

Veterinary Entomology

Ectoparasites of Veterinary Importance

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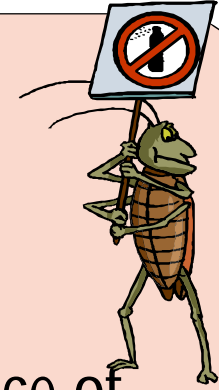
Vet. Entomology



Veterinary Entomology:

- Study of insects of veterinary importance.
- Commonly used to describe the wider study of **all arthropods parasitic on animals**, including **arachnids** such as *ticks* and *mites*.
- More species of arthropods than all other animals on earth combined (> 1, 000, 000 spp).
- Some species live at the expense of other animals (host)----*Parasitism*

Ectoparasites



- With few exceptions , they live on or burrow into the surface of the host's epidermis (Ectoparasites)

Ectoparasite-Host Relationships

□ The Parasite

I. Obligatory Parasitism

- The parasite is totally dependent on the host

II. Facultative Parasitism

- The parasite may feed or live only occasionally on the host, without being dependent on it

Ectoparasites

□ The Host

- Supplies a source of food (blood, lymph, tears or sweat or the debris of skin, hair or feathers)
- Provides ambient and protective environment to the parasite
- Provides transportation from place to place
- Serves as a mating site for the parasite

Ectoparasites

Damages Caused by Ectoparasites

- ❑ Ectoparasites can cause direct or indirect damage to the host
- ❑ **Direct Damage:**
 - Blood loss, myiasis (*the infestation of living tissues by parasitic larvae*), skin inflammation and pruritis (*Itching*), usually followed by hair and wool loss (*alopecia*), occasionally followed by skin-thickening (*lichenification*)
 - Toxic and allergic responses (*caused by antigens and anti-coagulants in the saliva of blood-feeding arthropods*).
 - Disturbances

Ectoparasites

- Self-infliction
- Social nuisance

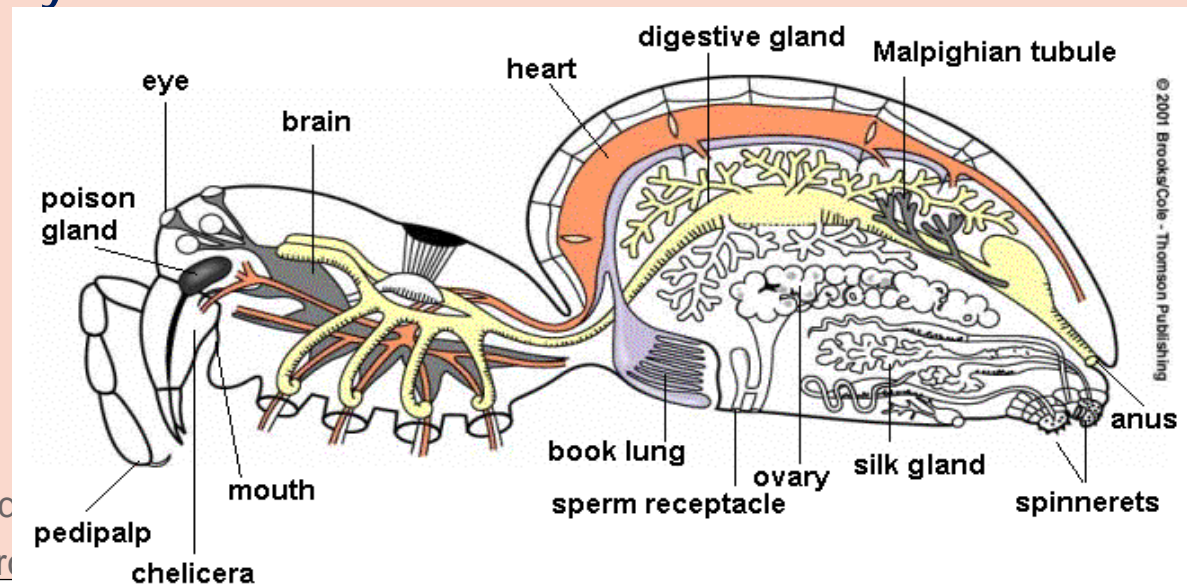
Indirect Damage

- ❑ Ectoparasites act as vectors of pathogens [bacteria, virus, protozoa, cestodes (tapeworm), nematodes (round worms)]
- ❑ Pathogens such as bacteria and virus can be transmitted directly by the ectoparasite acting as mechanical vectors
- ❑ Many protozoa, cestode and nematodes go through specific stages of their life cycle in the body of the parasitic arthropods

Vet. Entomology

Phylum Arthropoda

- Contains over 80% of all known animal species
- Invertebrates with segmented body and jointed limbs
- Covered by hard chitinous exoskeleton



Arthropod Classification

- There are two major classes of arthropods of veterinary importance, namely the *Insecta* and *Arachnida*

Insecta:

- Have three pairs of legs,
- The head, thorax and abdomen are distinct
- They have a single pair of antennae.

Arachnida:

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

Arthropod Classification (general)

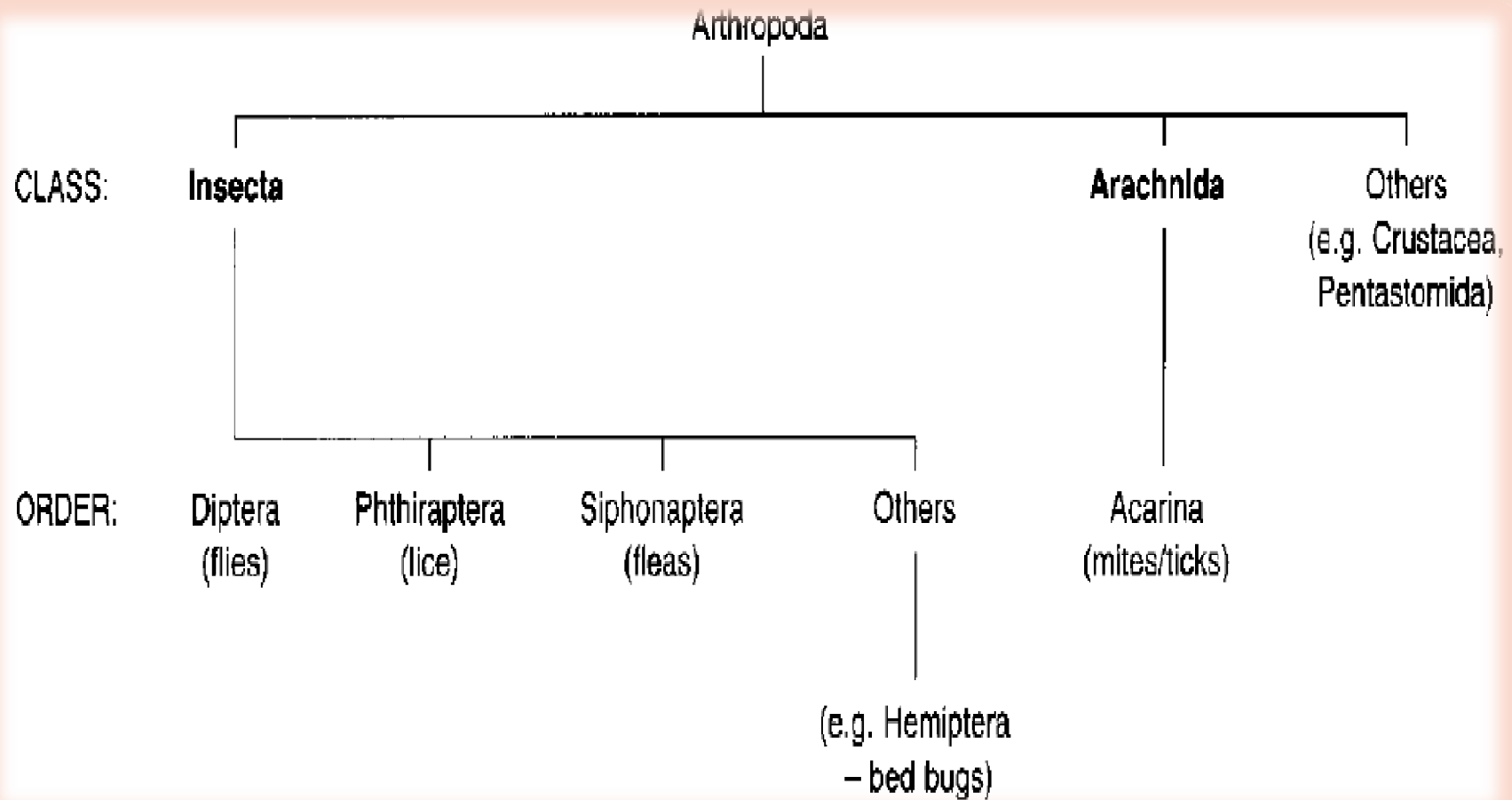


Fig. General classification of arthropods

Arthropoda

Arthropod Classification

(Veterinary importance !)

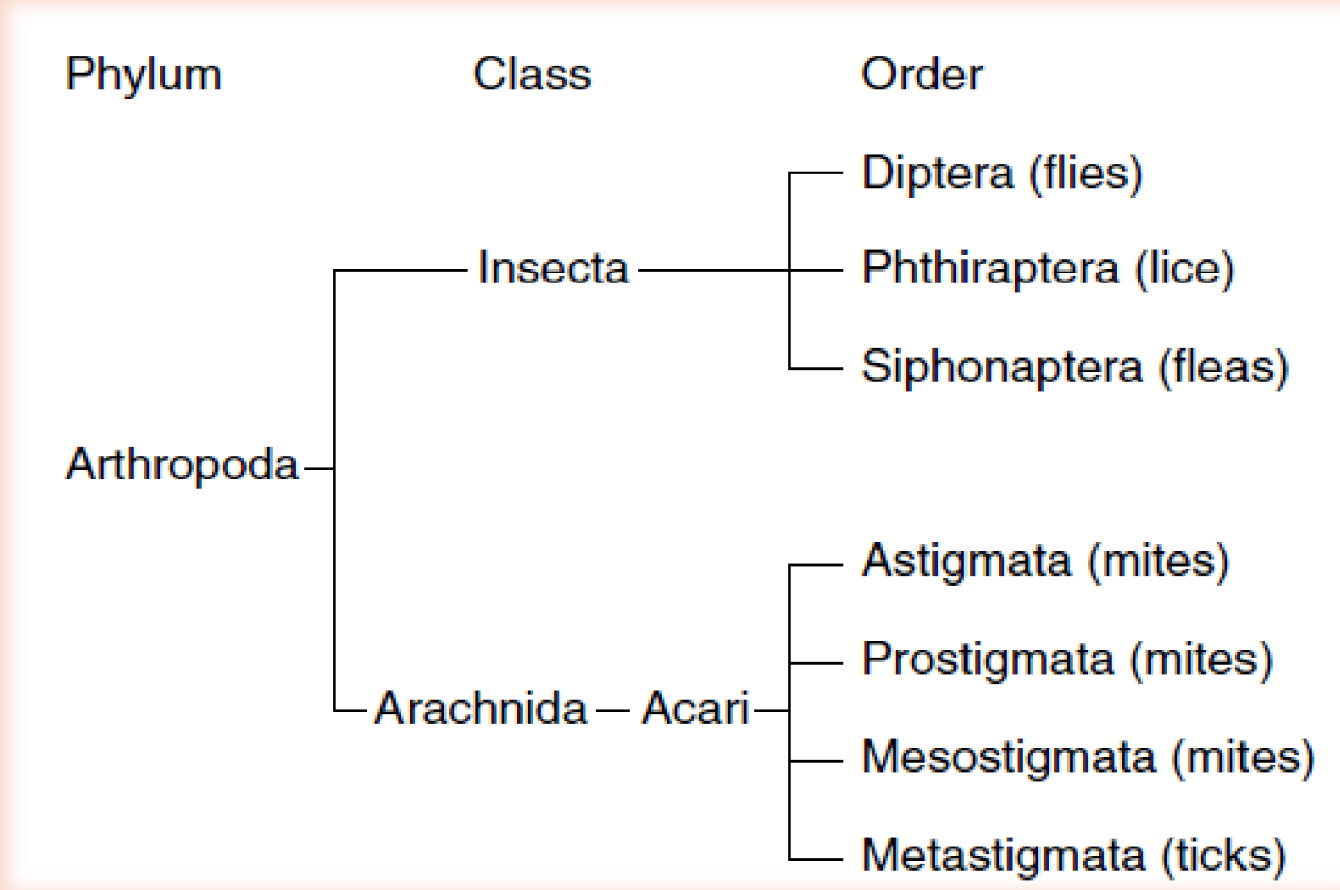
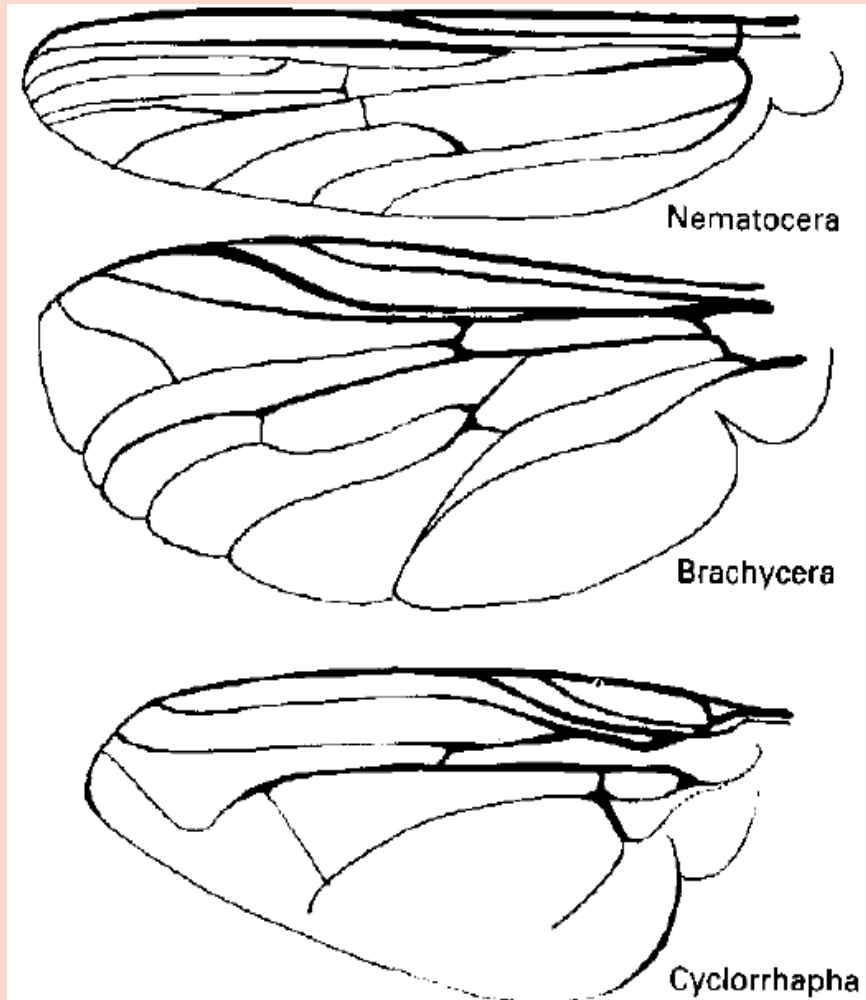
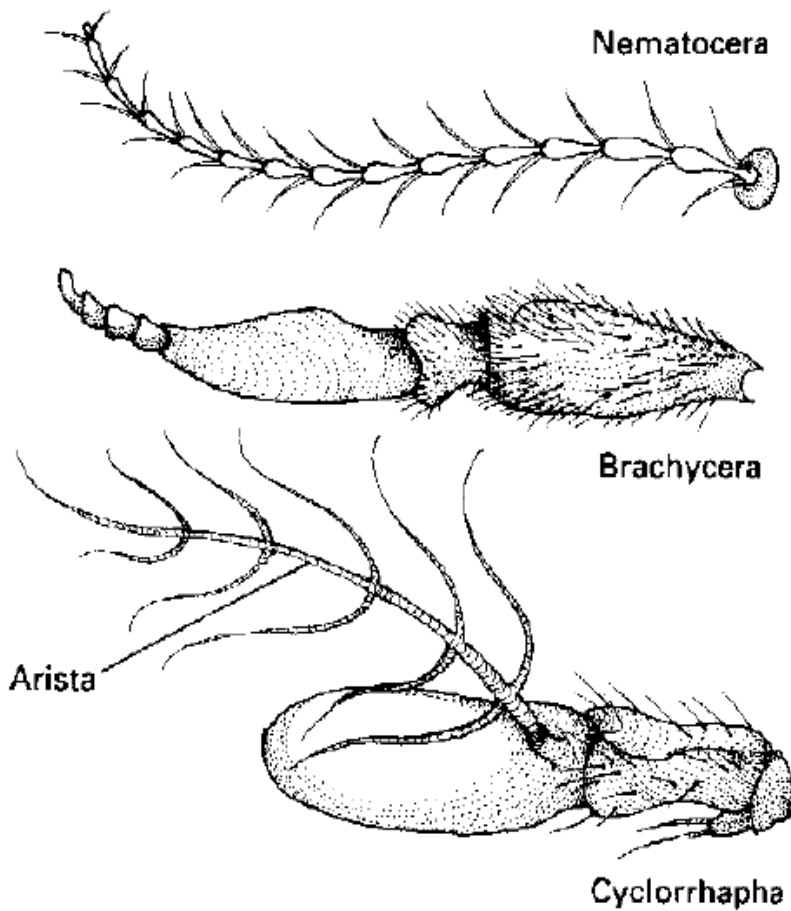


Fig. The arthropod order of veterinary importance

Order Diptera

- Contains all of the flies of veterinary importance.
- Have a single pair of membranous wings and a pair of halteres.
- Some are important as external parasites
- In others the larvae parasitize the tissues of the host
- Many members of this group are also important as vectors of disease.
- Divided into three suborders, namely, the *Nematocera*, *Brachycera* and *Cyclorrhapha*

Order Diptera



12 *Characteristic antennae of the three suborders of Diptera.*

Variations in wing venation found in the three suborders of Diptera.

Order Diptera

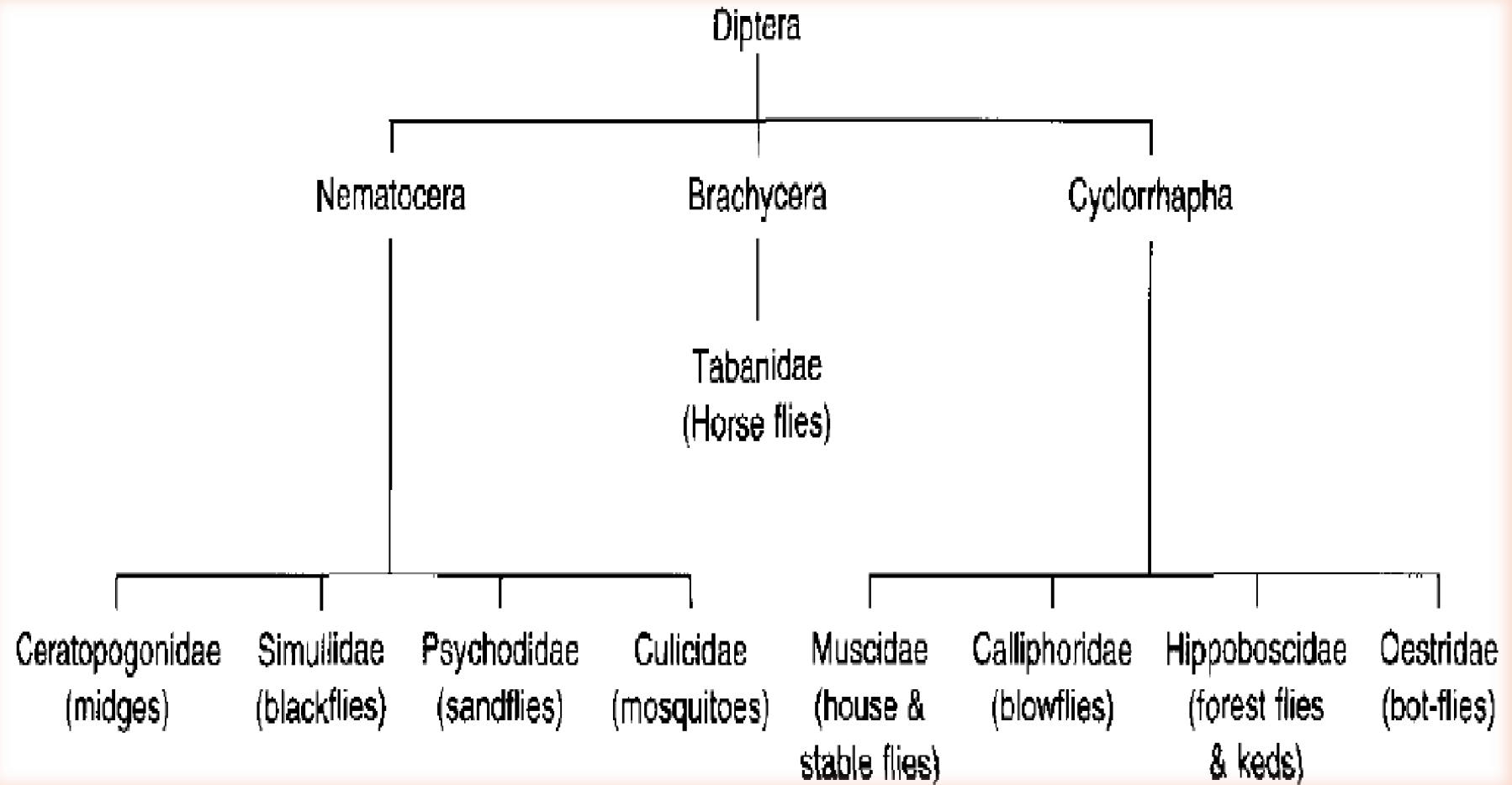


Fig. Classification of the Diptera

Suborder Nematocera

Family Ceratopogonidae

- Very small flies which are commonly known as biting midges.
- The females feed on man and animals and are known to transmit various viruses, protozoa and helminths.
- The only important genus from a veterinary standpoint is *Culicoides*

Culicidae (*Mosquitoes*)

Host:

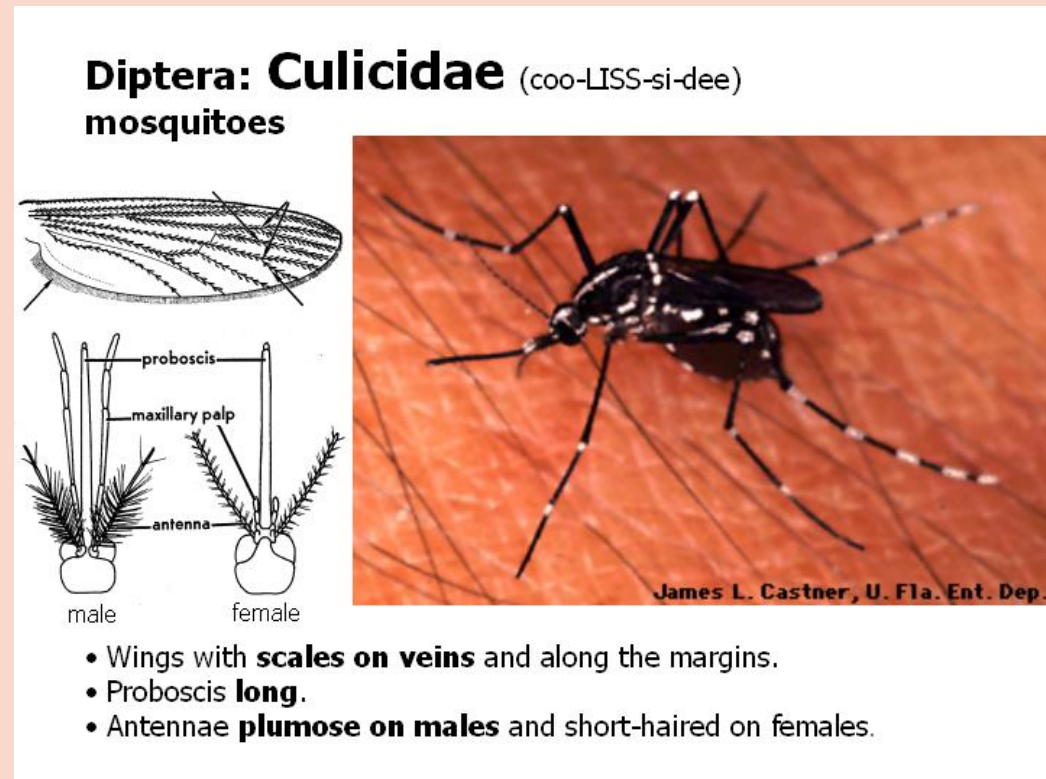
- All domestic animals and man.

Species:

- There are over 800 species of *Culicoide*, commonly known as midges.

Distribution:

- Worldwide (*from tropics to arctic*).



Identification:

- Long and narrow wings with scales along veins and wing margin

Culicidae (*Mosquitoes*)

□ Classification

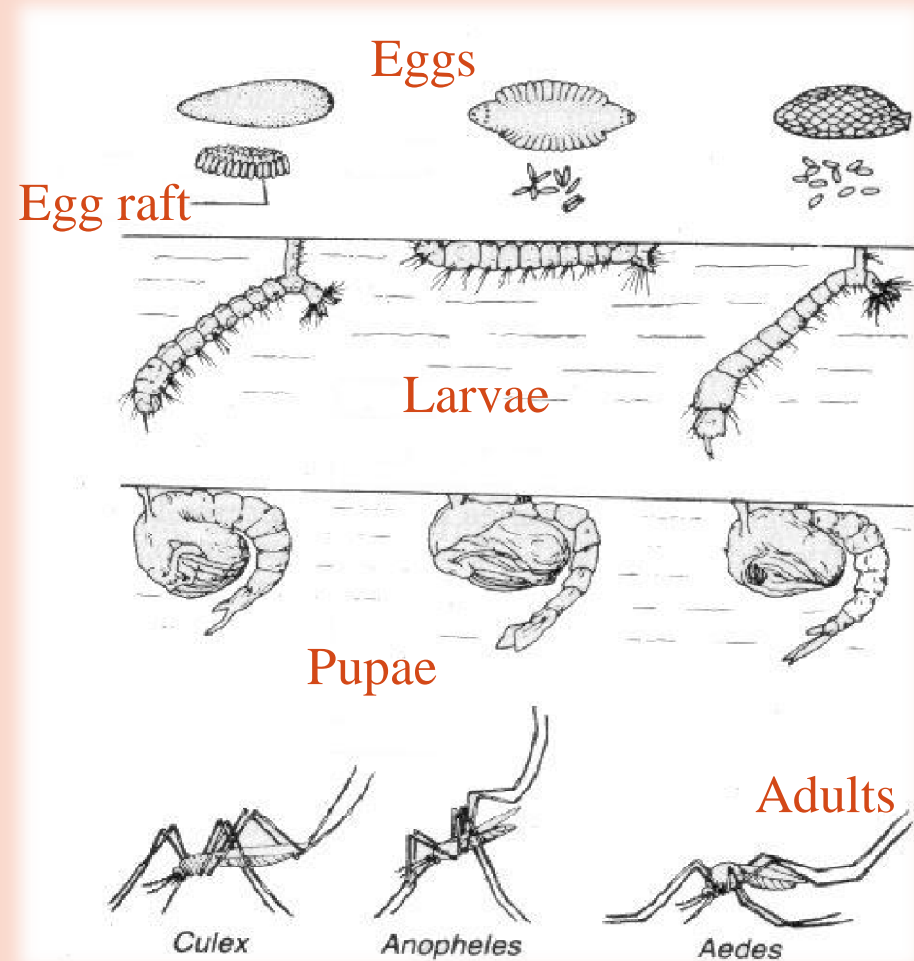
❖ Two subfamilies

- **Anophelinae**

- Genus *Anopheles* (human malaria)
- Adults rest with abdomen tilted at steep angle to substrate
- Larvae rest horizontally on water surface

- **Culicinae**

- Genera *Aedes* & *Culex* (arboviruses & filarial worms)
- Adults rest with abdomen parallel to substrate
- Larvae hang at angle from water surface



Culicidae (*Mosquitoes*)

□ Biology

- Almost all blood-sucking; only females take blood; males take nectar and plant juices
- Eggs laid in flowing or still water; water collected in containers, tree cavities and leaf axils of plants
- Eggs laid singly or together in floating raft
- Larvae and pupae are aquatic; active swimmers and breathe via siphon tube
- Adults usually close to breeding sites

Blood-feeding females



Aquatic larva

Culicidae (*Mosquitoes*)

Pathogenic Significance

- Cause considerable nuisance and reduce the productivity of livestock
- Sensitivity to mosquito bites.
 - Most hosts suffer only minor reaction, showing local swelling, redness and irritation
 - Others show hypersensitivity reaction to mosquito saliva and if the bites are scratched, a secondary bacterial infection may ensue
- Causes seasonally occurring, intensely pruritic, skin disease of horses called 'sweet itch'



Fig. A case of 'sweet itch' in a horse

Culicidae (*Mosquitoes*)

Pathogenic Significance

- Mosquitoes can be vectors of the dog heart worm, *Diroflaria immitis*
- Act as vectors of various viral diseases , including arboviruses, such as equine encephalitis (a toga virus), ranbbit myxomatosis and infectious equine anemia (a retrovirus)
- They may also transmit virus diseases such as bluetongue and African horse sickness as well as filarioid nematodes such as *Dipetalonema* spp., *Onchocerca reticulata* and *O. gibsoni*.

Culicidae (*Mosquitoes*)



Control

- Destruction of breeding sites by drainage or spraying with insecticides
- Use insect repellent or insecticide impregnated screens

For 'sweet itch'

- Antihistamine treatment for immediate relief
- Application of synthetic pyrethroid dressings may help prevent recurrence



Simuliidae (Black Flies)

- The genus *Simulium* is the most important

Hosts:

- All domestic animals and man

Species:

- Numerous and often divided into sub-species.

Distribution:

- Worldwide except New Zealand, Hawaii and some minor island groups.

Simuliidae (Black Flies)

❖ Features

■ Females are blood-feeders

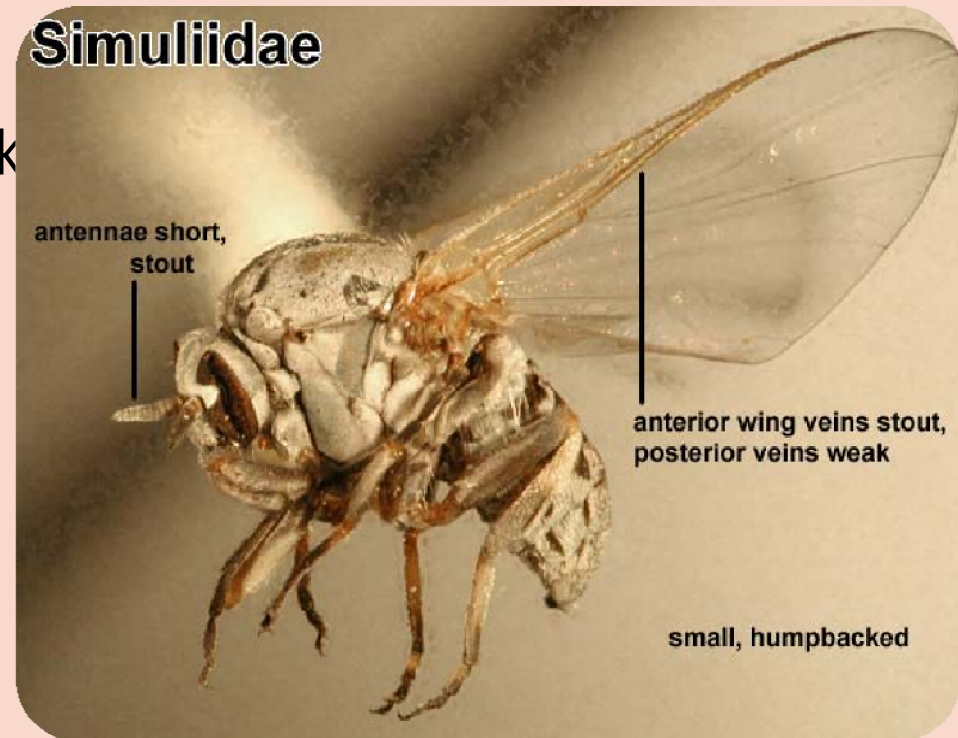
- Vicious biters and cause major distress to poultry, livestock and humans
- Cause extreme pain, itching and local tissue swelling
- Vast swarms cause livestock deaths via blood loss, suffocation and trauma
- In tropical Africa, *Simulium damnosum* transmit filarial worms that cause river blindness in humans
- Also transmit filarial worms, trypanosomes and Leucocytozon disease in poultry



Simuliidae (Black Flies)

❖ Identification

- Small (2-5 mm) stocky grey-black flies
- Humped thorax (buffalo gnats)
- Clear wings without hairs or scales



Simuliidae (Black Flies)

- **Biology**

- Aquatic larvae live in fastest flowing parts of streams and rivers
- Larvae attach to rocks and vegetation (via silk and hooks)
- Larvae are filter-feeders using complex labral fans on head
- Pupate on rocks underwater
- Adults may occur several km from water



Aquatic larva



Head fans

Simuliidae (Black Flies)

Pathogenic Significance

- The painful bite inflicted by adult female black fly may cause considerable disturbance and reduced productivity
- Biting stress may be compounded by allergic reaction to saliva
- In domestic animals, mass attack may cause sudden death characterized by general petechial haemorrhage, together with the oedema of the larynx and abdominal wall
- Act as vectors for a range of pathogenic nematodes, viruses and protozoa
 - Filarial nematode, *Onchocerca cervicalis* in horses and *Onchocerca gutturosa*, causing equine and bovine onchocerciasis respectively
- May transmit viruses causing Eastern equine encephalitis and vesicular stomatitis in horses and cattle
- Vector for filaroid nematode *Onchocerca volvulus* causing 'River blindness' in humans in Africa, Central and South America

Simuliidae (Black Flies)

❖ Control

- Application of insecticides to breeding sites to kill larvae (the most practical control strategy)
- Bush clearing to remove adult resting sites
- Aerial spray of insecticides in areas where breeding occurs in in network of small streams and watercourses

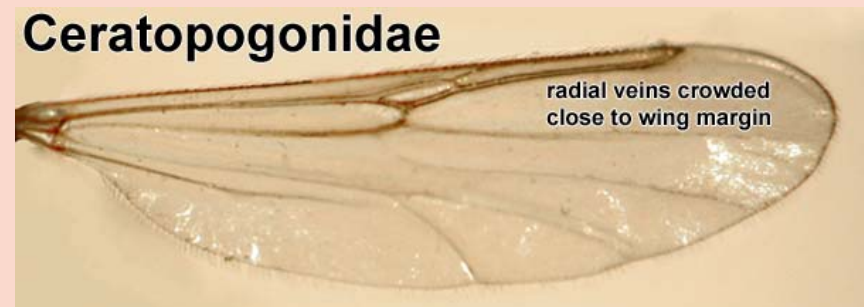
Ceratopogonidae (Biting midges)

- ❑ Females of some genera (*Culicoides*) are blood-suckers; males visit flowers
 - Painless bite is followed by intense irritation & itchiness

- ❑ Identification
 - Very small flies (0.5-2mm)
 - Grey or yellowish bodies
 - Wings folded over body at rest
 - Wings have thick radial veins crowded close to wing margin



Culicoides



Ceratopogonidae

radial veins crowded
close to wing margin

Ceratopogonidae (Biting midges)

- **Biology**

- Larvae carnivores or detritivores
- Larvae mostly live in water bodies with high organic content; some live in moist or terrestrial habitats
- Adult females transmit arboviruses in livestock
 - Bluetongue virus in sheep
 - African horse sickness
- Species that bite humans may transmit filarial worms & viruses



Infestation by *Culicoides*

Tabanidae (Horse flies, Deer flies and Clegs)

Tabanidae

- The largest families of order Diptera (8000 spp. divided into three genera)
- *Tabanus* (horse flies), *Haematopota* and *Crysops* (deer flies) are the three species of major veterinary importance
- Female horse flies are voracious blood-feeders



James L. Castner, U. Fla. Ent. Dep

Tabanidae (Horse flies, Deer flies and Clegs)

• Biology

- Adults feed on nectar & plant juices; females take vertebrate blood
- Larvae develop in moist habitats, often in mud at edges of water bodies
- Most larvae feed on decaying plant matter; some are predaceous



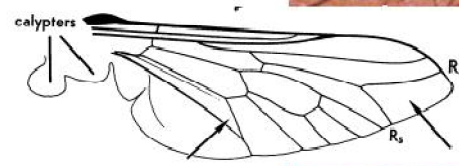
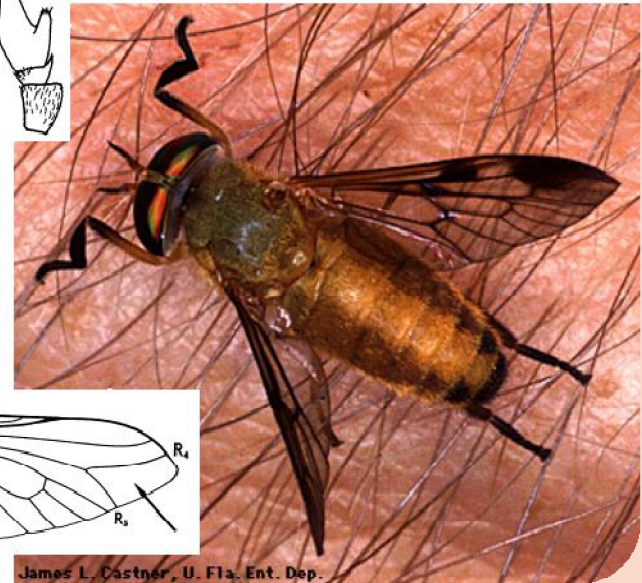
Tabanidae (Horse flies, Deer flies and Clegs)

❖ Identification

- Large, stoutly built flies
- Often have iridescent eyes
- Antennae have 3 segments; 3rd segment is elongated and annulated
- Wings have large calypters
- Wing veins diverge at wing tip to form an open 'V'

Diptera: **Tabanidae** (tuh-BAN-ni-dee) horse flies, deer flies

- Medium- to large-sized, stout-bodied flies; wings held in **single plane** over abdomen.
- 3rd antennal seg **elongate and annulated**
- Wings with **large calypters**; veins **R4 & R5 divergent and enclosing wing tip**



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Tabanidae (Horse flies, Deer flies and Clegs)

❖ Pathogenic Significance

- Cause great deal of disturbance to the animal which results in reduced weight gain and milk production
- Are efficient mechanical vectors of the organisms responsible for such diseases as anthrax, pasteurellosis, trypanosomosis, anaplasmosis and the human filarial disease, loaosis

Tabanidae (Horse flies, Deer flies and Clegs)

□ Pathogenic Significance



Tabanus sulcifrons feeding on a cow.
Note the bleeding droplets from a prior bite wound

Glossinidae (tsetse flies)

- Are distributed over 10 million square kilometers of Africa
- Extremely important as vectors of African trypanosomosis which is a serious disease of domestic animals and man.
- Both sexes are host-specific blood-suckers (bites are painful)
- Larviparous giving birth to larvae ready to pupate.
- The larva is deposited in loose, dry soil, and soon completes development.

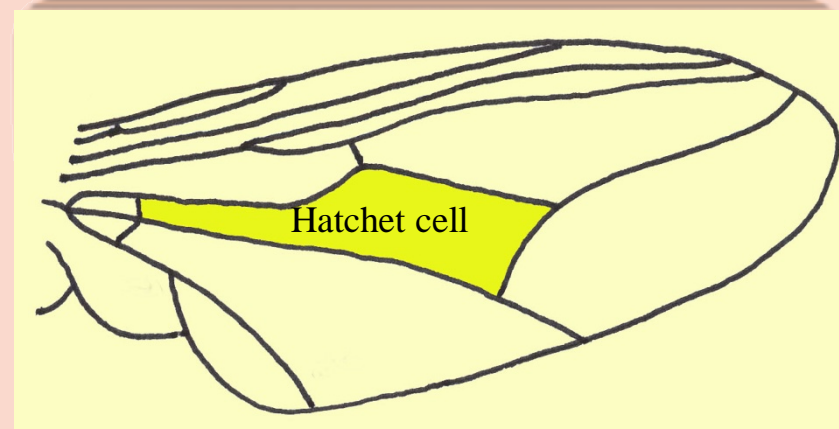
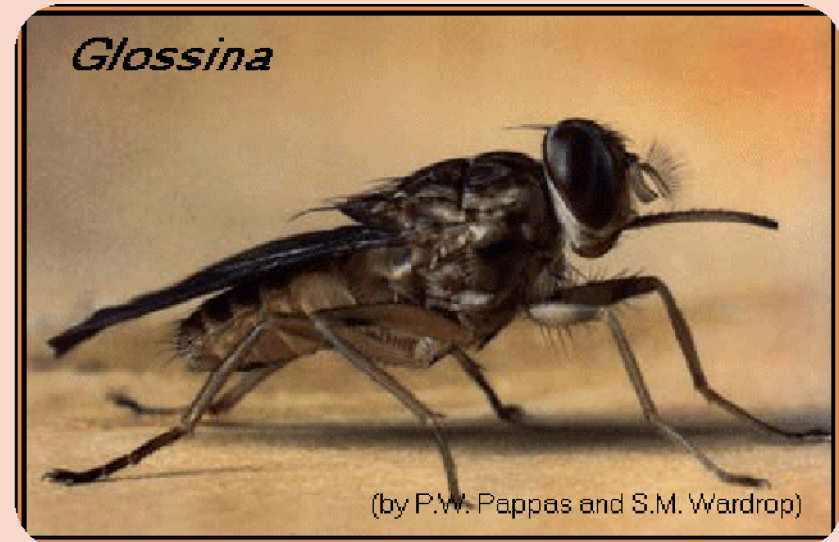


Glossinidae

tsetse flies

❖ Identification

- Medium sized flies with very tough and leathery body (survive swatting)
- Flattened body and short forward-pointing proboscis
- Wings folded scissor-like at rest; conceal abdomen
- Wings have 'hatchet cells'



Glossinidae

tsetse flies

❖ Biology

- Adults active during day
- Occupy habitats with trees (e.g. grasslands & woodlands)
- Both sexes feed on large mammals; humans only attacked in absence of game
- Females incubate single maggot in their bodies
 - Nourished by 'milk gland'
 - Larvae pupate in soil; very soon after deposited



Glossinidae

tsetse flies

❖ Pathogenic Significance:

- Bites of tsetse flies are very painful and cause marked irritation
- Mainly significant in the transmission of animal and human trypanosomosis

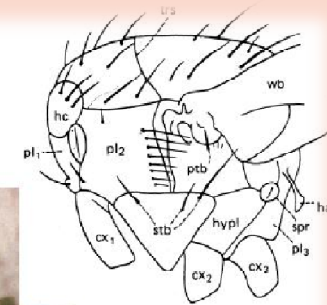
❖ Control

- Insecticide spray
- Use of traps (cheap and environment friendly)

Muscidae (house flies)

- ❑ Large group with many common flies and some important pests
 - Nuisance flies
 - Mechanical disease transmitters
- ❑ **Identification**
 - Thorax lightly striped
 - Mostly based on presence or absence of bristles on thorax
- ❑ **Biology**
 - Larvae live in various types of organic matter; manure, garbage, rotting vegetation
- ❑ Two important subfamilies
 - Muscinae
 - Stomoxyinae

Diptera: Muscidae
(MUS-si-dee)
house flies, stable flies



- Thorax **lightly striped**
- Arista **plumose** for entire length
- Hypopleuron **without bristles**
- **More than one sternopleural bristle**

Muscidae (house flies)

□ Muscinae

- Non-biting species – short fleshy proboscis for mopping up surface liquids
- Some species extract fluids from human food and faeces (e.g. house fly, *Musca domestica*)
- Such species mechanically transfer bacteria and viruses causing diseases in humans
 - Cholera, poliomyelitis, leprosy, typhoid fever, dysentery etc
- Others feed on wounds or run off from wounds
- Some involved in myiasis



Muscidae (*house flies*)

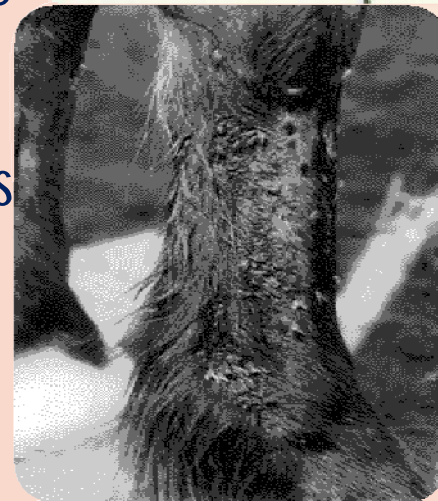


Chicken egg speckled with vomit and faeces
from house fly (*Musca domestica*)

Muscidae (*house flies*)

□ Stomoxyinae

- Biting species – long piercing mouth parts
- Some species are aggressive and persistent blood-suckers (e.g. stable fly, *Stomoxys calcitrans*)
- Torment wild and domestic animals (e.g. ears of dogs)



Stomoxys calcitrans - Stable fly

□ *Stomoxys calcitrans* - Stable fly

- Looks like a house fly but has long pointed proboscis
- Palpi much shorter than proboscis

□ **Life cycle** - approximately three weeks

- Eggs laid in manure/straw, decaying vegetation (lawn clippings), sea weed
- Bimodal spring and fall population peaks



Stomoxys calcitrans - Stable fly

□ Pathogenic Significance

- Production losses primarily in dairy cattle
 - Irritating, persistent biter
- Transmits disease agents
 - Mechanical transmission of anthrax, EIA, anaplasmosis
 - Biological vector - horse stomach nematode *Habronema microstomum*

● Control

- Application of residual insecticides to surfaces
 - Walls, fence posts, and other resting places
- Disposal of organic waste (compost piles) and manure

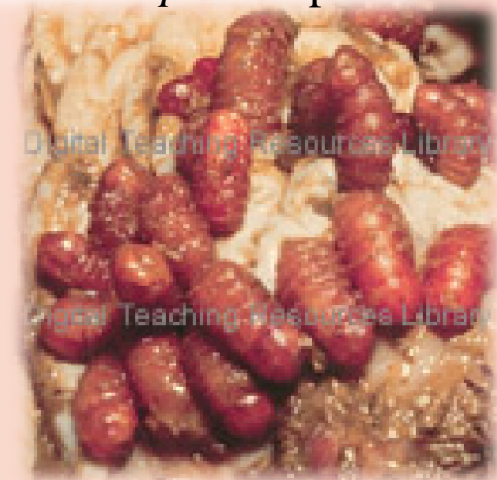
Gasterophilidae (horse bot flies)

Identification

- Adults are dull yellow & bee-like
- Short-lived adults lack mouth parts & don't feed; rarely seen
- Genus *Gasterophilus* associated with myiasis
- Larvae inhabit guts of large mammals
- Larvae are barrel-shaped & armed with rows of spines



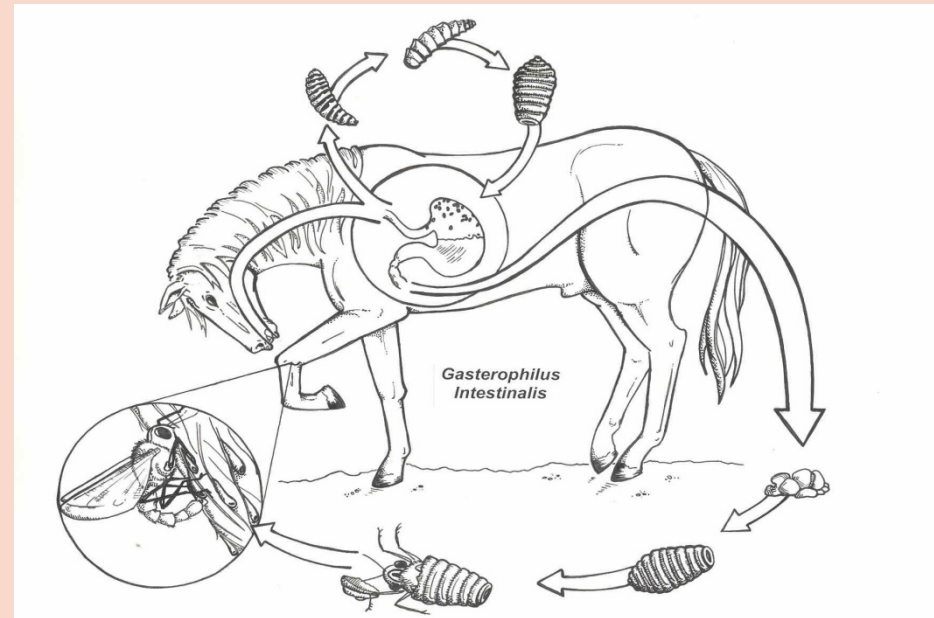
Gasterophilus sp.



Gasterophilidae (horse bot flies)

□ Biology

- Eggs laid on host's fur; near mouth or on forelegs
- Larvae enter mouth of host
 - Burrow through skin into mouth
 - Eggs are licked & swallowed by host before hatching
- Larvae move to stomach & attach to wall
 - Nourished by horse's blood
 - May damage guts & weaken animals
- Mature larvae pass out in faeces & pupate in soil



Oestridae (warble flies, bot flies)

□ Identification

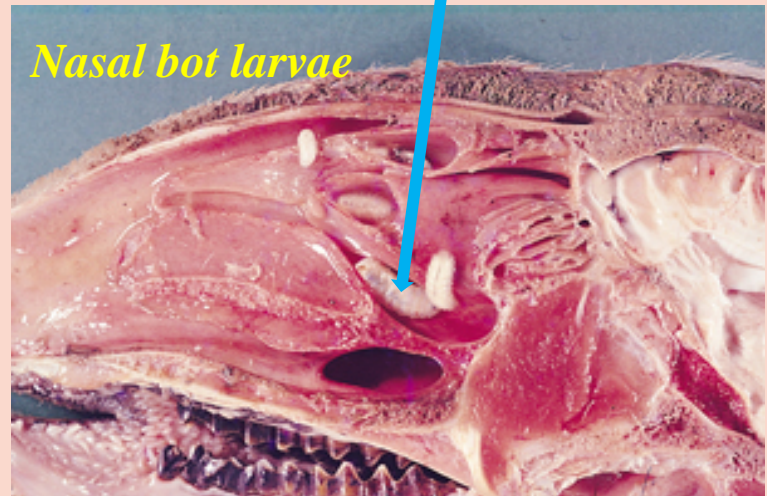
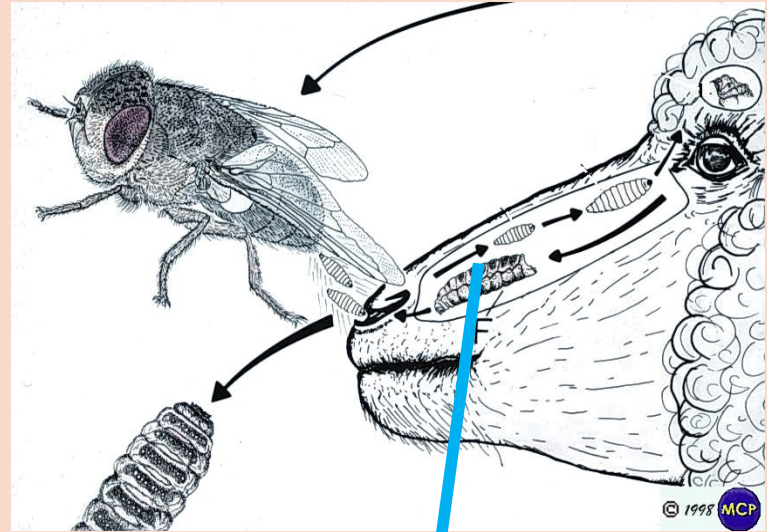
- Large, stout, hairy flies with large inflated head and mottled grey colour
- Adults don't feed; short-lived and rarely seen
- Larvae are involved with myiasis
- Larvae are white, spiny, barrel-shaped and have black mouth parts



Oestridae (warble flies, bot flies)

□ Biology

- Larvae are internal parasites of mammals
 - Nasal cavities of sheep, horses, antelope etc
 - Under skin of cattle, antelope, rodents etc
- Sheep nasal bot fly (*Oestrus ovis*)
 - Living larvae deposited into nostrils; attack to sinus membrane and feed on mucous
 - Sneezed out and pupate in soil



Oestridae (warble flies, bot flies)

- Skin parasites cause pus-filled boils (warbles) that damage animal hides
- Other species of *Oestrus* and *Geddoelstia* live in pulp cavity in horns of antelope and sheep



Fig. Warbles on cattle

Phthiraptera (*Lice*)

- Small, flattened and wingless
- Short stout legs; end in strong claws
- Permanent ectoparasites on birds and mammals

❑ **Biting lice**

- Biting and chewing mouth parts
- Head is as wide as or wider than thorax
- Previously Suborder Mallophaga; now three suborders
- Mostly associated with birds (also mammals)

❑ **Sucking lice**

- Piercing and sucking mouth parts
- Head generally narrower than thorax
- Suborder Anoplura
- Associated with mammals (also humans)

The Lice:

Mallophaga (mal-LOF-fa-ga)

mallo = wool, *phaga* = eat

Chewing Lice

- **chewing** mouthparts
- head **wider** than thorax

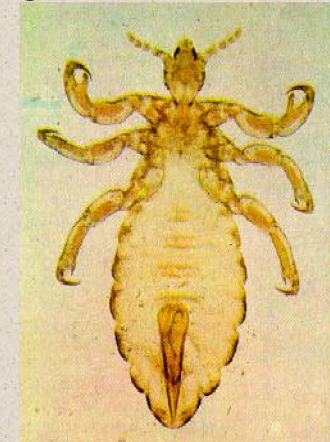


Anoplura (ann-no-PLU-ra)

anopl = unarmed, *ura* = tail

Sucking lice

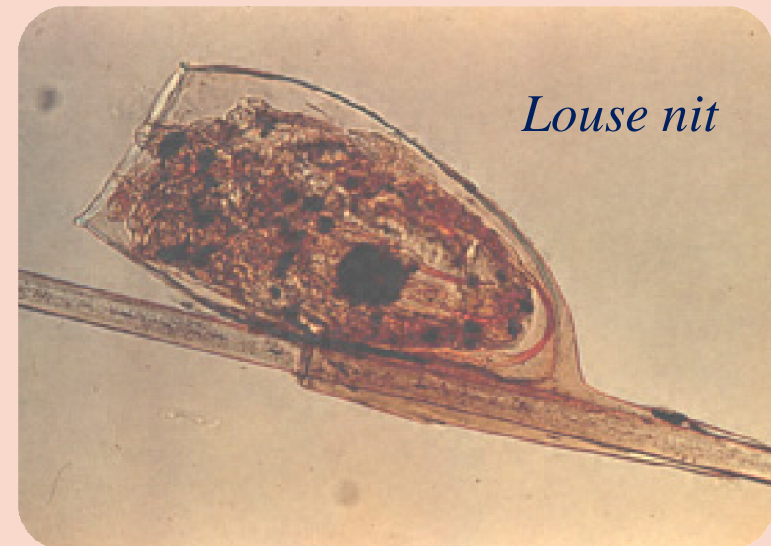
- **piercing-sucking** m'parts
- head **narrower** than thorax
- legs have distinct **claws**



Phthiraptera (*Lice*)

□ Biology

- Entire life cycle occurs on host
- Eggs (nits) are cemented onto host's hair or feathers
- All stages (nymphs and adults are blood sucking
- Transmission via contact between hosts
- Unable to survive for long when off hosts
- Many species are host specific
 - Attack one or few related species
 - Live in specific region of host's body
 - Identity often indicated by host



Biting Lice

- ❑ Mostly associated with birds and don't attack humans
 - Feed on feathers and mostly host specific
- ❑ Two important families
 - ***Menoponidae (biting bird lice)***
 - Antennae fold into grooves on side of head
 - ***Philopteridae (bird lice)***
 - Largest family of lice
 - Antennae not concealed in grooves in head
 - ***Pests of poultry***
 - Heavily infested birds become emaciated
 - May bite humans when infested birds nest in houses



Head of Menoponidae

Table. Lice Found on Domestic Animals

Host	Anoplura	Mallophaga
Cattle	<i>Haematopinus eurysternum</i>	<i>Damalinia bovis</i>
	<i>Haematopinus quadripertussus</i>	
	<i>Haematopinus tuberculatus</i>	
	<i>Solenopotes capillatus</i>	
Horse	<i>Haematopinus asini</i>	<i>Damalinia equi</i>
Pig	<i>Haematopinus suis</i>	None
Sheep	<i>Linognathus ovillus</i>	<i>Damalinia ovis</i>
	<i>Linognathus pedalis</i>	
Goat	<i>Linognathus africanus</i>	<i>Damalinia caprae</i>
	<i>Linognathus stenopsis</i>	<i>Damalinia crassipes</i>
Dog	<i>Linognathus setosus</i>	<i>Damalinia limbata</i>
		<i>Heteroxus spiniger</i>
		<i>Trichodectes canis</i>
Cat	None	<i>Felicola subrostrata</i>

Phthiraptera (*Lice*)

Phthiraptera (*Lice*)

□ Veterinary Importance

- Heavy louse infestation (pediculosis) may cause pruritis, alopecia, excoriation and self-wounding
- Disturbance caused by lice may result in lethargy and loss of weight gain or reduced egg production
- Severe infestation with sucking lice may cause anaemia
- In medical entomology, lice are well known as vectors of important human diseases such as typhus and louse-borne relapsing fever



Phthiraptera (*Lice*)

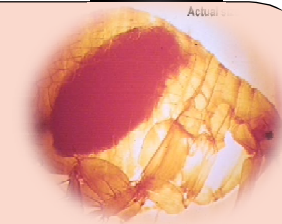
- Blood-sucking lice associated with domestic animals have been implicated for disease transmission
- *Haematopinus suis* (pig louse), may spread pox virus
- Cattle lice may transmit rickettsial anaplasmosis
- Some species of lice may act as intermediate hosts for tapeworm, *Diplydium caninum*



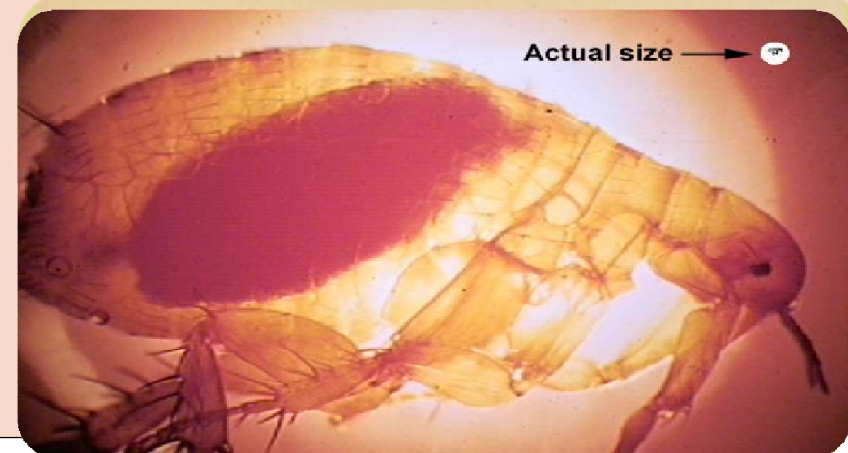
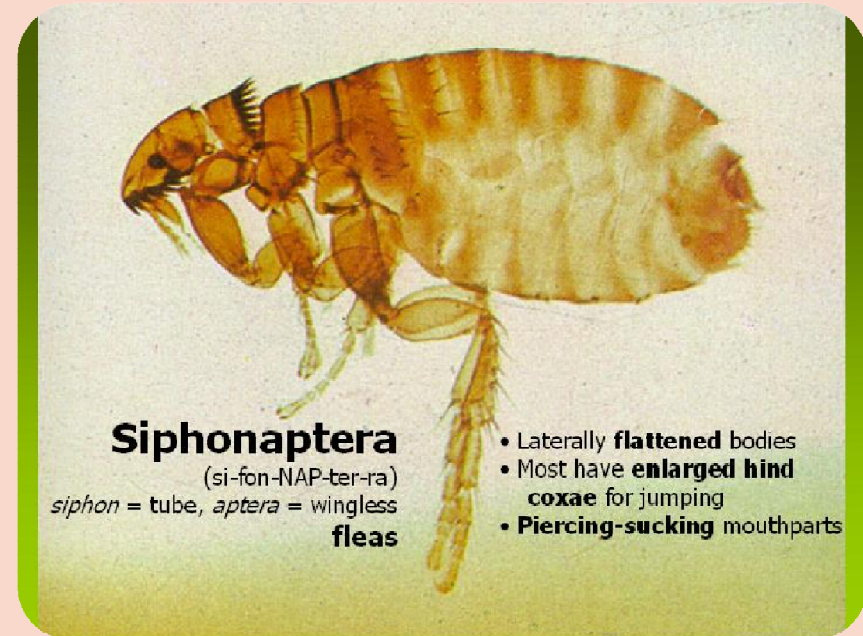
*Lice infestation
in chicken*



Siphonaptera (fleas)



- Small, laterally flattened, wingless insects
- Large hind legs and spectacular jumps
- Parasitic on birds and mammals
 - All adults have piercing and sucking mouth parts and feed on blood
 - Females need blood to lay eggs
 - Some species are host specific, but most feed on several hosts
 - Annoying pests due to blood sucking, skin burrowing and transmission of diseases and parasites



Siphonaptera (fleas)

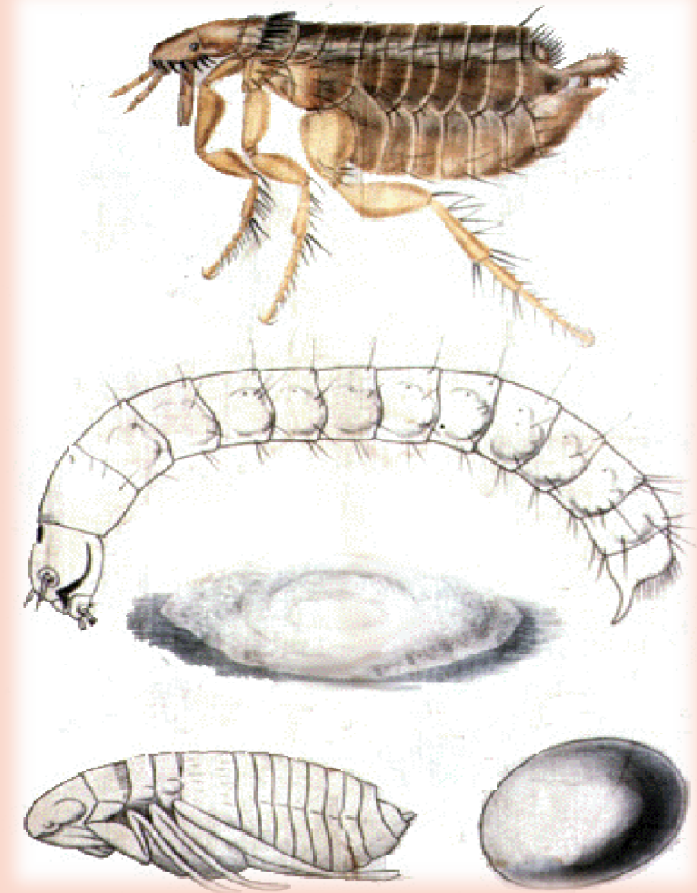
- Most fleas locate host by CO₂, specific odours, light/dark contrast, vibrations, and air currents.
- Host specificity varies & many species can move between different host species.
- This increases the vector potential of these species
- Some fleas are very specific, e.g. rabbit fleas.
- Some female fleas attach permanently as adults, e.g. "sticktight flea", *Echidnophaga gallinacea*. Most other species only spend a proportion of their time on the host.



Siphonaptera (fleas)

□ Biology

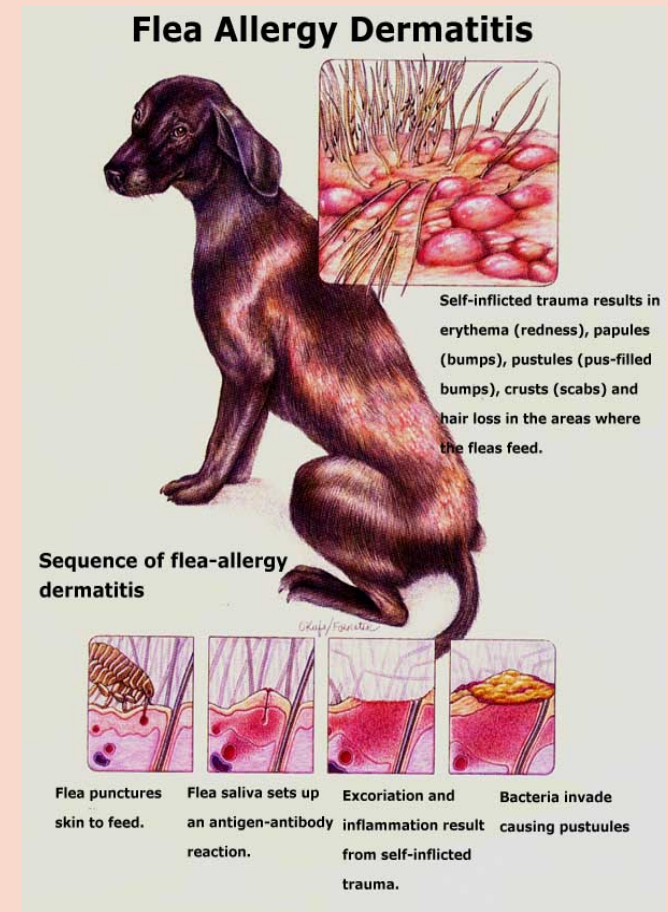
- Eggs are laid in host's nest or habitat; eggs laid on host will drop off
- Larvae are slender, whitish and legless (maggot-like)
 - Well developed head and two small hooks on back end
 - Develop off host and feed on organic material in dirt or debris
 - After three moults, pupate in silken cocoons
- Pupae are dormant for several months
 - Hatch in response to vibrations from host's movement
- Adults are very active
 - Move freely on host & between hosts
 - Can survive off host for long periods



Siphonaptera (fleas)

Consequences of flea infestation:

- **Irritation.**
 - Animals, particularly cats (& humans), may develop a sensitivity to flea saliva, causing an allergic skin reaction (skin eruptions).
 - Scratching due to allergy at bite site may lead to skin damage & secondary (e.g. bacterial) infections of damaged skin.
- **Blood feeding** may lead to **anaemia** particularly in young, old or sick animals. High population density in some bird nests may lead to mortality.



Siphonaptera (fleas)

❑ Tissue damage.

- Subcutaneous fleas such as *Tunga* can cause serious damage. Severe pain results from necrosis of host tissue.
- ❑ Fleas can act as **vectors of disease** and may transmit bacterial, viral and protozoan diseases and tapeworms
- ❑ Cat fleas (*C.felis*), dog fleas (*Ctenocephalides canis*) and human fleas (*Pulex irritans*) can act as intermediate hosts of *Diplydium cainum*, the double pored dog tapeworm
- ❑ Are vectors of viral and bacterial infections such as plague and tularaemia



A severe case of flea allergy dermatitis in a cat