

# WOLLO UNIVERSITY SCHOOL OF VETERINARY MEDICINE

## VETERINARY PARASITOLOGY FOR ANIMAL SCIENCE

# CHAPTER 1. INTRODUCTION TO PARASITOLOGY

## 1.1. Definitions

- **Parasitology** ( para = beside; sitos = food)
  - a science which deals with **parasites** and **parasitism**.
  - parasite is an organism which lives on another animal called its host and is dependent metabolically on it.
- **Parasitology** is the area of biology concerned with
  - Provides better understanding of
    - the biology, pathogenic effects, methods of diagnosis, treatment & control measures against a parasite

## 1.2. Types of animal association

- The **majority of animals** live independently in their natural habitat.
- In **some animals** a variety of patterns of association have been developed.
  - Any interaction between two living organisms is considered as symbiosis

- **Commensalism**

- one is benefited and the other is neither harmed nor benefited
- their association is **not usually obligatory for their existence.**

Eg. Intestinal bacteria

- **Mutualism**

- an obligatory association when both animals benefited from the association.

- One partner cannot live without the other

- Eg. Ciliates in ruminants.

- **Parasitism**

- a harmful association, which an organism ( parasite) is metabolically dependent on another species of an animal (host).

- The term **parasitism** will be used here for those parasites which are harmful to their hosts in various ways.

# 1.2.1. Important features of Parasitism

## (Host-parasite relationship)

- always involves two species,
  - the parasite and the host.
- Many of these associations produce pathological changes in hosts that may result in disease.
- The parasite is always the beneficiary and the host is always the provider.

☞ Successful treatment and control of parasitic diseases requires

- information about the parasite itself
- understanding of parasites' interactions with their hosts.

# 1.3. Clasification of parasites

## *A. Based on the location in or on the host*

- **Ectoparasites**

=these are external parasites situated on the external part of the body of the host. Eg. Fleas, ticks, insects.

- **Endoparasites**

=these are internal parasites situated on the internal part of the body of the host. Eg. Nematodes, trematodes.

## *B. Based on physiological & metabolic relationship*

- **Haemoparasites**

=they live in blood .E.g. Trypanosoma, Babesia

- **Haematophagus parasite**

= they take/suck blood as food. E.g. Haemonchus

## 1.4. Classification of host

- **Host** - an animal which is parasitized by the parasite and can be harmed
- **Predilection site** - the part of the host body on which the parasite can reside on it.

### Types of hosts

- **Definitive host (final host)**
  - a host in which the adult, reproducing (sexually matured) stage of a parasite exist on it.
  - Eg. *Tania saginata* – man is the final host.
- **Intermediate host**
  - a host in which part of the immature stage can live on it in the phase of the life cycle.
  - In this host there must always be development process from one stage to the other stage.

## Transport host

- part of the immature stage of the parasite spent but with no development.

Eg. Earth worm ingests eggs of parasites from soil and can be eaten by birds and acts as transport host.

## Paratenic host

- a host that harbors the immature infective stage to spent on it and cannot get read of it.

## Vector

- an invertebrate animal that transmits an infectious agent between infected & susceptible vertebrates.

Eg. Snails – IH for Fasciola,

Mosquito – Final host for malaria



## 1.5. Roots of entry

- **Natural opening**

Mouth, Excretory organs and External openings of reproductive organs .

- **Skin Penetration**

- **Transplacental entry**

- **Transovarian transmission**

- **Involvement of Vectors**

Vectors are usually IH maintaining the larval stage of the parasite.

## 1.6. Effect of parasites on their hosts

(Pathogenic and economic importance of parasites)

- Parasites harm their hosts in the following ways
  - Absorbing readily digested food material intended for the host.

E.g. Cestods
  - Sucking body fluids (blood, exudates, lymph).

E.g. Haemonchus
  - Feeding on the tissue of the host.

- Causing mechanical obstruction
- Causing growth of nodules and perforating vessels
- Causing wounds through which infection may enter into the body.
- Causes irritation
- Reducing the immune status of the host

## 1.7. Types of life cycle

- **Direct life-cycle**
  - does not involve any intermediate host between the parasite and its host. E.g: Strongylid nematodes
- **Indirect life-cycle**
  - Involves necessarily one or more intermediate hosts or vector to complete its life cycle. E.g: Digenetic trematodes

## Important terminologies

- **Ecology** – the external requirements like humidity, temperature, PH& nutrition necessary for the effective survival of an organism.
- **Pathogenesis (Greek pathos – disease, genesis = Origin)** – is the progressive development of a disease from the time it is initiated until its conclusion.
- **Infective larval stage** - in most nematodes the 3rd stage larva” – is the stage infective for the host while grazing.

## CHAPTER 2. Classification Vet. Parasitology

- **Helminthology**

the study of helminthes (worms).

- **Protozoology**

protozoa which are unicellular organisms.

- **Entomology**

arthropods (arachnids and insects).

## 2. 1. VET. HELMINTHOLOGY

### 2.2. Definitions

- is the study relating to helminthes and their relationship with their hosts.
- “*helminthos*” = parasitic worms .

### 2.3. Taxonomy of Helminth Parasite

- Phylum, Class, Order, Family, Genus and Species.
- Each of these categories is known as **Taxon**.

## Con...

- The parasitic helminthes comprise three phyla of veterinary importance:
- Phylum : **Nemathelminthes**  
Class : Nematoda (round worms)
- Phylum : **Platyhelminthes**  
Class : Trematoda ( Flukes)  
Class ; Cestoda(Tapeworms)
- Phylum : **Annelida**  
Class : Hirudina (Leeches)



## Class : Nematoda

- **Gastro-Intestinal Nematodes (GIT-Nematodes)**
  - Genera;
    - *Haemonchus*
    - *Trichostrongylus*
    - *Bunostomum*,
    - *Nematodirus*, *Oesophagostomum* and *Trichuris*
- **Lung worm Nematod**
  - Genus; *Dictyocaulus*

# General morphology of Class – NEMATODA

- Called round worms
  - because are round in cross section.
- Are elongate cylindrical multicellular worms
- Body isn't segmented
- Cuticle looks smooth
- Are very complex - variable in sizes & shapes.
- Infect a variety of organs & organ systems
  - and cause significant economic losses

- They are small, often hair-like worms
- Parasitize the alimentary tract of animals and birds, with the exception of *Dictocaulus*.
- The life cycle is **direct** and usually **non-migratory**.
- $L_3$  is the infective stages.
- Are responsible for considerable economic loss

## BASIC LIFE CYCLE OF NEMATODES

- Females lay eggs,  $L_1$  containing egg or give birth to  $L_1$ ,  
—which pass in the faeces of the host.
- development either in the faecal pat or in the IH.
- Life cycle can be direct or indirect.
- A nematode **molts** at intervals shedding its old cuticle (sheath) during development.
- Usually there are 4 molts in complete life cycle.

- The nematode life cycle consists of
  - egg
  - four larval stages
    - usually designated by  $L_1$ ,  $L_2$ ,  $L_3$ ,  $L_4$  and  $L_5$  that mature to an adult stage, with a molt between each stage.
- With a few exceptions the  $L_3$  stage of parasitic nematodes is usually the infective stage.

## Free-living stages:

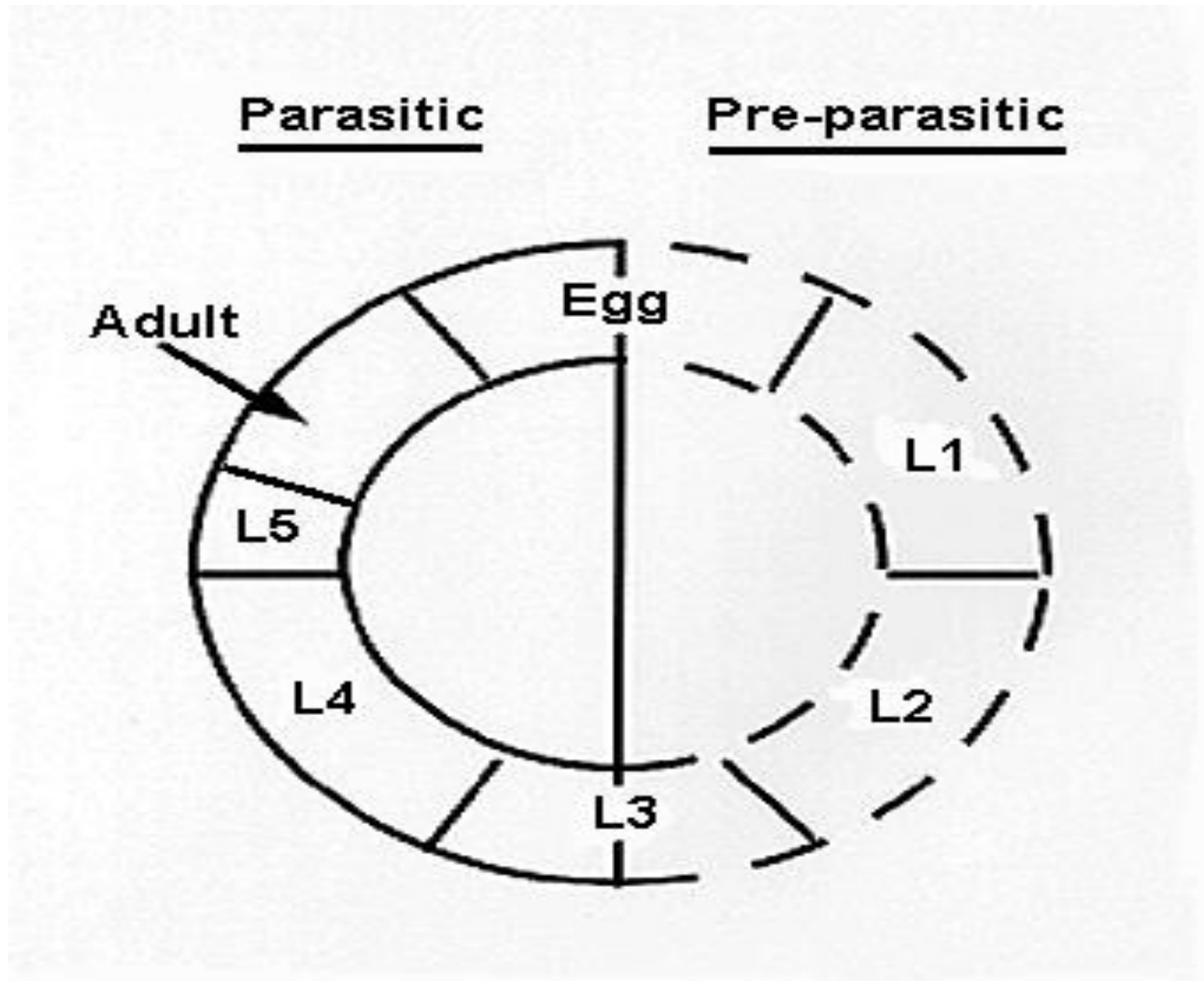
- **First larval stage ( $L_1$ )**- hatches from egg feeds on lipid reserve
- **Second larval stage ( $L_2$ )** – also feeds on lipid reserve & grows to molt to  $L_3$ .
- **Third larval stage ( $L_3$ )**- it is enclosed hence it doesn't feed & is the infective stage.
- **Temperature & humidity** are the two most important component of external environment for the larval development
  - **Maximum number of larvae** in the shortest feasible time generally develops in the optimum temperature of 18-26°C & 100% humidity.

# Parasitic stages:

## Ingested $L_3$ :

- $L_3$  casts off (exsheaths) & start feeding & grows to under go molting.
- ingested  $L_3 \rightarrow L_4 \rightarrow L_5$
- **Fifth larval stage** -is immature initially Feeds, grows & copulate to become an adult.
- Nematodes don't multiply inside the final host

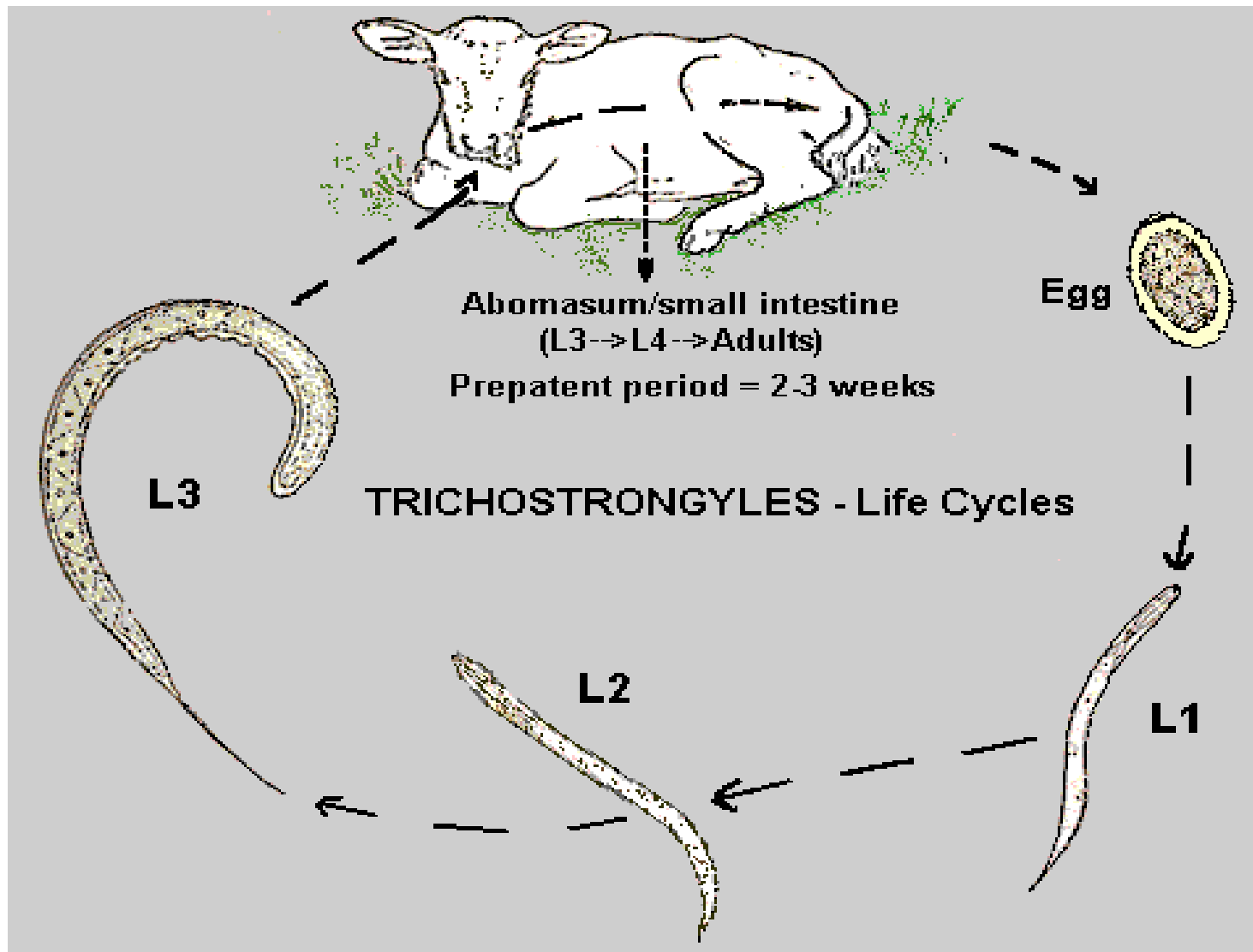
# Cont'd





- The parasitic phase of development in the body of the host can be of two types:
  - **Migratory:** where larvae travel considerable distance through the body before arriving in their final (predilection site)
    - *Hepatotracheal route*
    - *Lymphatic route*
  - **Non-migratory:** it completes its development in the GIT

# General life cycle



## 2.1. GENUS: HAEMONCHUS

- Is blood sucking abomasal parasite
- Responsible for extensive losses in sheep & cattle in tropics & subtropics
- **Site - Abomasum**
- **Species**
  - *H. contortus* → sheep & goats
  - *H. placei* → cattle
  - *H. longistipes* → camel, sheep and goat



*Haemonchus contortus* female adult



*Haemonchus* eggs

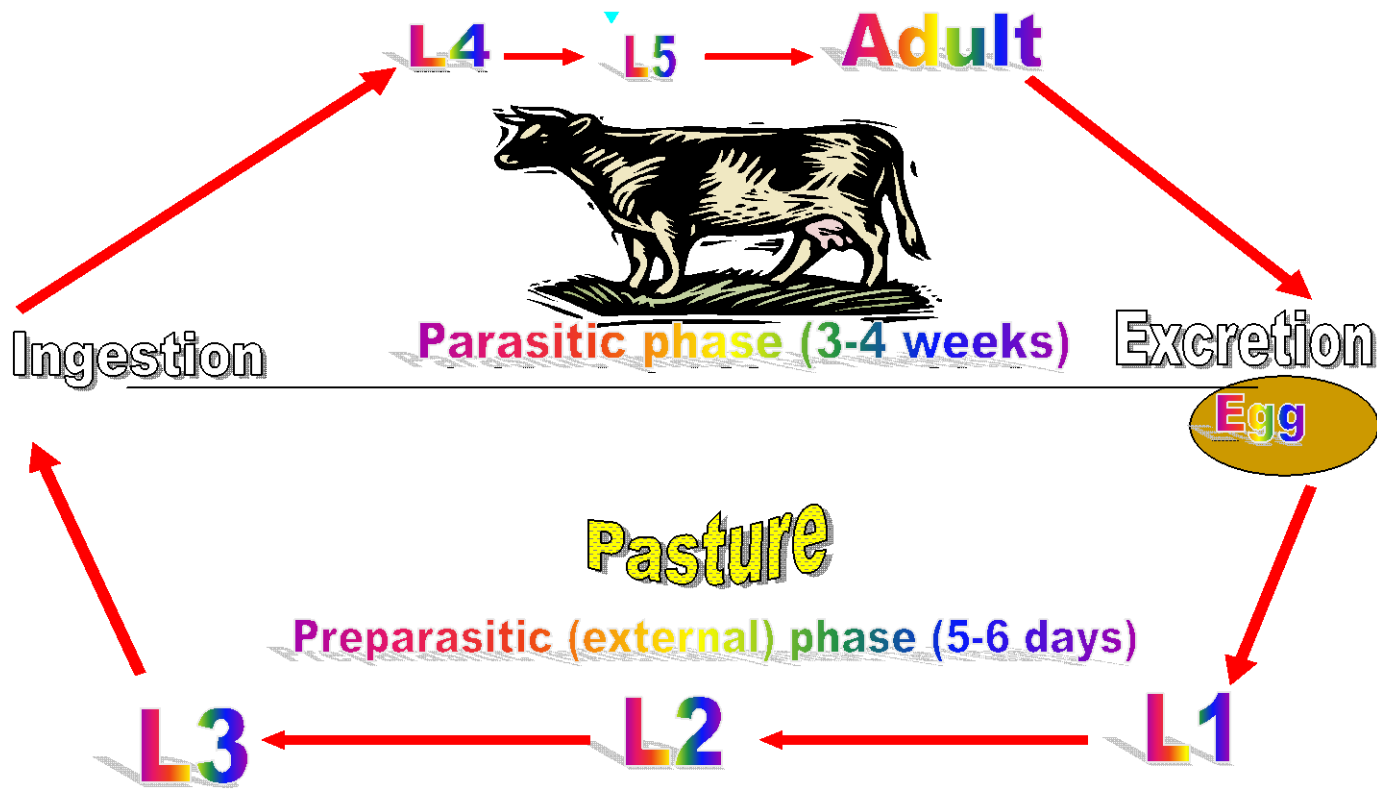
## Morphology

- Have a small **buccal cavity** with slender lancet.

# Life Cycle

- Direct and the females are prolific egg layers.
- The eggs hatch to L<sub>1</sub> on the pasture and may develop to L<sub>3</sub> in as short a period

## *Haemonchus* spp (Life cycle: direct)



## Clinical signs

- Young susceptible animals show anemia, submandibular edema (bottle jaw) & ascites, dark colored faeces
- But diarrhoea isn't generally a feature

## Diagnosis

- History & clinical signs supported by high epg.
- Coproculture to identify  $L_3$ .
- Definitive diagnosis is by conducting autopsy & examination of abomasums.

# Pathogenesis:

- Voracious blood sucking habit
- Each parasite removes 0.05 ml of blood per day by ingestion & seepage.
- Pale & edematous carcass
- The host become **anemic**.....died if not treated

## Epidemiology

- Should be considered differently in tropical, subtropical or temperate areas.
- **High biotic potential** high faecal egg output 2000-20,000 epg

## Treatment

- Benzimidazoles
- Levamisole
- Avermectins

## Control

- Regular use of modern benzimidazoles at 2-4 weeks as prophylactic treatment
- Use of genetically resistant breeds of animals like Red Massi of Kenya, etc



## 2.2. Genus: Trichostrongylus

- In subtropics it is one of the most important causes of parasitic gastroenteritis.
- **Hosts** – ruminants, horses, pigs, rabbits & fowls
- **Site** – small intestine except *T.axei* & *T.tenuis*

Parasite species	Host	Site
<i>T. vitrinus</i> <i>T. capricola</i>	Sheep & goats	Small intestine
<i>T. colubriformis</i>	Ruminants	Small intestine
<i>T. axei</i>	Horses, ruminants & pigs	Stomach, abomasum
<i>T. tenuis</i>	birds	Small intestine , caeca

# Life Cycle

- This is direct and similar with the genus *Haemoncus*
- The parasitic phase is **non-migratory**

## Pathogenesis

- L<sub>3</sub> of intestinal species penetrate between the epithelial glands of the mucosa with formation of tunnels containing the developing worms.
- Considerable hemorrhage, edema & loss of plasma proteins into gut lumen.

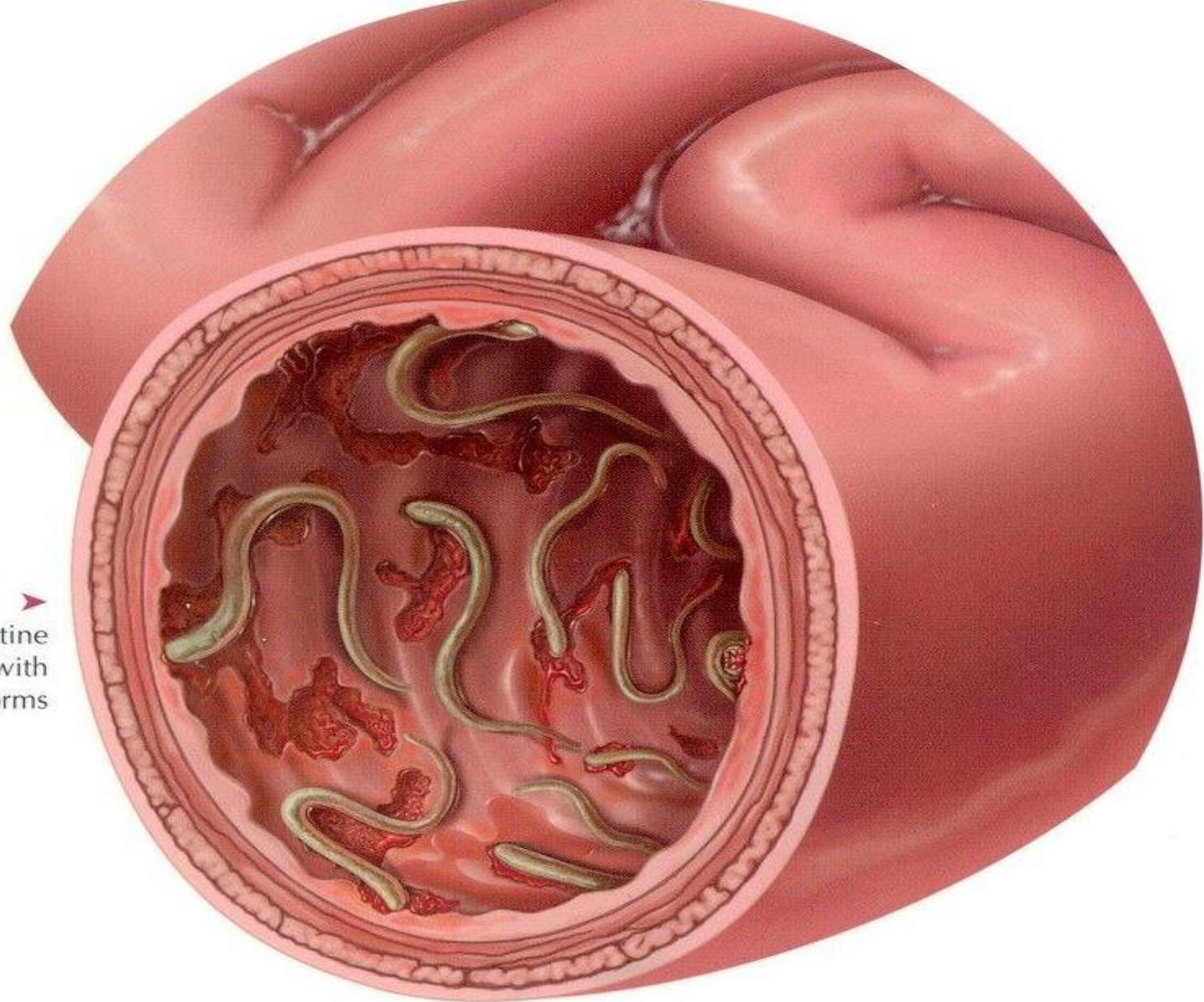
**cont'd**

- Distorted & flattened villi reduces nutrient & fluid absorption

## **Treatment & control**

- As described for Haemonchosis

intestine  
ted with  
okworms



# Lung worm

## 2.7. GENUS DICTYOCAULUS

- Lung worms of farm animals
- Causes a disease called **vermnious pneumonia**, **bronchitis** or simply Dictyocaulosis.

**Host** - Ruminants, horses & donkey

**Site** - tracheae & bronchi especially the diaphragmatic lobe

# Lung worm

## 2.7. GENUS: DICTYOCAULUS

- Lung worms of farm animals
- Causes a disease called
  - **verminous pneumonia, bronchitis or** simply  
Dictyocaulosis
- **Host:** Ruminants, horses & donkey
- **Site:** tracheae & bronchi especially the diaphragmatic lobe

# Life cycle

- $L_3 \rightarrow$  penetrate intestinal mucosa  $\rightarrow$  mesenteric lymph nodes to moult to  $L_4 \rightarrow$  travel via lymph & blood to lungs  $\rightarrow$  break out of capillaries into  $\rightarrow$  alveoli air passages  $\rightarrow$   $L_4 - L_5$  in bronchioles  $\rightarrow$  adult matures in bronchi
- $L_1$  migrate up the trachea & swallowed to pass out with faeces.
- $L_1 \rightarrow L_3$  in the faeces
- $L_3$  leave faecal pat to reach the herbage

# Epidemiology

- Typically affect youngs, as older animals have strong immunity in endemic areas.
- Heavy rainfall facilitates migration of  $L_3$  from faecal pads onto herbage



# Diagnosis

- Clinical signs, time of the year & history of grazing
- Demonstration of L<sub>1</sub> in fresh samples

## Treatment:

- Benzimidazoles, Imidazothialoles, avermect

## Control

- Vaccination by attenuated larval vaccines in endemic areas
- Avoid overstocking

Phylum : **Platyhelminthes**

- Class Trematoda
- Class Cestoda

## **CHAPTER 3. Class TREMATODA**

- General Features
  - Also called **Flukes**
  - Have leaf, like body
  - Are not segmented (unsegmented)

This class Has 3 groups

Liver Flukes

- Genus *Fasciola*

Stomach flukes

- Genus *Paramphistomum*

Blood Fluke

- Genus *Schistosoma*

### 3.1. Genus: Fasciola

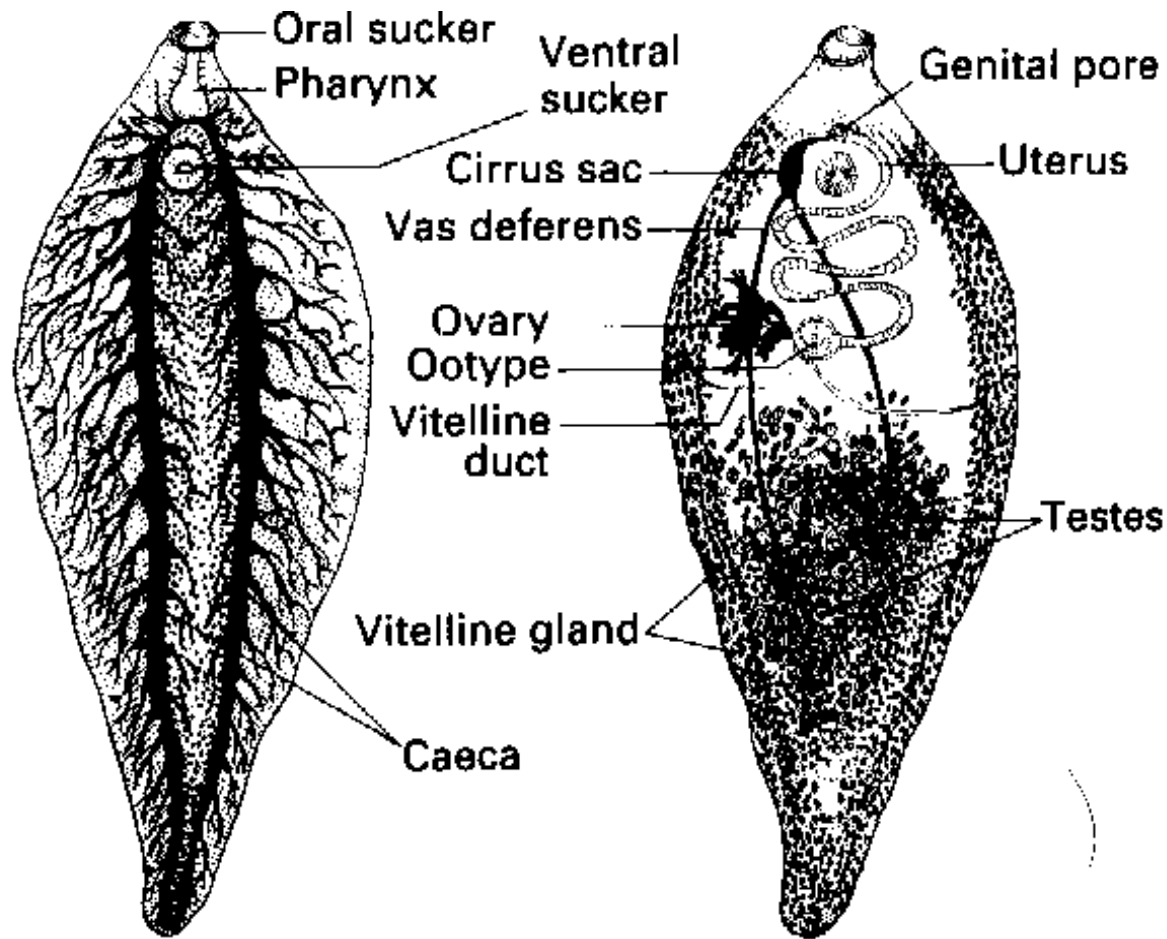
- Called liver flukes
- Cause weight loss  
anemia  
hypoproteinaemia
- Has 2 species
  - *Fasciola hepatica*--->common temperate & cooler area of high altitudes
  - *Fasciola gigantica*---->predominates in tropical areas

#### a. *Fasciola hepatica*

- **Hosts** \_ **sheep & cattle**, most mammals
- **IH** \_ genus **Lymnea** snails
  - (amphibious snail)
  - highlands of Africa (Ethiopia)

# Site

- Bile duct-----→adults
- Liver parenchyma-----→immature flukes



## ***b. Fasciola gigantica***

**Final Hosts:** Ruminants

**IH:** *Lymnaea*, *L. natalensis* in Africa is a primarily **aquatic snail**.

- found in streams, irrigation channels and marshy swaps

**Site:** Adults in the bile ducts

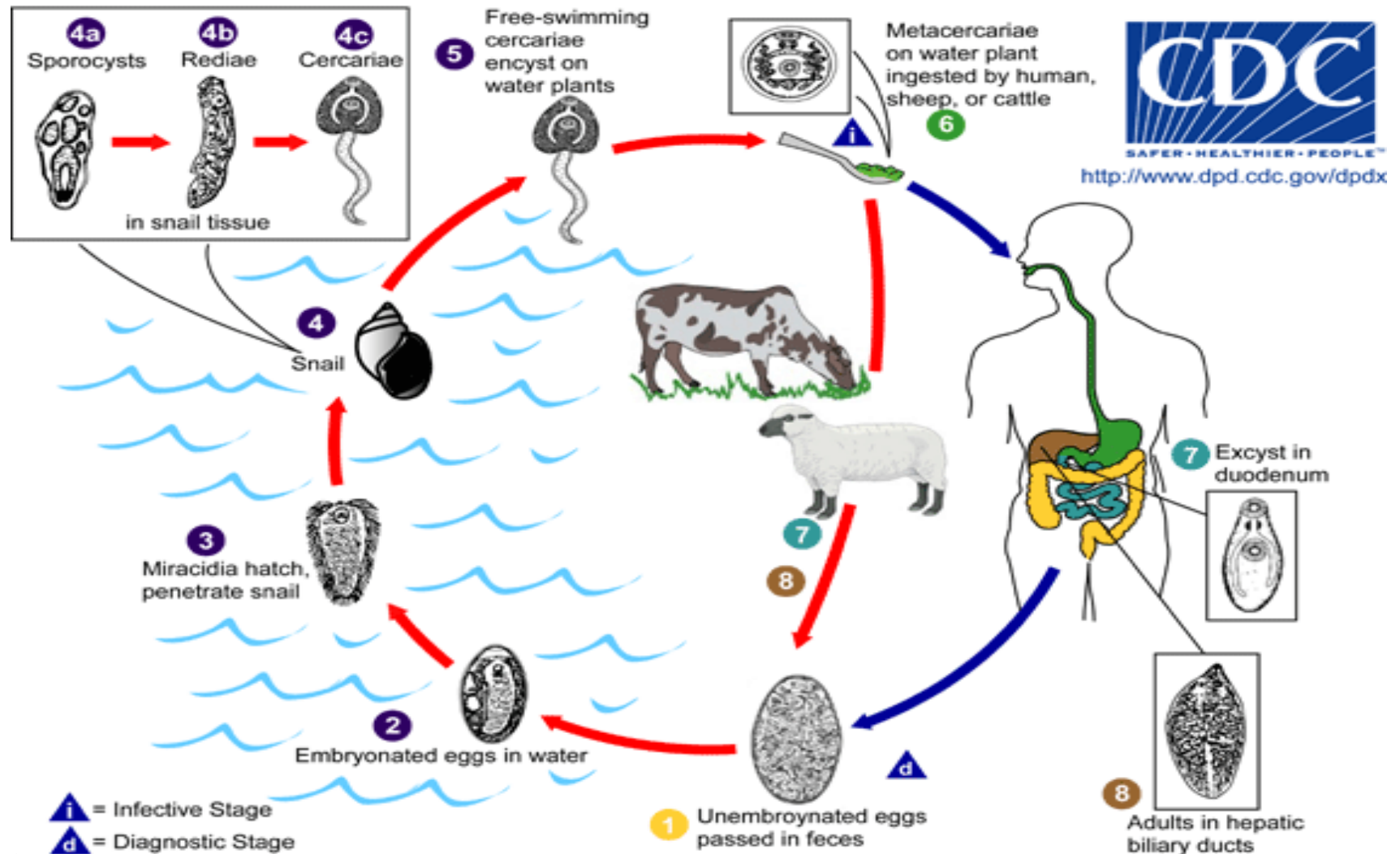
- immature in the liver parenchyma.

## **Identification**

- **Gross**
  - Up to 7.5 cm hence larger than *F. hepatica*
  - Is more leafy than *F. hepatica*

# Life cycle

Egg → Miracidium → Sporocyst → Redia → Cercaria → Metacercaria → ---  
-->adult



# Epidemiology

Three main factors influencing the production of large numbers of metacercariae

- Availability of suitable snail habitats:
  - wet mud to free water
  - permanent habitats include the banks of ditches or streams
  - edges of small ponds is preferable
- Temperature:
  - 10°C or above is necessary both for snails to breed and for the development of *F. hepatica* within the snail.
- Moisture:
  - the ideal moisture when rainfall exceeds transpiration, and field saturation is attained.



## Treatment

- Triclabendazole

## Control

- It should be approached in two ways;
  - 1. Reducing populations of the intermediate Snail host
  - 2. Using anthelmintics /Triclabendazole

### 3.2. Genus Paramphistomum

- **Final Hosts** \_ Ruminants
- **IH** \_ water snails--→ **Planorbis & Bulinus**
- **Site** \_ Rumen & reticulum---→ adults
  - \_ Duodenum-----→ immature stages

# Morphology

## Gross

- Adults are light red in colour
- Conical fluke, pear shaped
- Small, maggot-like fleshy & round body up to 1 cm in length
- Sucker at cone & a larger posterior subterminal are visible

## Life cycle

- Development in the final host occurs entirely in the alimentary tract.
- Exsheathment of encysted metacercariae in the duodenum
- Young flukes attach and feed there for about six weeks before migrating forward to the forestomach

## Pathogenesis

- Associated with the intestinal phase of the infection
- Young flukes are plug feeders results in severe erosions of the duodenal mucosa
- In heavy infections
  - enteritis characterized by edema, hemorrhage, and ulceration
- The adult parasites in the fore stomach are well tolerated

## Clinical signs

- Diarrhoea then anorexia & intense thirst, rectal haemorrhage followed by straining

## Diagnosis:

- Clinical signs
- History of grazing around snail habitat
- Faecal examination is of little value
- Confirmation can be made by PME

## Control

- Similar to *F. gigantica*

## 4. Class CESTODA

### Common features

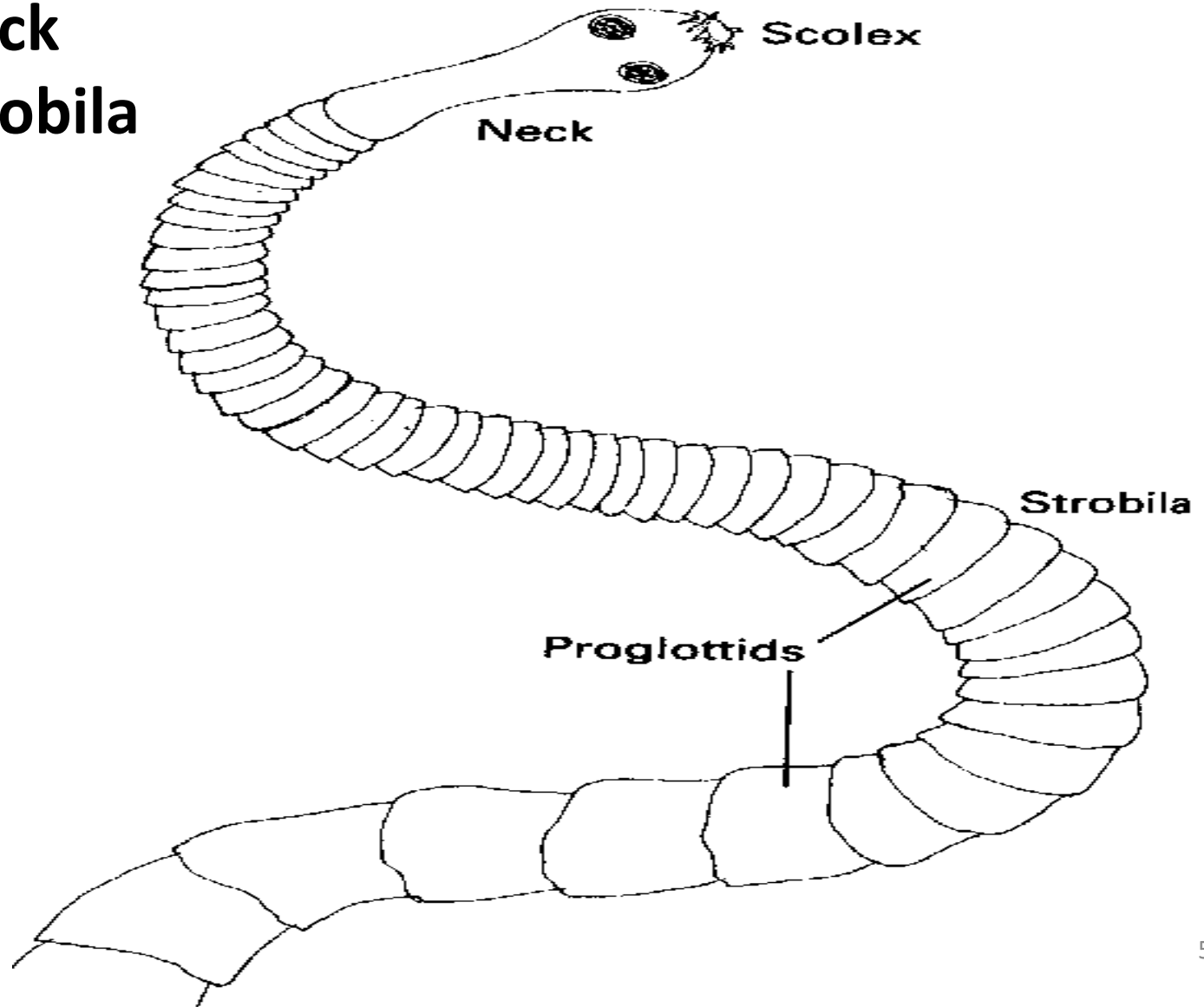
- Long, segmented, flattened (tape like body)
- They are hermaphrodite
- The outer most body wall of cestodes is known as **tegument** is highly absorptive.
- The longest animal in the world is tapeworm
- Adults are usually found in small intestine

**Body is divided**

**Head (scolex)**

**Neck**

**Strobila**



## 4.1. Genus *Moniezia*

**Final Host** \_ ruminants

**IH** \_ Oribatidae--->**forage mites**

**Site** \_ small intestine----->adults

**Species** \_ *M. expansa*---->sheep & goats, rarely cattle

\_ *M. benedeni*---->chiefly cattle

### **Morphology**

- up to 2m long
- unarmed having only suckers
- Segments are broader than are long



## **Pathogenesis**

- Heavy infections are associated with unthriftiness, diarrhoea & intestinal obstruction

## **Clinical signs**

- generally symptomless
- unthriftiness, diarrhoea, respiratory sign & even convulsions

## **Epidemiology**

- related active periods of forage mite vectors during summer

## **Diagnosis**

- Presence of mature proglottids & eggs in the faeces

## **Treatment**

- Niclosamide, praziquantel, bunamidine & benimidazoles

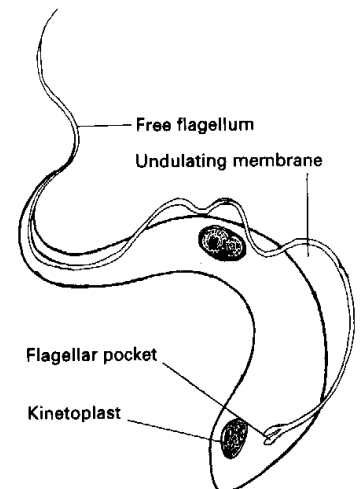
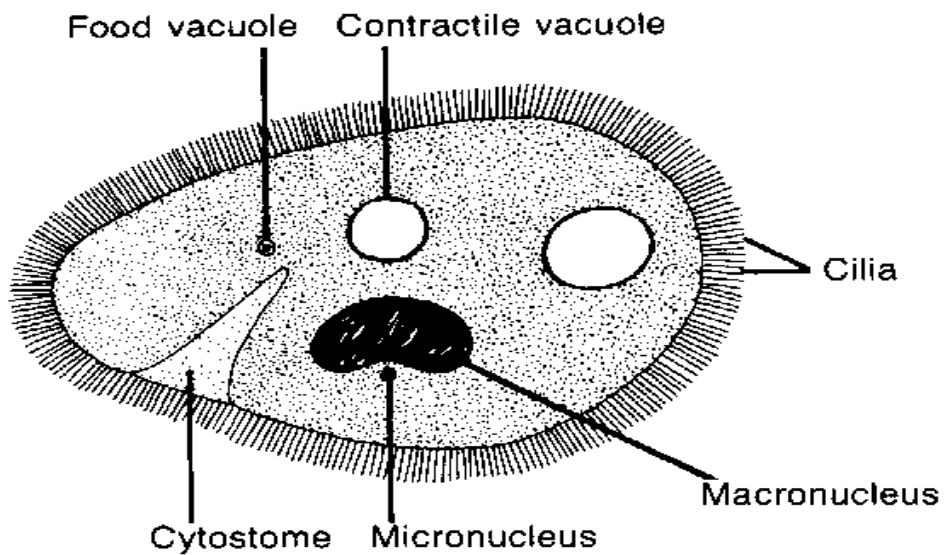
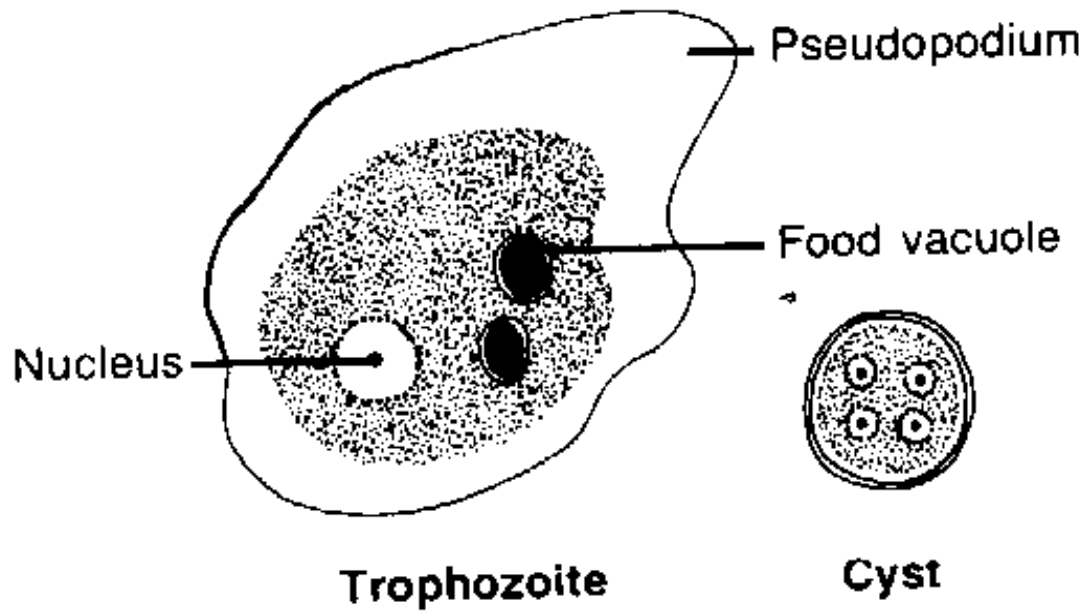
## 5. Veterinary protozoology

### Introduction

- Unicellular primitive animals (the first animals)
- Microscopic, except very few species
- Most protozoas are free-living organisms
- Of those that live in the body of animals, only a very small proportion are associated with disease
- Protozoa of great pathogenic and economic importance are
  - Malaria and ameba in human
  - Trypanosomes, piroplasms and coccidia in animals

# Structure of protozoa

- Protozoa are eukaryotic: nucleus enclosed in a membrane
- Contain one or more nuclei
- Move by means of flagella, cilia, pseudopods



- **Feeding (Nutrition)**
  - Many protozoa ingest nutrient materials in solution-pinocytosis
  - In some, nutrients being absorbed through the body wall
- **Reproduction and lifecycle**
  - binary fission (each individual divides into two)
  - Multiple fission (schizogony)
    - The nucleus divides several times before the cytoplasm divides
  - Budding: a small daughter individual separates from the side of the mother and grows to full size

## 5.1. Genus: *Trypanosoma*

- Trypanosomes and Trypanosomosis
- Main morphological features
  - Trypanosomes are unicellular, flagellated organisms
  - They are blood parasites (haemoparasites) which in the vertebrate host occur in the blood and tissue fluid
  - the movement by the thread-like filament called flagellum
  - Within this genus they are known as **haemoflagellates**

## Life cycle

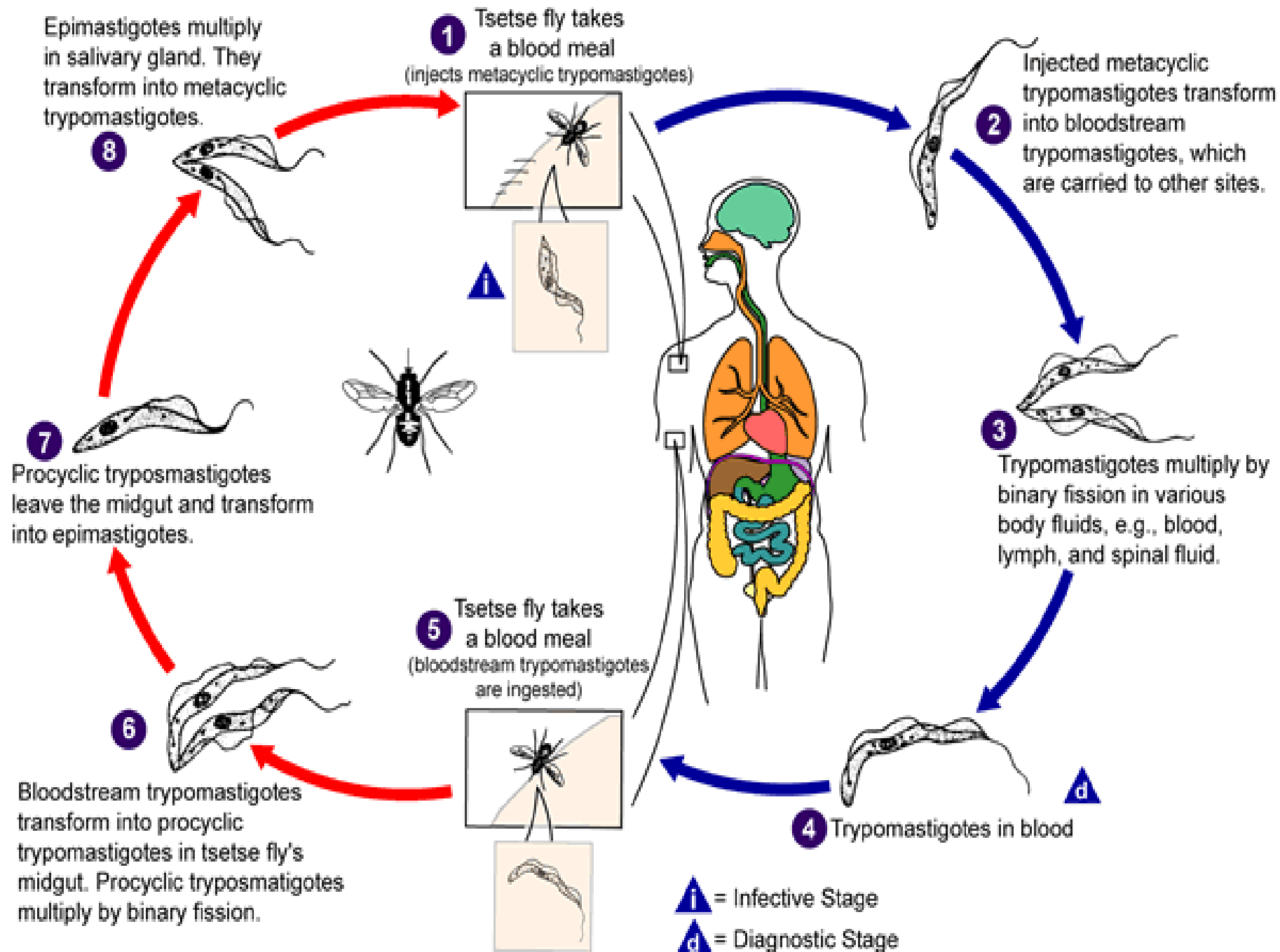
- The life cycle has two phases
  - in the insect vector
  - in the mammalian host
- Transmission by insects may be
  - cyclical by tsetse flies, *Glossina* species
  - mechanical by other biting flies

## Cyclical transmission

- A tsetse fly acquires a trypanosomal infection when feeding on a parasitaemic mammalian host
- The trypanosomes undergo a cycle of development and multiplication in the digestive tract of the fly

## Tsetse fly Stages

## Human Stages





## Mechanical transmission

- A biting insect passes the blood forms from an infected animal to another in the course of **interrupted feeding**

## Reproduction

- Is by a process of division to produce two daughter cells, the division into two daughter cells (binary fission)

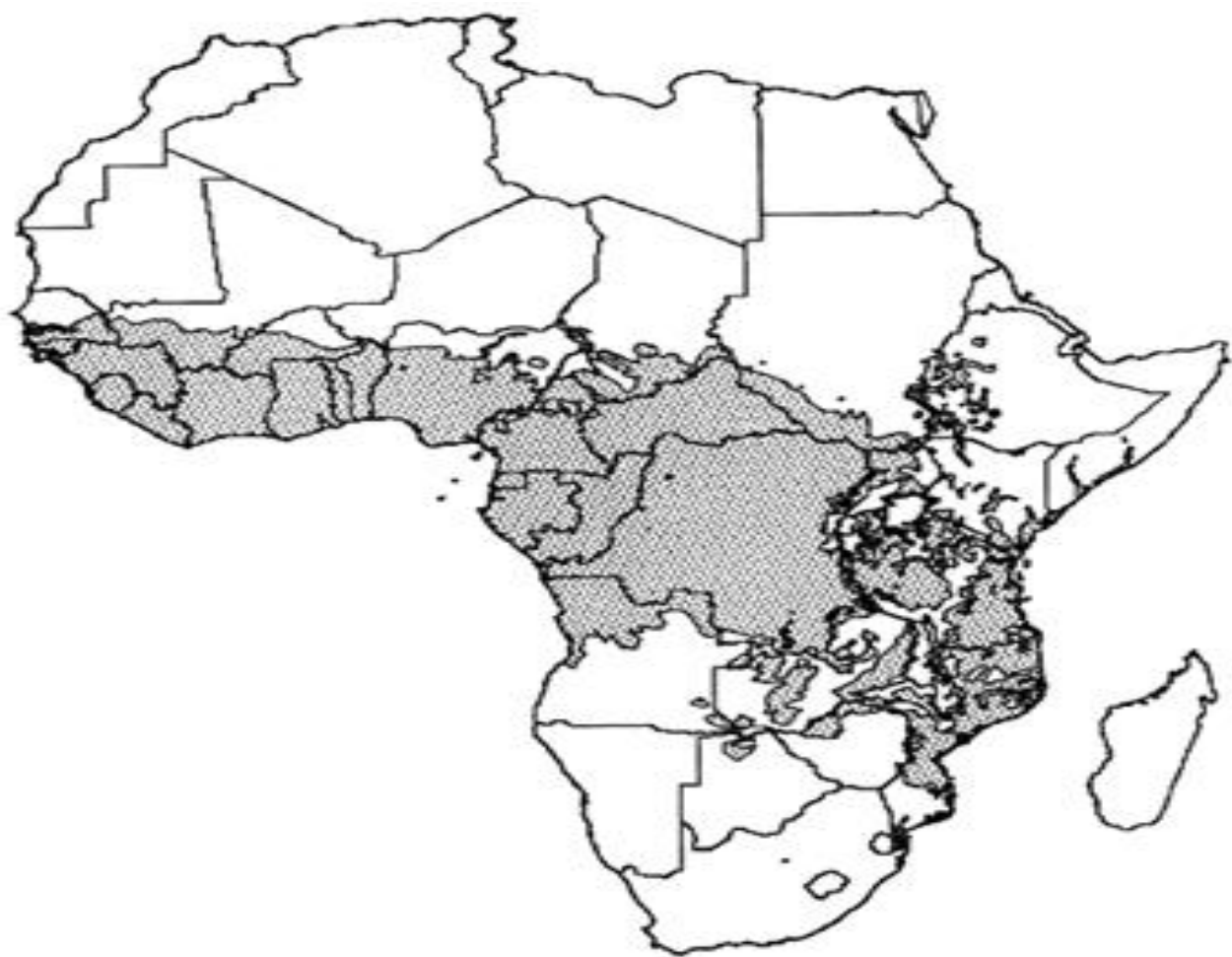
## Transmission and distribution

- In Africa, the primary vector for *T. congolense*, *T. vivax*, and *T. brucei* is the tsetse fly



The tsetse fly

- The distribution of the tsetse-transmitted African trypanosomes is governed by that of their tsetse vectors, which infest an area of sub-Saharan Africa
- That extends from the southern edge of the Sahara desert (15° N to 20° S.)
- Trypanosomosis is also mechanically transmitted by other biting flies through the transfer of blood from one animal to another.
- The most important mechanical vectors are flies of the genus *Tabanus* and *Stomoxys*
- In Africa, both *T. vivax* and *T. evansi* have spread beyond the "tsetse fly belts" by mechanical vectors



## Distribution in Ethiopia

- Tsetse flies in Ethiopia are confined to the southern and western regions
- Tsetse infested areas lie in the lowlands and also in the river valleys of
  - Abay (Blue Nile)
  - Baro (Akobo)
  - Didessa
  - Ghibe and Omo

# Cattle

- The most important trypanosome species affecting cattle in Ethiopia are *T. congolense*, *T. vivax* and they cause (Nagana) *T. brucei*
- Cattle infected by trypanosomes develop
  - fever, anaemia, weight lose, and progressively become weak , unproductive and abort or may become infertile



# CONTROL OF TRYPANOSOMOSIS

- Control strategies in trypanosomosis except dourine, can be based on
  - vector control
  - parasite control
  - use of trypanotolerant breeds of animals

## Vector control

### a. Past methods

- Those methods have been based on *ecological control*
  - vegetation clearing (destroying tsetse habitat)
  - ground and aerial insecticide spraying
  - selective game destruction (wild ruminants and wild pigs)
- These methods have been discouraged due to the high costs involved in addition to being environmentally un-friendly



## **b. Baiting methods**

- They are more of environmentally acceptable techniques
- These include the use of insecticide impregnated
  - traps or targets
  - more recently, the use of 'pour-on' insecticides (deltamethrin) applied to cattle



## Parasite control

### Chemotherapy/Chemoprophylaxis

- Are presently the major methods of control of trypanosomosis in livestock
- Chemotherapy, by stopping the multiplication of the trypanosomes helps the immune system to overcome the infection

### Vaccination

- So far all attempts at developing a vaccine against trypanosomosis have failed

### INTEGRATED CONTROL

- A combination of **chemoprophylaxis** against the disease and **insecticidal application** on the cattle against the vector may greatly improve the trypanosomosis situation

# Intestinal Protozoa

## 5.5. Genera: Eimeria

- are mainly intracellular parasites of the intestinal epithelium
- **Schizogony** and **gametogony** occur within the host and sporulation, or maturation of the fertilized zygote, usually takes place outside the host.
- **Sporozoites** are the infective stages of these parasites.
- The term coccidiosis is usually reserved for infections caused by **Eimeria**
- Transmitted to the host by ingestion of numerous **sporulated oocysts** through **water or feed**

### **5.2.1. Genus Eimeria(coccidia)**

**Hosts:** Poultry, cattle, sheep, goats, pigs and horses.

- It causes major disease condition primarily in poultry and cattle
- It is a disease of young animals (chicken, calves and lambs). Older animals are usually carriers of the disease

**Site:** Epithelial cells of the intestine

#### **Important Species**

- Eimeria tenella, E. necatrix, E. brunetti, E. maxima, E. mitis and E. acervulina – Chickens
- E. zuernii, E. bovis and E. alabamensis - in cattle

**Distribution:** worldwide, especially in the tropics and it occurs where ever chicken present

# Life cycle

- Mostly have a direct life cycle
- There are three major components
  - Schizogony: asexual reproduction within the host
  - Gametogony: sexual stage within the host
  - Sporogony: this takes place in the outside environment (multiplication in the early stage).

## Control:

- Sanitation and management practices
- vaccination or prevention with **anticoccidial drugs** (prophylactic and curative medication).
  - Amprolium
  - Sulphonamides

## Vaccination:

- Commercial vaccines consist of low doses of live, sporulated oocysts

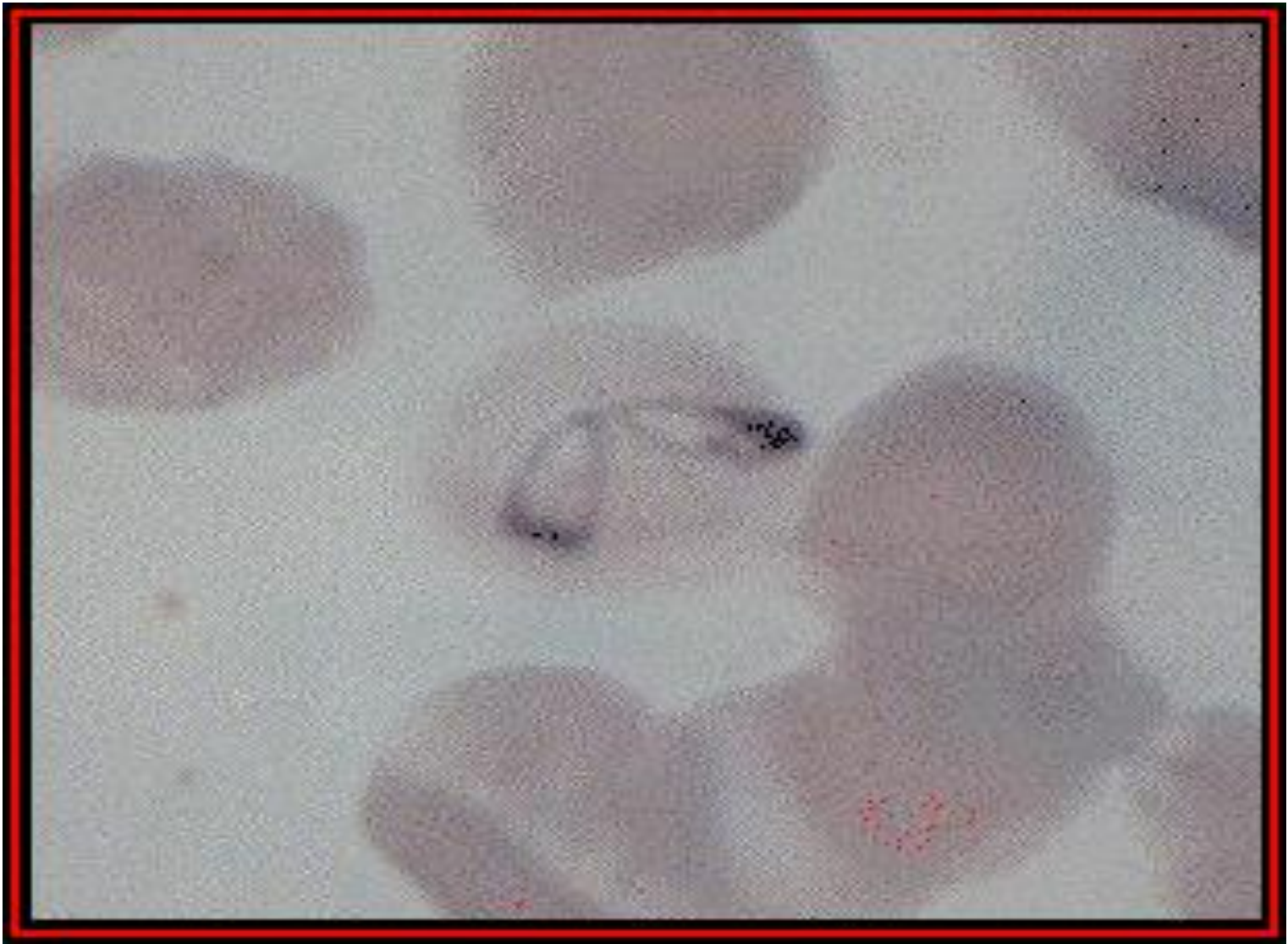
## 5.2. Genus: Babesia

- Babesia is world wide in distribution causing a tick borne haemoprotozoa disease Babesiosis in cattle, sheep, goats, horses, pigs and dogs.
- But the major economic impact of babesiosis is on the cattle

### Morphology and identification

- In the blood almost always singly or paired arranged with their characteristic angle with their narrow end opposed





*Babesia bigemina* in the red blood cell of a cow

# Species of babesia

- Cattle
  - *B. bigemina*, *B. bovis*, *B. divergens*, *B. major*
- Dogs
  - *B. canis*, *B. gibsoni*
- Horses
  - *B. cabali*, *B. equi*
- Sheep and goats
  - *B. motasi*, *B. ovis*
- Pigs
  - *B. trautmanni*

.

# **General life cycle and transmission**

## **A. Final hosts**

- Asexual multiplication in RBC by binary fission so that the resulting merozoites burst the cell (erythrocytes) – the released merozoites invade new RBCs and the cycle continues.

## **B. Intermediate hosts**

- The sexual phase occurs in the tick gut followed by schizogony

# Bovine Babesiosis

- is a febrile, tick-borne disease of cattle, caused by one or more protozoan parasites of the genus *Babesia*
- and generally characterized by extensive erythrocytic lysis leading to **anemia, icterus, hemoglobinuria**, and death
- Two important species in cattle including *B. bigemina* and *B. bovis* are widespread in tropical and subtropical areas are transmitted primarily by *Boophilus* ticks

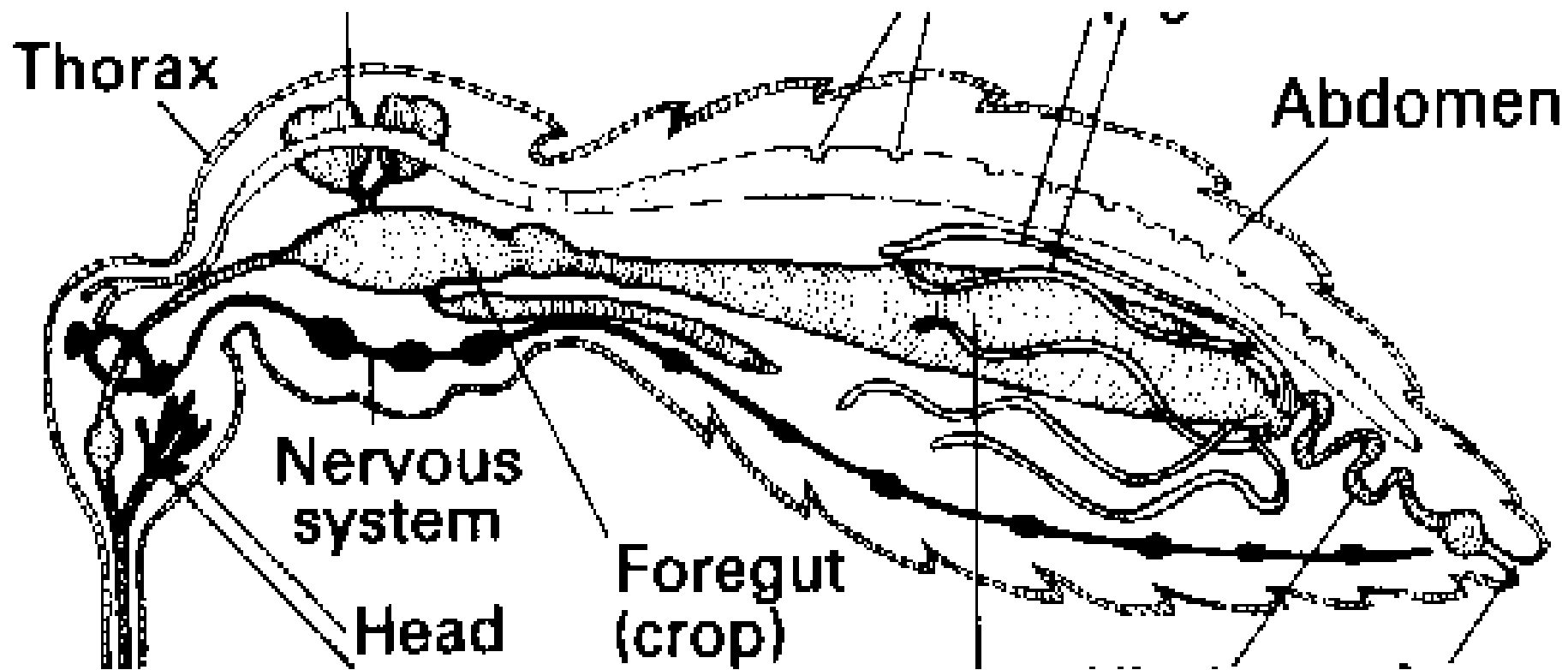
## Control of Babesiosis

- Treatment of infected animal.
- Regular spraying or dipping with acaricides(tick challenge control)
- Introduction of tick resistant cattle breed

# 6 PHYLUM : ARTHROPODA

## General characteristics

- Are invertebrates having a **segmented body** and **jointed appendages** (take the form of legs, antennae, or mouthparts)
- Developed an outer covering of a hard chitinous exoskeleton which encloses the whole body
- The digestive system extends from mouth to anus
- Sexes are separate and they have respiratory spiracles



There are two major classes

## 6.1. **Class Arachnida:**

- The adults have four pairs of legs
- The body is divided into a cephalo-thorax and abdomen, and there are no antennae.
- The larval stage may have less than four pairs of legs (3 pairs).
- The arachnida include ticks and mites

## 6.2 **class Insecta**

characteristics are

- three pairs of legs
- distinct head, thorax and abdomen
- single pair of antennae

# Mites

**Genera:** Sarcoptes, Psoroptes, Chorioptes and Demodex

## General characteristics

- Mites are tiny arthropods, microscope ectoparasite
- 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)
  - in severe cases weakness



## Genus: Sarcoptes

- Sarcoptic mites are economically the most important cause of **Sarcoptic mange** in goats, but rare in sheep.

## Species

- *Sarcoptes caprae*.....goat
- *Sarcoptes cameli*.....camel
- *Sarcoptes ovis*..... sheep

## Biology

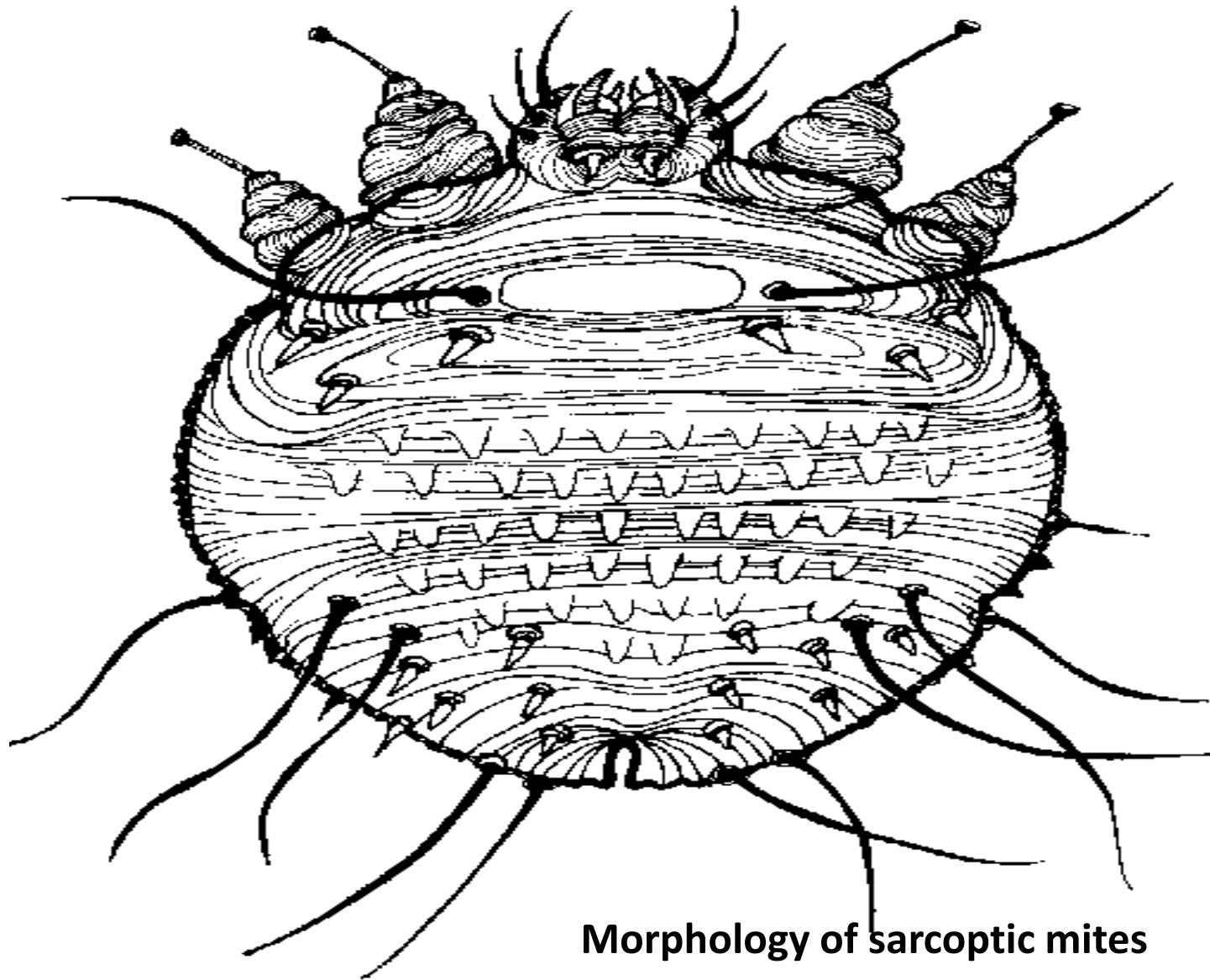
- Mating takes place on the surface of the skin. Then the females burrow in to the skin and lay eggs in the tunnels.
- The eggs hatch out to larval form.
- The larvae can remain in the tunnels or can make another tunnel.

- This continuous tunneling (burrowing) of the skin by different stages results in
  - marked irritation and itching
  - marked thickening and wrinkling and loss of hair
- Sarcoptic mange usually starts on relatively hair less part of the skin and may later generalized.









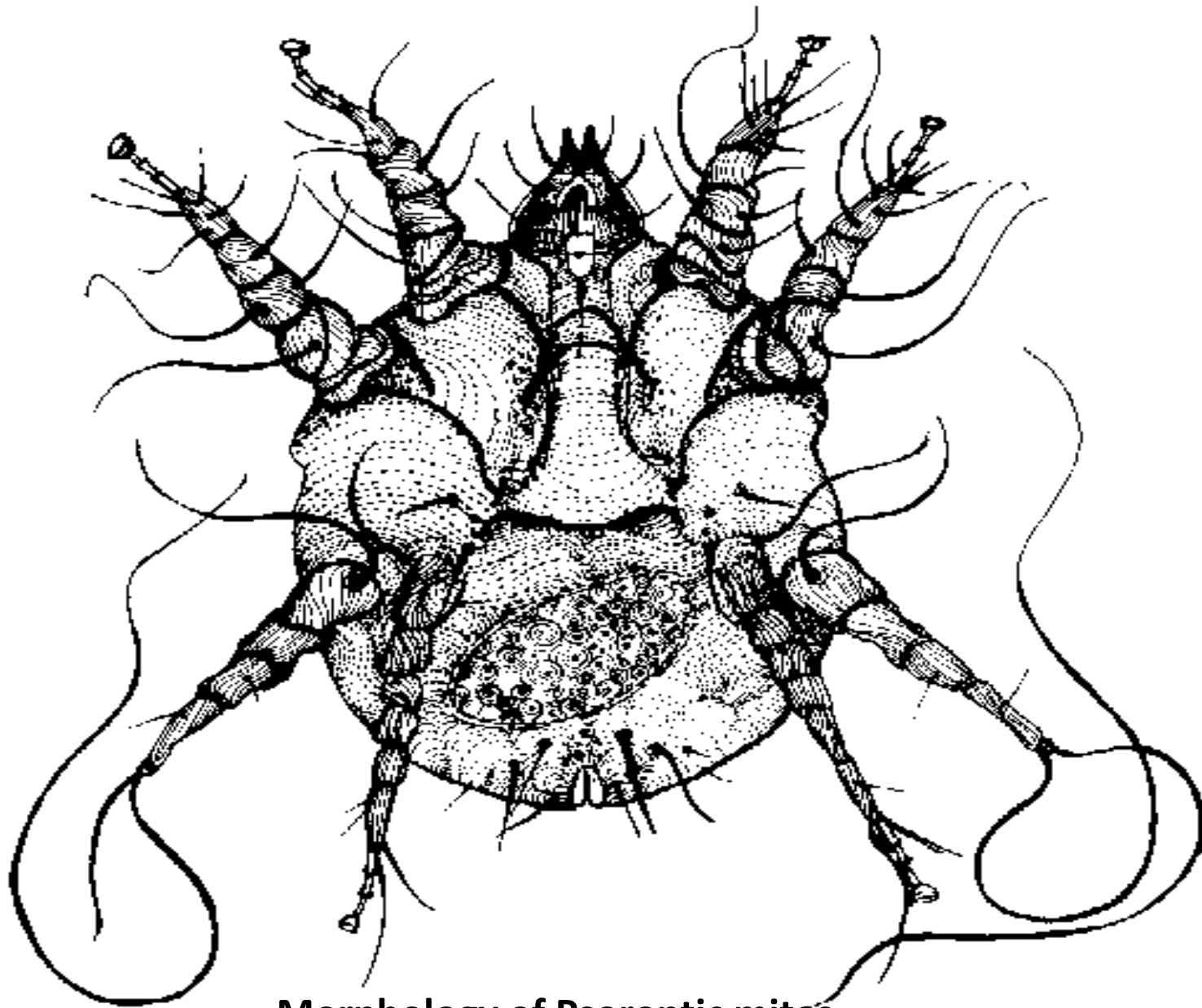
**Morphology of sarcoptic mites**

# Genus Psoroptes

- Psoroptic mange (sheep scab)
- Species
  - *Psoroptes ovis*.....sheep
  - *Psoroptes cuniculi*....goat

## Biology

- The overall biology of Psoroptes resembles that of Sarcoptes. The only difference is that Psoroptes do not burrow in to the skin but parasitic in its surface layers
- The mites migrate in to all part of the skin and prefer areas covered by wool or hair.
- Mites are spread by direct contact and can survive for a long period (10-14) **off their host allowing** clean animals to become infested from contaminated housing.



**Morphology of Psoroptic mites**

## Genus: Demodex

- Demodectic mange (hair follicle mite)
- Species: *Demodex bovis*,  
*Demodex ovis*, *equi*, *canis*
- These are tiny elongated mites embedded in the hair follicle or sebaceous gland
- where they spend their entire life and unable to survive off host.
- The disease appears nodular filled with pustules which may develop in to large abscess





## Control and prevention of mange mites

- providing good health for animals, animals in poor health are more susceptible to mite infestations
- Housing, nutrition and sanitary conditions should be at optimal levels.
- Newly acquired animals should be examined for mites and, if necessary, treated to prevent contamination of animals already present.
  - use of approved **acaricides** or drugs

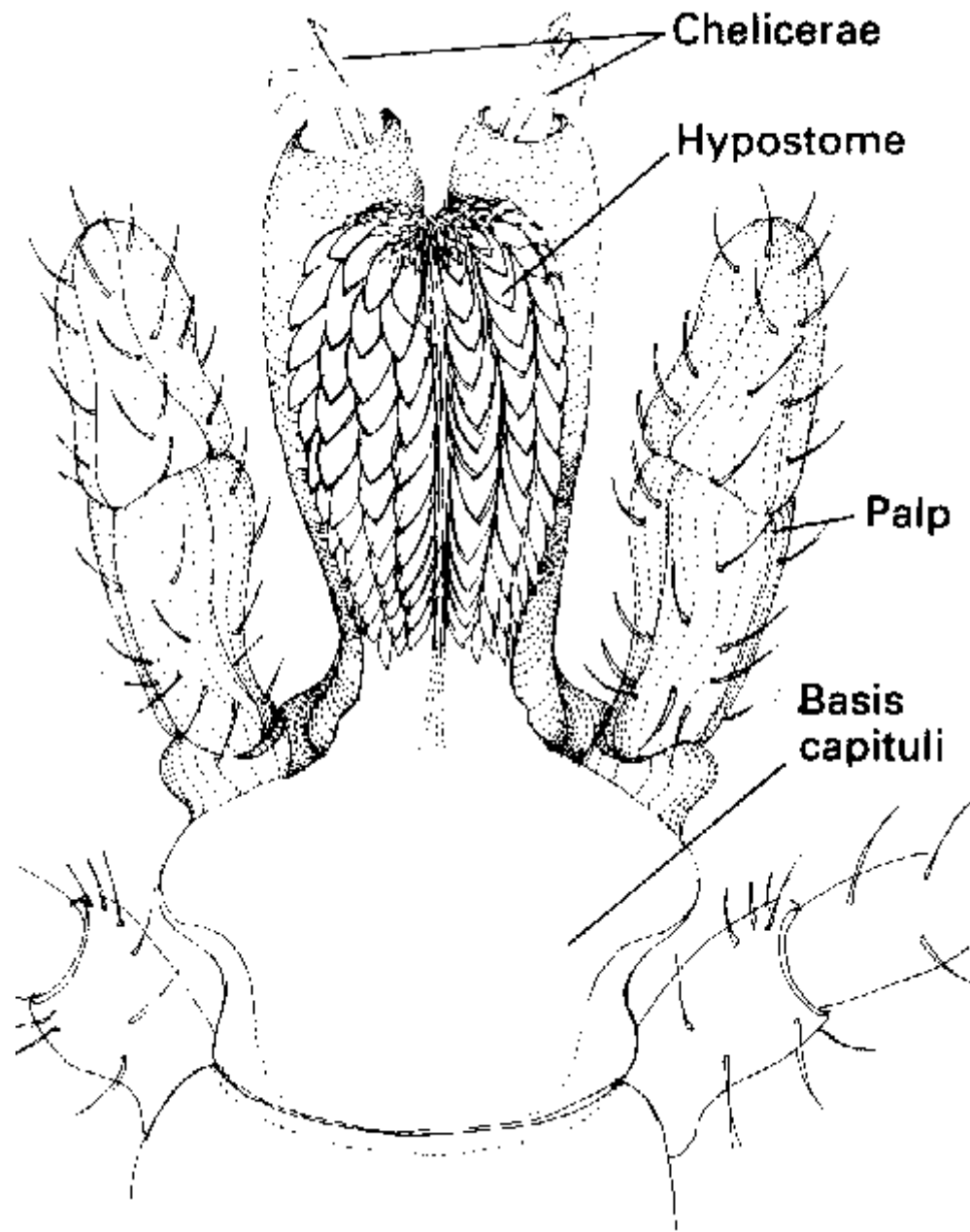
- Control of mites on animals or in the environment usually requires use of approved pesticides or drugs.
- Pesticides that are used to control mites or ticks are called **acaricides**.

# Ticks

- Ticks are blood sucking ectoparasites of animals.
- Some of them act as vectors of diseases.
- Ticks are more important in tropical & subtropical countries.
- Tick & tick-borne diseases affect about 80% of the world cattle population

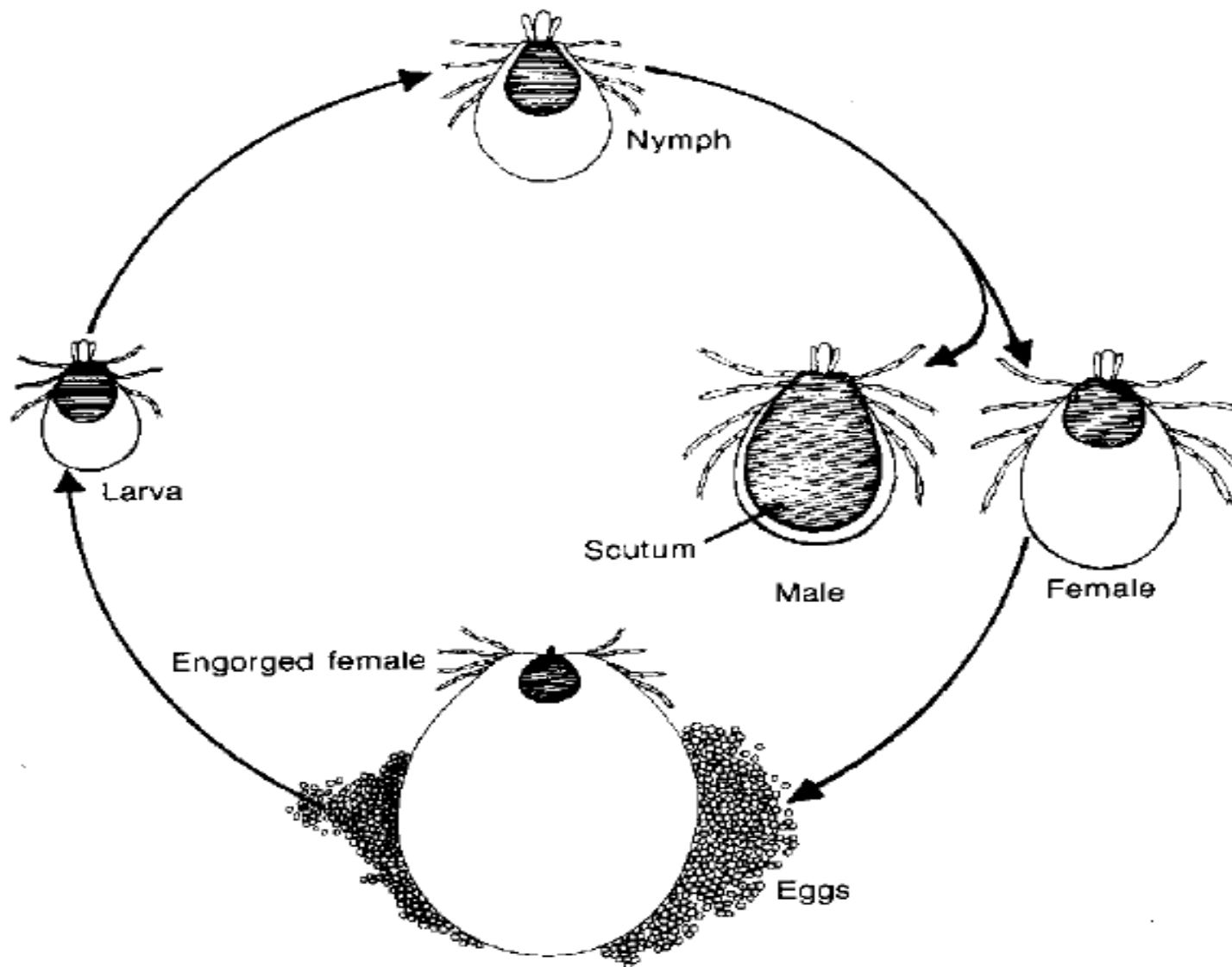
# Biology of Ticks

- In most ticks mating takes place on the host.
- Male ticks remain on the host and will attempt to mate with many females between repeated feedings.
  - Fully engorged females detach from the host and drop off
- Eggs of all ticks are laid in the physical environment, never on the host
- Factors like blood meal, temp., & humidity affect the biology of ticks.



# Lifecycle

- The female lay a bunch of eggs almost as much as the size of itself.
- The eggs then hatches to larvae.
- The larvae feed on the host and moult to nymph.
- The nymph feed and moults to an adult.
- The different stages may feed in the same host or may locate different hosts.



**Structure and life cycle of of hard ticks**



# Effects of ticks on livestock

## Direct Losses

- Blood loss
- Pruritus & skin inflammation
- Downgrading quality of skin & hides due to damage
- Reduce weight gain & milk production

## Indirect losses

- Vectors
- 2° bacterial complications

# Types of control methods

- Chemical control
  - most commonly used but confronted by
    - resistant ticks
    - environmental & animal products contamination
    - effects on non target organisms.
- Pasture management:
  - includes pasture spelling, rotational grazing & cultivation of tick trapping grasses
- Biological control: ticks have few natural enemies

## 7. CLASS: INSECTA

- The class insecta consists of ectoparasites of veterinary importance including: Lice, Flea, Flies

### General morphology and life cycle

- The head of an insect generally comprises six fused segments with a single pair of antennae.
- There is greater variation in the structure of the mouth, with adaptations for **chewing, biting and piercing-sucking**.
- Adult insects have a body which is divided into 3 segments including head, thorax and abdomen.

# Development of insects

- The rate of development of insects is greatly influenced by  $T^{\circ}$  and moisture
- The process of development and change in morphology is called **metamorphosis**.

Egg ----- Larvae ----- Pupa ----- Adult

## Classification of Insects

**Lice:** are primitive insects which undergo incomplete metamorphosis i.e. Egg- Nymph(NI, NII- NIII) – Adult

- They do not have wings so that they are adapted to parasitic way of life.

**Flea:** are advanced insects.

- have complete metamorphosis
- do not have wings

**Flies:** are advanced insects with complete metamorphosis and they have wings.

# LICE

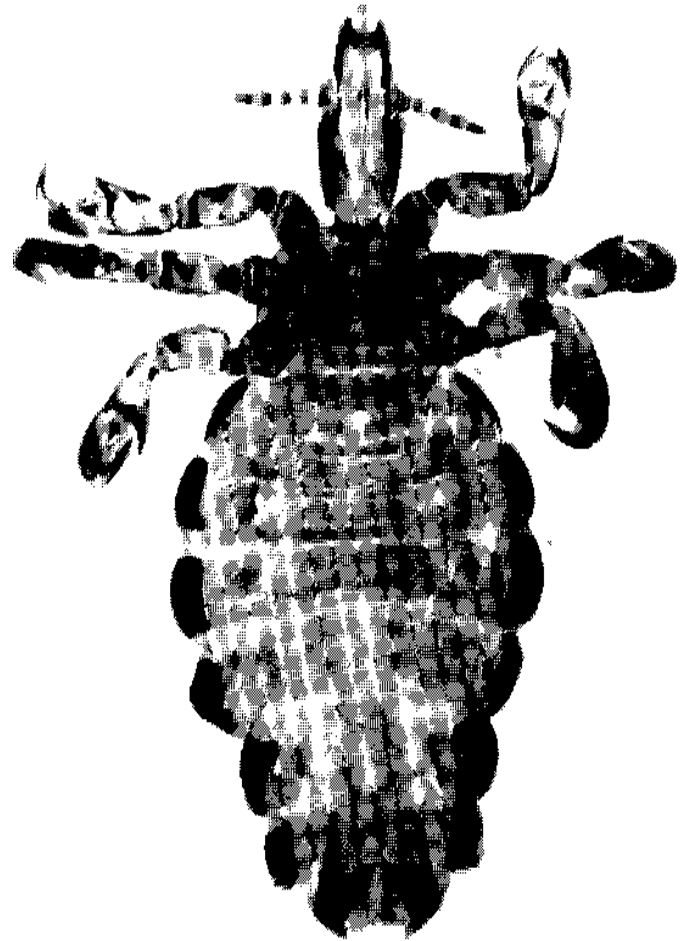
- They spent their entire life cycle on the same host.
- Therefore they are host specific ectoparasites

## Order Anoplura (Sucking lice)

- Sucking lice have got mouth which is adapted for piercing the skin of their hosts.
- They can suck blood or tissue fluid.
- Eyes reduced or absent, legs strong and terminating in a powerful claw

## General effects of Anoplura.

- Anemia because of blood sucking
- Irritation which may lead to loss of appetite.
- Decrease in production

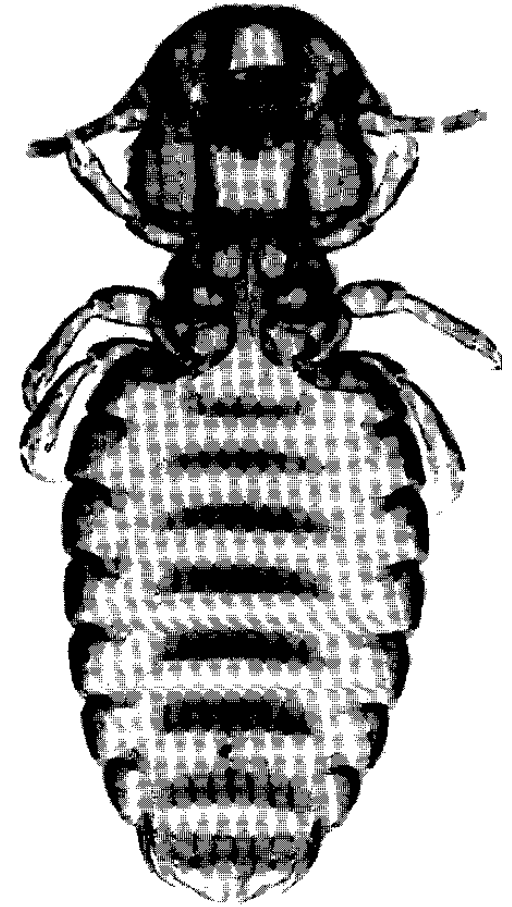


## Order Mallophage(Biting lice)

- They have chewing or biting mouth parts and therefore do not penetrate skin or suck blood.
- Are vary small host specific mainly on birds and less frequently on mammals but anoplura do not parasitize birds.
- Transmission is through close contact

## Morphology

- Head is larger than thorax(broad head).
- Mouth part modified for chewing(biting)





# Effects of Mallaphage

- Sever irritation and decrease in production
- Damage to skin and hide b/c of biting
- Loss of wool in case of wooly sheep

# Control of lice infestation

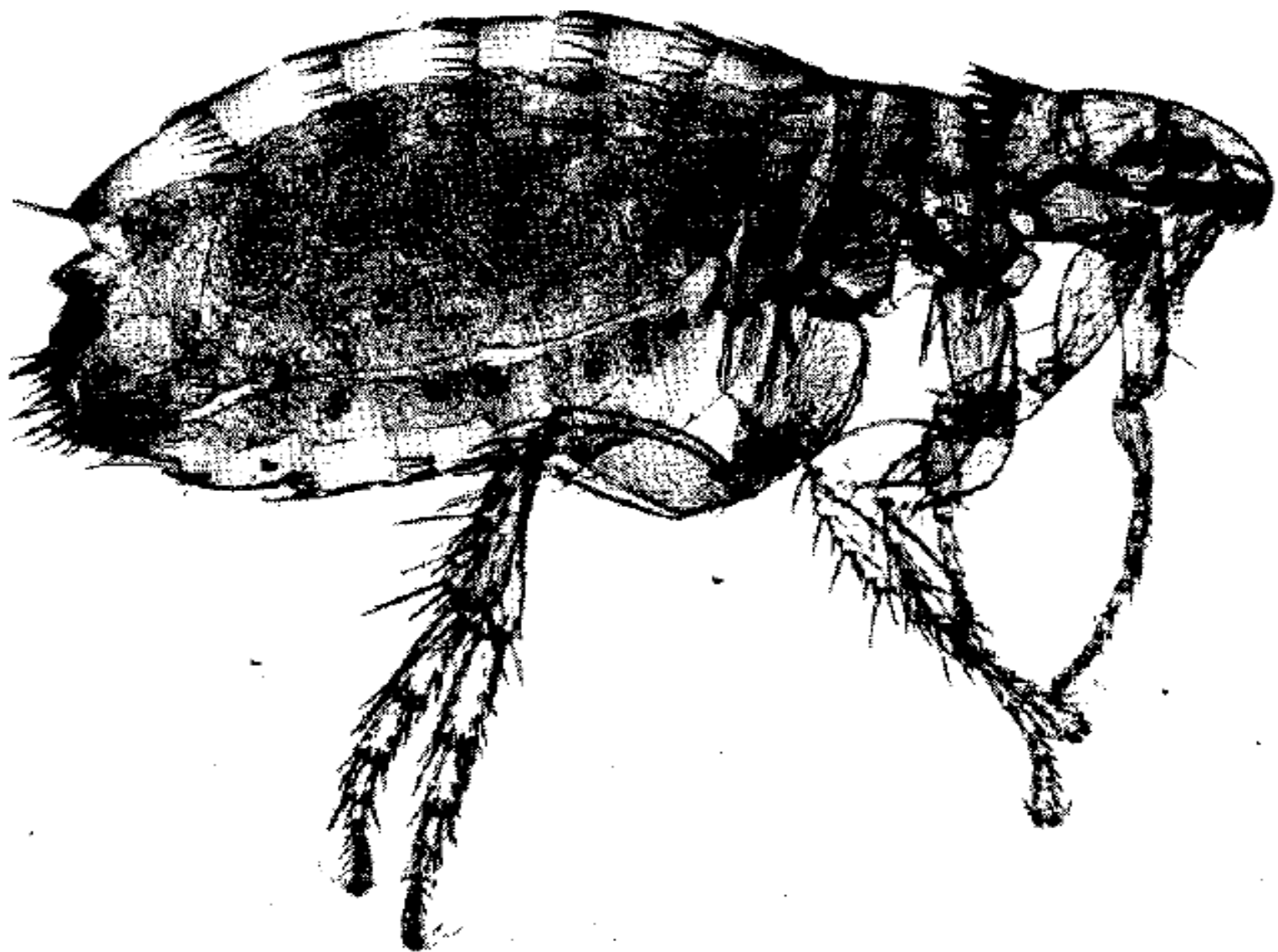
- It is based on thorough application of acaricides since lice infestation is a **herd** problem **all animals** in herd should be treated.
- In case of poultry application could be:
  - Spraying all members of the poultry house
  - House and neighboring environment

# FLEA

- These are both ectoparasites and vectors of disease
- They are not host specific unlike lice

## Morphology of flea

- They have sucking mouth parts (blood feeding)
- are without wing (wingless)
- The third pair of legs is much longer than the others, an adaptation for jumping



# Life cycle

- Both sexes are blood suckers, and only the adults are parasitic
- The egg laid on the ground or on the host from which they soon drop off
- The larvae have chewing mouthparts and feed on debris and on the feces of the adult fleas

## Effects of flea

- Flea causes sucking stress i.e irritation or painfull reaction
- They suck blood and hence cause anemia
- They are vectors of disease
- They cause allergic reaction which is known as flea allergic dermatitis (FAD)



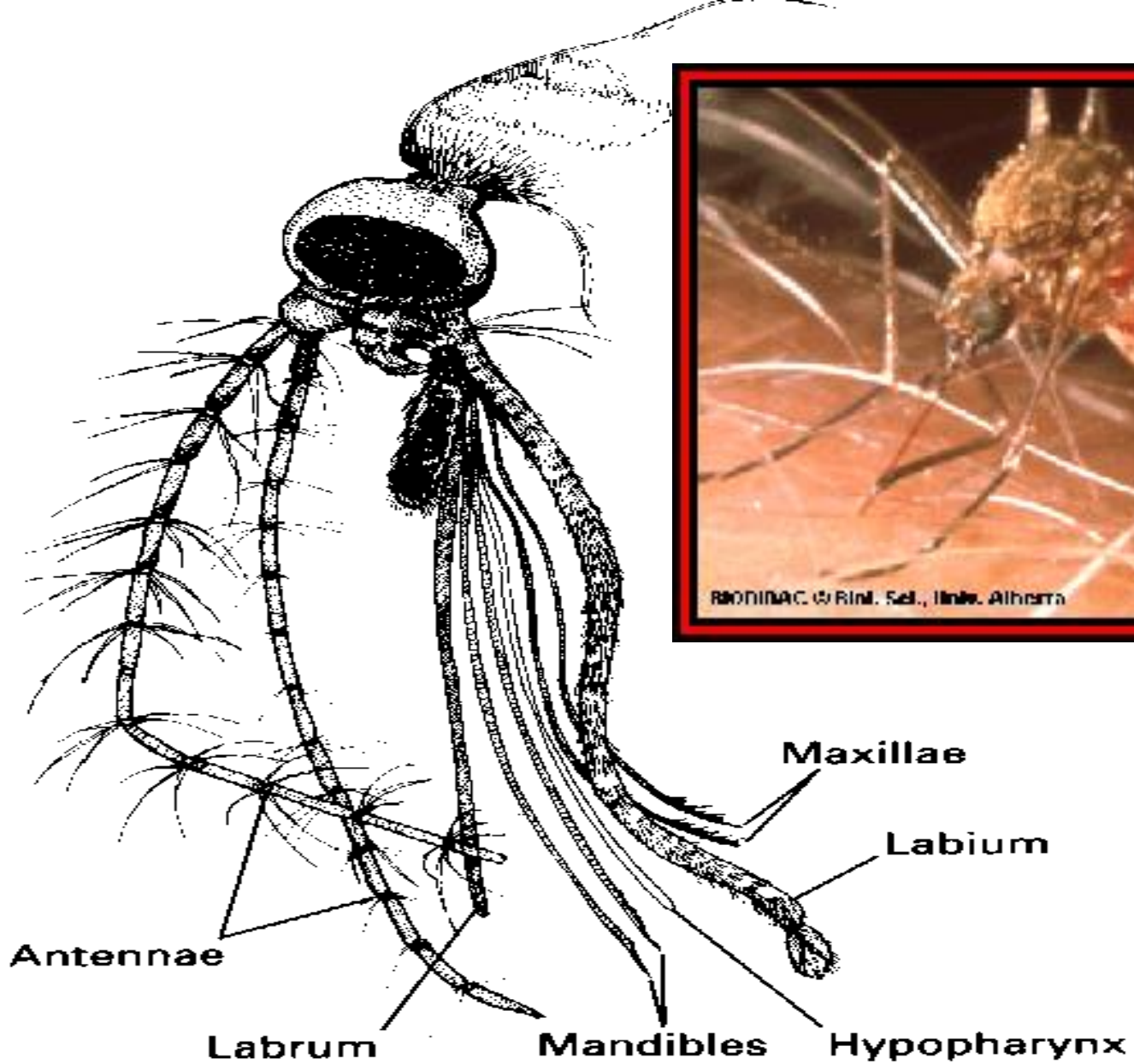
# Order Diptera (True flies)

## Culicidae (Mosquitoes)

- They are small slender flies with spherical head with long proboscis and longer legs

### *Mosquitoes :*

- Vectors of diseases such as Malaria, dog heart worm
- They feed on the blood of animals causing anemia
- They cause irritation while attacking the host



**Fig. 116** Piercing and sucking mouthparts of a mosquito.



# Genus Tabanus (Horse flies)

## Morphology

- They are large robust flies with powerful wings and large eyes

## Importance

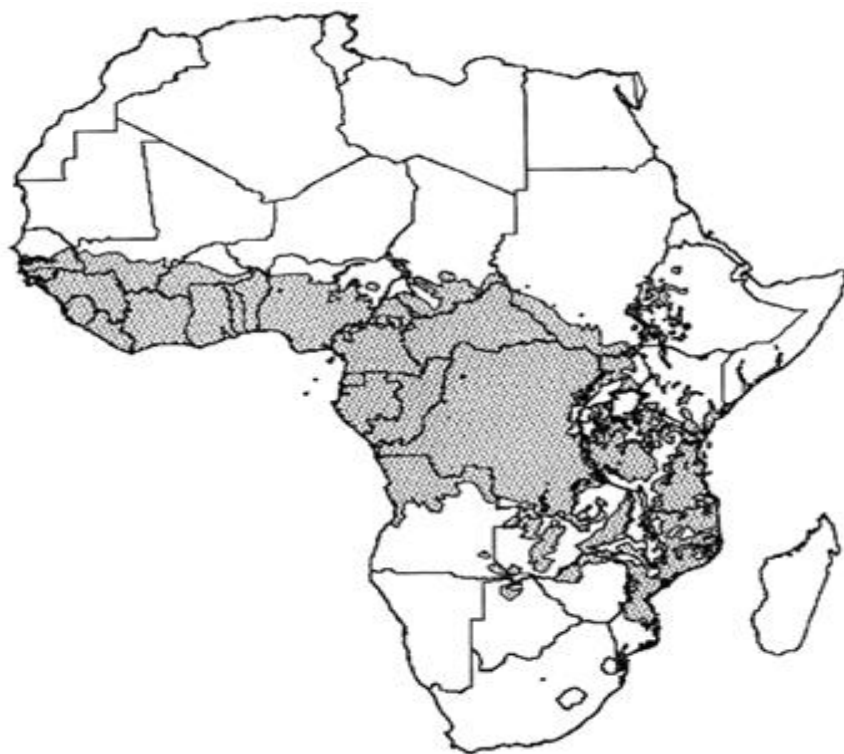
- These powerful flies may disperse many kilometres from their breeding areas and are most active during hot, sunny days
- The adult females locate their prey mainly by sight and their bites are deep and painful
- They feed every 3-4 days causing a great deal of annoyance, and because their feeding is often disturbed are efficient **mechanical vectors** of the organisms responsible for such discases as anthrax, pasteurellasis, trypanosomosis, and others

# Genus *Stomoxys* (Stable fly)

- Their feeding is painful and stable flies may be a serious pest of animals and human
- feeding is often interrupted, thus allowing mechanical transmission of pathogenic microorganisms such as *Trypanosoma spp*
- When in large numbers these flies are a great source of annoyance to grazing cattle and there are estimates of milk and meat production losses of up to 20%

## Genus: *Glossina* (Tsetse flies)

- They occur only in Africa where both sexes suck blood of man and animals
  - Morsitans group (Savannah) – *G. morsitans* and *G. palidipes*
  - Palpalis group (Riverine) – *G. fuscipes* and *G. tachinoides*
  - Fusca group (Forest) – *G. longipennis*
- These five spp. of Tsetse flies are found in Ethiopia.
- They occur only in Africa that extends from the southern edge of the Sahara desert (15° N to 20° S)



# Distribution in Ethiopia

- Tsetse flies in Ethiopia are confined to the southern and western regions.
- Tsetse infested areas lie in the lowlands and also in the river valleys of
  - Abay (Blue Nile)
  - Baro (Akobo)
  - Didessa
  - Ghibe and Omo

## Morphology.

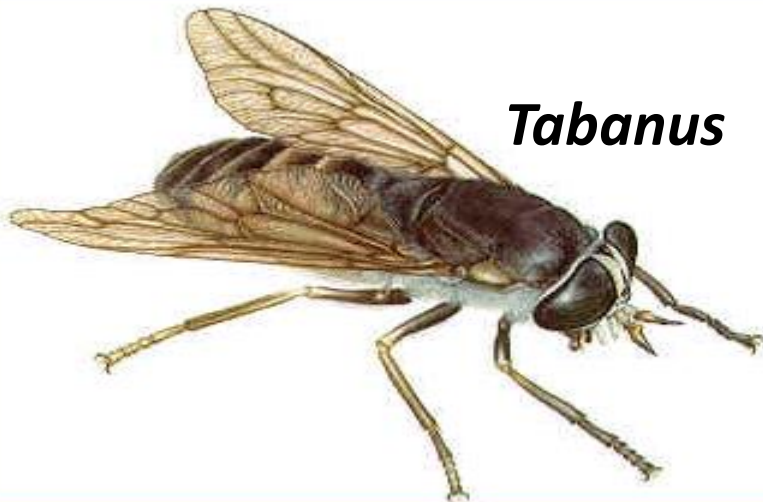
- The body is not brightly colored, varying from dark gray to light brown
- Flight is rapid.
- Both male and female are haematophagus
- Proboscis- has distinct structure which is long, thin and attached to bottom of the head and pointing forward
- Antenna- consists of three segments and bears arista
- Wings have hachet cell in the middle of the wing, a characteristic hachet shape resembling a meat cleaver.

*Glossina*



(by P.W. Pappas and S.M. Wardrop)

*Tabanus*



# Tsetse Biology

- Females mate just once in her life time and store the spermatozoa in the spermathica
- They produce one fully grown larvae every 9-10 days which then pupate in light or sandy soil.
- The adult fly will emerge after pupal period that varies according to temperature .
- They have very low rate of reproduction but tries to ensure the continuation of the generation of their progeny.



# Control of Tsetse flies

- Bait system
  - attraction of the fly from its surrounding to some introduced objects which may be insecticidal (trap) or live host treated with insecticides.
- It has low environmental impact and requires low technology.
- It can be adopted by local communities on self help basis.

- Traps and targets involve control using targets impregnated with insecticides and potent odour attractants like acetone and cow urine.
- The insecticides include Delthametrine, Cypermethrin etc. this method is more acceptable from ecological and environmental impact point of view.
- Spot on/ pour on technique involves application of insecticide to the back of the animal and spread over the body surface.

# Myiasis

- Myiasis is the infestation of living animals with the larvae of dipteran flies.
- Depending on their location, myiasis causing organisms can be grouped as:
  - Nasal myiasis  
Eg. *Oestrus ovis* affects nasal cavity.
  - Cutaneous myiasis  
Eg. Tumbu fly
  - Somatic myiasis  
Eg. *Hypoderma bovis* = affects bovine.