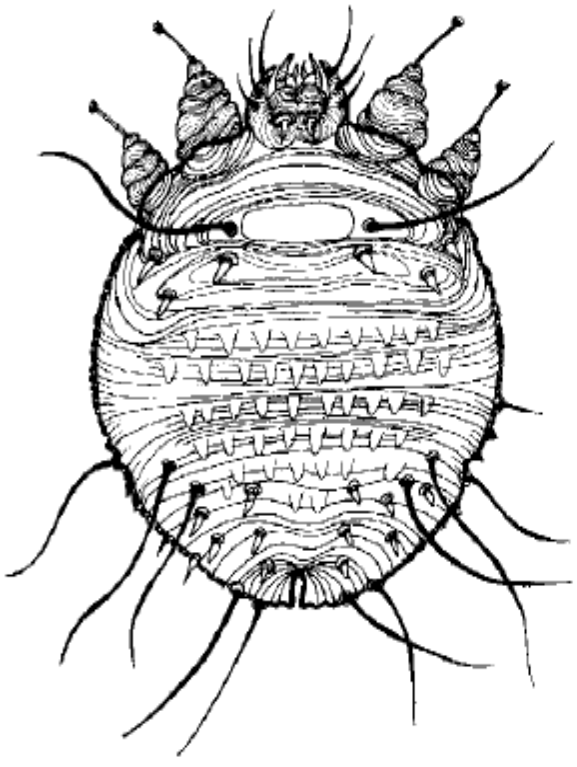
Only the 1st & 2nd pairs of legs project beyond the margins

Unique feature is the presence of numerous transverse ridges & also bears a central patch of triangular scales on the dorsum

Family Sarcoptidae

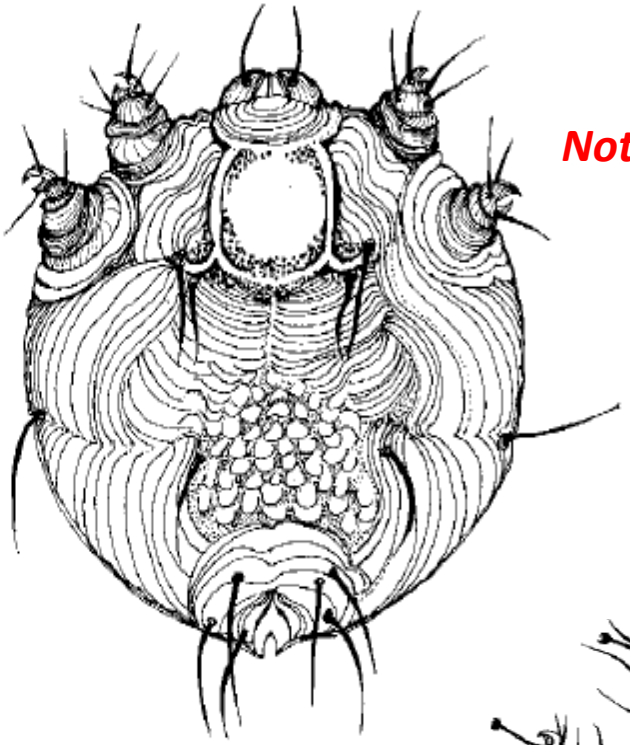
Genus	Species	Host	Location	Morphology	Symptoms/Pathogenesis
Sarcoptes	*S.scabiei*	All domestic animals and man	Hair follicle and sebaceous glands	Round in outline 0.4 mm in diameter with short legs	Produce marked irritation Causes itching,scratching resulting in inflammation of skin Skin- thickened & wrinkled Alopecia Secondary infections
Notoedres	*N.cati*	Cat & Rabbit	Face & 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

Diagnosis & Treatment: Same as for Demodex

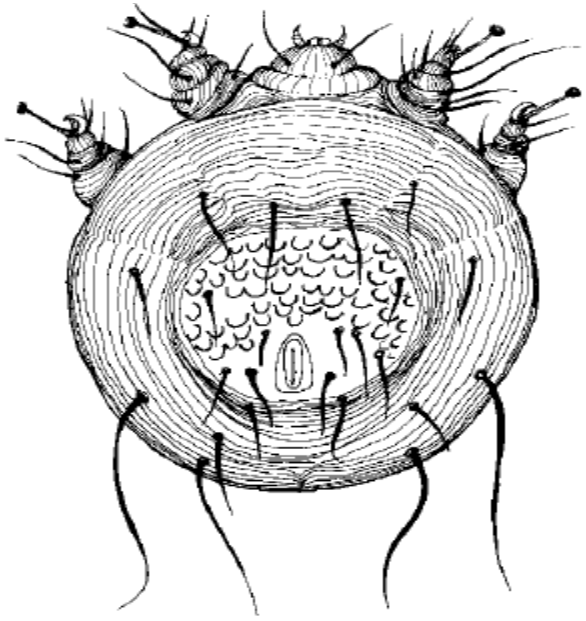


(a)

Sarcoptes scabiei



Notoedres cati

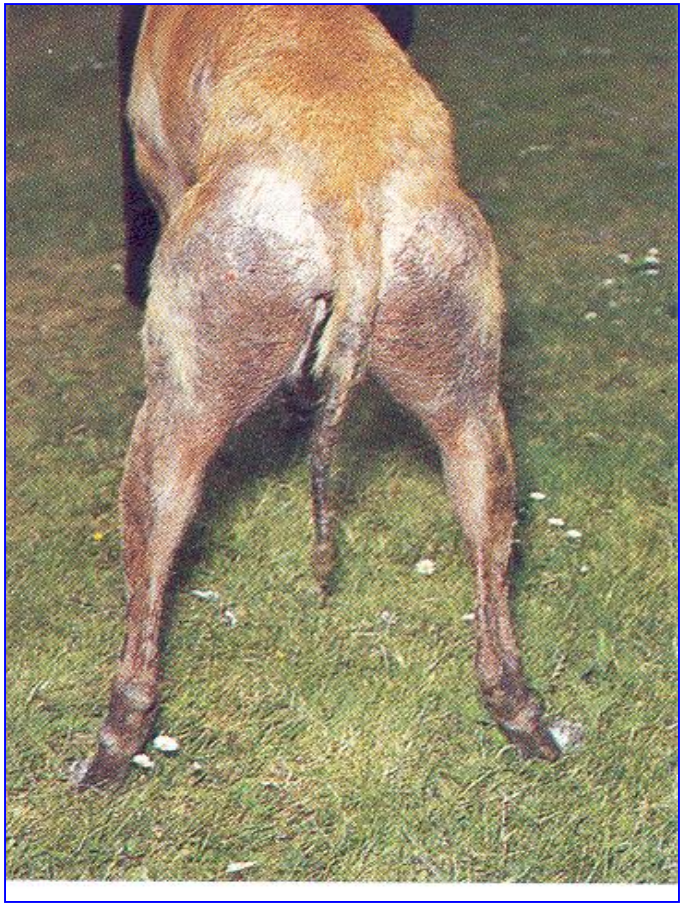


(b)

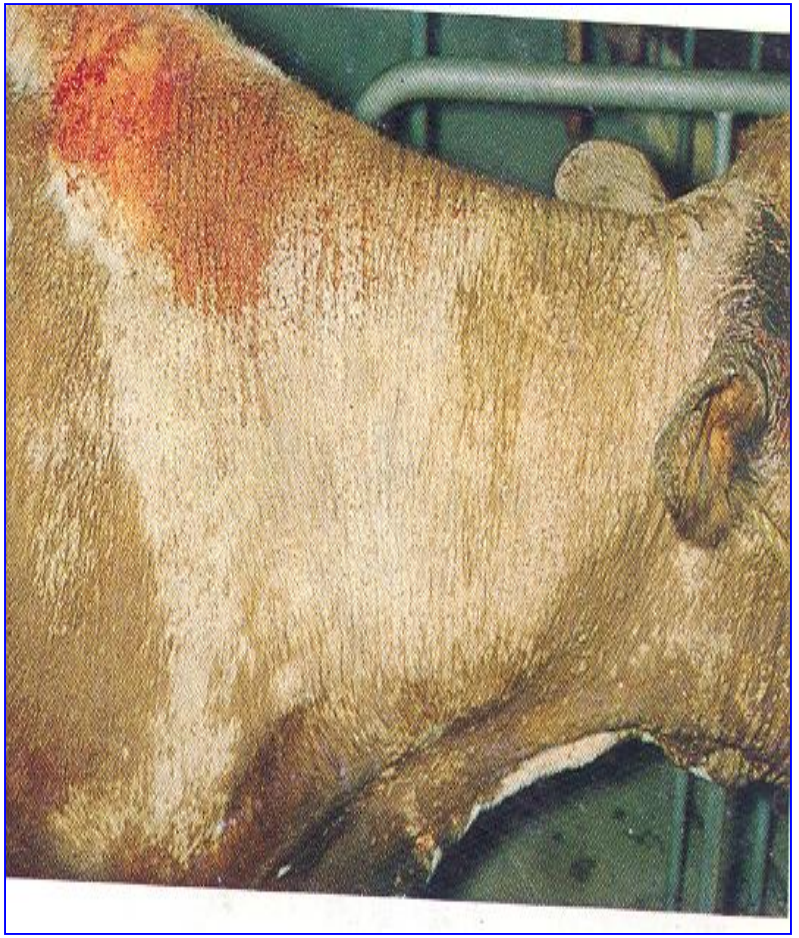
Knemidocoptes

Fig. 137 (a) Dorsal view of *Sarcoptes scabiei* showing transverse ridges and triangular scales; (b) Dorsal view of *Notoedres cati* showing concentric striations; (c) Dorsal view of the poultry mite *Knemidocoptes*.

Dog affected with Sarcoptic mange



Cattle affected with Sarcoptic mange



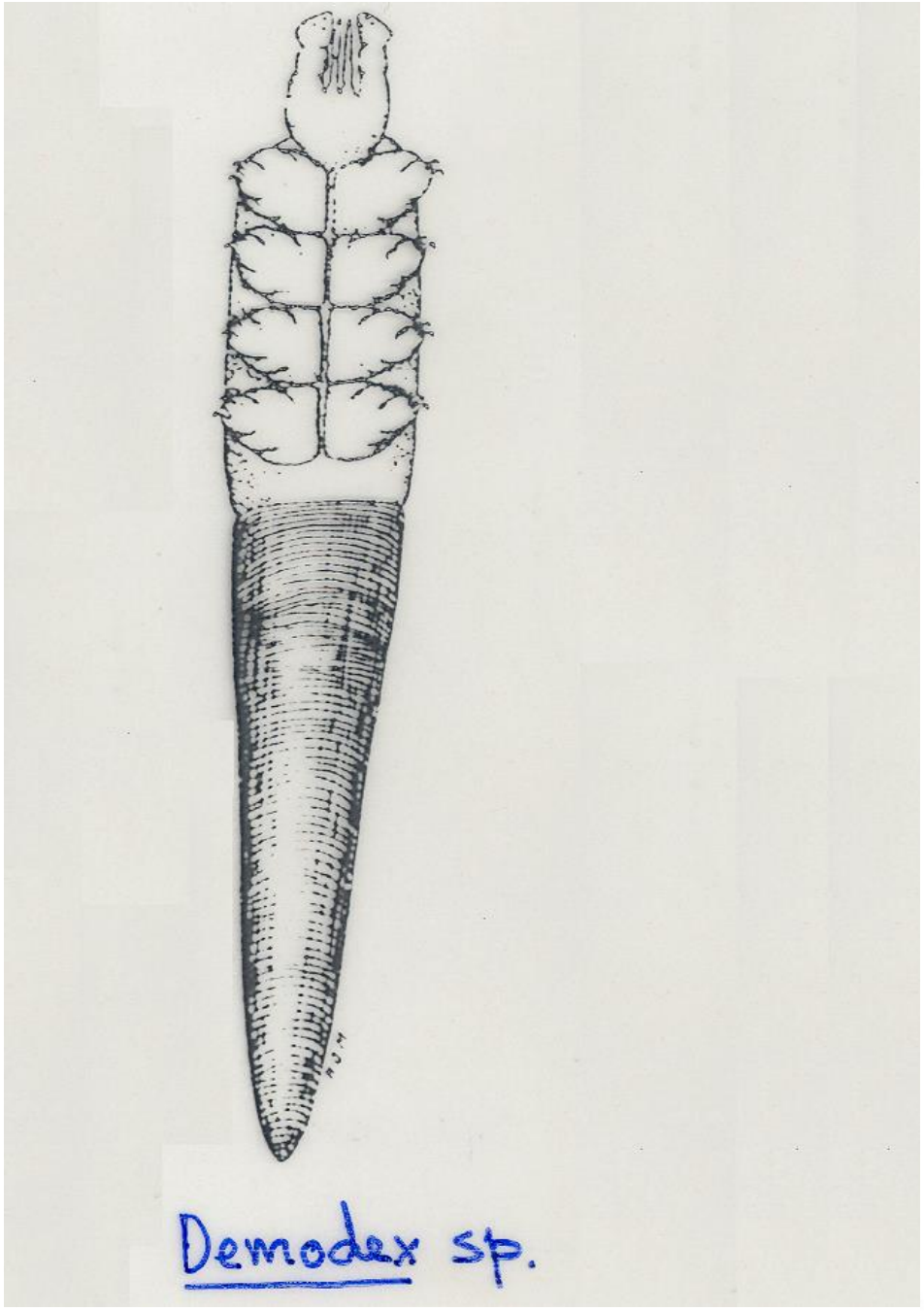
Diagnosis:

Skin scrapping in 10% KOH & look for typical morphology of the mites

Family: DEMODICIDAE

Genus: *Demodex*

- ✓ This is a very specialized group of parasitic mites which live in the hair follicles and sebaceous glands of various mammals causing demodectic or follicular mange.
- ✓ The parasites are elongate, usually 0.25mm long, They have a head, a thorax which bears 4 pairs of stumpy legs and an elongate abdomen.
- ✓ The mouth parts consist of paired palps and cheicerae and an unpaired hypostome.
- ✓ The penis protrudes on the dorsal side of the male thorax & the vulva is ventral in female. The eggs are spindle-shaped.



Demodex sp.

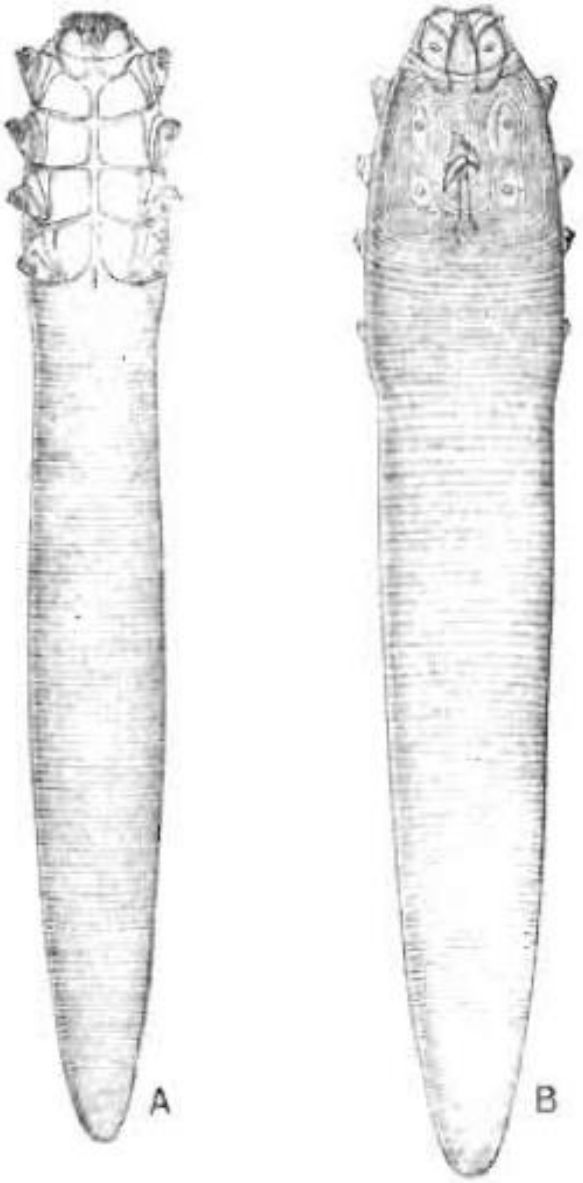


FIGURE 23.17 Human follicle mite, *Demodex folliculorum* (Demodicidae) (A) Female, ventral view; (B) male, dorsal view. (From Hirst, 1919.)

Demodex

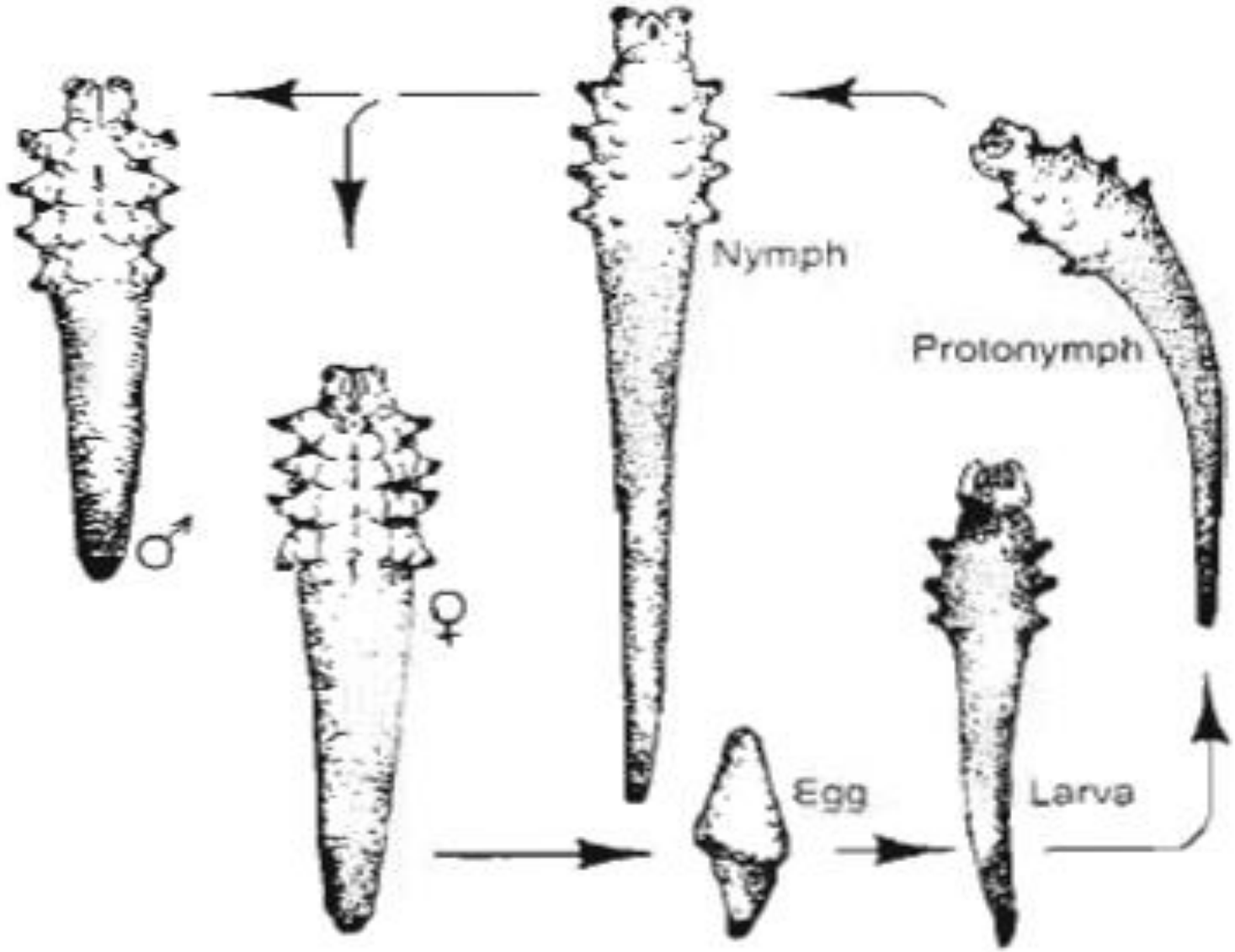


FIGURE 23.18 Life cycle of human follicle mite, *Demodex folliculorum* (Demodicidae). (Modified from Nutting, 1984.)

Family: Demodocidae

Genus: *Demodex*

Species	Host	Location	Morphology	Symptoms/Pathogenesis
D.folliculorum	Man	Hair follicle and sebaceous gland	✓ Elongated tapering body ✓ 0.2 mm long. ✓ 4 pairs of stumpy legs anteriorly	✓ Squamous demodicosis is less serious & is dry reaction. Alopecia, Thickening of skin ✓ Pastular demodicosis is the severe form & follows bacterial invasion. Skin become thickened and wrinkled ✓ It is thought that certain bitches carry a genetically transmitted factor which results in immunodefficiency in their offspring. ✓ *Demodex* itself thought to cause a cell mediated immunodeficiency. This defect disappear when mites have been disappeared.
D.bovis	Cattle			
D.canis	Dog			
D.equi	Horse			
D.phylloides	Pig			

Diagnosis

✓Deep scrapings should be sampled to reach the mites including fold of skin until capillary blood appears.

Familhy Psoroptidae

Three genera of veterinary importance-

1. *Psoroptes-* is a typical non-burrowing mite

- ✓ Oval in outline & Pointed moth parts
- ✓ All legs project beyond the body margin but the 4th pair is exteremly short in males.

2. *Chorioptes*

3. *Otodectes*

Life-cycle:

The female lives 30 – 40 days & lays up to 90 or more eggs

Diagnosis:

- ✓ Should be confirmed by identifying mites from scraping the edges of a lesion placed in warm 10% KOH & examined under microscope

Family Psoroptidae

Genus	Species	Host	Location	Morphology	Symptoms/Pathogenesis
Psoroptes	*P.ovis*	Sheep & cattle	Superficially on the skin	Oval, 0.75 mm With piercing & chewing mouth parts	Intense itching, rubbing, restlessness, weight loss, cease feeding.
	P.equi	Equines			
	P.caniculi	Rabbit & equines			
Chorioptes	*C.bovis*	Cattle, sheep & equines	Superficially on the skin Chewing feeding on scales & skin debris	”	In cattle: Scratching & rubbing. Affected area- Neck, udder, leg, tailroot In horse: Ichy leg In sheep: Wrinkling and thickening of skin. In Newzeeland, Testicular atrophy observed
Otodectes	*O.cynotis*	Dog & cat	Superficially on the skin	”	In dog: Otitis externa Black waxy deposits in ear canal resulting head shaking and ear scrat- -chig cause Haematoma

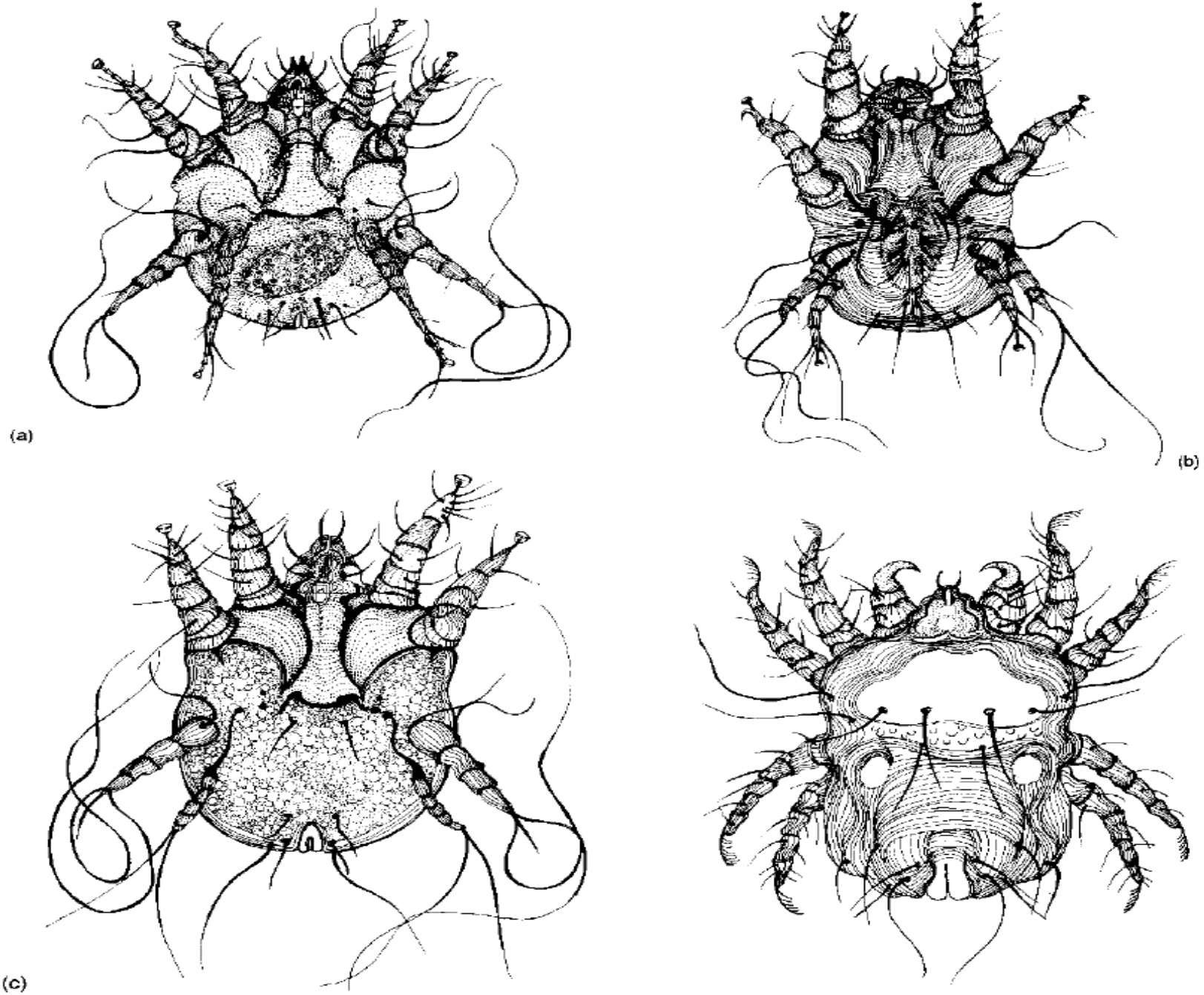
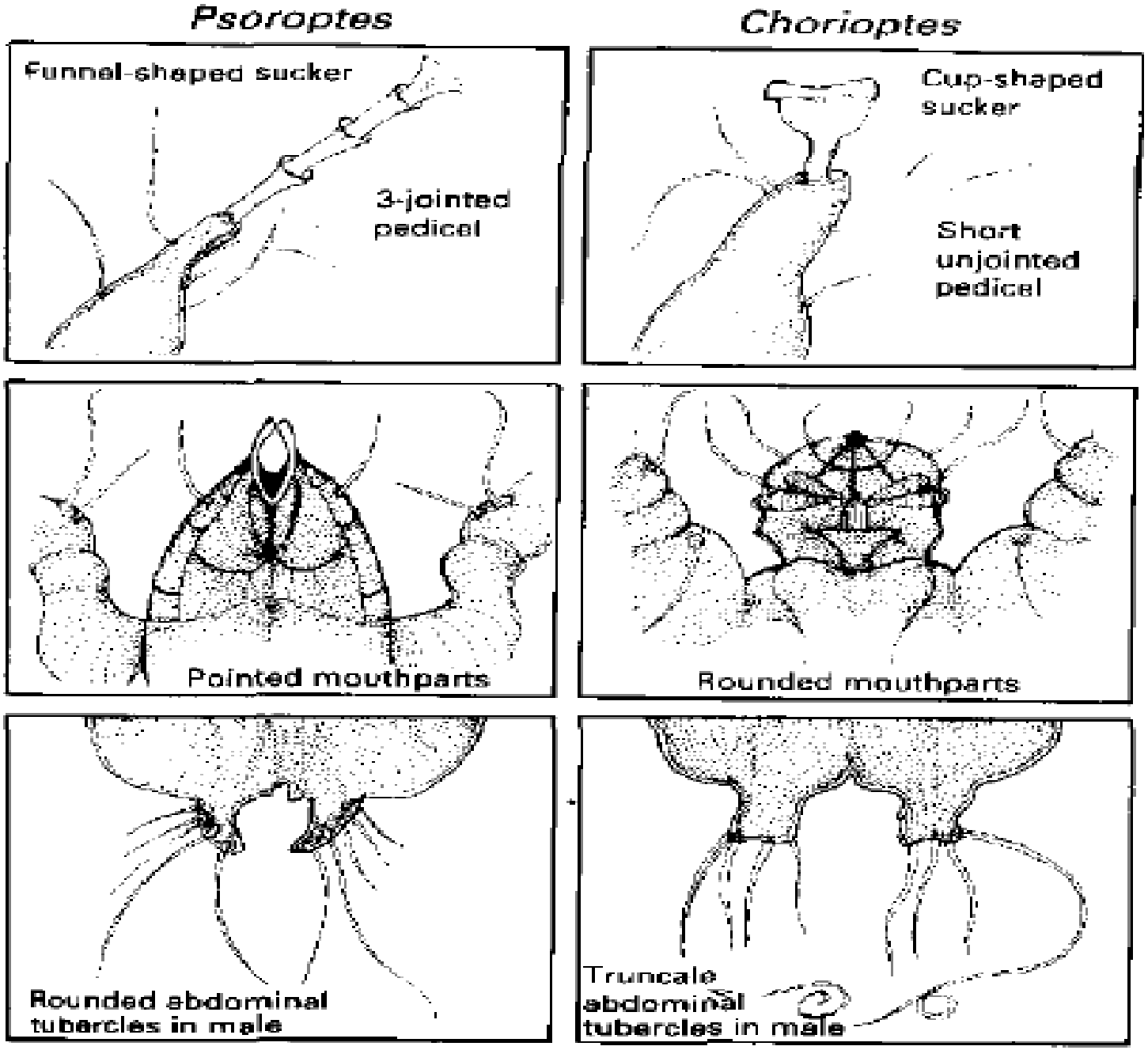


Fig. 140 (a) Ventral view of female *Psoroptes* mite; (b) Ventral view of female *Chorioptes* mite; (c) Ventral view of female *Otodectes cynotis*; (d) Dorsal view of female *Cheyletiella*.


Psoroptes
Chorioptes
Funnel-shaped sucker
3-jointed pedicel
Cup-shaped sucker
Short unjointed pedicel
Pointed mouthparts
Rounded mouthparts
Rounded abdominal tubercles in male
Truncate abdominal tubercles in male

(a)

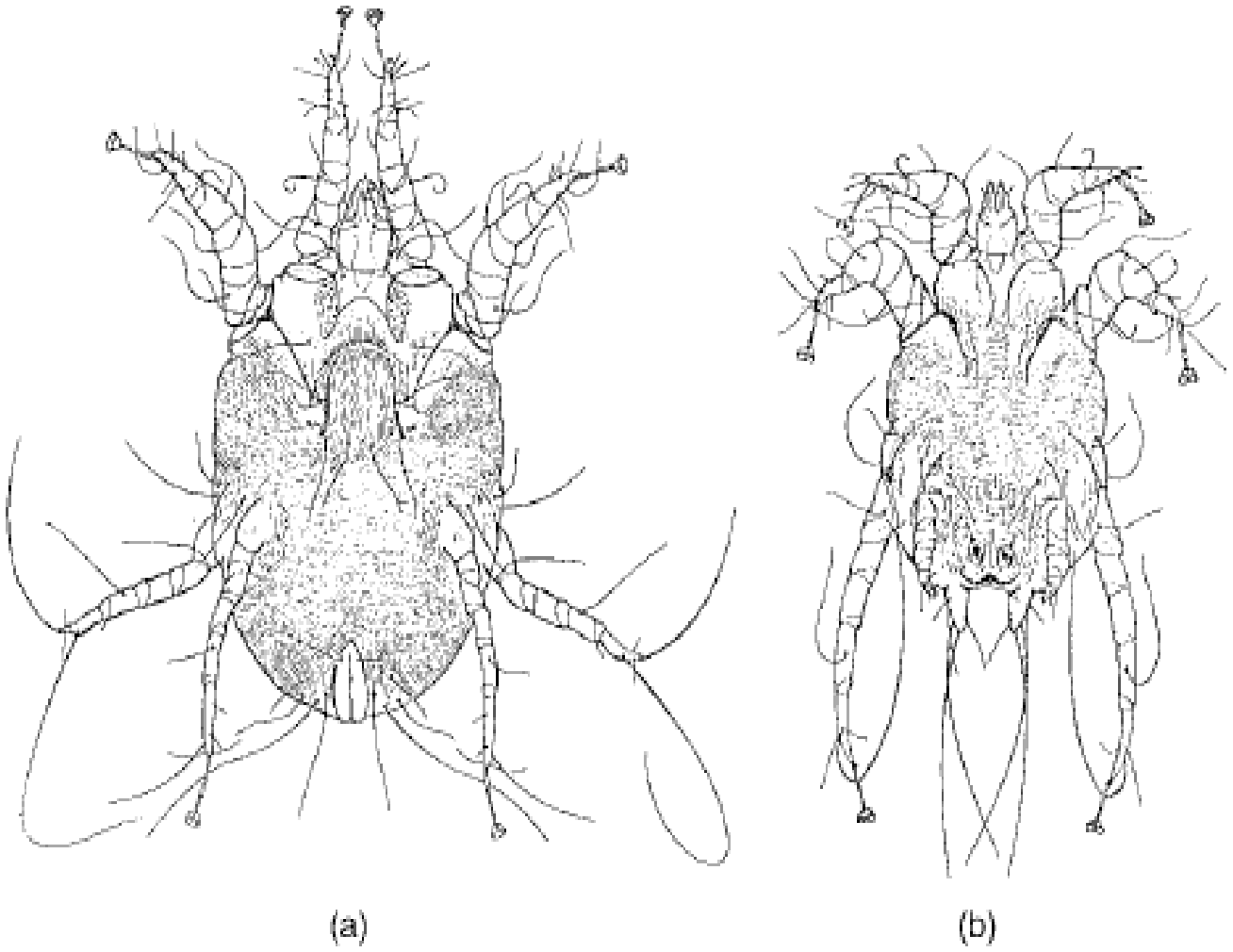
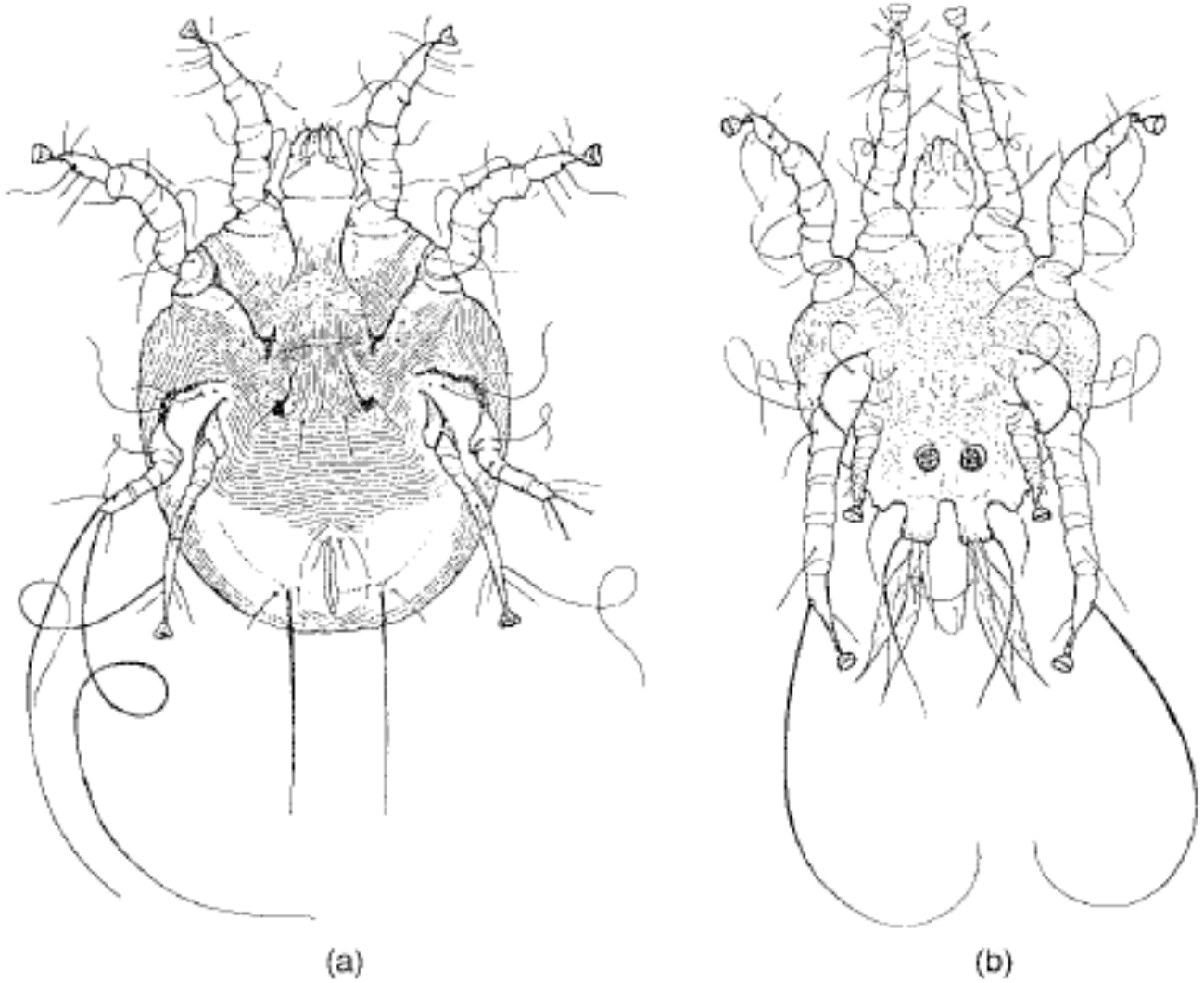


Fig. 2.8 Adult *Psoroptes ovis:* (a) female, ventral view; (b) male, dorsal view (from Baker *et al.*, 1956).



2.9 Adult *Chorioptes bovis:* (a) female, ventral view; (b) male, dorsal view (from Baker *et al*., 1956).

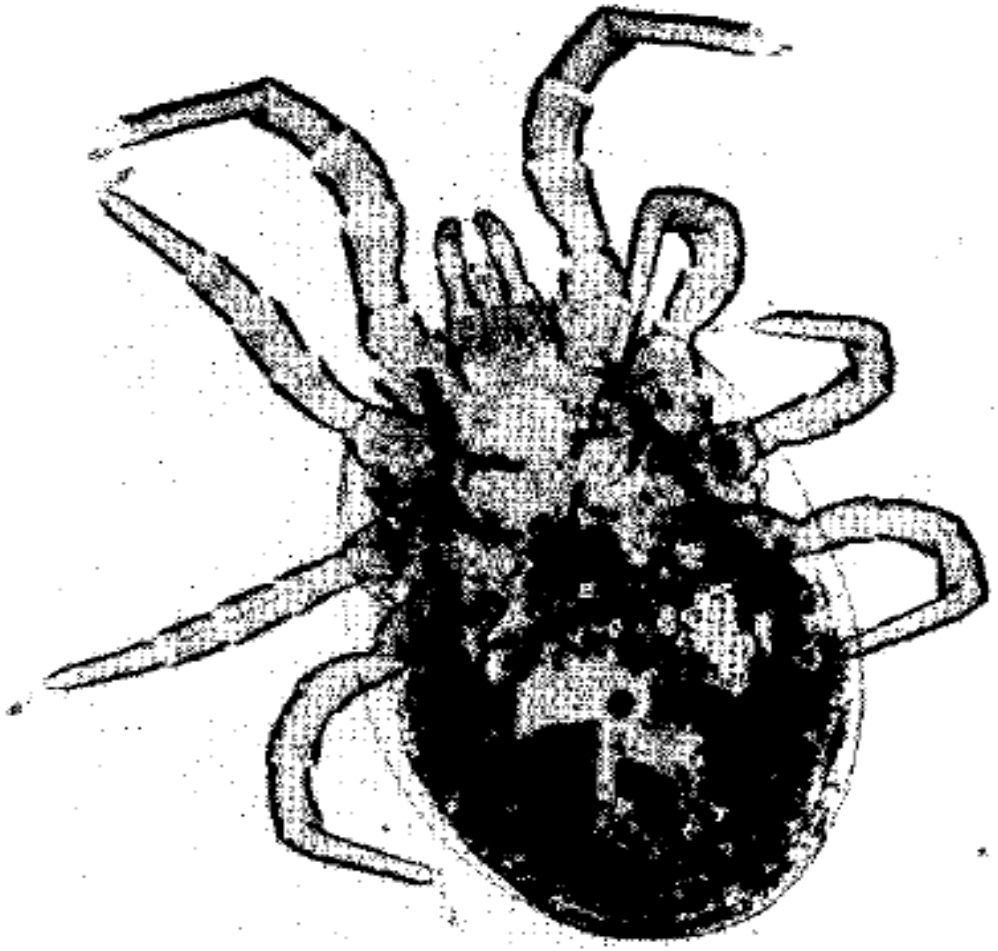


Fig. 143 The poultry 'red mite' *Dermanyssus gallinae*.

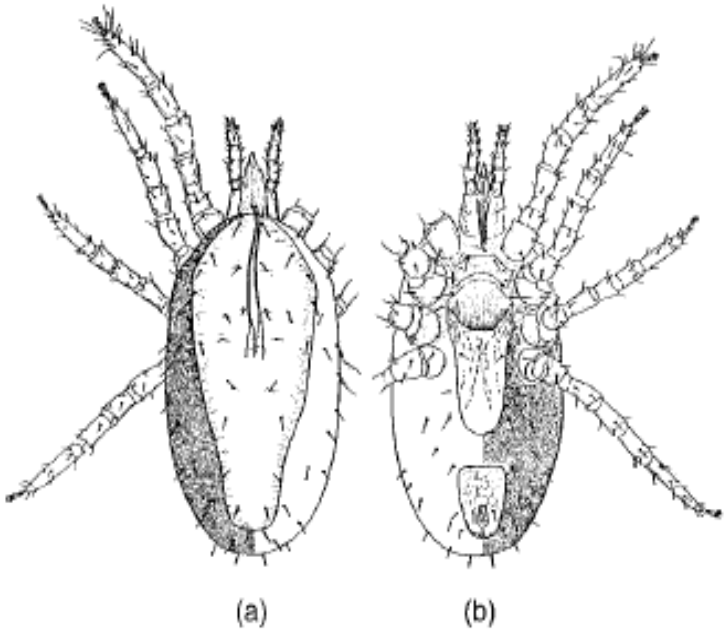
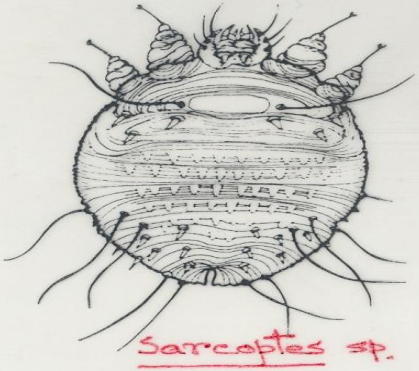
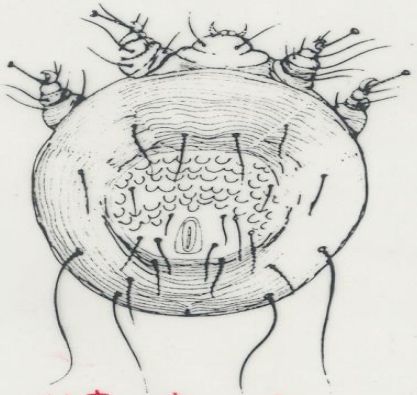


Fig. 2.21 Adult female of the red mite, *Dermanyssus gallinae* (a) dorsal view; (b) ventral view (from Baker *et al*., 1956).

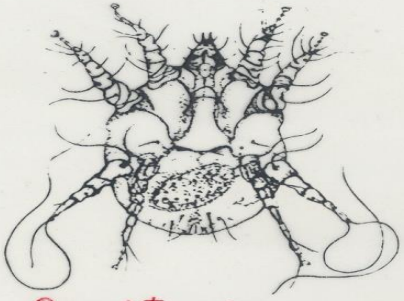


Sarcoptes sp.

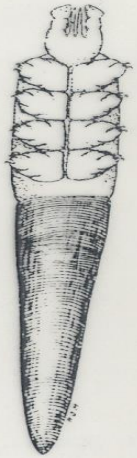
Knemidocoptes sp



Notoedres sp

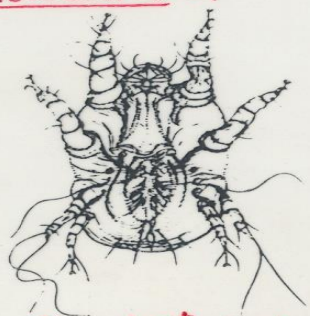


Psoroptes sp.



Demodex sp.

Otodectes sp.



Chorioptes sp.