

Veterinary Parasitology II

Chapter 2: Veterinary entomology

CHAP 2 : VETERINARY ENTOMOLOGY

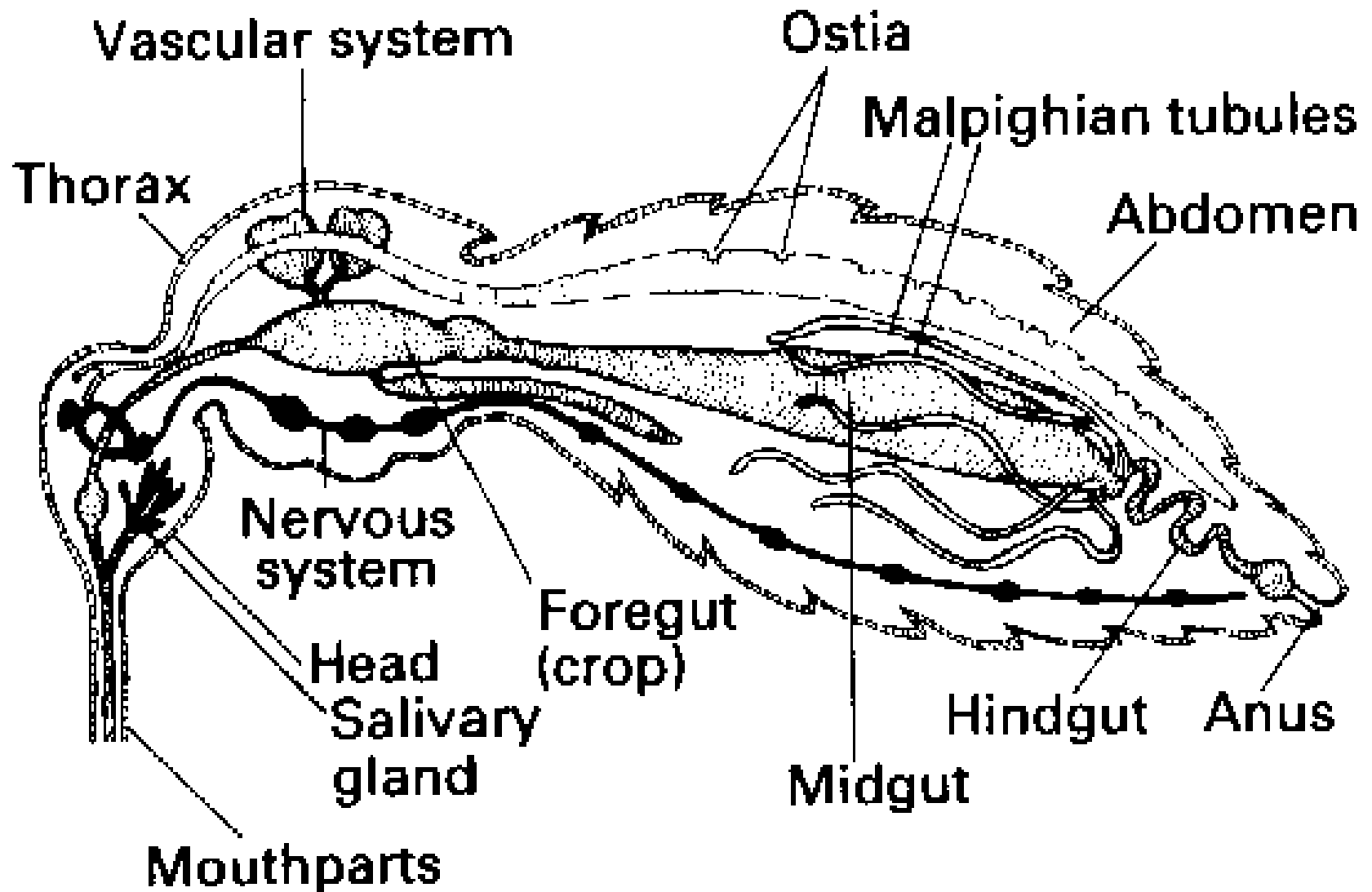
- Is study of insects of veterinary importance
 - including arachnids
- describe the wider study of all arthropods parasite on animal
- It consists of invertebrates
 - hard chitinous exoskeleton
 - a segmented body and jointed limbs

Phylum: Arthropoda (arthros=joint, podos=foot)

- Arthropods contain 80% of all extant, metazoan animal species
- Some arthropods utilize a rich and abundant source of nutrients, the blood (body fluids) of vertebrates
 - Hematophagy:- the habit of feeding on blood
 - increased mobility of disease causing agents
 - more importantly, find and occupy novel vertebrate hosts

Some common features of Arthropoda

- Bilateral symmetry
- Hard chitinous exoskeleton
 - secreted by underlying epidermis
- with jointed legs
- Growth by molting---controlled by hormones
- Complete digestive tract from mouth to anus
- Nervous system
 - anterior & ventral ganglia
- Metamerism or Tagmatization(true segmentation)
- Haemocole -→ body cavity--→open type of circulatory system



Importance

- Intermediate hosts for various parasites
 - Vectors for bacteria, viruses, protozoa and other pathogens
- Direct causal agents of disease
- Produce venoms that may be toxic

Ectoparasite damage

- result of their activity, may have a variety of direct and indirect effects on their hosts

Direct harm

A. Blood loss

- individual ectoparasite only removes a small volume of blood
- in large numbers the blood removed by feeding
 - debilitating and anaemia is common in heavily infested hosts.

B. Myiasis: - the infestation of the living tissues with fly larvae

- direct damage to carcasses or skin

C. Skin inflammation and pruritus:

- skin infestation by arthropod activity cause pruritus (itching, often accompanied by hair loss(alopecia)
- by skin thickening(lichenification).

D. Toxic and allergic responses

- antigens and anticoagulants in the saliva of blood feeding arthropods

Indirect harm

- The behavior of ectoparasite , particularly when they are present at high density

A. Disturbance

- the irritation caused, by flies as they attempt to feed or ovoposit
- results in a variety of behaviors
 - head shaking, stamping, skin twitching, tail switching or scratching

B. Self-wounding

- dramatic avoidance responses in the intended host, known as gadding
- stamping animal may inflict serious self injury following collision with fences and other objects

C. Vector role

Classification of phylum Arthropoda

Two major classes

1. Class Insecta

- 3 pairs of legs
- the head, thorax and abdomen are distinct
- have a single pair of antennae

2. Class Arachnida

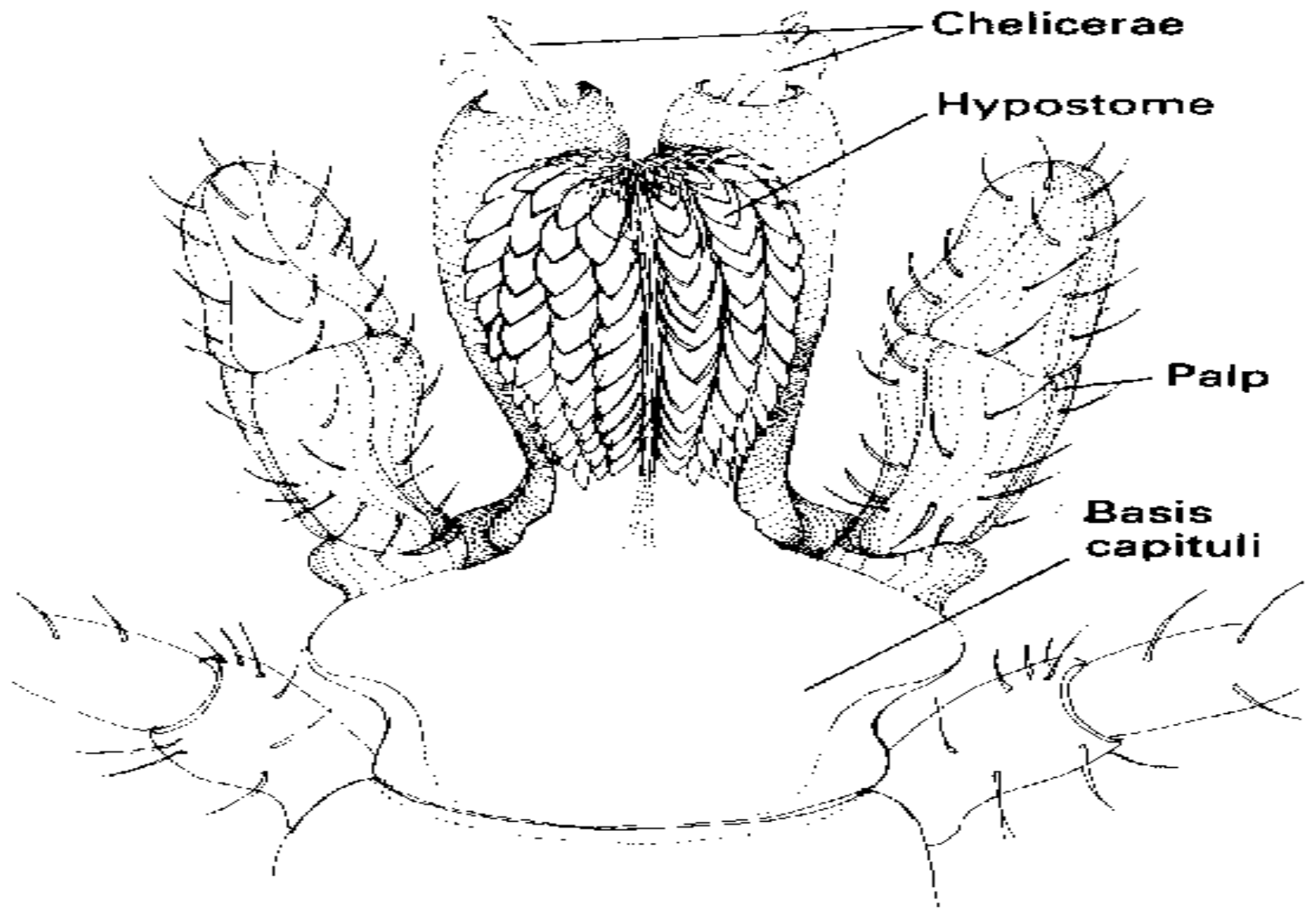
- adults have four pairs of legs
- body is divided into a cephalo-thorax and abdomen
- there are no antennae

CLASS: ARACHNIDIA

- Has 4 pairs of legs
- Body is divided into cephalo-thorax & abdomen
- Lack antennae
- Ticks & mites-----→ Acarines of vet. Importance

• TICKS

- the basis of their mouth capituli (gnathosoma)
 - Pair of chelicerae with mobile digits for cutting
 - Pair of sensory palps
 - Ventromedially has unpaired hypostome with recurved teeth



Two families

1. Family Argasidae (soft ticks)

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



2. Family Ixodidae

General Distinguishing Features

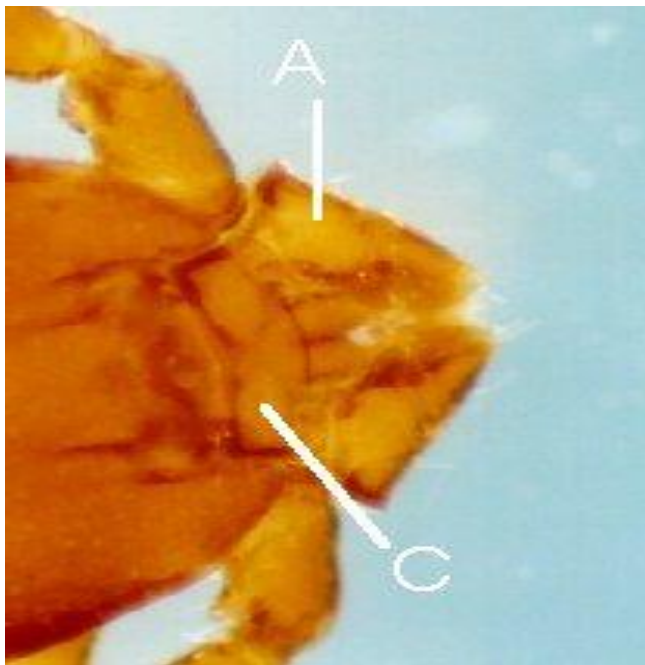
- Chitinous covering or scutum (sclerotized dorsal shield or plate)
 - whole dorsal surface of the male
 - $\frac{1}{3}$ - $\frac{1}{8}$ of the body behind the head in the larva, nymph & female
- Mouth parts carried on the capitulum are anterior & visible from the dorsal surface



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A. Capitulum

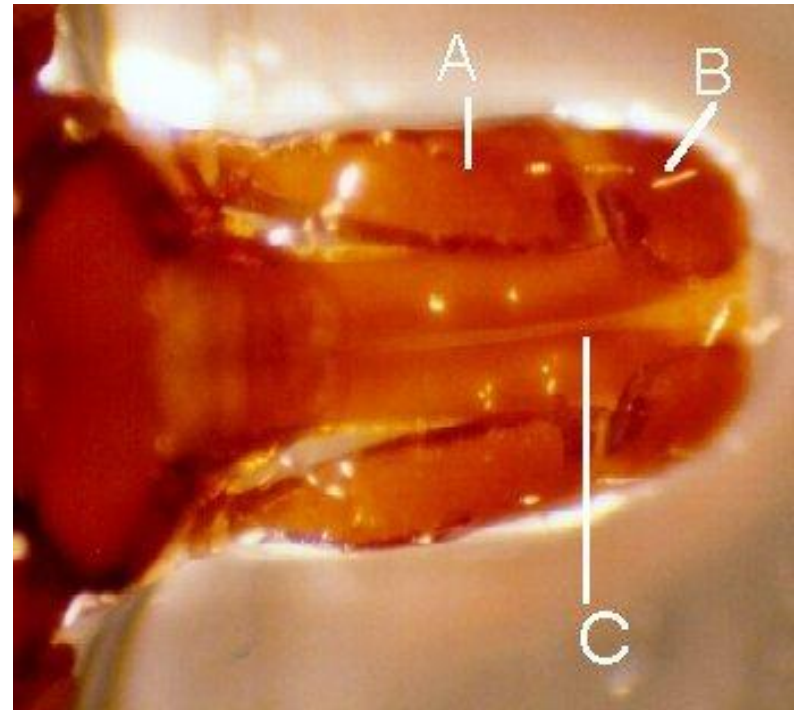
C. Basis capituli



A. Article II of palpi

B. Article III of palpi

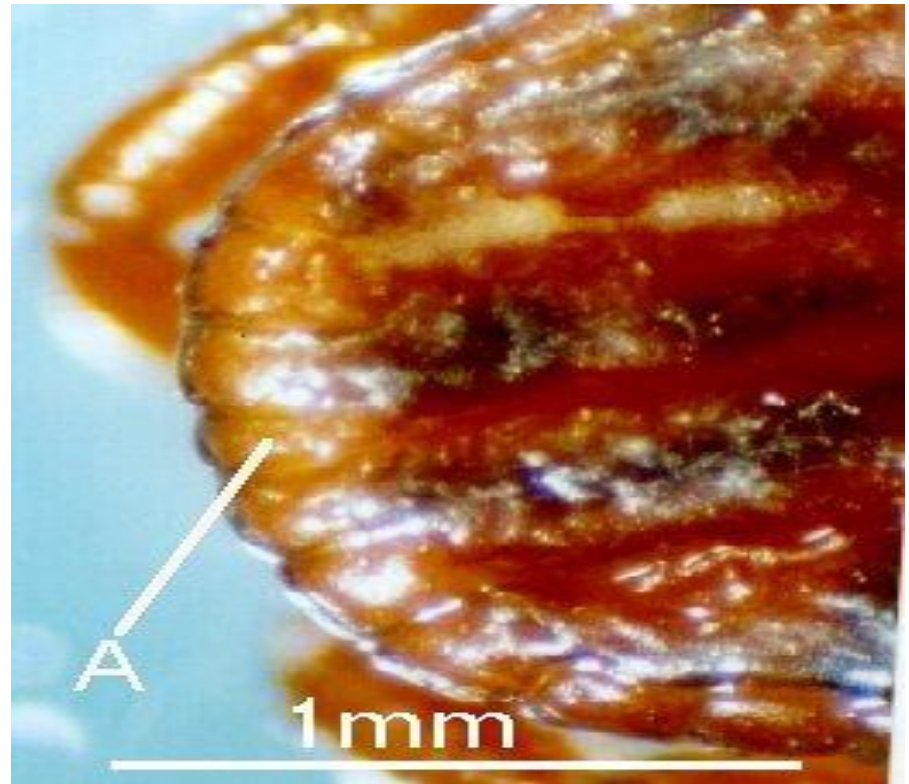
C. Hypostome



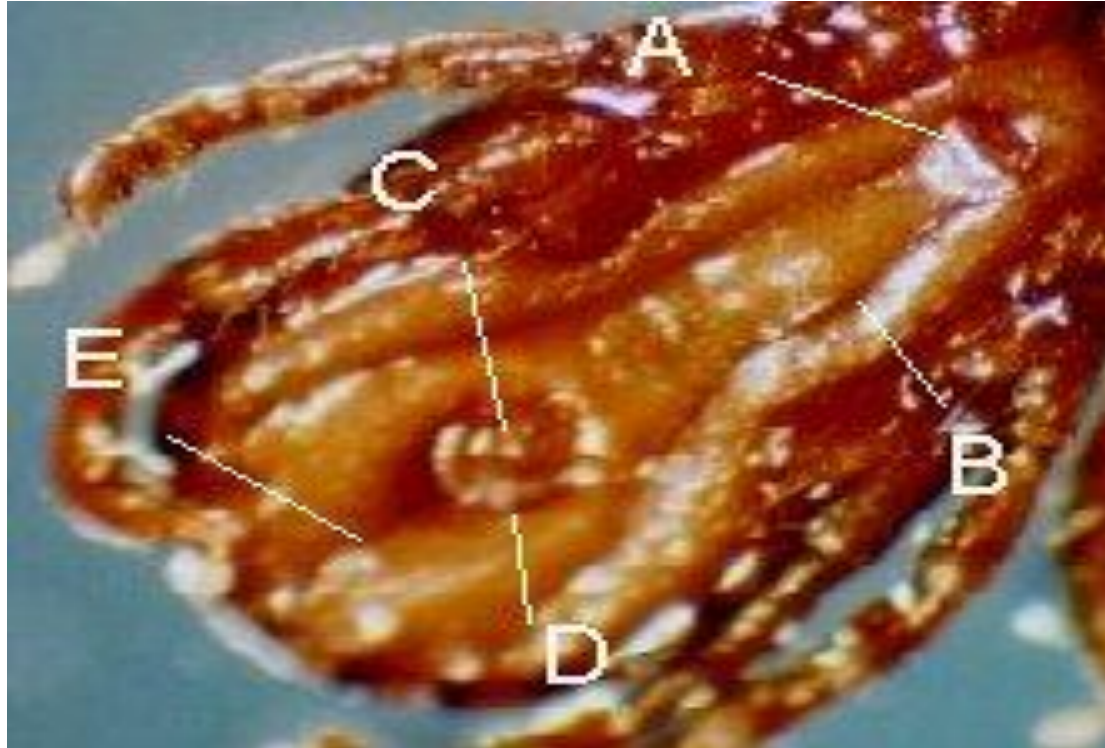
- Series of grooves on the scutum & body
- in some species, A row of notches (uniform rectangular regions) on the posterior border of body called *festoons*
- Chitinous plates on the ventral surface of males sometimes present
- Genital opening is on the ventral mid-line at the level of 2nd pairs of legs
 - Anus is located posterior to it.



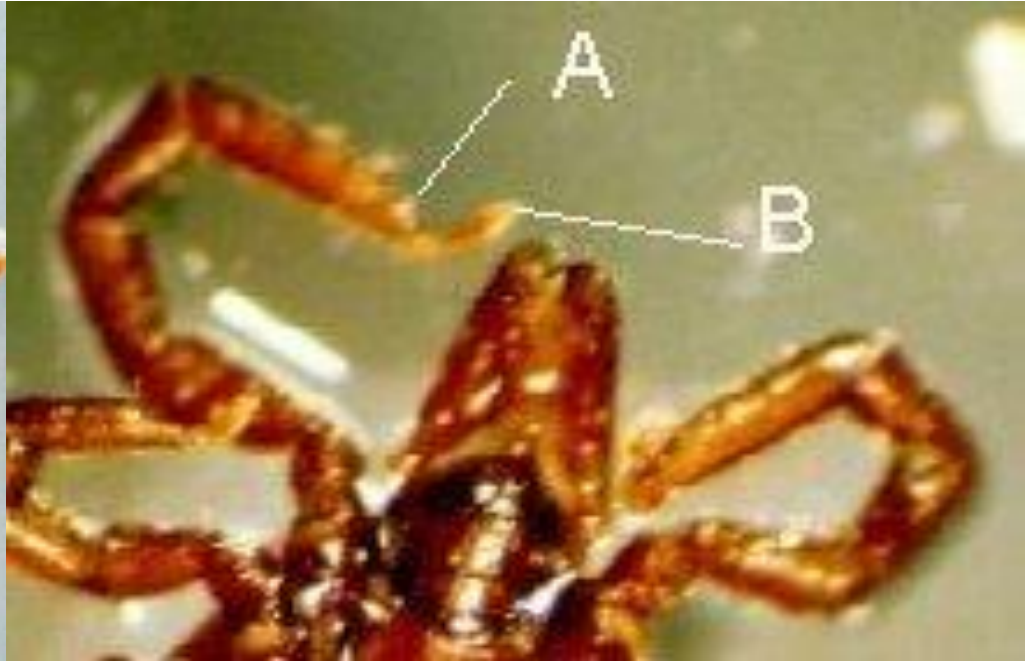
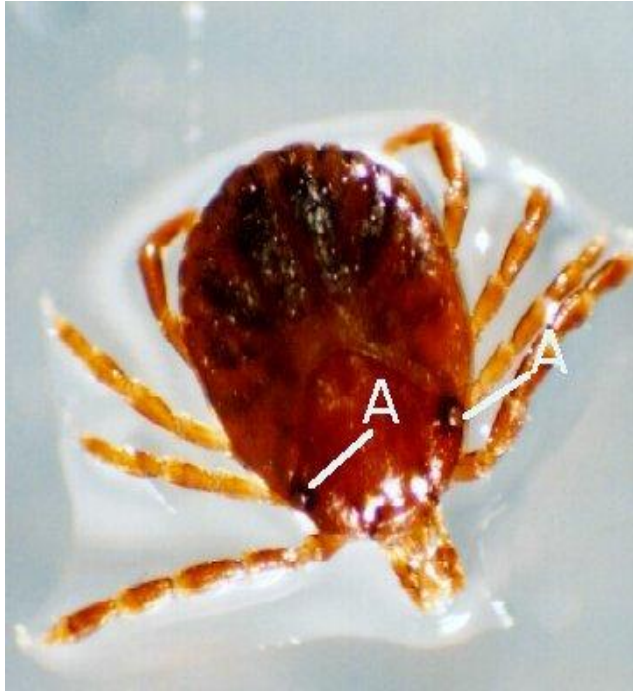
A. Anal groove
B. Anus



A. Festoons



- A. Genital apron
- B. Genital groove
- C. Anus
- D. Anal groove
- E. Postanal median groove



A. Pulvilli

B. Claws

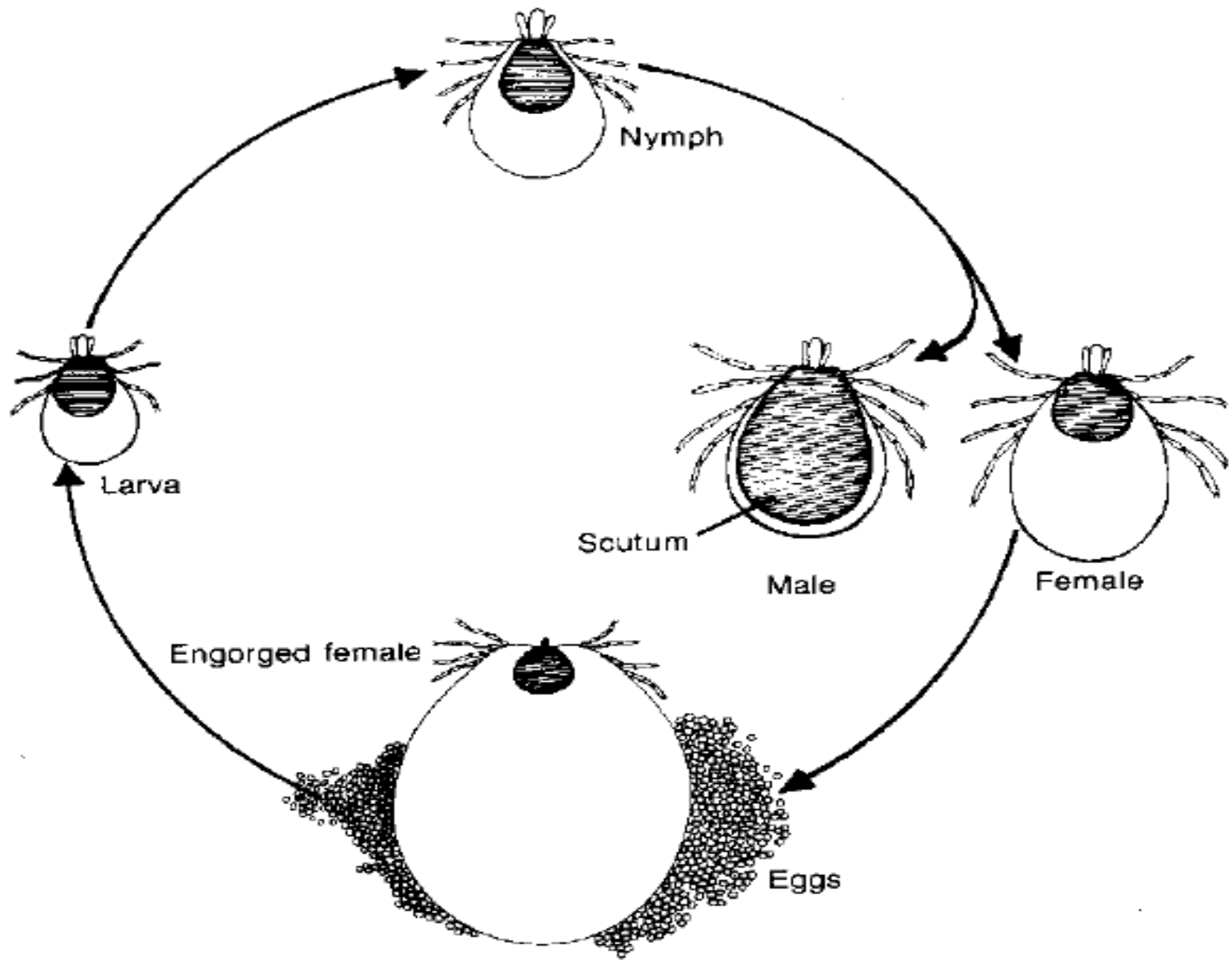
- In some genera colored enamel-like areas (pattern of gray & white on a dark background)
 - on the body & are called “**ornate ticks**” E.g. Amblyomma.
 - lacking are called “**inornate ticks**”
- Eyes.....dorsal surface on the lateral margin of the scutum.
- Are temporary parasites
 - spend relatively only for short periods on the host
- The number of hosts, they attach during their parasitic lifecycle varies from one to three

- **One-host tick**--→larvae to adult development occurs on 1 host
 - Eg. all species of the genus *Boophilus*
- **Two-host tick**---→larvae-----→nymph occurs on one host.
 - Eg. Some species of *Hyalomma*.
- **Three-host tick**---→each stage of development takes place on different hosts
 - Eg all species of the genus *Amblyomma*
- All stages feed on blood & tissue fluids of animals
- Males don't increase much in size after feeding
- females are engorged with blood till legs are useless
- 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
 - important for planning control programs & disease epidemiology
- many genera of Ixodidae ticks occurring worldwide
 - 5 exists in Ethiopia
 - Genus Amblyomma,
 - Genus Hyalomma,
 - Genus Boophilus,
 - Genus Rhipicephalus
 - Genus Haemaphysalis

Life Cycle

- Simple metamorphosis with larval and nymphal stages resembling adults
- Separate sexes with females laying eggs off the host
- Larva (six legs, no reproductive organs) hatches, feeds on host and molts to nymph.
- Nymph (eight legs, no functional reproductive organs) feeds on host and molts to another nymph (soft ticks) or adult (hard ticks).
 - Soft ticks have two or more nymphal stages
 - hard ticks have only one
- adult hard ticks feed on blood whereas not all adult soft ticks do
- Soft ticks
 - live inside (burrows, dens, hutches, etc.)
 - feed rapidly, and spend relatively little time on the host
- Hard ticks
 - live outdoors, feed slowly
 - spend longer time on the host



Control of Ticks

- Tropical ticks may be active throughout most of the year
- One host ticks
 - treatment every 21 days during the tick season by Acaricides.
- Two & three-host ticks
 - from 4-10 days treatment by Acaricides
- But development of resistance to most available acaricides poses threat to livestock production

MITES

- Smaller than ticks & have same body plan
- parasitic or free living
- free living are LH of **Anoplocephala Cestodes**
- parasitic species spend their entire life cycles on the host
- mite infestation in animals is called acariasis and can result in severe dermatitis known as Mange or scabies
- Mange is a deterioration of the skin's condition (pathology) leading to hair or feather loss, a rash, skin discoloration (inflammation) and in severe cases lethargy and weakness
- Broadly divided into two
 - Burrowing Mites
 - Non- Burrowing Mites

Burrowing Mites

Family: Sarcoptidae

Genus: Sarcoptes

Notoedres

Knemidocoptes

Family: Demodecidae

Genus: Demodex

Family Sarcoptidae

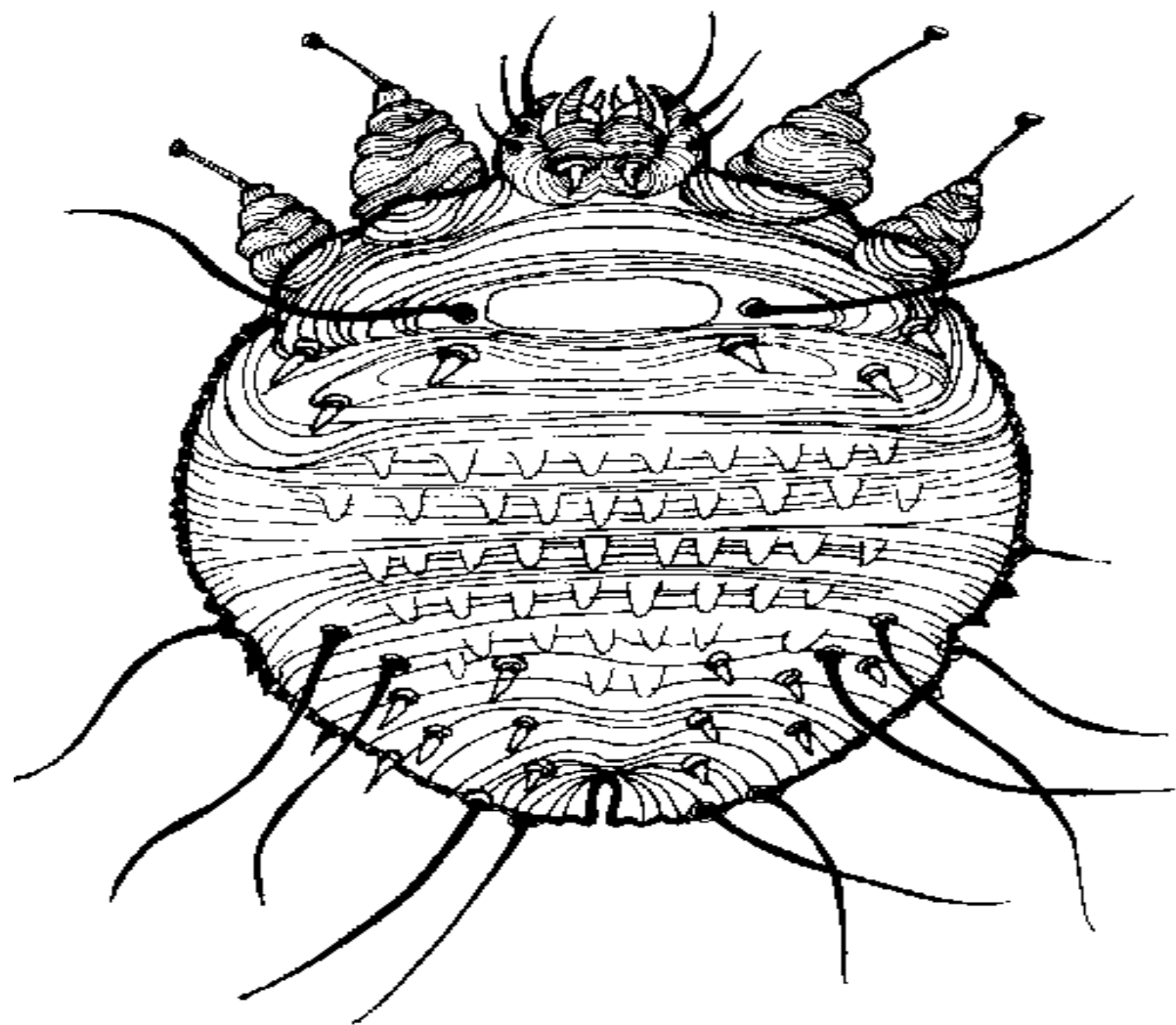
- Have circular outline
- Very short legs
 - 3rd & 4th pairs of legs don't project beyond the body margin
- Long unsegmented pedicle with a sucker on end of some legs.

Genus Sarcoptes

- Only one species called *S. scabiei* that evolved to become a Variety in different animal species
- Eg. *Sarcoptes scabiei var caprae* in goat, *S. var cameli.....camel*
 - *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

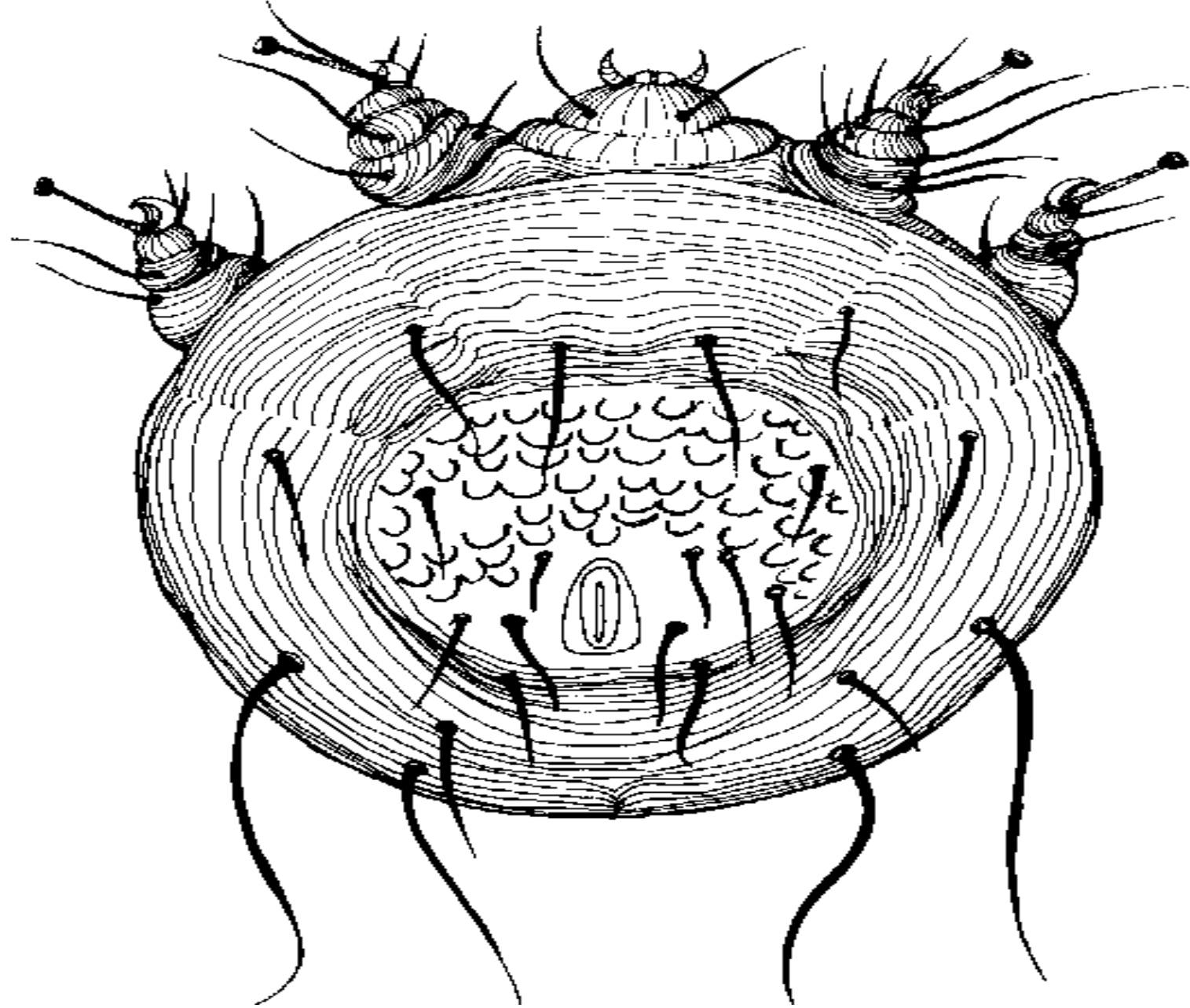
Morphology

- 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



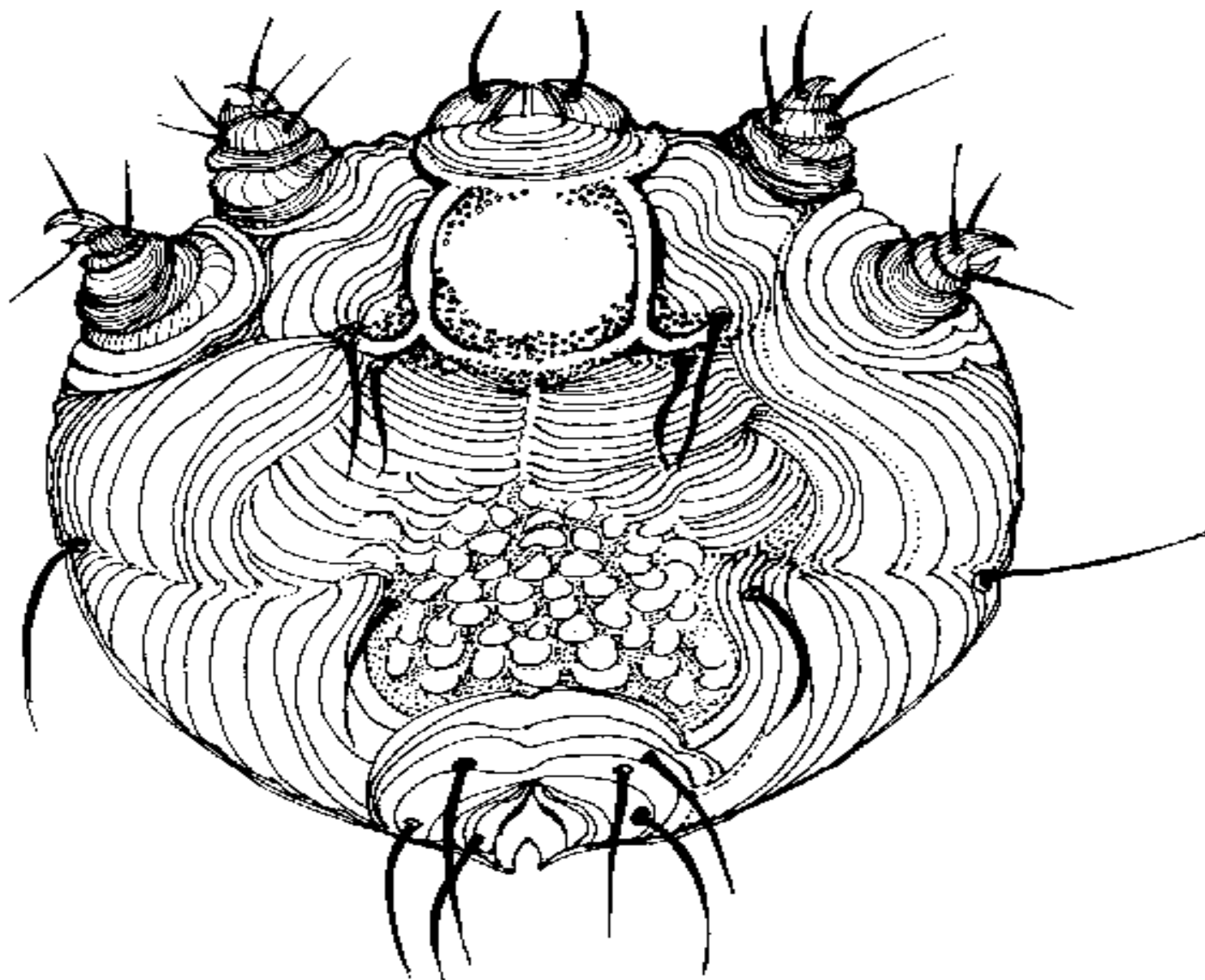
2. Genus Notoedres

- Anus is dorsal & smaller in size
- Circular outline & short legs
- Has concentric “**thumb print**” striations
- Don’t have spines on the body
- Host---→ cat, dog (temporary), rabbits (severe strain in the face & heads)
- Species-----→ *N. cati*

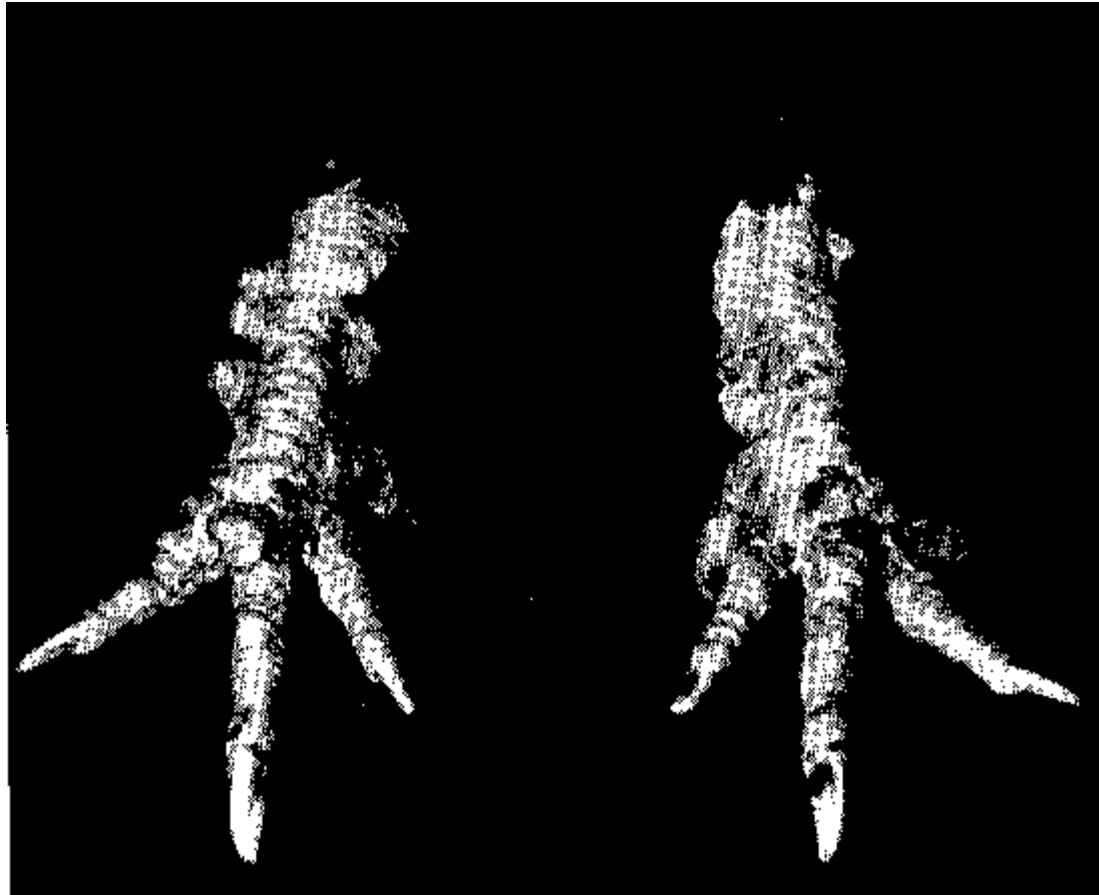


3. Kinemidocoptes (Cnemidocoptes)

- Is the only burrowing genus of domestic birds
- Hosts are poultry & cage birds
- Important species are:
 - *K. mutans*-----→poultry---→scaly leg
 - *K. gallinae*-----→poultry----→"depluming itch"
 - *K. pilae*-----→cage birds---→scaly face, tassel foot
- For generic diagnosis being avian hosts is sufficient



(c)



Life cycle of Family Sarcoptidae

- Most mites spend their entire lives in intimate contact with the host
- Fertilized females create burrow (tunnel) in the upper layer of epidermis & lay their eggs
- produce large eggs small six legged larva hatches
- larvae crawl on to skin surface then burrow into superficial layer
- Larvae moults to an eight lagged nymph
- may be three nymphal stages
 - protonymph, deutonymph and tritonymph
- nymph becomes an adult
- Larvae----→nymph-----→adult-----→in the moulting pockets
- Adult males emerge & seek females in the moulting pockets or on skin
- Transmission from host to host is primarily by physical contact.
- High temperature and sun light favor mange mite infestation.³⁷

Pathogenesis:

- Burrowing & feeding activity of the mites is responsible for pathogenesis.
- Skin piercing----→irritation---→intense itching & scratching----→inflammation---→excessive keratinization & proliferation of tissues
- accompanied by secondary bacterial complication may cause severe dermatitis

Clinical signs:

- Body parts with sparse hairs like face, ears, hock, elbow, muzzle, tail root, head, neck, sacral region & back are most preferred.
- Irritation, biting & scratching, excessive thickening of the skin

Diagnosis:

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

Treatment:

- Acaricides like diazinon, trichlorphon, organophosphates, amitraz
- Ivermectin

- Sarcoptic mange usually starts on relatively hair less part of the skin and may later generalized.
- The course of this mite infestation is more acute than other mange mites in that they involve the entire body surface in short period



Genus: Demodex

burrowing mite cause demodicosis

Host: all domestic mammals & man

Species:

D. phylloides-----→ pigs

D. folliculorum-----→ man

D. canis-----→ dog

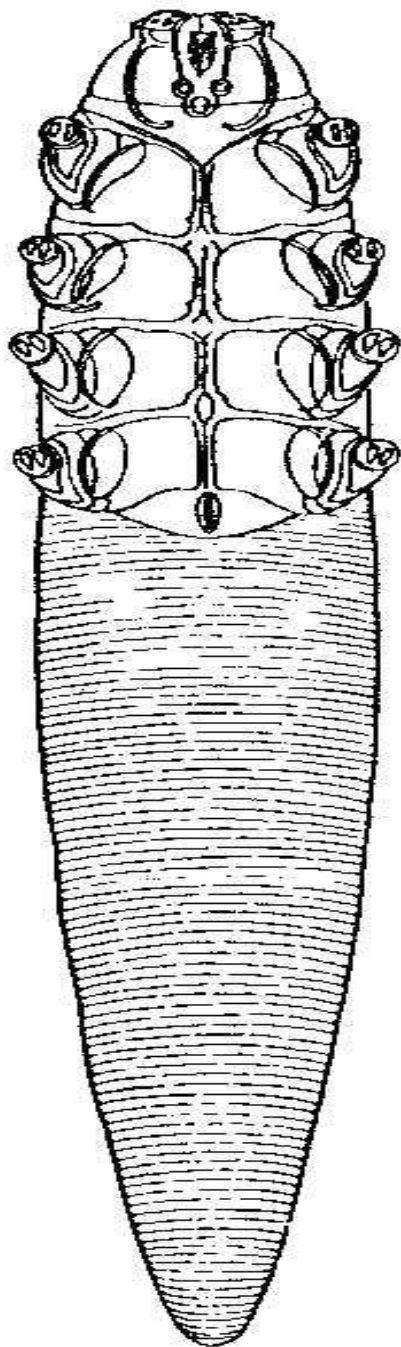
D. bovis-----→ cattle

D. equi-----→ equine

Site: hair follicles & sebaceous gland

Morphology

- Elongated tapering body & the abdomen is transversely striated on the dorsal & ventral surfaces.
- Has 4 pairs of stumpy legs anteriorly & looks cigar with legs or alligator (crocodile like) tapered body.





- Setae are absent from the legs& body.
- Live as commensals in the skin
- Found in large numbers in the follicles or glands
- less accessible to surface acting acaricides
- Transmission is during suckling
- Causes formation of many pear-sized nodules
 - containing caseous material
 - several thousand mites
- Common in cattle and dog but rare in sheep, pig, horse & cat
- First affect body parts like muzzle, face, perorbital region & forelimbs

Clinical signs

- All types of demodectic mange lack pruritis
- Generalized demiodicosis can be squamooous, pustular or follicular type.
- **Scaly form** causes loss of hair, thickening & wrinkling of skin.
- **Pustular form** causes development of pustules due to concurrent bacterial infection
 - Causes cell-mediated immunodeficiency-----→suppress normal T-lymphocyte response

- In dogs cause immunosuppression
 - concurrent infection with *Staph. Pyoderma* & *Staph. intermedius*

Diagnosis

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

Demodectic mange of Dogs

- If the lesions spread over the entire body it may take one of two forms
- Squamous demodicosis- less serious
 - is a dry reaction, with little erythema, wide spread alopecia desquamation and thickening of the skin
- Pustular or follicular demodicosis
 - the severe form, and follows bacterial invasion of the lesions
- A notable feature of all types of Demodectic mange is the absence of pruritus
- The pathogenesis of Demodex is more complex than that of other Mangelmites
 - b/c immune factors play a large part in its occurrence and severity





Diagnosis:

- Deep scrapings are necessary to reach the mites deep in the follicles and glands
- Treatment: Repeated treatment is necessary

Demodectic mange of cattle

- It is characterized by
 - formation of many pea-sized nodules
 - containing caseous material
 - several thousand mites that cause hide damage and economic loss
- Transmission occurs during the early days of suckling
- The muzzle, neck, withers and back are common sites.



11. Non-burrowing Mites

Families: Psoroptidae, Cheyletidae, Dermanyssidae

- Not burrow into dermis
- Only feed superficially
- Some feed solely on the skin
- Few suck tissue fluid from skin

Family Psoroptidae

Genus *Psoroptes* _ is a typical non-burrowing mite

- Host-----→sheep, cattle, equines

Species:

- *P. ovis*-----→sheep & cattle
- *P. equi*-----→equines
- *P. cuniculi*-----→equines & rabbits

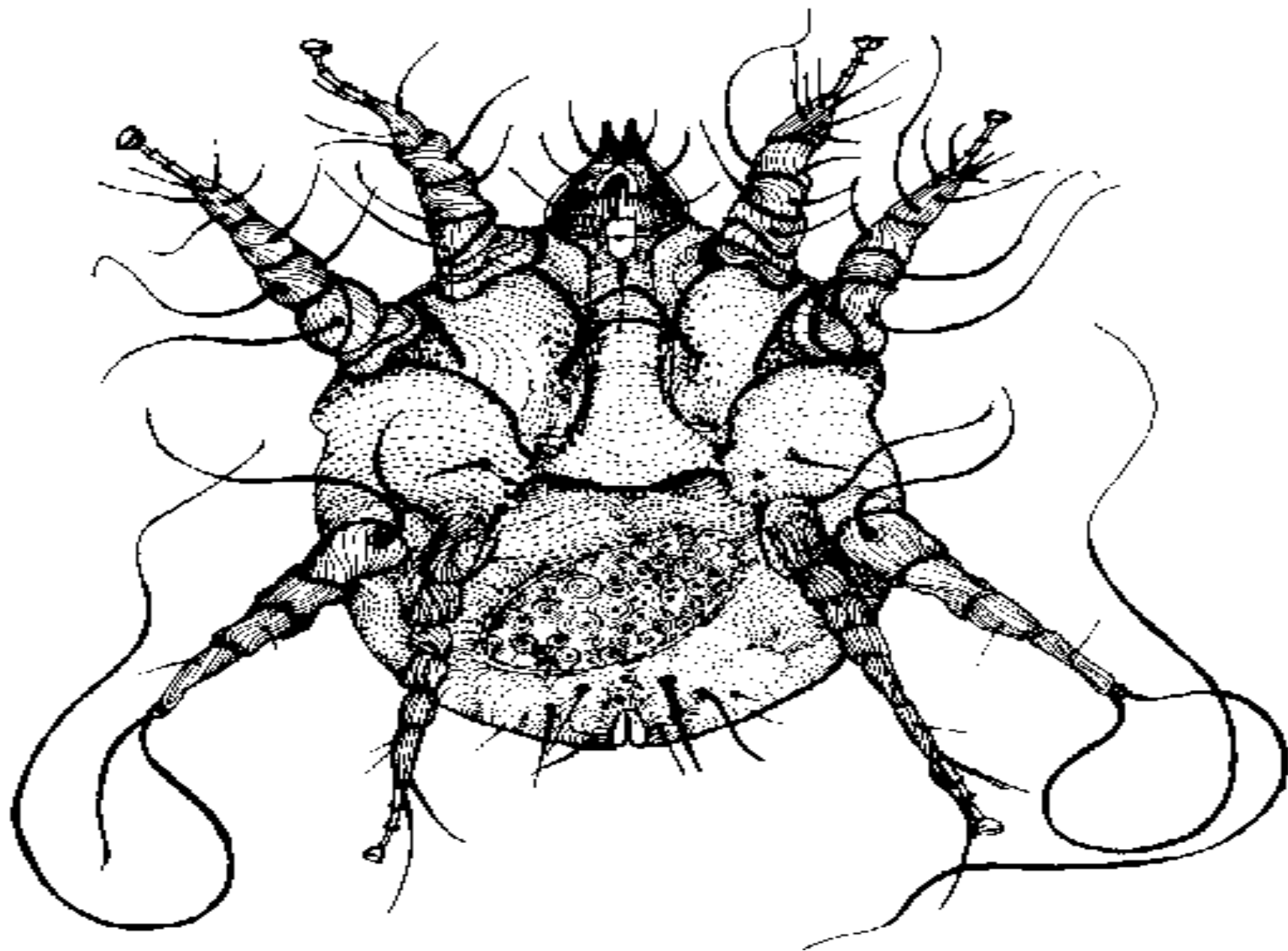
Morphology

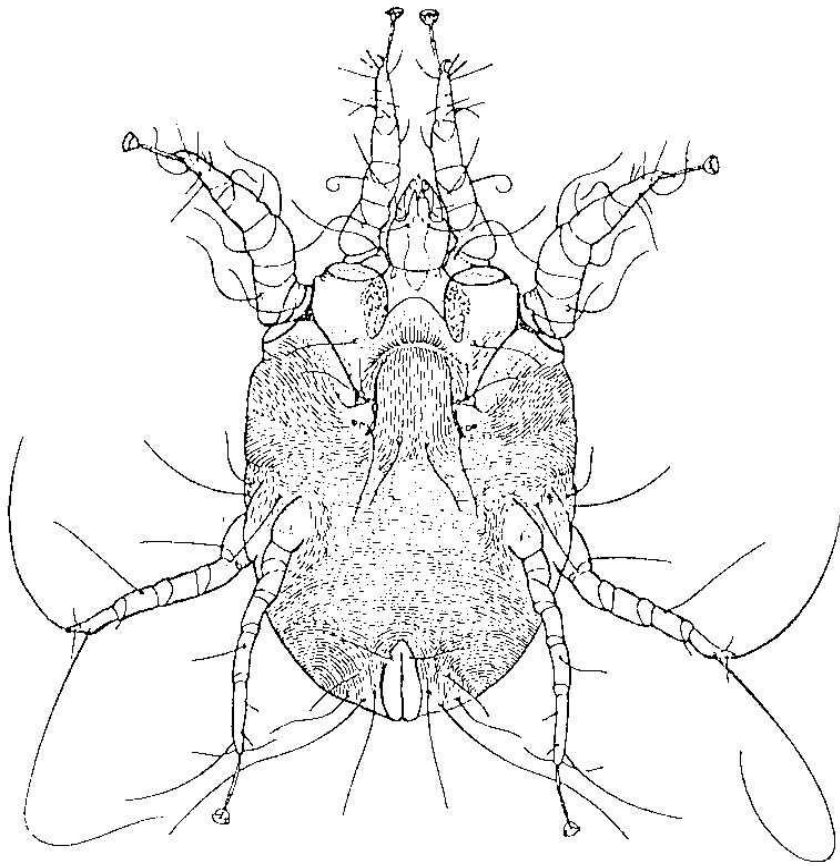
- Oval in outline
- All legs project beyond the body margin
 - the 4th pair is extremely short in males

- Pointed mouth parts
- Males have rounded abdominal tubercles
- On most of the legs
 - 3 jointed pedicles bearing funnel shaped suckers
 - the only mite with a segmented pedicle
- Piercing & chewing mouth parts severely damage the skin & Pruritis
 - biting & sucking activity is the main effect in cattle

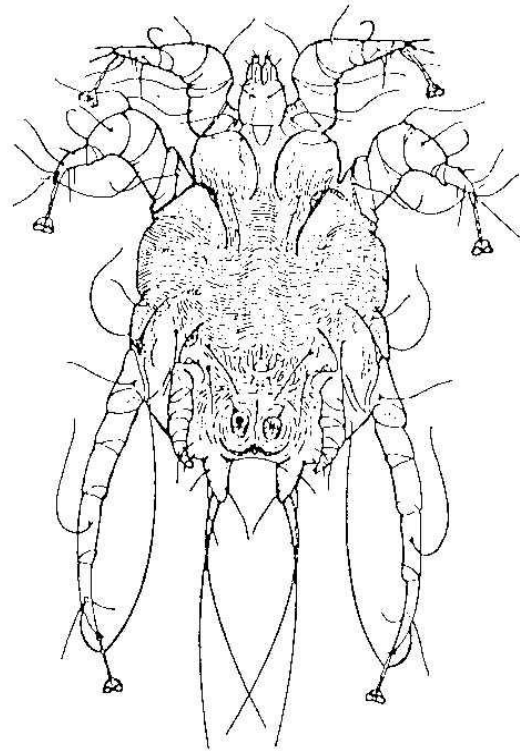
Diagnosis

- Confirmed by identifying mites from scraping the edges of a lesion
 - placed in warm 10% KOH
 - examined under microscope





(a)



(b)

Life cycle

- The female lays about 90 eggs during her lifetime of 4-6 weeks
- Development from egg to adult takes about 10 days.
- The greater pathogenicity of this mite is attributable to its **piercing and chewing** mouth parts which can severely damage skin

Psoroptic mange of sheep (sheep scab)

- Psoroptes is very active in the keratin layer
 - causes direct damage to the skin
- The earliest phase of infection occurs as a zone of inflammation with small vesicles and serous exudates

- as the lesion spreads
 - the center becomes dry and covered by a yellow crust
 - the borders, in which the mites are multiplying, are moist
- The first visible sign is patch of lighter wool and followed by intense itching
- Wool loss, restless cease to feed reduced weight gain
- In severe infestations animals may even succumb

Treatment and Control

- Application of acaricides
- Inspection of flocks
- Limitation of movement of sheep in and from areas infection is diagnosed
- Two treatments with injectable Ivermectin at an interval of seven days given complete clearance of *Psoroptes ovis*

Genus Chorioptes

- Mouth parts is rounded hence can't pierce the skin
- Solely adapted for chewing, feeding on shed scales hence less harmful than Psoroptes

Host: cattle, sheep, goats & equines

Species: *C. bovis* (*C. ovis*, *C. equi*)

Morphology

- Distinctly rounded mouth parts
- Male abdominal tubercles are noticeably truncate
- Short un segmented pedicles with suckers on ends of some legs
- Un jointed tarsal pedicles bear cup shaped suckers
 - Causes mild condition affecting neck, tail end, udder & legs in cattle
 - In sheep mainly found on legs & cause little harm

Epidemiology, pathogenesis and Treatment

In cattle

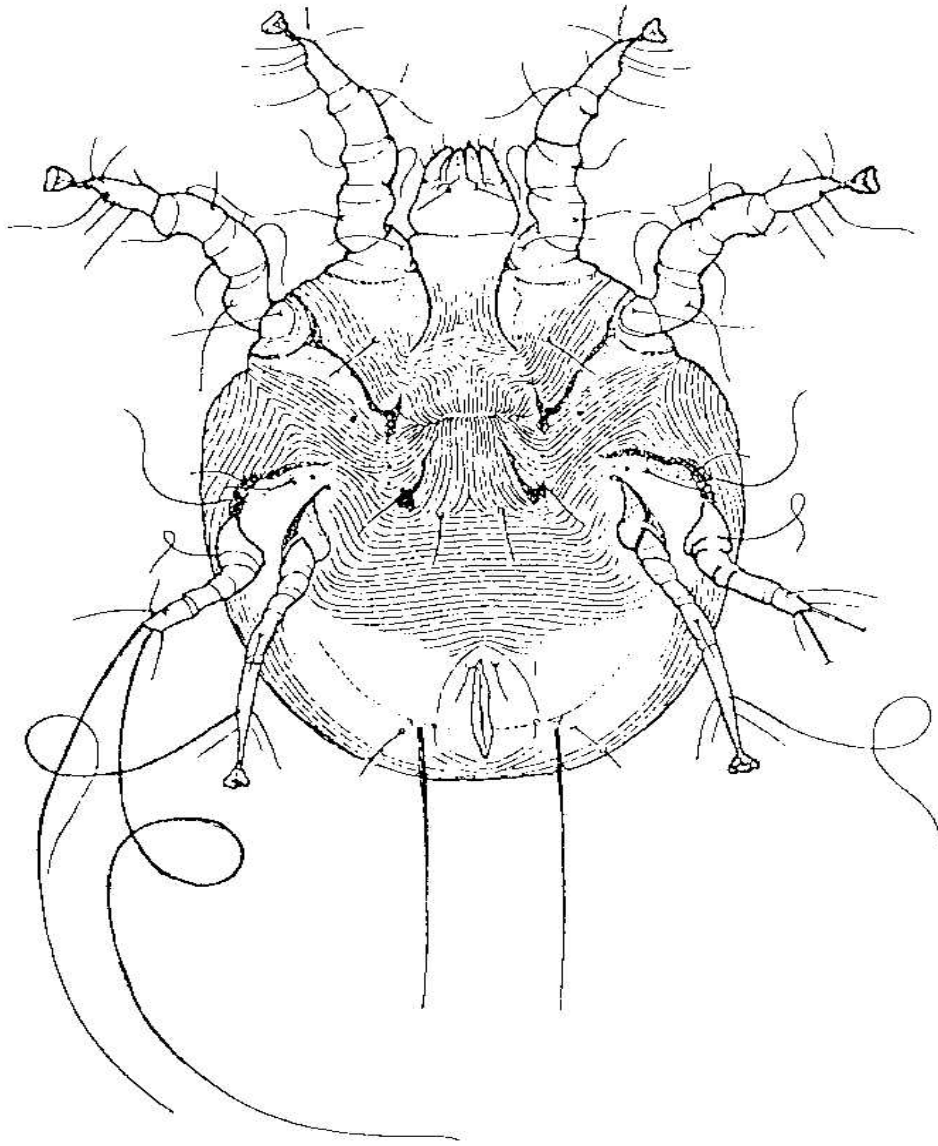
- It occurs most often in housed animals, affecting mainly the neck, tail-head, udder and legs.
- The pruritus nature cause damage of hide

In sheep:

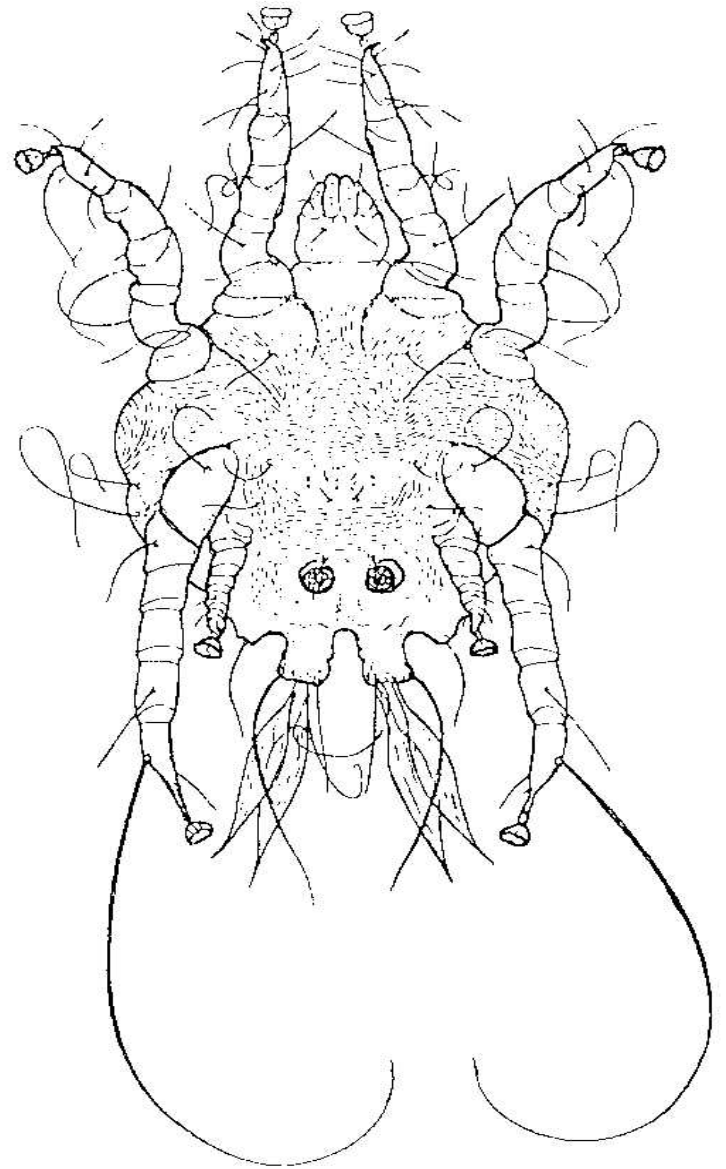
- The mites are found mainly on the legs and little harm
 - mange spreads to the scrotum the thickened and inflamed skin allows the scrotal temperature to remain high
 - It can be treated easily by dipping or local treatment.

In equine

- occurs as crusty lesions with thickened skin on the legs below the knees and hocks
- The movements of mite are active only superficially causes irritation and restlessness



(a)



(b)

Genus Otodectes

- Hosts: cats & dogs
- Species: *O. cynotis*

Morphology

- Have ovoid body
- All legs project beyond body margin
- Unjointed pedicles like chorioptes
- The 4th pair of legs in female is short.
- Cause deposition of dark waxy & exudates in the ear canal aiding tentative diagnosis
- Can be confirmed by observing mites within ear by auroscope

Genus Cheyletiella(Walking dandruff)

- Affects dogs, cat, rabbits & man

Morphology

- Are large mites visible to naked eye
- Palps are greatly enlarged
- Appearing as extra pair of legs
- Each palp ends in a prehensile claw
- Has 6 long hairs or setae on the body
- Legs terminate in comb like structures instead of claws , suckers or setae

Genus Dermanyssus

- genus of veterinary importance
- Called “**red mite**” of poultry

Host----->Poultry & wild birds

Occasionally mammals & man

Species ----->D. gallinae

Morphology

- Is a large mite
- Has long legs
- Some what spider like
- White to grayish-black color
- Becomes red when engorged with blood
- Spend much time away from its host

Life cycle, Epidemiology and Pathogenesis

- spends much of its life cycle away from its host, the adult and nymph only visiting birds to feed mainly at night
- The favoured habitats are poultry houses, usually of timber construction, in the crevices of which the eggs are laid
- The feeding **nymphs** and **adults** cause irritation, restlessness and debility, in severe cases fatal, anemia
- Can be a vector of *Borrelia anserina* the cause of Avian Spirochaetosis

Treatment and control

- attention should be paid to the mite habitats in buildings.
- cleaned, scalded with boiling water and treated with an acaricide
 - carbaryl or synergized pyrethroids
- Individual birds may be treated with an acaricide such as pyrethrum or carbaryl.

The economic impact Mangemites in Ethiopia

- Morbidity
- Mortality
- Reduced growth rate
- Reduced productivity
- Condemnation or rejection of hide and skin
- Affecting the foreign currency which can be gained from export market

Class Insecta

- Head comprises 6 fused segments, thorax 3 & 11 in abdomen.
- Has single pair of antennae
- Mouth parts differ depending on feeding habits
 - Chewing –biting
 - Sponging
 - piercing-sucking
- Thorax bears a pair of wings
- Halteres are reduced to small knob like sensory structures having a balancing function
- Sexes are separate

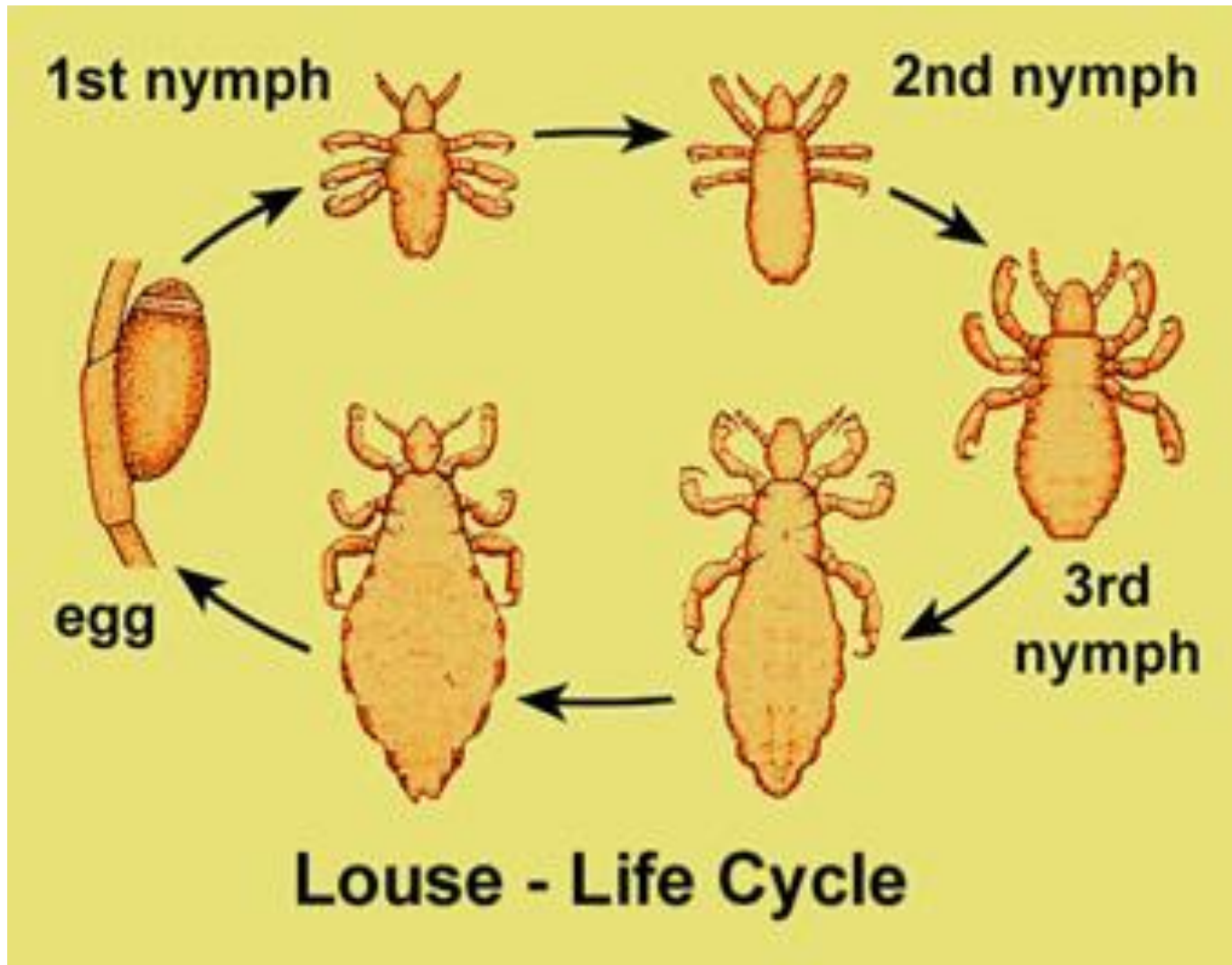
Order Phthiraptera.

Order Siphnoaptera.

Order Diptera

Life cycle

- After fertilization either eggs or larvae are produced
- marked transformation or metamorphosis to the adult stages
 - eg. flies and fleas- a **holometabolus** life cycle.
- from the egg through several nymphal stages which resemble the adult
 - eg. in lice, a **hemimetabolous** life cycle.
- The different stages in the life cycle are called instars.
- **Egg →larvae→puparium →adult fly**
Eg. A holometabolous life cycle
- **Egg→nymph→nymph→nymph→adult lice**
Eg. A hemimetabolus life cycl



Order Phthiraptera (lice)

- highly host specific & more common in cattle than any animal species
- **Pediculosis:** refers heavy lice infestation
- permanently ectoparasites & transmission is by direct contact.
- All are dorsoventrally flattened
- Eyes are vestigial or absent, Legs terminate in claws
- Those affecting mammals have 1 claw on each legs, those of birds have two

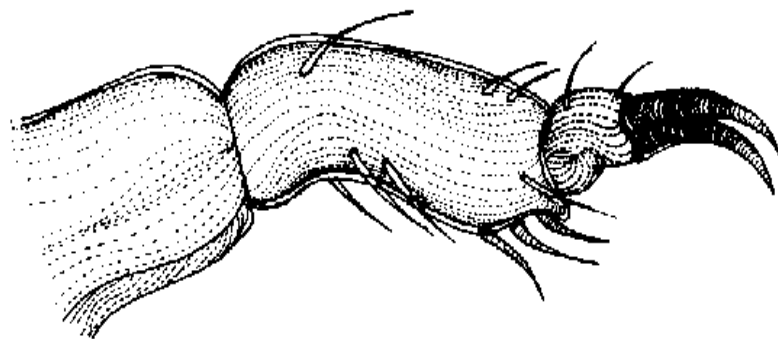
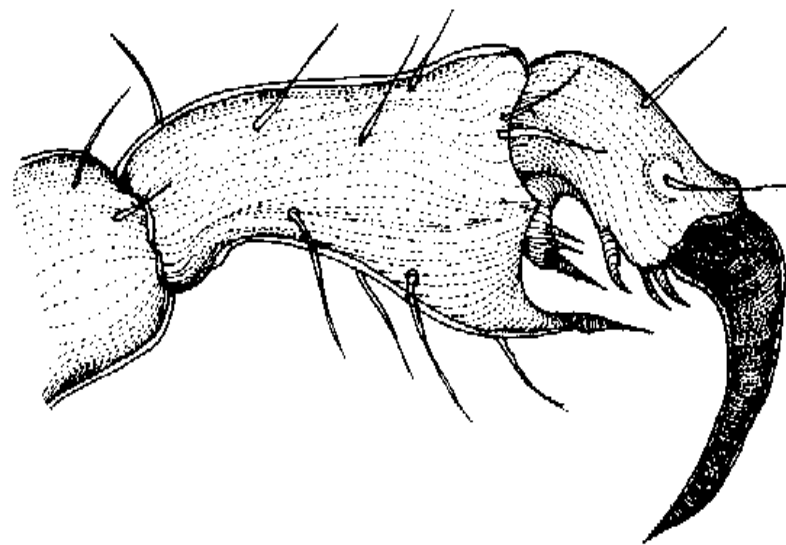
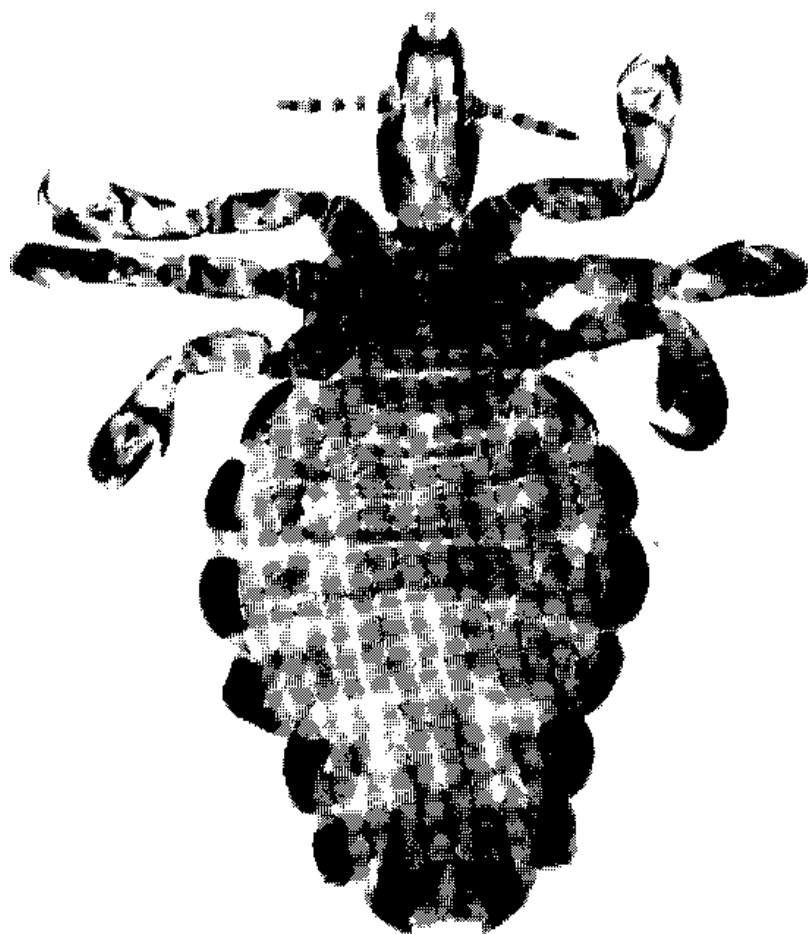
Divided into 2 suborders as:

1. Suborder Anoplura (Suckling lice)

- Occur only on mammals means birds don't have sucking lice
- Can cause severe anemia
- But both suckling & biting lice causes irritation & skin damage-----
loss of production

2. Suborder Mallophaga (biting lice)

- “Mallophaga”=wool eating
- Occur both on mammals & birds



Suborder Anoplura

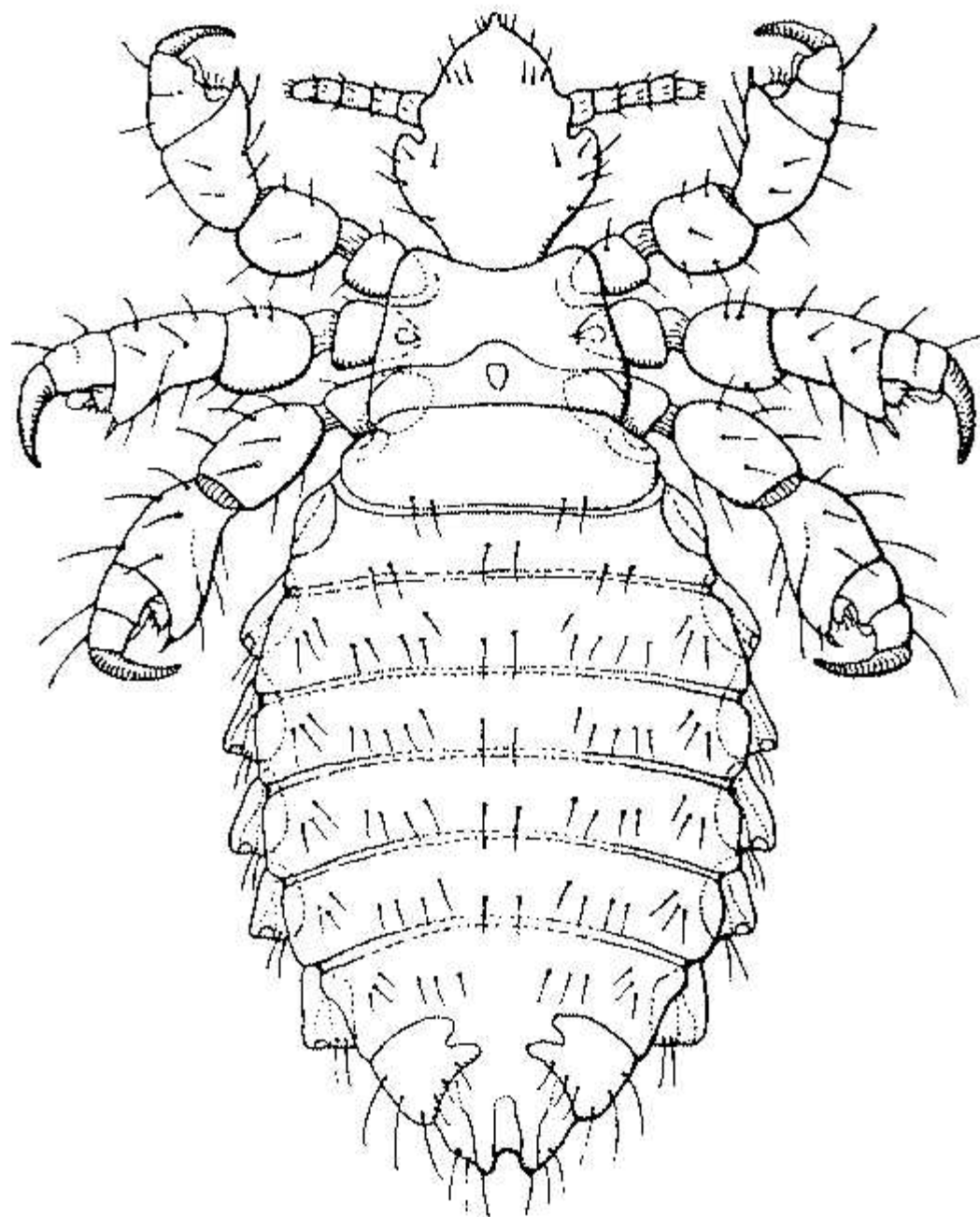
- Are large up to 5mm long
- Small pointed heads that is narrower than the widest part of the thorax.
- Has terminal mouth parts
- Are generally slow moving

Important genera are:

1. Genus Haematopinus

- Short nosed louse
- Largest louse of domestic mammals up to 0.5cm
- Legs are of similar size ending in **a large claw & lack eyes**
- Have distinct sclerotized paratergal plates on 2(3)-8 abdominal segments.
- Possess prominent angular process called ocular points or temporal angles behind the antennae.
- Thoracic sternal plate is dark & well developed
- Yellow or grayish-brown with dark strip on each side

Host-----→cattle, pigs, equines

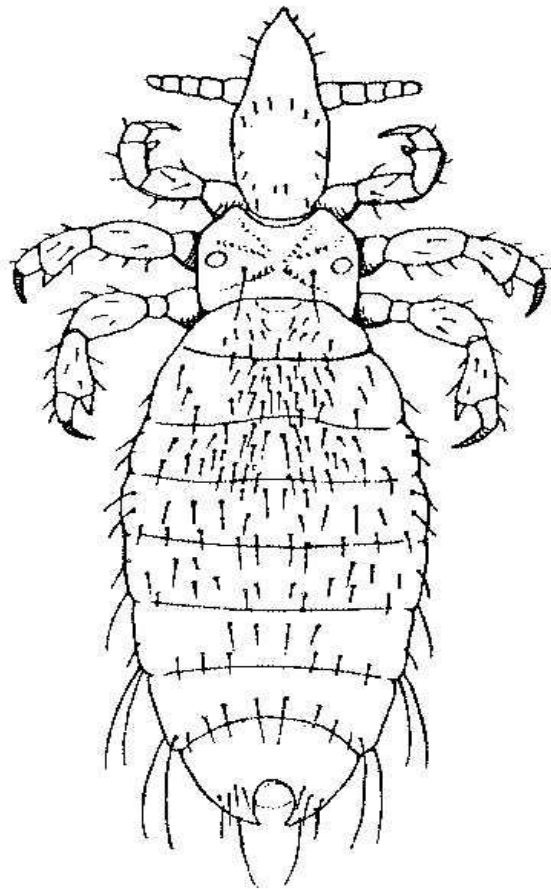


2. Genus Linognathus

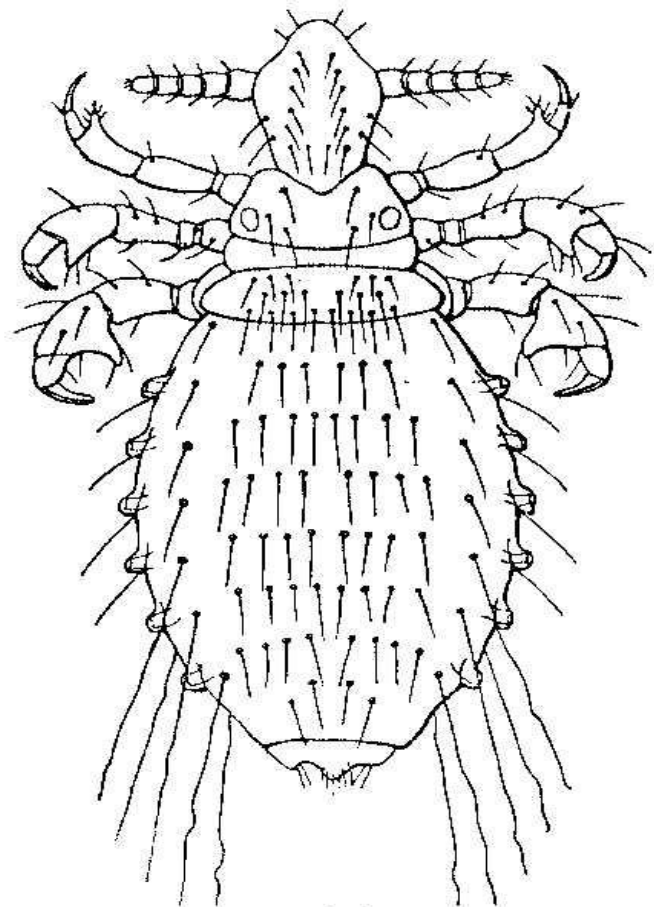
- Long nosed louse
- Lack eye & ocular points
- 2nd & 3rd pairs of legs are larger than the 1st pair
- Lack thoracic sternal plate & parategal plates
- Is bluish-black
- Eggs are dark blue & less easy to see on hair
- Host----→cattle, sheep, goats, dogs

3. Genus *Solenopotes* (little blue cattle louse)

- Smallest of the anopluran lice on cattle
- Lack eyes & ocular point
- Lack paratergal plates on the abdomen
- 2nd & 3rd pairs of legs are larger than the 1st pair.
- Small bluish lice
- Occurs in clusters
- Host-----→cattle
- Species _ *S. capillatus*----→head, neck, dewlap, muzzle, shoulders back & tail.



(a)



(b)

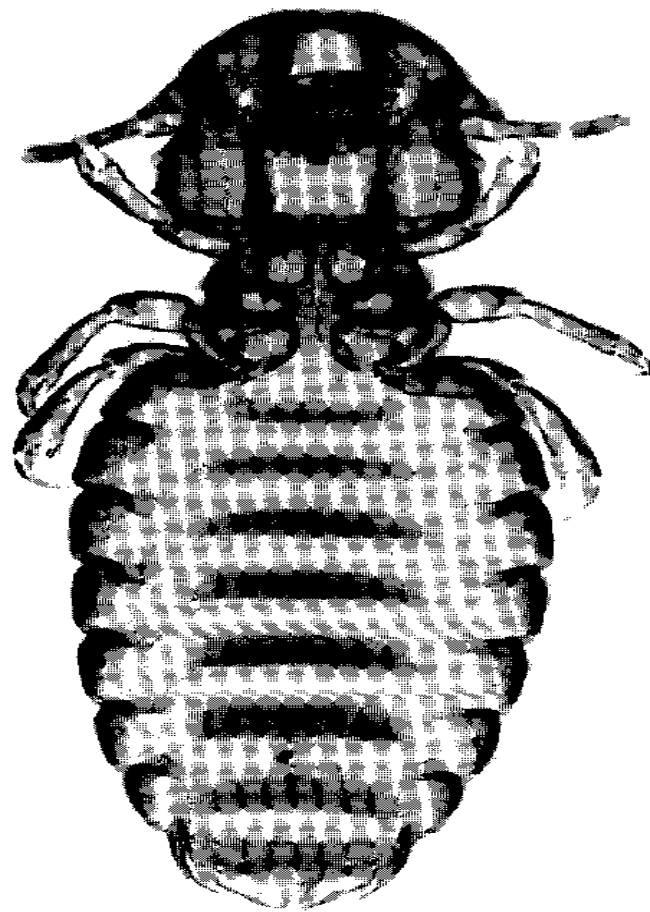
11. Order Mallophaga

- Generally smaller than anoplurans
- Head is much larger & wider than the widest portion of the thorax.
- Head is rounded anteriorly
- Mouth parts are ventral
- Small claws one on each leg unlike in birds

Biting lice of mammals

1. Genus Damalinia(Bovicola)

- Have rounded head with 3 segmented antennae
- reddish-brown in colour
- Have transverse bands on the abdomen
- Host----→cattle, sheep, goat & equines



Species:

- *D. bovis*: cattle---→ is small reddish brown
 - Can be parthenogenetic
 - Favors top of head, curly hair of poll & forehead, neck, shoulder, back & rump
- *D. ovis* (body louse): shoats -----→ is more active & pale colored
- *D. caprae*: found on goats
- *D. equi*: equine----→ is more active & cause intense & irritation.
 - Favors head, mane, tail base & shoulder

Genus Felicola

- Unique among mallophagans due to pointed head
- Has ventral mouth parts
- Head is triangular & pointed anteriorly
- Has ventral median longitudinal groove on head
- Smooth abdomen with setae.
- Host-----→cat

Genus Trichodectes

- Tarsi bear single claw & head is broader than long & is very active lice
- Short, broad & yellowish
- Vector of *D. caninum*
- Host-----→Dog
- Species-----→*T. canis*-----→dog
- Cause irritation, scratching, alopecia & bacterial complication

4. Genus *Heterodoxus*

- Slender, yellowish louse
- Host-----→ dog
- Species-----→ *H. spingera*
- Tarsi end in 2 claws & is a large yellow coloured
- 4 segmented antennae protected in antennal groove hence only the last segment is visible.
- A dense covering of thick, medium & long setae.

Human lice:

- *Pediculus humanus*-----→ body louse
- *Pediculus capitis*-----→ head louse
- *Phthirus pubis*-----→ human crab lice under the arm.

Biting lice of birds

A great many genera

- 1. Genus *Lipeurus*-----→ wing louse
- 2. Genus *cuculotogaster*-----→ head louse
- 3. Genus *menacanthus*-----→ body louse
- All affect domestic birds

General life cycle of lice

- During a life span the female lays 200-300 operculate eggs ('nits')
- nits are usually whitish, and glued to the hair or feathers and seen with the naked eye.
- no true metamorphosis (egg to nymph similar to adult but small)
- After 3 moult the fully grown adult
- The whole cycle takes 2-3 wks
- Some genera are capable to asexual reproduction
 - **parthenogenesis**- e.g. *Damalina*

Louse Infestation (Pediculosis) in cattle

Damalina bovis

- Solitary biting species
- Prefers the top of the head (the poll and forehead, the neck, shoulders, back and rump)

Linognathus vituli

Solenopotes capillatus - they are sucking lice- prefer the head, neck and dewlap.

***Haematopinus* species**

Epidemiology

- There is no marked seasonality
- heaviest infestation are in late winter and early spring
 - the coat is at its thickest, giving a shelter, bulky and humid habitat for optimal multiplication
- In dray the number is low-b/c the thinness of the coat provides a restricted habitat,
 - partly because high skin surface temperatures
 - direct sunlight limit multiplication and may even be lethal especially to **Damalina**

Pathogenesis

- Irritation (intense)
- Dermatitis
- Loss of hairs
- Hide damage
- Anaemia
- Loss of weight

Louse Infestation in sheep

- Two species of sucking lice
 - *Linognathus pedalis*
 - foot louse- inhabit the lower region of the hind limbs
 - *Linognathus ovillus*
 - face louse - occur on the face and ears
- *Damalina ovis*- biting louse
 - body louse more active than *Linognathus*

Pathogenesis and clinical signs

- Anemia
- Create irritation – pruritus
- Sheep becomes restless
- Grazing interruption
- Damage to the fleece and some loss of wool
- Reduction in the value of the wool clip
 - most important consequence of **ovine pediculosis**

Pathogenesis and clinical signs

- Heavy infestations are most found in neglected and underfed
- Anaemia
- Self inflicted injury by scratching
- Loss of hair and excoriation of the skin
- In heavy combined infestations pups may die from anaemia and debility.

Treatment and control

- Powder, washes or shampoos of synthetic pyrethroids, organophosphate or carbamate insecticides.

Louse Infestation In Birds

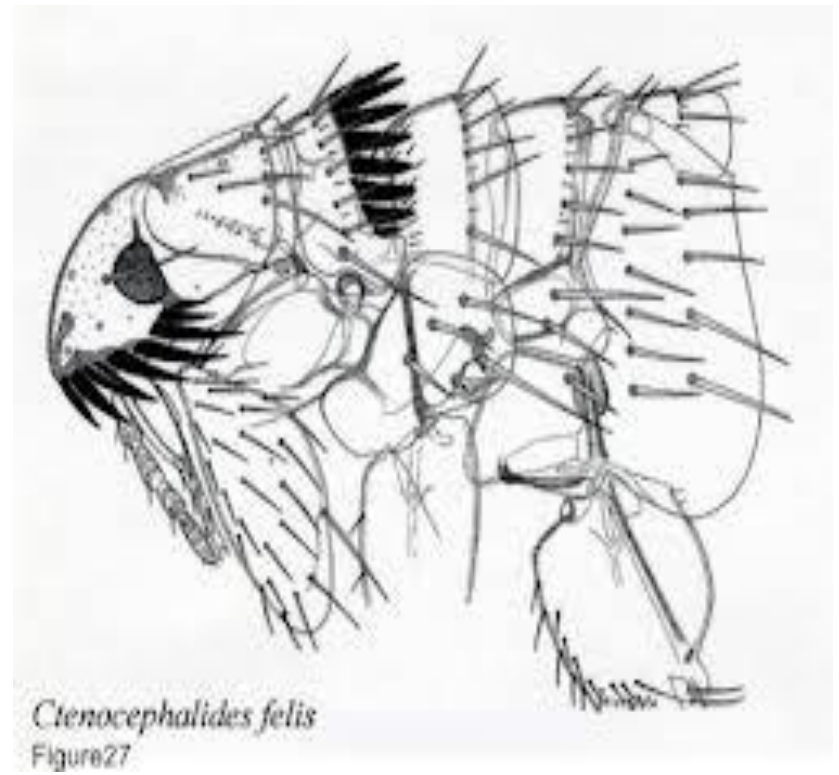
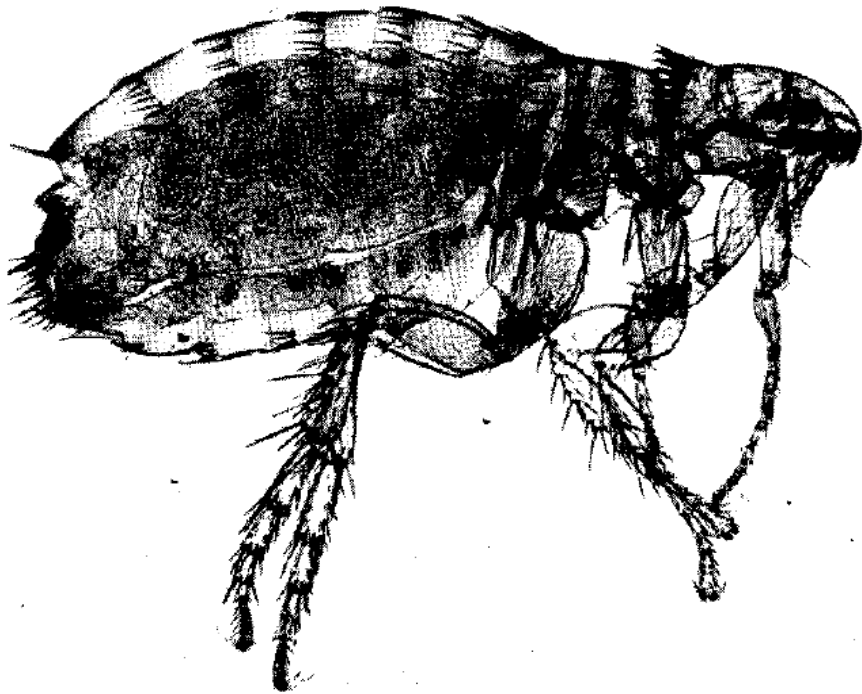
- More than 40 louse species, all Mallophaga occur on domestic birds
- Lipeurus and menacanthus are the most pathogenic
- Lipeurus : are grey, slow moving found close to the skin
- Menacanthus : are yellow body louse - favors the skin surface as a habitat
 - Being active and a voracious feeder
 - severe irritation and the skin is inflamed and covered by scabs
 - mainly the vent and in young birds on the head and throat
 - It is the most pathogenic louse of adult birds and has been responsible for fatalities in chicks

Order Siphonaptera(Fleas)

- Has effect on host & transmit diseases
- Most important in dogs, cats & poultry
 - ruminants, horses & pigs don't have their own species of fleas

Morphology

- Are dark brown
- Are wingless insects
- Laterally compressed bodies
- Body is armed with backwardly directed spines
- Antennae are short & club-like recessed into the head
- 3rd pair of legs is much longer than the others
- Head may bear at its posterior (pronotal) or ventral (genal) borders rows of dark spines called **ctenidia or combs**
- Only adults of both sexes are parasitic





Life cycle

- Both sexes are blood suckers
- Only adults are parasitic
- Eggs may be laid on the ground or on the host from which soon drop off
- Hatching to larvae with 2 days – two wks
- The larvae have chewing mouth parts
 - feed on debris and the faeces of adult fleas
- The larvae moult twice
- woolly puparium from which the adult emerges

- Most fleas feed for only a few minutes
 - moving to another part of the host
 - leaping to the ground or to a fresh host
- Causal feeding is common and most will feed on a wide range of mammals and birds.

Fleas of mammals

Family Pulicidae

1. Genus Ctenocephalides

- Only important in dogs & cat
- Species---→ *C. canis* & *C. felis*----→ dog & cats
- *C. felis* is more common in dog & man, cats
- Both are IH for D. caninum of dogs & cats
- Responsible in provoking flea bite allergic dermatitis



What is Flea Allergy Dermatitis?

- It is an allergic skin disorder which occurs when a dog or cat is hypersensitive to flea saliva.
- When a flea bites a dog or cat it injects it's saliva into the animal.
- Flea saliva contains many antigens which some dogs and cats are very susceptible to.
- Flea allergy dermatitis is the most common allergy in dogs and is a very itchy and painful condition
- Cooler temperatures and low humidity tend to inhibit flea development

Pathogenesis

- Pruritus
- Distress
- repeated flea bites for a period of several months
 - dogs and cats develop flea bite allergy (FAD) with profound clinical signs
- Flea bite allergy (FAD): is a hypersensitive reaction to the flea saliva
 - in the saliva hapten combine with the hosts skin collagen to form a complete **allergen**
- preferred biting sites are the back, the abdomen and inner thighs
- The most important damage is inflicted by the animal themselves
 - produce areas of alopecia or of moist dermatitis (wet eczema)



Genus Pullex

- Characterized by absence of ctenidia & rounded frons (forehead) anteriorly

Pullex irritans

- Primary parasites of man
- Also common on dogs & cat
- Can act as IH of *D. caninum*
- Cause flea bite dermatitis



Genus Tunga

Species *T. penetrans*

- burrowing flea of mammals
- Occurs in man, sheep & rarely pigs
- Forms a distinct nodular containing female distended with eggs
- Affects feet of man causes severe irritation



Diagnosis

- Combing and examine the debris for fleas or flea feces
 - show as dark brown to black crescentic particles.
- Use of vacuum cleaner with fine gauze inserted behind the nozzle applied to the host or its habitat and the fleas are retained on the gauze

Treatment and control

- Corticosteroids as palliative treatment- FAD
- Insecticides
 - powders, spray, shampoos or spot on preparations, **flea collars** (with low conc.)
- Insecticides
 - quarters and general indoor habitats, and that bedding should be destroyed where possible

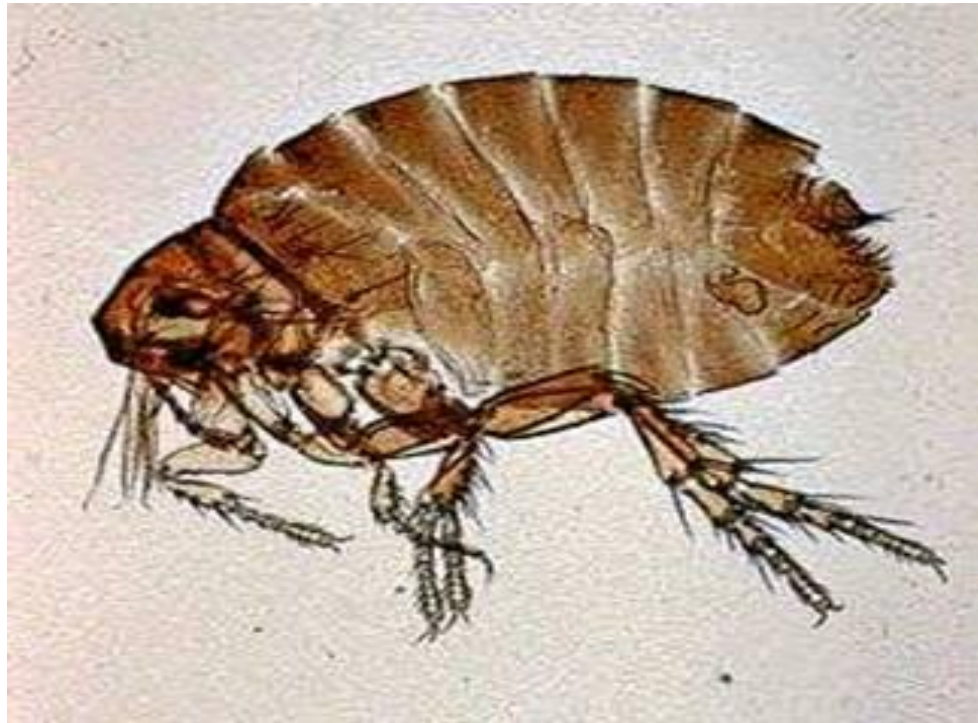
Fleas of Birds

Genus Ceratophylus

- *C. gallinae* – commonest flea of domestic poultry
- responsible for irritation, restlessness and anaemia
- It can feed on human and domestic pets

Genus Echidnophaga

- the stick-tight flea is a burrowing fleas
- After fertilization the female burrows in to the skin of the fowl mainly on the comb and wattles
 - nodule formation in which the eggs are laid
 - Hatching occurs within the nodules and larvae drop to the ground
- Species: *E. gallinacea*
- Host: rodents, carnivores & also affects poultry
- Morphology: head is sharply angled at frons
 - Has neither genal nor pronotal ctenidia
 - 3 setae behind antennae



Order Diptera(Flies)

- “Di pteron”= 2 winged
- Having a single pair of wings
- A pair of halteres
- External parasites
- The larvae of some species parasites the tissues of the host
- Many are vectors of diseases
- Conveniently divided
 - 3 suborders,
 1. Nematocera. 2. Brachycera. 3. Cyclorrapha

1. Nematocera

- Small flies
- Have a pair of long, jointed antennae and segmented maxillary palps
- The wings have few cross-veins
- Only females are parasitic and have piercing mouth (sucking mouth parts)
- Eggs are laid near water--→aquatic larvae--→pupae
- A few have biting, **blood-sucking adult females**
 - transmit pathogenic micro-organisms to humans or farm animals when they bite.
 - mosquitoes
 - black-flies
 - sand-flies
 - midges



Family Ceratopogonidae(biting midges)

- Transmit various protozoa, helminths & Onchocerca of cattle & equines, blue tongue, African horse sickness
- Culicoids are the only important genus

Genus Culicoides

- Hosts---→all domestic animals & man
- Species--→over 800 called midges

Morphology

- Thorax humped over a small head
- Wings are held at rest like a closed pair of scissors over abdomen
- Prominent long antennae
- Short & small vertically hanging mouth parts
- Microscopic hairs cover mottled wings
- Ex. causes “sweet itch” in pony



Pathogenic significance

- Cause annoyance
- transmit diseases
 - Blue tongue and African horse sickness
 - filaroid nematodes
 - Dipetalonema species, Onchocerca
- Skin disease of horses called “sweet itch”
 - immediate type hypersensitivity reaction to the bites of the flies

Control

- Difficult due to extensive breeding habitat
- Destruction of breeding sites
- Repellants
- Antihistamine Rx for sweet itch
- Regular application of pyrethroids
- Housed animals
 - fly activity is maximal usually in late afternoon and early morning

Control:

- Application of insecticides to breeding sites to kill larvae
- Bush clearing will remove adult resting sites

Family Culicoidae (Mosquitoes)

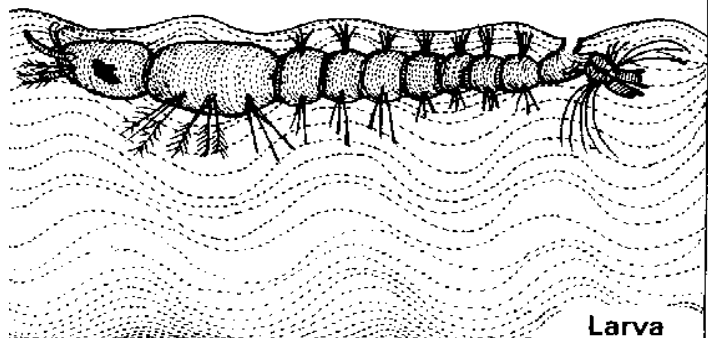
- Small slender flies
 - long legs
 - long & slender proboscis
- Severe nuisance, bite to man & animals
- Important vectors of *D. immitis*, malaria, filarial nematodes & viruses
- Most important genera are
 - **Anopheles** → transmits **Malaria**
 - **Culex** → all the others & *Wuchereria bancrofti* & Brugia
 - **Aedes** → transmits **Yellow fever**

Life cycle

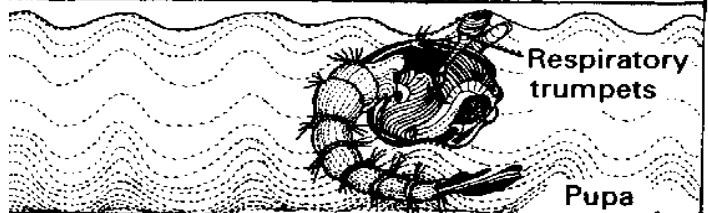
- a blood meal gravid female lays up to 300 eggs on the surface of H₂O
 - singly or in the case of *Culex*, in group forming egg-rafts
- Hatching after several days to weeks
- All four larval instars are aquatic
- Larval habitats
 - small temporary collections of water to extensive marshes
 - usually absent from lakes and from fast flowing streams or rivers
- All mosquito pupae are aquatic motile and comma, shaped
- The adult emerging through a dorsal split in the pupal teguments
- fly only up to a few hundred meters from their breeding sites
- The life span is generally short

Anopheles

Eggs



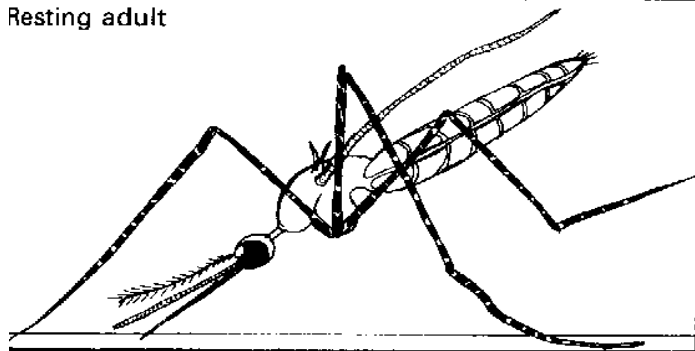
Larva



Respiratory trumpets

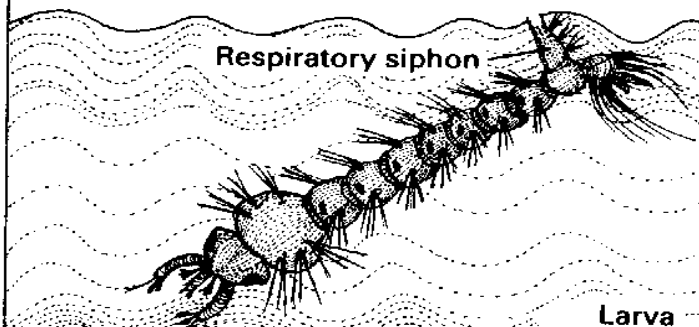
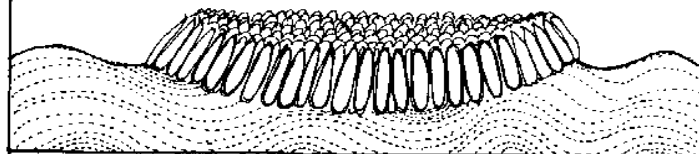
Pupa

Resting adult



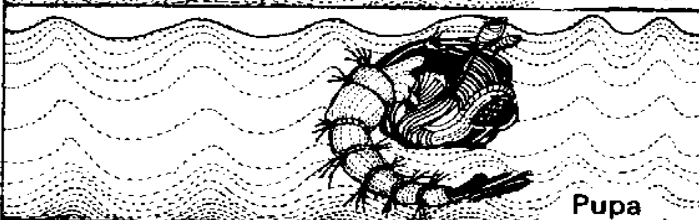
Culex

Egg raft



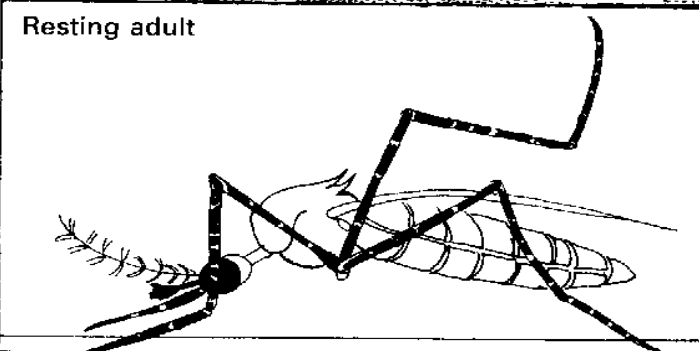
Respiratory siphon

Larva



Pupa

Resting adult



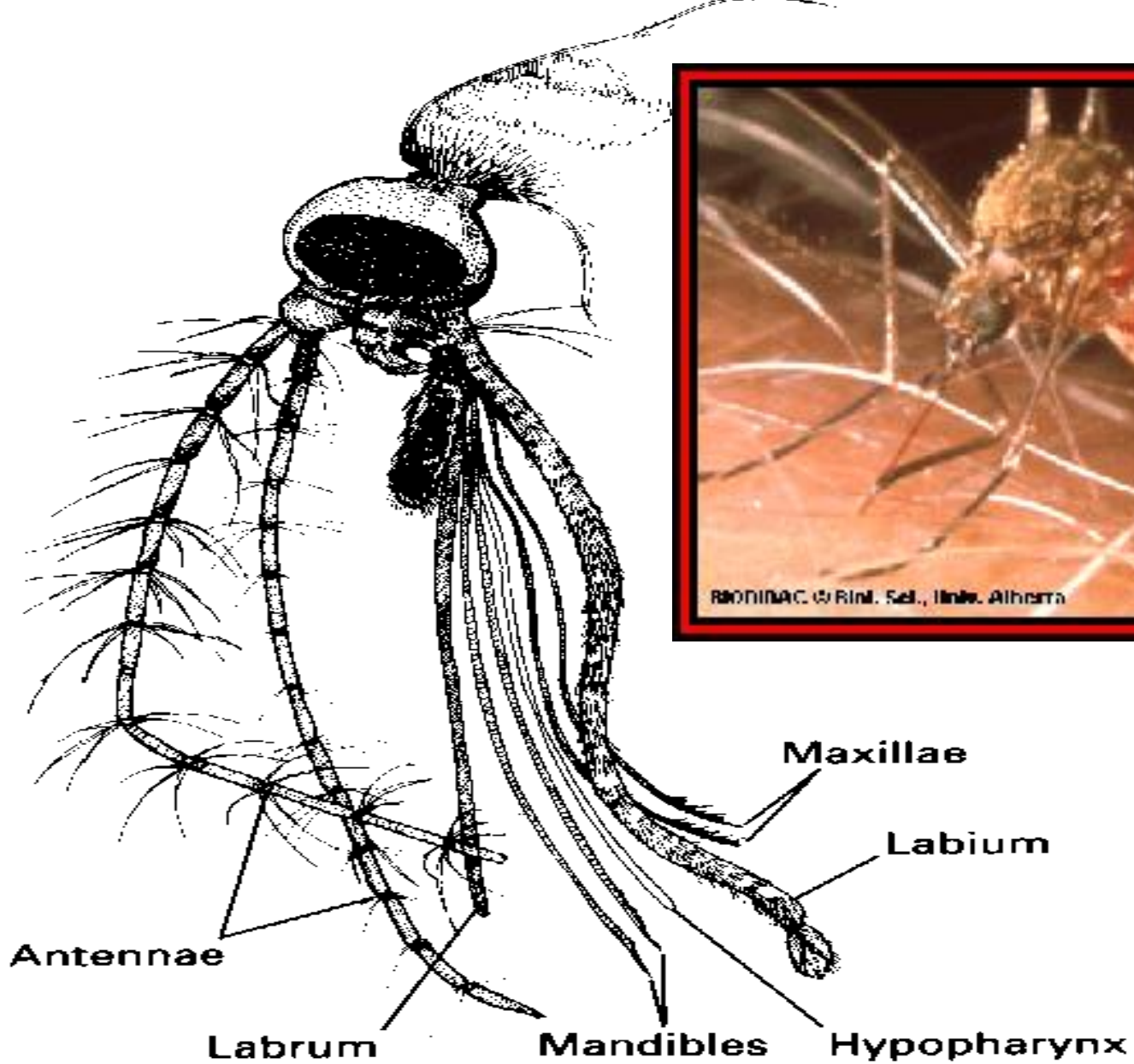


Fig. 116 Piercing and sucking mouthparts of a mosquito.

Pathogenic significance

- Most species are nocturnal feeders cause annoyance by biting
- their long mouth parts allow them to bite man even through clothing
- Vector role
 - Anopheles, Culex and Aedes transmit both *Dirofilaria immitis* and Avian malaria
- The vectors of human malaria is *Anopheles*
- The vectors of yellow fever is *Aedes*
- All three genera transmits human filarioid nematodes *Wucheria* and *Burgia*

Control

- Removal or reduction of available breeding sites by drainage
- Biological control- introducing predator fish in to marshy areas
- Genetic control
 - development of mosquito pathogens (micro-organisms, protozoa, nematodes)
- Application of toxic chemicals, mineral oils or Insecticides to the breeding sites
- permanent solution is the destruction of breeding sites
- Insecticides with a residual action are effective
 - against the adult stages, particularly if applied indoors.
- Fly screens, nets and repellents are also used for the protection of man

Suborder Brachycera

- Large flies with stout antennae with the last segment bearing annulations
- Maxillary palps are held forwards
- Cross veins are present on the wings
- The females feed on blood
- The eggs laid on vegetation over hanging mud or shallow water carnivorous larvae
- larvae and pupae are mobile and aquatic and are usually found in mud.

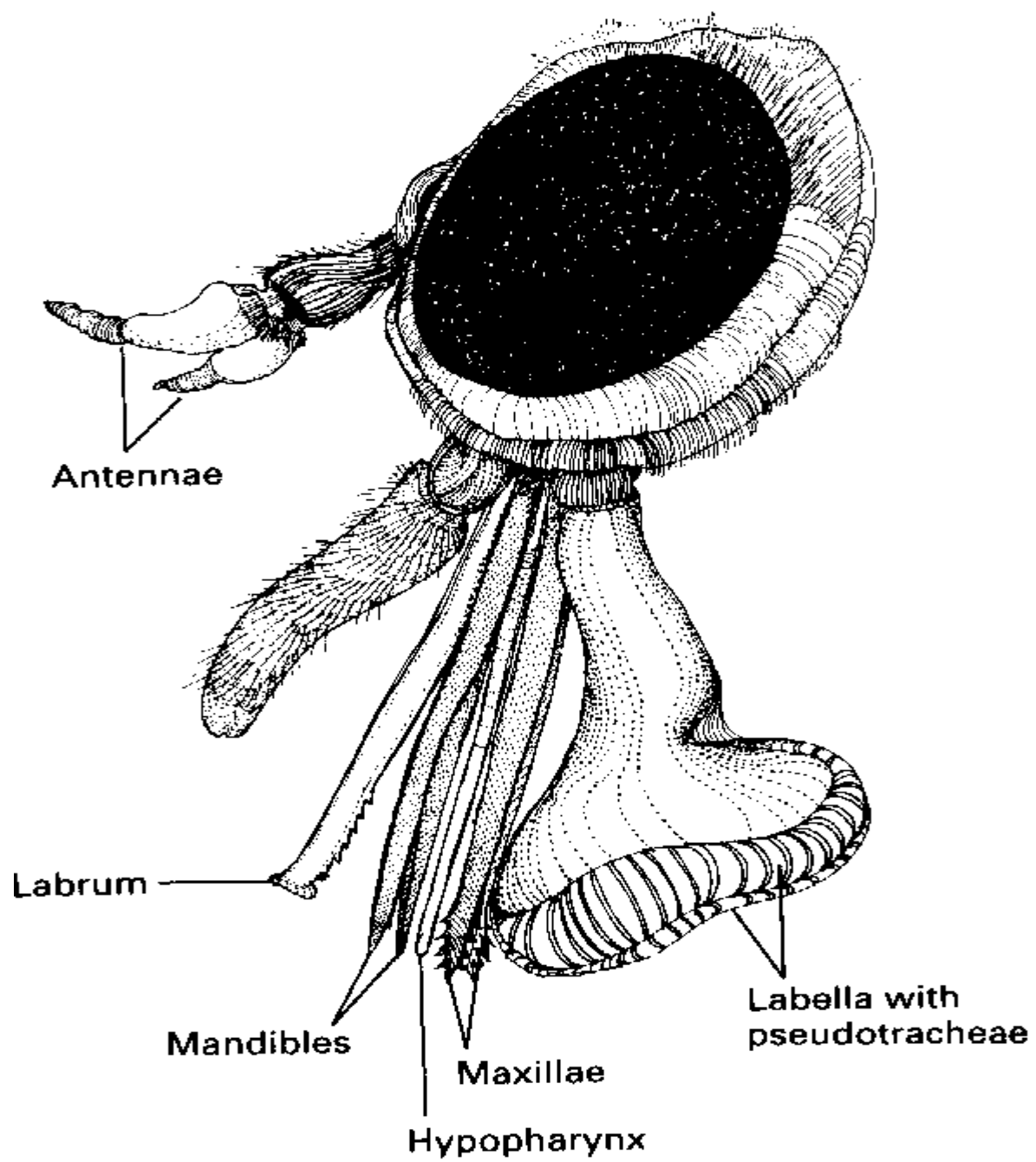
Family Tabanidae (Horseflies)

- Large robust flies with large, broad heads & bulging eyes.
- Has distinct wing venation with R_{4+5} forked to form a large “Y” shape across a wing tip.
- Their pain causes interrupted feeding
 - feed on a succession of hosts
 - important in mechanical transmission like trypanosomosis
- 3 genera are vet. Important
 1. Tabanus
 2. Haematopota
 3. Chrysops

- Host-----→ large domestic or wild animals & man
- Species-----→ over 3000 of tabanids

Morphology

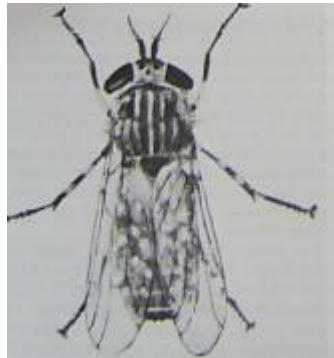
- Are generally dark colored
- Large eyes are dichoptic in female but holoptic in males
- Both sexes feed on nectar & in most species females are also haematophagus



- Coloration of wings is used in differentiating the 3 genera
 - Tabanus clear or brownish wings
 - Chrysops dark bands across the wings
 - Haemaphysalis..... mottled or specked wings & zigzag bands on eyes
- Features of short 3 segmented antennae is useful in generic identification
- Antennae is without arista







Pathogenic significance

- fly many kilometers from their breeding sites
- are most active during hot, sunny days
- adult females locate their prey by sight and their bites are deep and painful
- feed every 3-4 days causing annoyance
- mechanical vectors
 - Anthrax, Pasteurellosis
 - Trypanosomosis, Anaplasmosis
 - human filarial disease..... loasis

Control

- difficult to detect the breeding places
- Insecticidal sprays
 - on animals houses
 - on the animals themselves.

Sub order: Cyclorrhapha

- Last segment of antaennae bears feather like attachment called arista
- Wings have cross-venation
- Vestigial or sponging mouth parts hence adults aren't parasitic
- Worm-like larvae called maggots

4 families

1. Oestridae
2. Muscidae (Anthomyidae)
3. Calliphoridae (Tachinidae)
4. Hippoboscidae

Family Muscidae (Anthomyidae)

- Has biting & non-biting genera
- Non-biting flies are called nuisance flies
- Cause “fly-worry” in livestock

Genera

Musca (house fly)

Hydrotaca (head fly)

Stomoxys (stable fly)

Haematobia (horn fly)

Glossina (tsetse fly)

Genus Stomoxys (Stable flies)

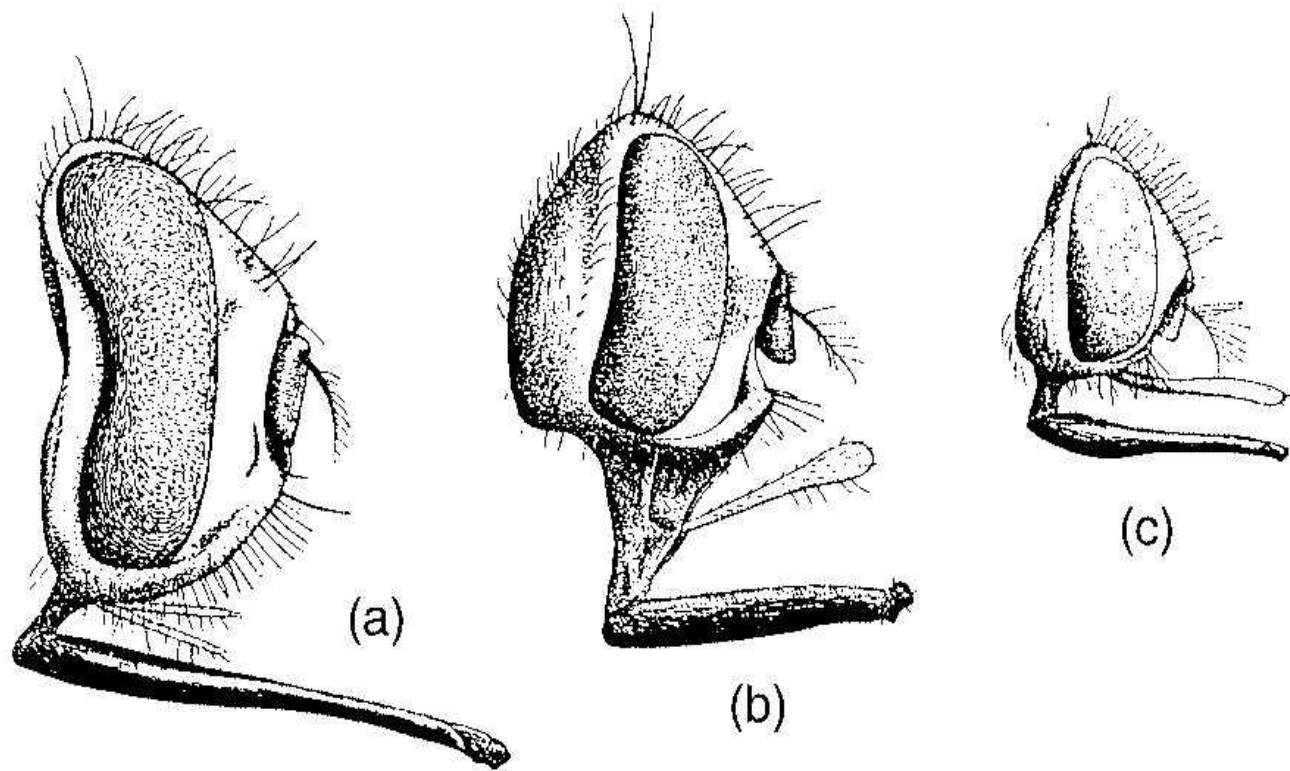
- Species-----→ *S. calcitrans*----called stable fly or biting house fly
- Vectors of protozoa & helminths
- Host-----→ most animals & man

Morphology

- Are generally gray in color
- Have biting mouthparts & both sexes are blood feeders
- Have 4 longitudinal dark strips on the thorax
- Shorter & broader abdomen than Musca
- Has 3 dark spots on the 2nd & 3rd abdominal segments
- Have conspicuous & forward projecting proboscis

- Posterior spiracles is important for identification
- **3 min** to take blood meal
 - **interrupted** -- **→ efficient mechanical transmitters**
- Cause 10% reduction in body weight & IH for Habronema
- Can transmit Surra, protozoa, & equine infectious anemia
- Is suspected to be transmitter of anthrax





Genus Glossina

- Are called tsetse flies
- Distributed over 10 million square km of Africa south of the Sahara
- Extremely important vectors of *African trypanosomosis*

Hosts: mammals, reptiles and birds

Species

- 31 species and sub-species

Distribution:

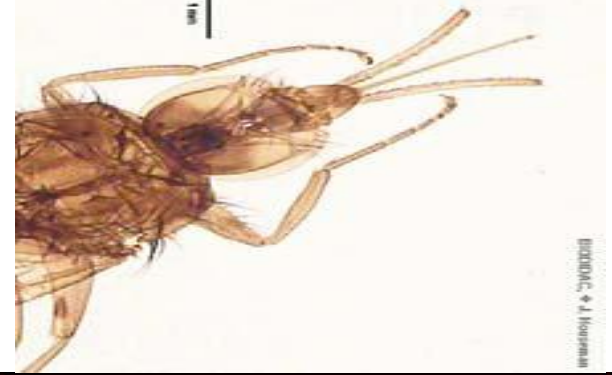
- Confined to a belt of tropical Africa
 - extending from the southern Sahara (lat. 15° N) in the north to Zimbabwe and Mozambique in the south (lat. 20-30 ° S)
- The species are restricted to various geographical areas according to habitat

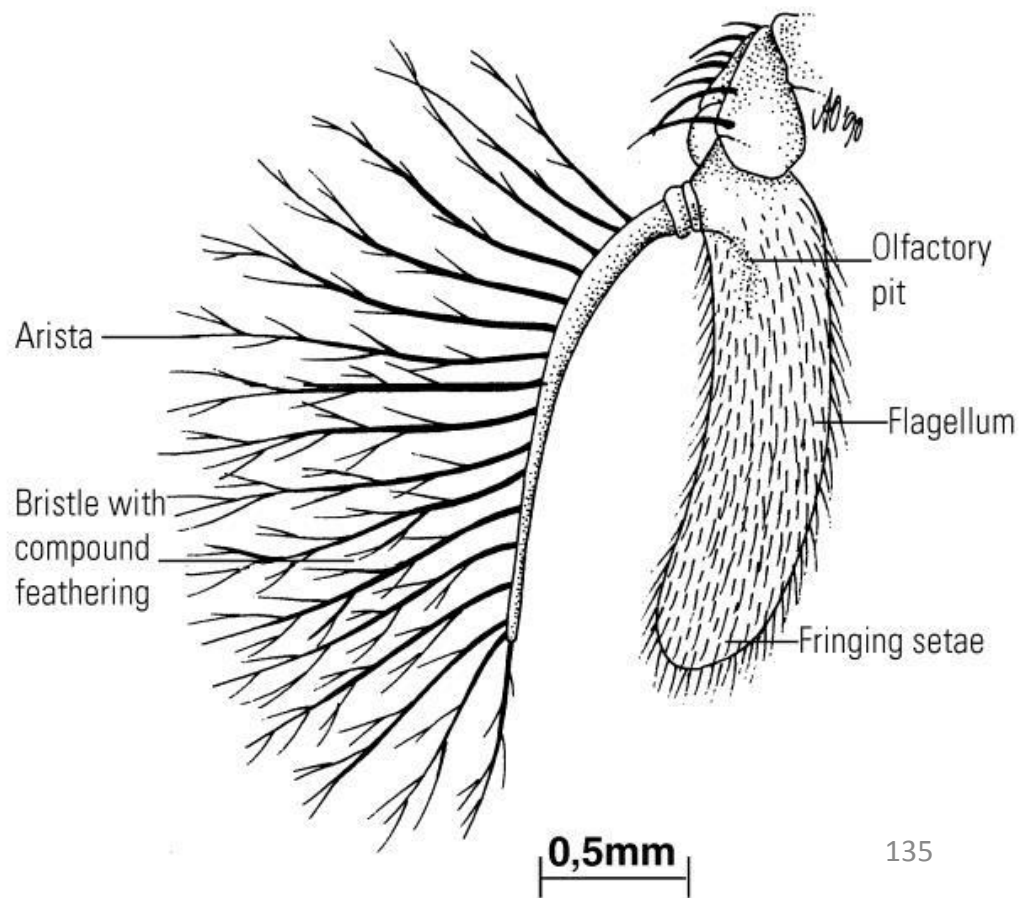
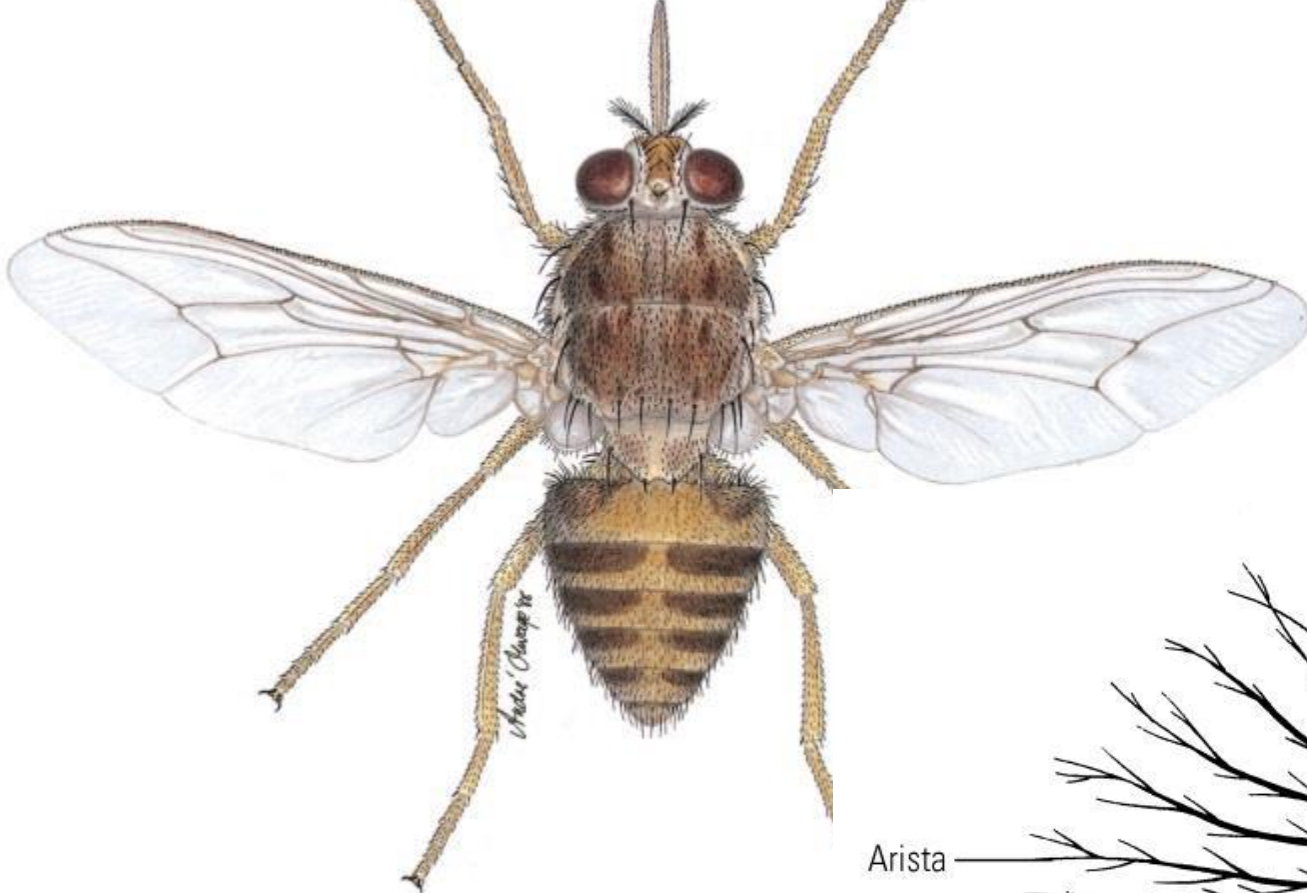
Three groups:

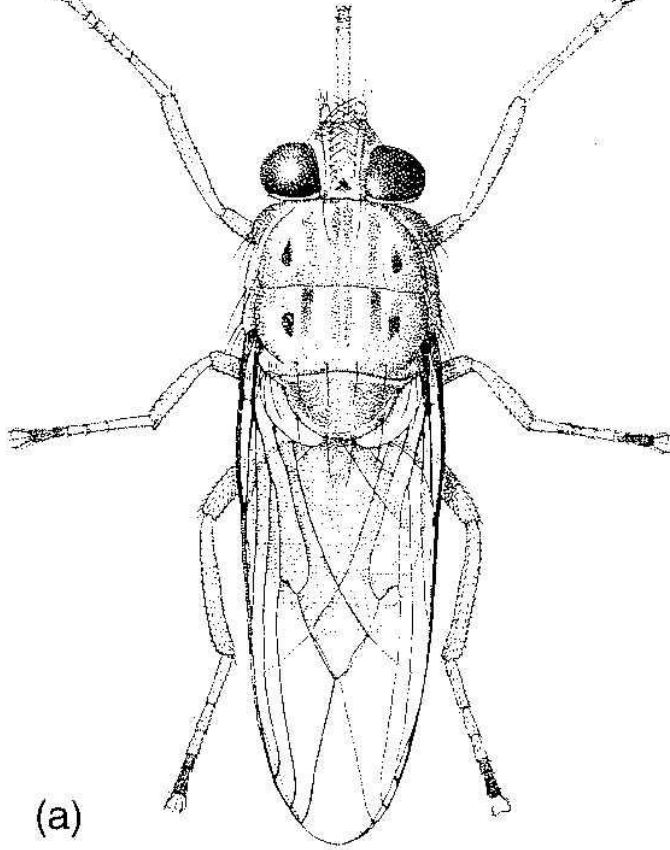
- Fusca.....forest habitat
- Palpalis.....riverine forest habitat
- Morsitans.....savannah habitat
 - Their presence in the large livestock-rearing areas is the most important from a veterinary standpoint

Morphology

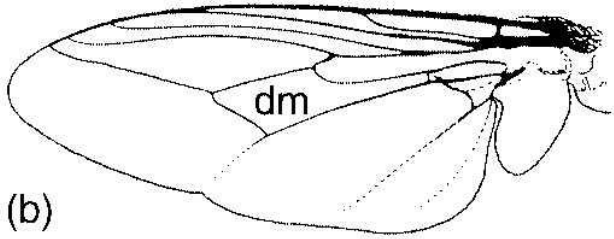
- Narrow, yellow to dark brown flies
- 6-15mm in length
- Long, rigid and forward projecting proboscis
- at rest the wings are held over the abdomen like a closed pair of scissors
- distinguished from all other flies by cleaver (hatchet) cell in the wings



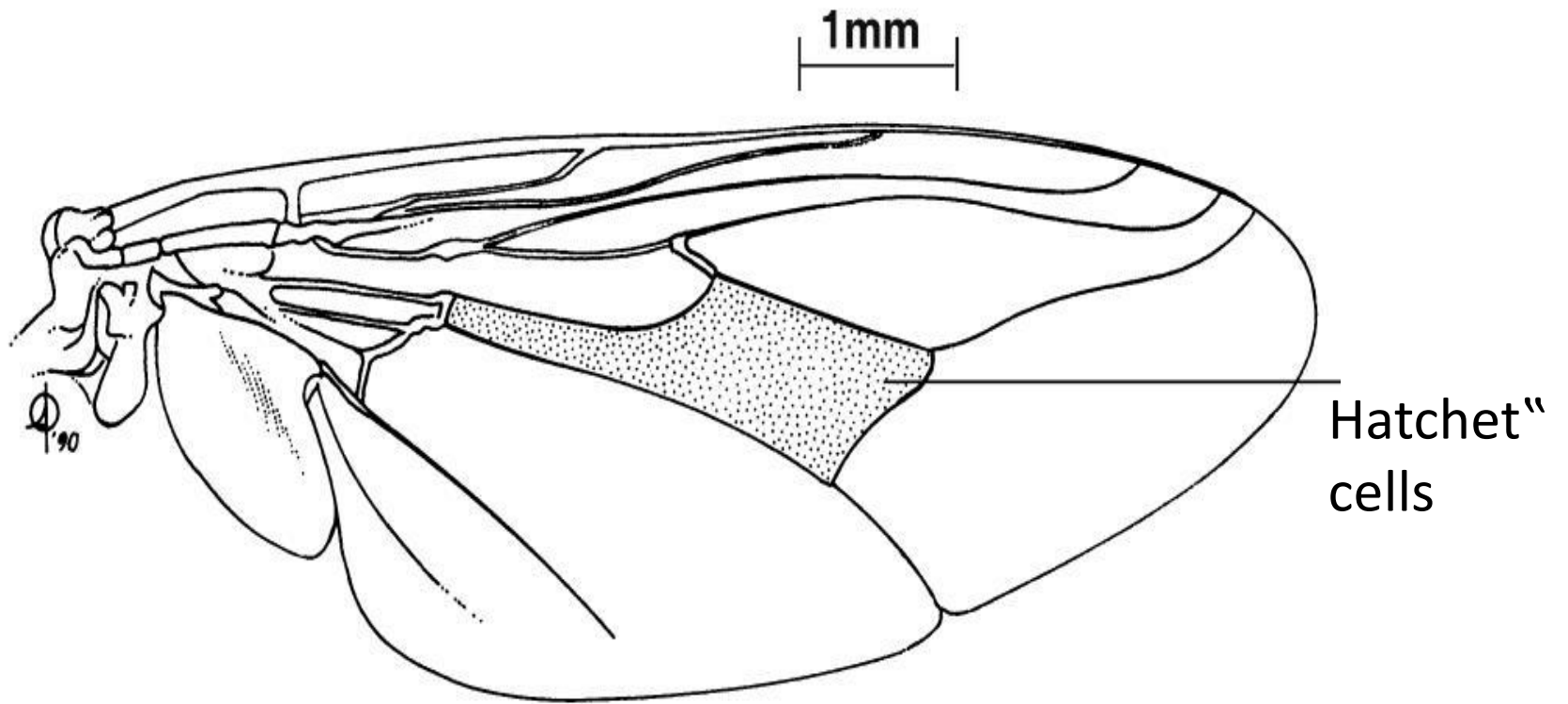




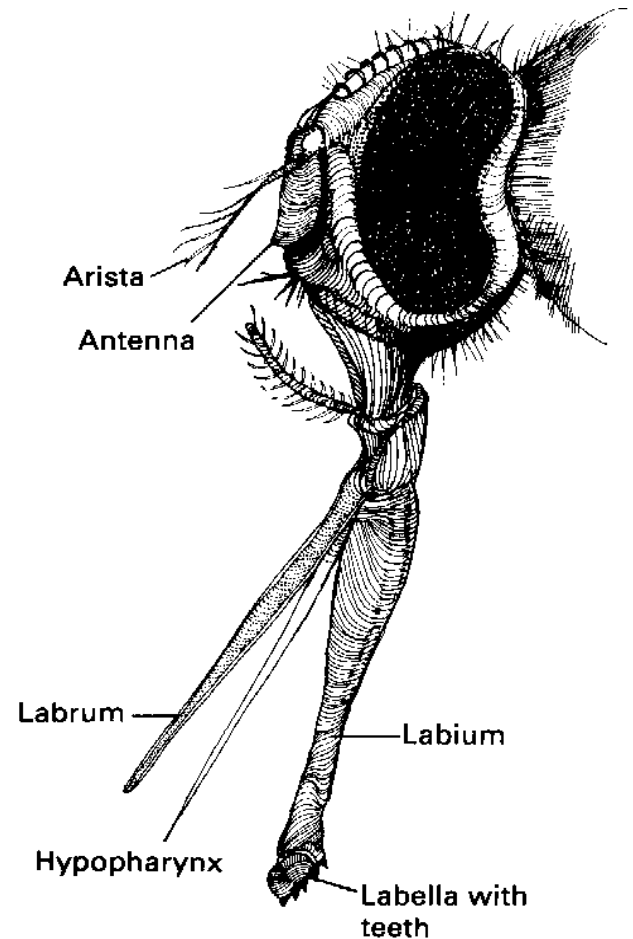
(a)



(b)



- no maxillae or mandibles in the mouthparts
- proboscis is adapted for piercing and sucking
 - consists of a lower U-shaped labium with rasp like labella
 - Upper narrower sharp labrum
- Between these a food channel hypopharynx
 - carries saliva and anticoagulant in to the wound formed during feeding

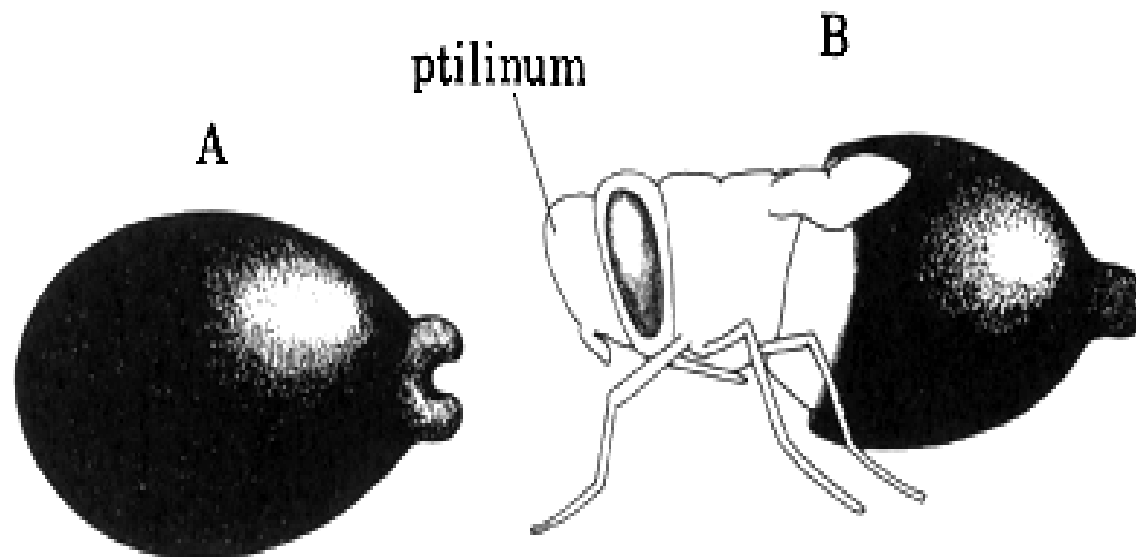
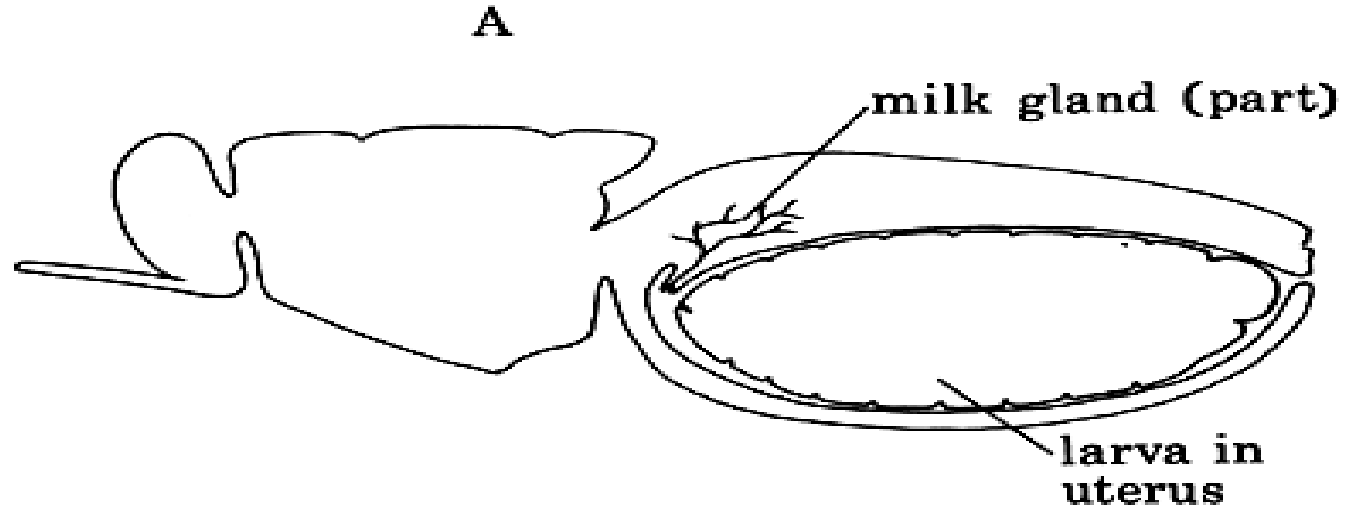


Life cycle

- Both sexes feed blood
- have some **host preference**
- are viviparous produce only one larvae at a time
 - total 8-12 larvae
- takes 10 days from egg- 3rd stage larvae (10mm long)
- The larva deposit in to the loose soil form a rigid dark brown, barrel shaped puparium will be developed

- Pupal period is long taking 4-5 weeks or more in cool weather
- On emergence the female fly requires several blood meals
 - a period of 16-20 days before producing the first larva
- Breeding generally continue throughout the year
 - peak fly numbers at the end of the rainy season
- The longevity varies from a few days to several months
- Painful bite and transmission of trypanosomosis

- Adult female produce a single egg
 - hatches to a first stage instar larvae in the uterus
- After development and moulting
 - a third stage larva is deposited on the ground
- Females produce a one full-grown larvae every 9-10 days which pupates in light or sandy soil
- adult fly emerge after a puparial
 - varies according to temperature (30 days at 24oC)
- Tsetse flies have a very low rate of reproduction (**k-strategist**)
- Flies that produce large number of eggs are **r-strategists**
- Reproductive method of tsetse
 - single egg hatches and develops to a third-stage larvae in the uterus of the fly
 - it is supplied with nutrients is known as **adenotrophic viviparity**



Family Hippoboscidae (keds & forest flies)

Genus Melophagus (Sheep ked)

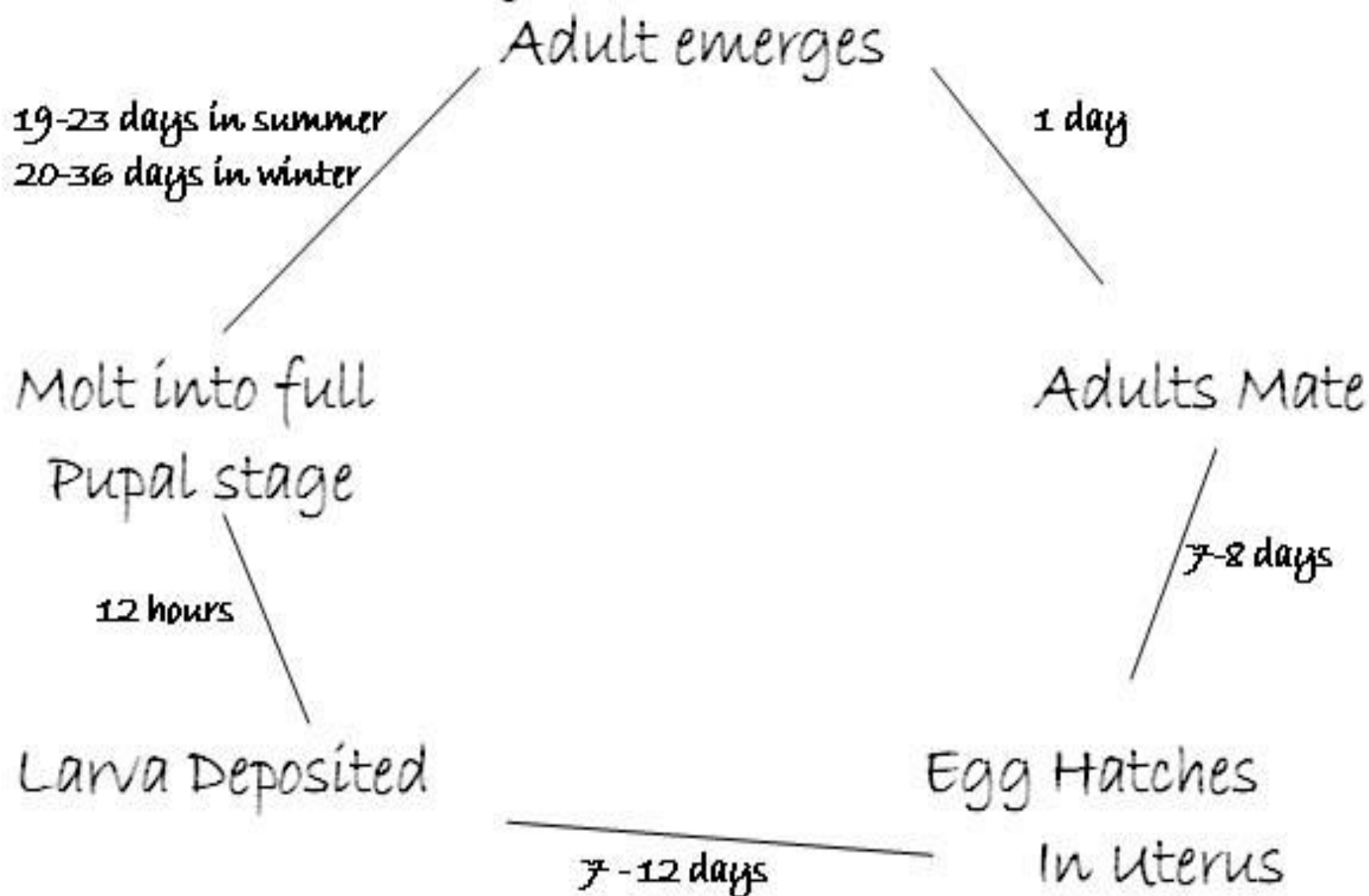
- Have leathery skin & soft tissue & lacks halteres
- Is hairy wingless insect
- Short head & is brown in colour
- Broad, flattened, brownish thorax & abdomen
- The legs of the sheep ked are very strong and are tipped with claws.
- lives their whole lives in the wool of sheep
- The areas of the sheep that sheep ked are most commonly found
 - the neck, shoulders and stomach



- Permanent ectoparasites
- Suck blood -----→ anemia & loss of condition
- Spread is by contact
- Long wool breed sheep are highly susceptible
- Self biting & rubbing-----
→ damage to fleece



Life Cycle of Sheep Ked



- lives for about four to six months.
- Within this time they produce anywhere from 10-20 larvae.
- larva is deposited on the wool of the sheep, they are attached with a glue-like material.
- The larva immediately hardens and becomes a darker color when forming a puparium.
- During this time the sheep ked is not susceptible to insecticides

Pathogenesis

- a blood sucking insect, causes irritation to the host, resulting in many different damages that are economical losses.
- In young lambs the sheep ked may cause anemia and retard weight gain.
- sheep ked sucks the blood from its host
 - irritation to the sheep's hide causing it to rub resulting in loss and damage of the wool.
- sheep ked bites and scratches the sheep, it makes firm, hard nodules that develop on the top layer of the skin called "cockle".
 - reduces the value of the skin

Myiasis causing Flies

Myiasis

Infection of living tissue of animals with the **larvae of dipteran** flies

- In animals & man by family of_ **Oestridae**

Calliphoridae

Sarcophagidae

- Cutaneous----->Lucilia
- Nasal----->Oestrus
- Somatic----->Hypoderma

1. Family Oestridae

- Is important family
- Large hairy flies
- Larvae are obligatory parasites of animals
- Adults have primitive non-functional mouth parts
- Adults are short lived
- larvae spend considerable time
- Important genera:
 1.Oestrus 2. Gastrophilus 3. Hypoderma

1. Genus Oestrus

- Larvae in the air passages (head sinuses & nasal passages)
- Commonly called nasal bots
- Host-----→sheep & goats
- Species---→ *O. ovis* (sheep nasal bot fly)

Morphology

- Female flies are viviparous
- Yellowish white colour about 3cm in length
- Each segment has a dark transverse band dorsally

Pathogenesis

- Usually slight
- sticky, mucoid can be haemorrhagic nasal discharge, sneezing & rub
- Heavy infections cause unthriftiness, circling
- Death of larvae in sinuses causes secondary bacterial invasion & cerebral involvement



Clinical signs

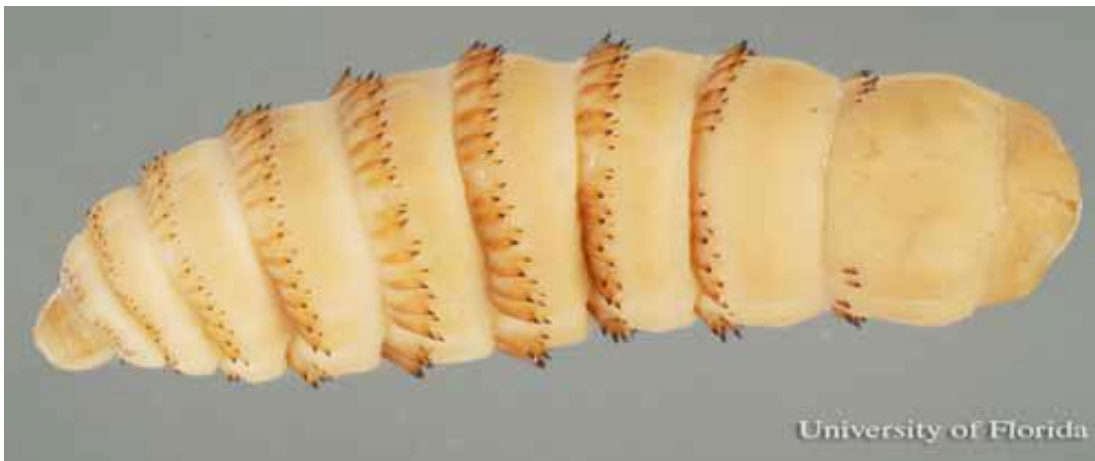
- Nose rubbing, head shaking
- Laying adults cause interruption in feeding, fail to gain weight.
- If larvae enters brain can cause ataxia, circling & head pressing
- **Diagnosis:** is only tentative from signs & others
- **Treatment:** Nitroxyini, rafoxanide, **ivermectin**, etc can be used in RX

2. Genus *Gastrophilus*

- obligate parasite
 - equines, zebras, elephants & rhinoceroses.
- Adult are commonly called **bot flies**
 - Larvae are called **bots**
- Develop in the stomach of equines
- little pathogenic
- Host-----→horses & donkeys

Species:

- *G. intestinalis*
 - segment 2-8 have dorsal spines
 - on each segment there are 2 spines
 - spines of the 1st row are larger than the spines of the 2nd row
- *G. nasalis*:
 - one row of spines on each segment
- *G. haemorrhoidalis*
 - segment 2-8 have dorsal spines
 - On each segment there are 2 spines
 - spines of the 1st row are smaller than the spines of the 2nd row.



Morphology

- Adults are short lived only for very few days
- have non functional mouthparts hence can't feed & resembles bee as they are brown & airy.
- Are robust dark flies
- *G. intestinalis* is most common---→has irregular transverse bands on the wings

Larvae

- When mature pass with faeces
- Are cylindrical
- Are reddish-orange with posterior spiracles
- Number & distribution of spines on various segments is used for species differentiation

Pathogenesis

- Egg laying adults cause annoyance
 - Larvae either crawl into mouth or transferred to tongue during licking
- In buccal cavity larvae causes stomatitis with ulceration
- Attachment to stomach provoke inflammatory reaction by oral hooks
- Heavy infestation can obstruct passage of food to intestines
- Irritation of rectum by *G. haemorrhoidalis* can cause rectal prolapse

Diagnosis: eggs from sites & larvae in the pharynx

3. Genus: Hypoderma

- They are called '**warble flies**'
- Hosts: cattle - the larvae occur erratically in other animals rarely man
- Species: *H. bovis*, *H. lineatum*

Pathogenic significance

- Economic loss caused by downgrading and condemnation of hides perforated by larvae
- Larvae develop under skin causing painful swelling
- With small central opening

4. Genus: Cephalopina

- This is the nasal bot fly of camels
- The fly deposits its larvae in the nostrils migrate to the nasopharynx and nasal sinuses
- It occurs about 11 months inflammation with purulent type on the nasopharyngeal mucosa
- Camels snort and sneeze, restless and may even stop feeding
 - especially during the emergence of mature larvae from the nostrils.
- Breathing and working capacity may be severely impaired.
- Adult Cephalopina do not panic the animals
 - large numbers are often seen resting on the camels head and nostrils

Family: Calliphoridae

- It is responsible for the cause of myiasis of domestic animals and man

Blowfly myiasis

- The type of myiasis caused is 'blow fly strike' -The laying of eggs by the fly being termed the 'strike'
- The development of maggot and the damage it cause is 'strike'.
- Hosts: mainly sheep but also other animals

Epidemiology

- They can be categorized in to two:
 - Primary flies – capable of initiating a strike on living–sheep– (Lucilia, Phormia and Calliphora)
 - Secondary flies –cannot initiate a strike but attack an area already struck or damaged (Calliphora species and Chrysomya)
- The epidemiology of cutaneous myiasis in sheep depends
 1. Temperature –high ambient temperature
 2. Rain fall – persistent rain can create ‘wool rot’ which makes the fleece attractive to the adult flies.
 3. Host susceptibility-this increased where putrefactive odours develop on the fleece

Pathogenesis

- Irritation and distress due to the larval lesion and secondary bacterial infections results
- debilitating and rapid loss of condition
- Death

Treatment

- All affected sheep should be separated
- clipped the lesion area remove the larvae and dressed
- lesion with suitable insecticide

Control

- Prophylactic treatment of sheep with insecticides

Thank you

Good luck