

# ***TRENDS IN VETERINARY PARASITOLOGY***

**A TWO-DAYS COURSE**

**DEPARTMENT OF VETERINARY PATHOLOGY, MICROBIOLOGY &  
PARASITOLOGY**

**FACULTY OF VETERINARY MEDICINE  
UNIVERSITY OF NAIROBI**

**10<sup>TH</sup> & 11<sup>TH</sup> AUGUST 2011**

**Roundworms of Veterinary/ Medical importance.**

**By Dr. J.N. Chege**



**University of Nairobi**

**Roundworms of Veterinary/  
Medical importance**

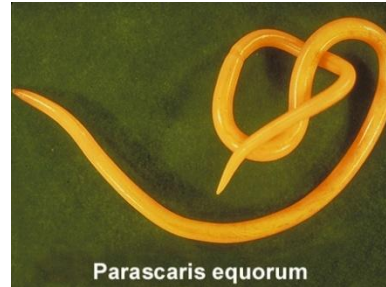
**Dr. J.N. Chege**

# Introduction

## Helminthes:

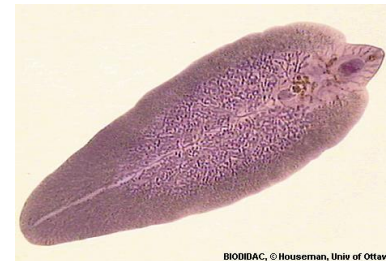
### 1. Round worms

- a) True round worms
- b) Thorny headed worms



### 2. Flat worms

- a) Tape worms
- b) Flukes



### 3. Annelids

- a) Leeches
- b) Earthworms

# Nematodes (Round worms)

## Geographic distribution

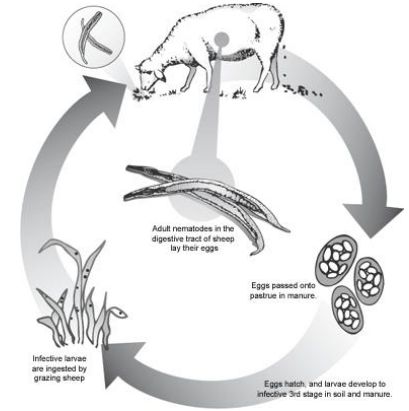
- World wide

## Hosts

- Domestic & wild animals including fish & reptiles
- May affect any body organ
- Mostly found in the gut

# Nematodes- General life-cycle

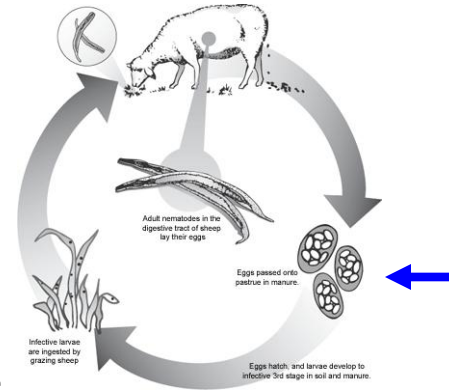
- Eggs passed out in faeces/ urine/ sputum/picked by arthropod vectors
- Eggs hatch to release first stage larvae ( $L_1$ )
- Larvae moult 4 times (ecdysis)
- 1<sup>st</sup> & 2<sup>nd</sup> moult usually in the environment
- $L_3$  normally the infective stage
- 3<sup>rd</sup> & 4<sup>th</sup> moult usually in the final host resulting in adults
- In some species the infective stages can be  $L_1$  or  $L_2$
- In other species, eggs hatch in-uterual & pass out  $L_1$
- In others, larval development occurs in eggs to the infective stages - i.e.  $L_1$  or  $L_2$  (Infection through egg ingestion)
- In others, larval development occurs in eggs to  $L_3$  - hatched out to infect host



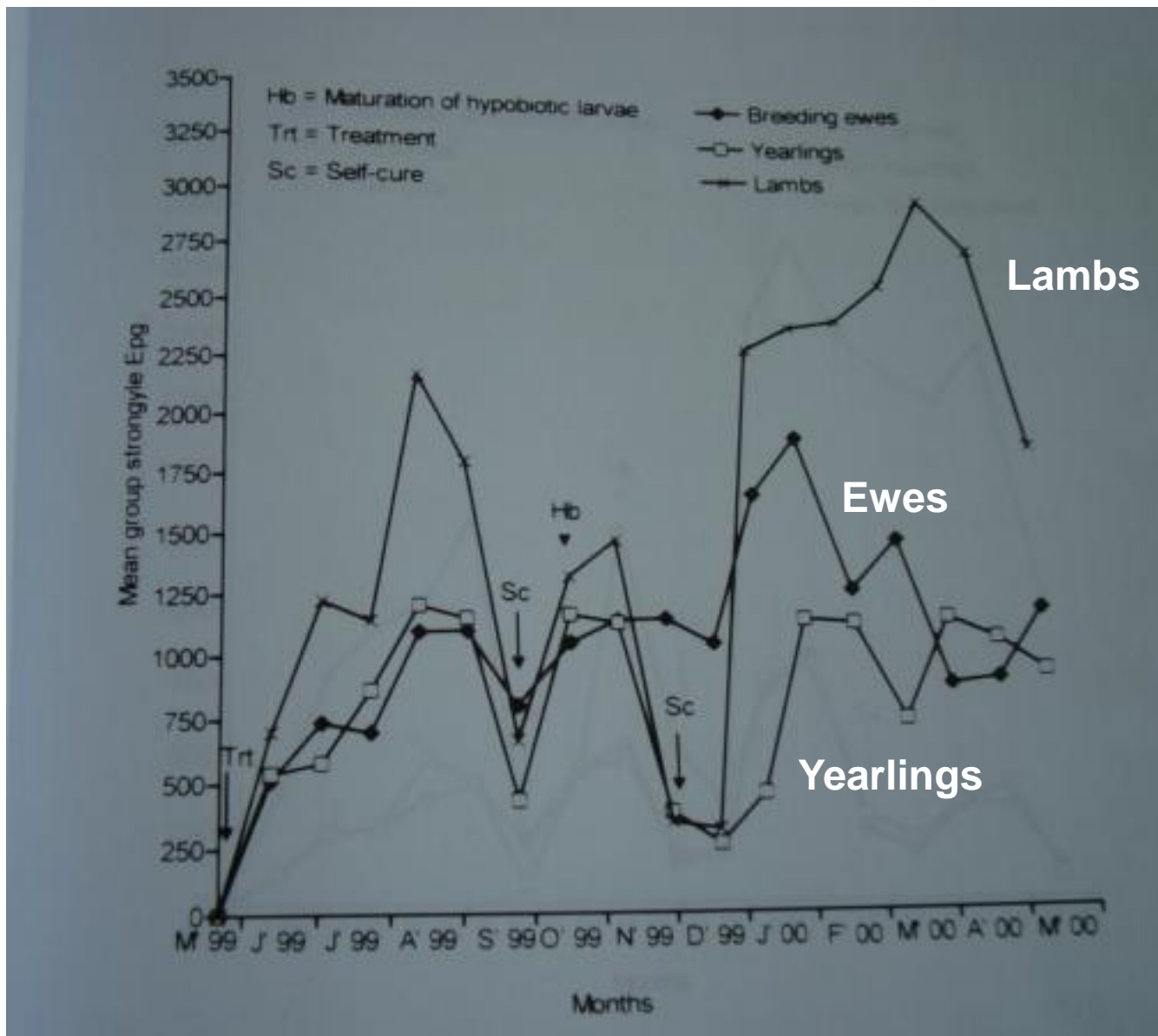
# General life-cycle cont.

## Factors influencing egg output

- **Parasite factors**
  - Species of parasite (fecundity)
    - Haemochus: 5000-15000/day/female
    - Trichostrongylus: 100-200/day/female
  - Stage of infection
- ## 2. Host factors
- Breed
  - Levels of host infection
  - Immunity/ age/ physiological stage (PPR)
- ## 3. Climate
- Changing patterns of infection



# Effects of age/ physiological factors

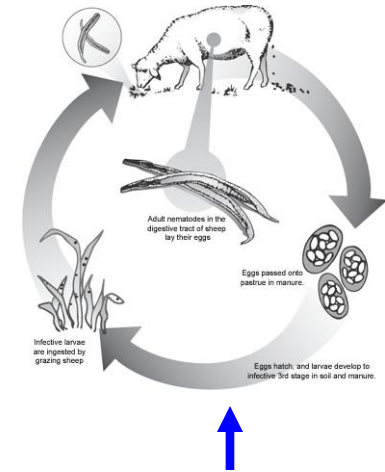


# General life-cycle cont..

## Development to infective larvae in the environment

Influenced by:

- Temperature: Optimum 22–26°C (5-30°C)
  - Little variation in tropics
- Humidity: 85 – 100%
  - High regional/ seasonal variation

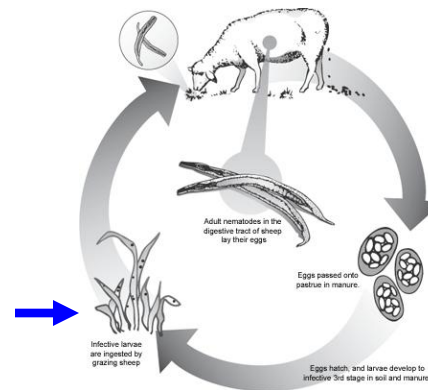




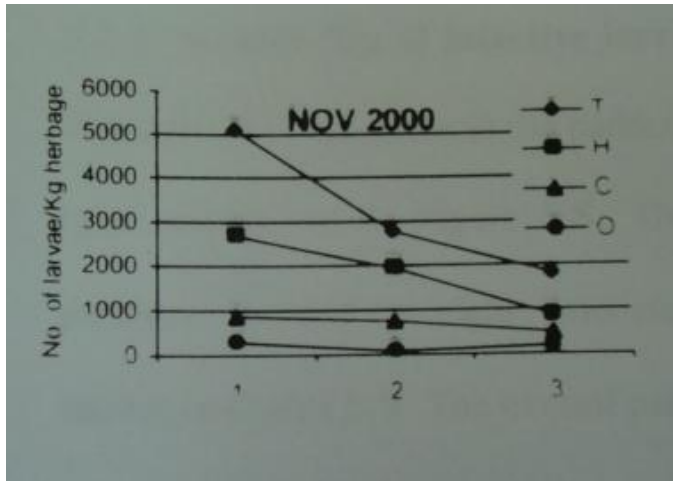
# General life-cycle cont...

## Survival of infective larvae in the environment

- Depends upon adequate moisture & shade
  - Microclimate
  - High moisture/ low vegetation cover: rapid movement/ fast death
  - Survive longest in cool weather
- Desiccation from lack of rainfall most lethal
  - Larvae protection from desiccation by crust of faeces or migration into soil
  - Larvae ingested during dry seasons undergo hypobiosis
- Effects of climate change
  - Changing patterns of infection

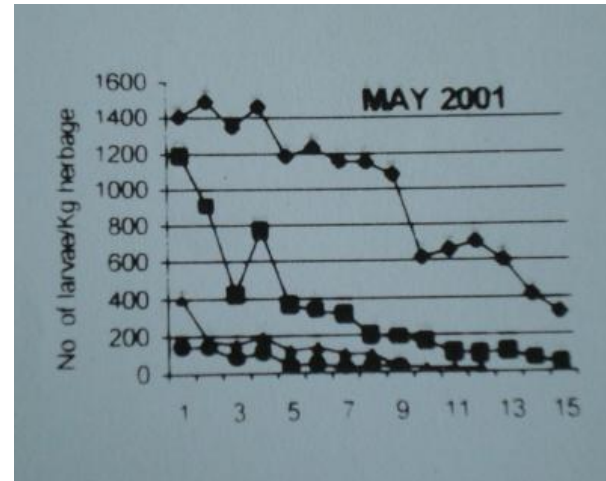


# Survival of infective larvae

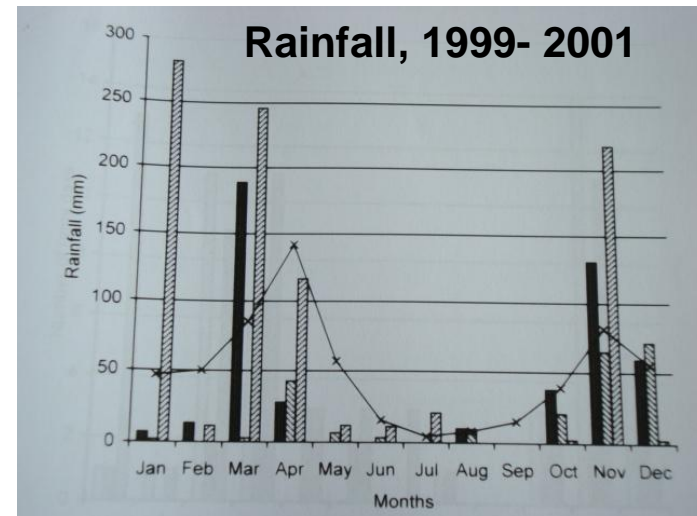


**NOVEMBER:** High moisture/ low vegetation cover, rapid L<sub>3</sub> movement, short live span

**JULY:** Low moisture, dry herbage no L<sub>3</sub> recovered



**MAY:** Low moisture/ heavy vegetation cover, Slow L<sub>3</sub> movement/ longer survival

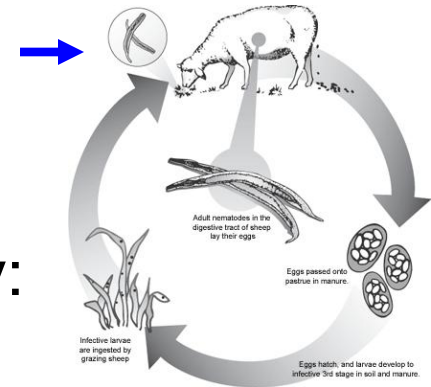


# General life-cycle cont....

## Levels of host infection

Depends on:

1. Number of infective larvae ingested as influenced by:
  - Climate
  - Levels of pasture contamination
  - Grazing patterns of ruminants present
2. Acquired resistance as influences by:
  - Parasite factors: Species & genetics
  - Host factors: Species, genetics, nutrition, physiological stress
3. Intrinsic multiplication rate of parasite as influences by:
  - Fecundity & pre-patent period
  - Development & survival rates of the species
4. Worm control practices: pasture mgt, deworming



# Pathogenicity of nematode infestation

Depends on:

## 1. Parasite factors

- Parasites species
- Single/mixed infection: Usually mixed infection with additive pathogenic effects
- Levels of infection

## 2. Host factors

- Species/ breed
- Nutritional status of host
- Age of host, young most susceptible
- Physiological status

# Pathogenicity cont.

## 1. Larval stage

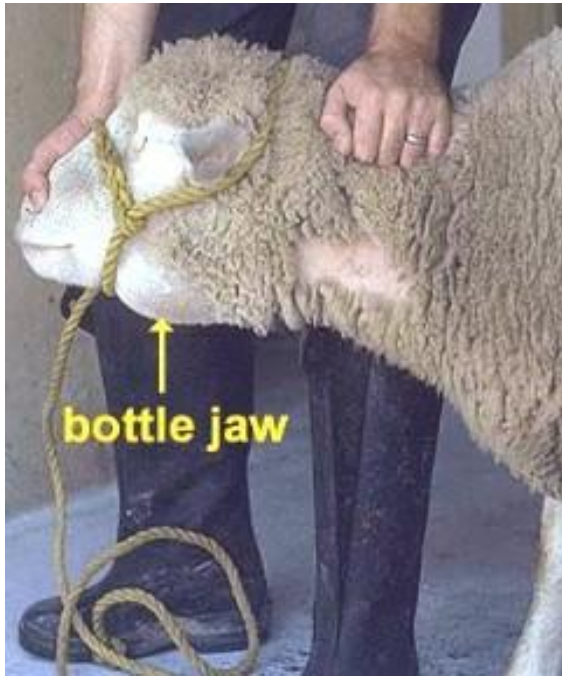
- Damage of gut mucosa by barrowing larvae: Ostertegia
- Migrating larvae cause tissue damage along the migratory route: Ascarids, strongylus
- Hypersensitivity reaction eg skin (hook worms)
- Blood/protein loss: Haemonchus, hook worms, Trichuris

## 2. Adults

- Compete for nutrients with host
- Obstruction: Ascarids, lungworms
- Tissue irritation
- Blood/ protein loss

# Manifestation of nematode infestation

- Anemia
  - ✓ Pale mucus membranes
  - ✓ Oedema- bottle jaw



# Manifestation cont.

- Unthriftiness
  - ✓ Poor body condition/  
thin/ pot belly
  - ✓ Weight loss/ decreased  
gain
  - ✓ Rough hair coat
  - ✓ Hair easily falls off



# Manifestation cont..

- Low productivity
  - ✓ Milk, wool, meat
  - ✓ Reproductive ability
  - ✓ Poor quality products
- Diarrhoea/ constipation
- Hypersensitivity (skin)
- Respiratory distress/ coughs
- Death





# Diagnosis of nematode infestation

- Clinical presentation
- Samples for laboratory analysis
  - Faecal epg
  - Faecal culture (L<sub>3</sub>)
  - Sputum
  - Urine
  - Blood
  - Tissue biopsy
- Postmortem
  - Pm lesions
  - Worm recovery & identification (Morphology)

# Nematodes of ruminants

Location	Genera
Oesophagus	Gongylonema
Stomach	Haemonchus*, Ostertagia, Trichostrongylus
S/ intestines	Trichostrongylus*, Cooperia, Nematodirus Bunostomum, Gaigeria, Toxocara*, Capillaria, Strongyloides
L/ intestines	Trichuris*, Oesophagostomum*, Chabertia, Skrjabinema
Lungs	Dictyocaulus*, Protostrongylus, Muellerius
Eye	Thelazia*
Skin/ C tissue	Stephanofilaria, Onchocerca, Parafilaria
Blood vessels	Elaophora
Ear	Rhabditis

# Haemonchus

(Large stomach worm, twisted wire worm)

## Species

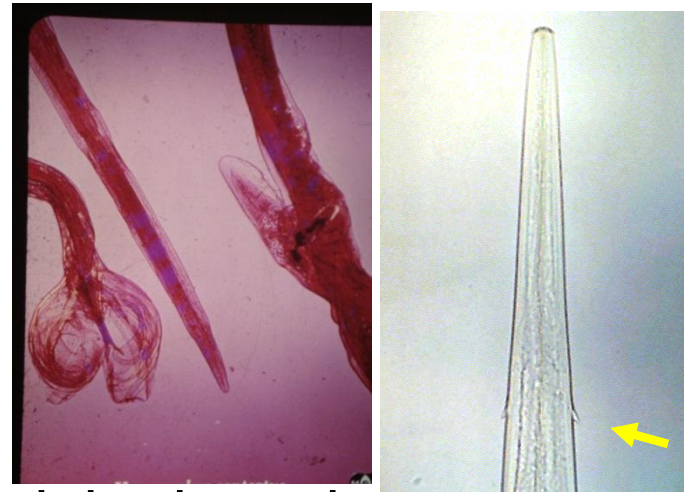
1. *H. contortus*
2. *H. placei*

## Hosts

- Sheep & goats  
Cattle

## Morphology

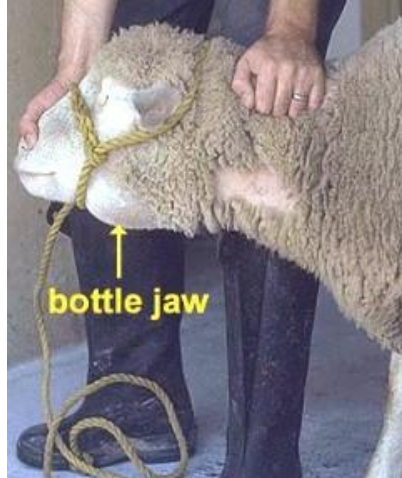
- Reddish brown worms
- Have cervical papillae
- Ovaries spirally arranged around the intestines
- Ovaries white, intestines red (blood filled) gives barbed wire look, thus name barber pole
- Males are bursate
- Females have large vulva flaps
- Typical strongyle eggs



# Haemonchus cont.

## Pathogenicity & clinical manifestations

- Blood suckers
- Causes anemia (pale mucous membranes)
- Oedema- bottle jaw
- Unthriftiness
- Death



# Trichostrongylus

## Species

- T. axei
- T. colubriformis

## Predilection site

- Stomach
- Small intestines

## Morphology

- Slender, small
- Size: 3 – 9 mm
- Males are bursate
- Females have no vulva flap
- Typical strongyle eggs

## Pathogenicity & clinical manifestation

- Catarrhal enteritis / gastritis
- Diarrhoea/ black scour
- Unthriftiness



# Ascarids in ruminants

**Genus: Toxocara / Neoscaris (Cattle ascarids, large round worms of cattle)**

## Species

- *T. vitulorum*

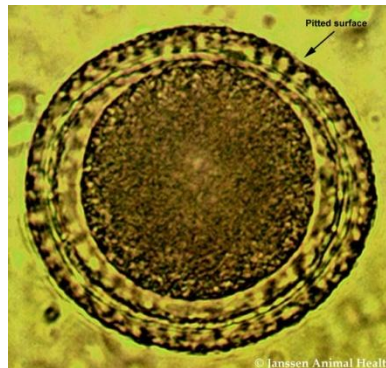
## Hosts

Cattle



## Morphology

- Size: 25 - 30 cm
- Translucent cuticle, organs visible through
- Typical ascarid eggs



# Ascarids cont.

## Transmission

- Infection by ingestion of L<sub>2</sub> in eggs, through colostum, possibly transplacental

## Pathogenicity & clinical manifestations

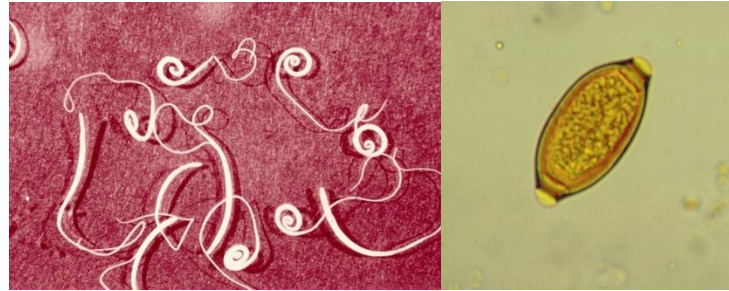
- Intestinal obstruction
- Pot belly
- Compete for food with host
- Poor appetite
- Diarrhoea
- Unthriftiness

# Genus: Trichuris (Whip worms)

Species T. ovis

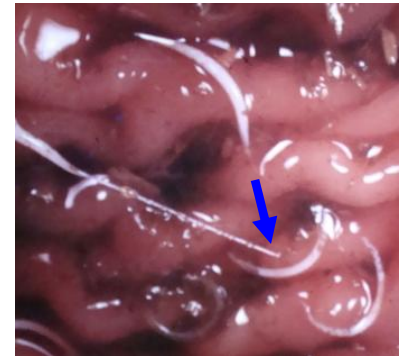
## Morphology

- Size: 5 – 7 cm
- Thin hair like anterior part & thick posterior part
- Posterior end curved in males
- Typical trichurid eggs



## Pathogenicity & clinical manifestations

- Blood suckers: Anaemia
- Burrow anterior end into mucosa,
  - Irritate mucosa, causing diarrhoea





# Oesophagostomum

## Species

*O. ovis*

*O. radiatum*

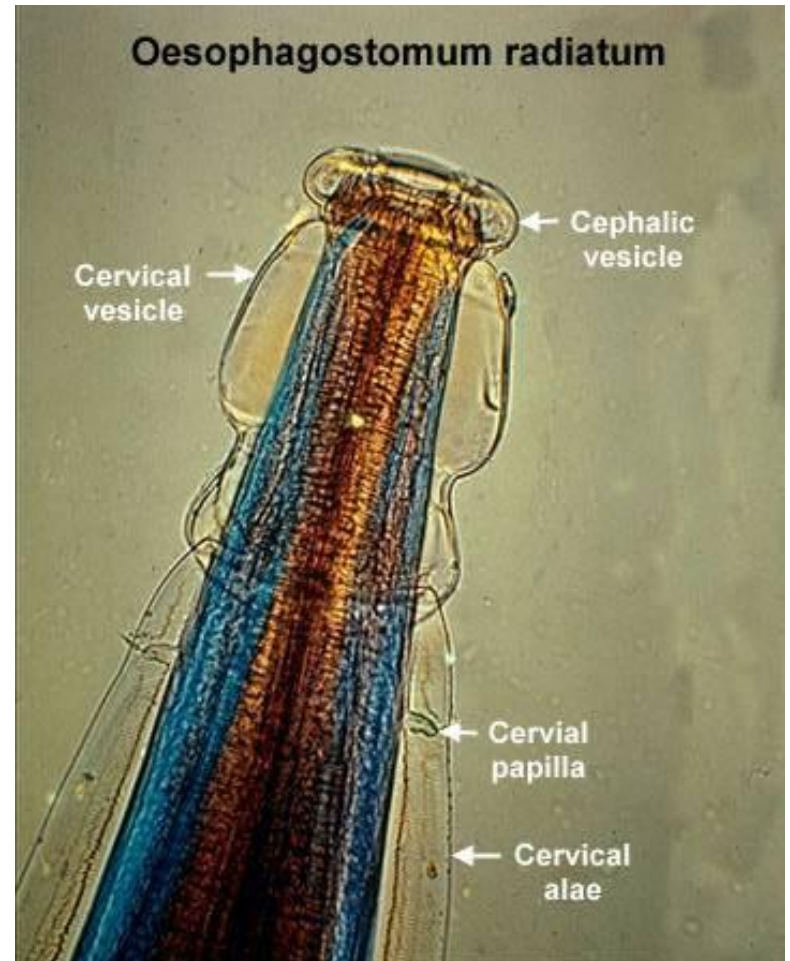
## Hosts

Sheep & goats

Cattle

## Morphology

- Size: 6 - 24 mm
- Males are bursate
- Have leaf-crown
- Have cephalic vesicle
- May have cephalic papillae
- May have cephalic alae



# Oesophagostomum cont.

## Pathogenicity & clinical manifestations

1. Larvae arrested in gut wall form nodules
2. Irritate mucosa, causing diarrhoea
3. Unthriftiness



# Lung worms in ruminants

## 1) Dictyocaulus

- | Species      | Hosts          |
|--------------|----------------|
| D. viviparus | Cattle & camel |
| D. filaria   | Sheep & goats  |

## Morphology

- Slender, thread-like
- Size: 3 - 10 cm
- Males are bursate



## Pathogenicity & clinical manifestation

- Causes bronchitis, pulmonary emphysema, oedema
- Manifests as respiratory distress, persistent coughs & froathing
- Decreased production

# Thelazia (Eye worm)

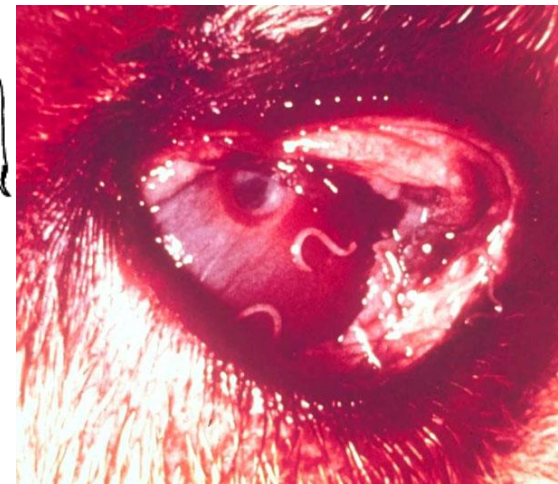
## Species            Hosts

- *T. rhodesii*    Cattle
- *T. bovis*

**Predilection site:** Lacrymal ducts & conjunctival sac

## Morphology

- Milky white
- Size: 8 - 18mm



**Transmission:** By muscid flies

## Pathogenicity & clinical manifestations

- Eye inflammation, obstruction of lachrymal duct
- Lacrimation, blindness

# Nematodes of equine

<b>Location</b>	<b>Genera</b>
Stomach	Habronema* Trichostrongylus
S/ intestines	Trichostrongylus, Parascaris*, Strongyloides
L/ intestines	Strongylus*, Triodontophorus, Craterostomum, Oesophagodontus, Trichonema, Oxyuris*
Lungs	Dictyocaulus
Eye	Thelazia
Skin/ C tissue	Onchocerca
Peritonium	Setaria

# Genus: Habronema

## Species

H. muscae

H. Microstoma (H. majus)

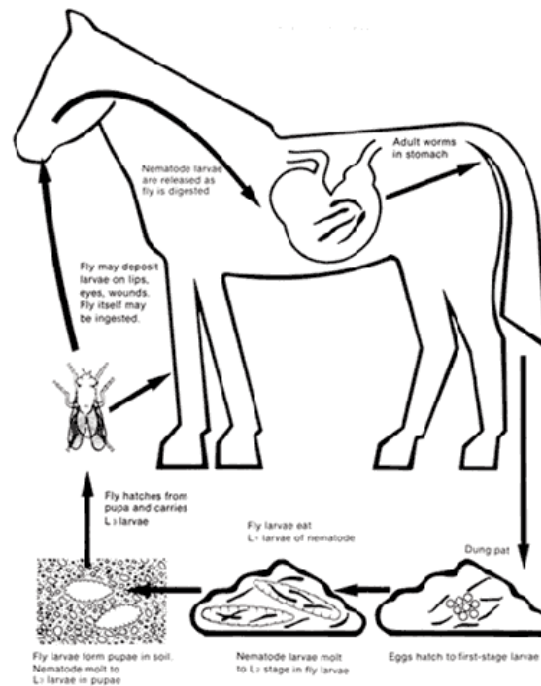
H. Megastoma (Draschia)

## Transmission

Musca domestica

Stomoxys calcitrans

M. domestica



# Genus: Habronema cont...

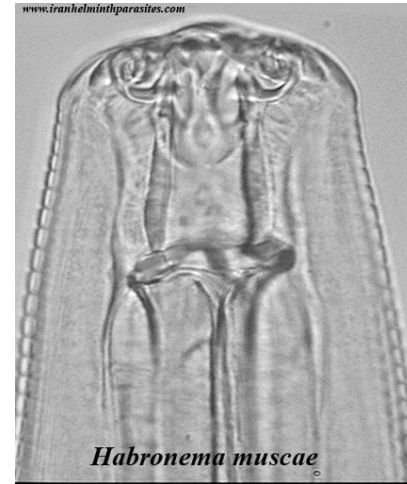
## Morphology

### *H. muscae* & *H. microstoma*

- Yellowish
- Pharynx is cylindrical
- Size: 16 - 25 mm long

### *H. megastoma* (*Draschia*)

- Whitish
- Head constricted off from the body
- Pharynx funnel shaped
- Size: 7 - 13



# Genus: Habronema cont...

## Pathogenicity & clinical manifestations

- Causes tumour-like lesions in stomach, eye & skin
- May be colics
- Causes catarrhal gastritis





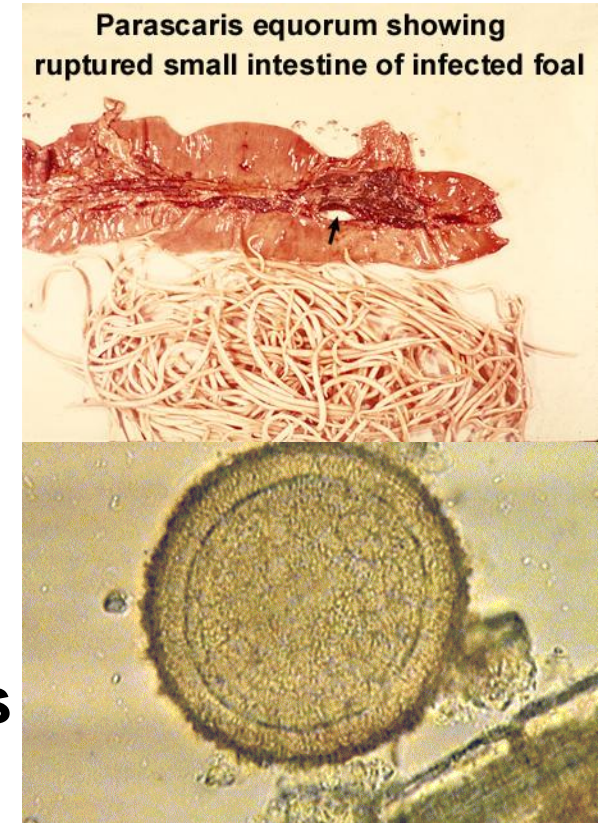
# Parascaris equorum

## Morphology

- Size: 15 - 50 cm by 3 – 8 mm thick
- Stout worms with large heads
- Eggs: Typical ascarid

## Pathogenicity & clinical manifestations

- Migrating larvae: Tissue damage
- Adults: intestinal obstruct & possible rupture
- Malnutrition
- Unthrifty

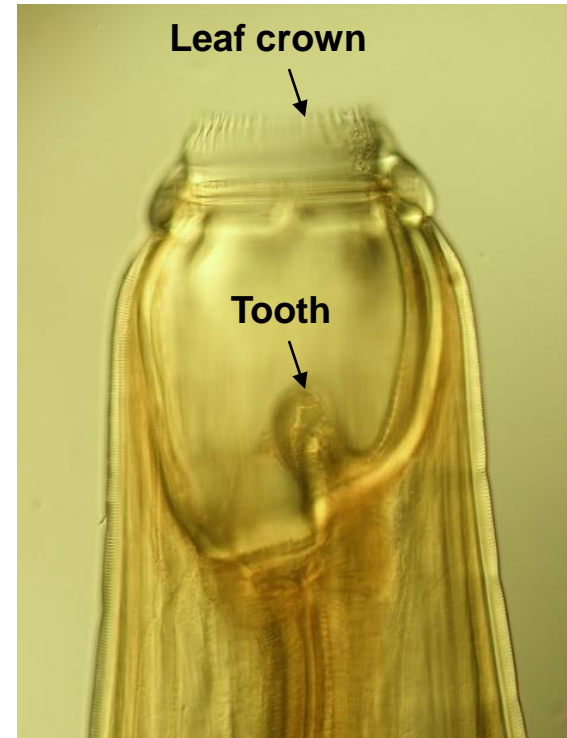


# Strongylus spp.

(Migratory strongyles of horse, large strongyles, large blood worms, large red worms)

## Morphology

- Size: 16 – 47
- Stout
- Large buccal capsule
- Well developed buccal crown
- May have teeth
- Males are bursate
- Typical strongyle eggs



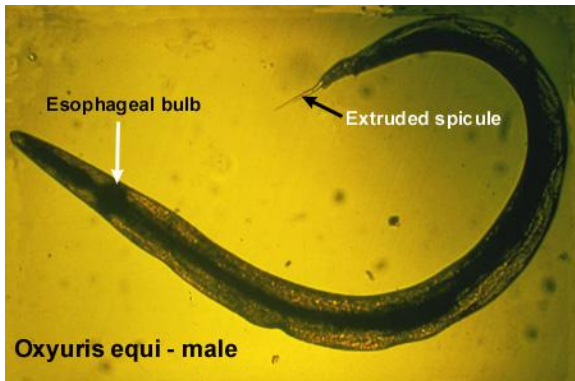
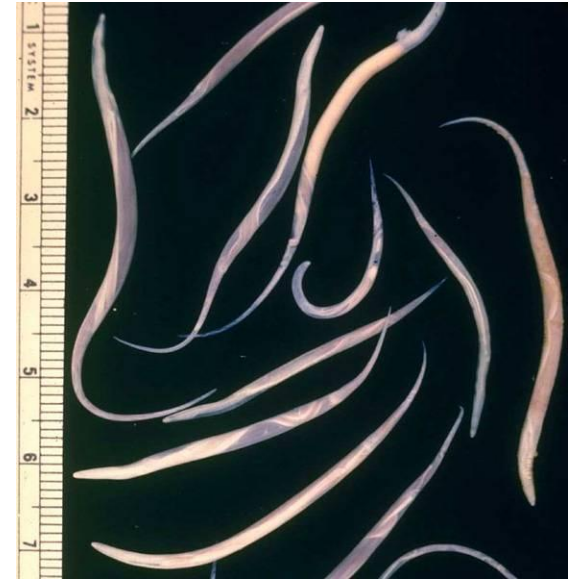
# Strongylus cont..

## Pathogenicity & clinical manifestations

- Plug feeders: Intestinal ulcers
- Blood suckers: Anaemia
- Nodular formation on gut wall: Interferes with function
- Damage to circulatory system: Haemorrhage, anaemia
- Liver damage
- Diarrhoea
- Colics
- Unthriftiness
- Lameness

# Oxyuris equi (Pin worms of horses)

- Oesophagus with large posterior bulb
- Females with long pointed tail
- Males: One pointed pin shaped spicule
- Size: 9 - 150 mm long
- Eggs: One side flattened
  - Unipolar plugs



# Oxyuris equi cont...

## Pathogenicity & clinical manifestations

- Plug feeders: Intestinal ulcers
- Irritate intestinal mucosa & skin when depositing eggs



# Nematodes of poultry

<b>Location</b>	<b>Parasite</b>
Oeso/ crop	Gongylonema ingluvicola, Capillaria spp.
proventriculus	Tetrameres spp*., Capillaria spp., Dispharynx nasuta
Gizzard	Acuaria hamulosa
SI	Ascaridia galli*, Capillaria spp.
Caecum	Heterakis spp*., Allodapa spp. Capillaria spp.
Eye	Oxyspirura mansoni
Trachea	Syngamus trachea*

# Tetrameres

**Species:** *T. americana*, *T. fissispina*

**Intermediate hosts:** Grass hoppers, cockroaches

## Morphology:

- Males are white, slender & Filiform
- Females are globular or coiled
- Size: Males 5– 5.5 mm long

Females: 3.5 – 4.5 mm long by 3 mm wide

## Pathogenicity & clinical manifestation:

- weight loss, decreased production, proventriculus thickens & oedematous, partial obstruction

## Diagnosis:

- Eggs in faeces
- Demonstrate worms at PM

Fig. 1 Female (A) and Male (B) *Tetrameres* fixed with 70% alcohol

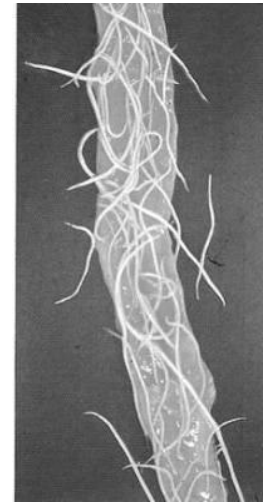
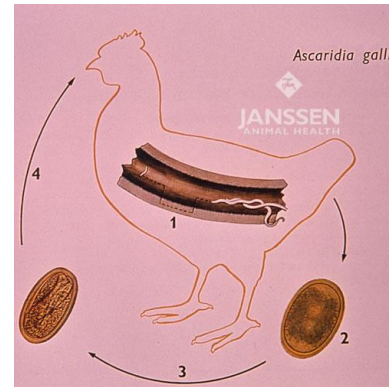


# Ascaridia galli

**Hosts:** Chicken, guinea fowl, turkey, duck, goose, other birds

## Morphology

- Size: 5 – 11.6 cm
- Eggs: Oval, smooth shell



## Pathogenicity & clinical manifestations

- Young birds most susceptible
- Loss of appetite, weigh loss, drooping wings, ruffled feathers, anaemia, diarrhoea & mortality, decreased egg production

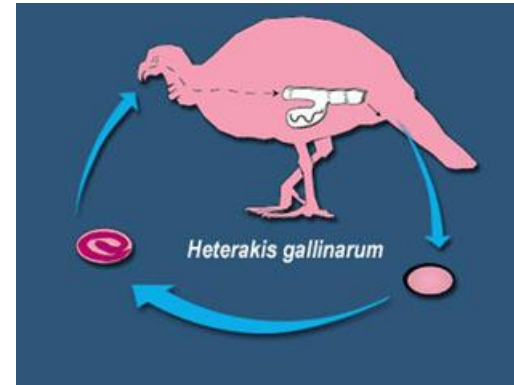


# Heterakis gallinarum

**Hosts:** Chicken, guinea fowl, turkey, duck, goose, other birds

## Morphology

- Have 3 lips anteriorly
- Size: 7 – 15 mm long
- Eggs: Thick, smooth shell



## Pathogenicity & clinical manifestation

- Immature stages feed on mucosa leading to ulceration, thickening of mucosa, haemorrhages, & malnutrition
- Biological vector of *Histomonas meleagridis*

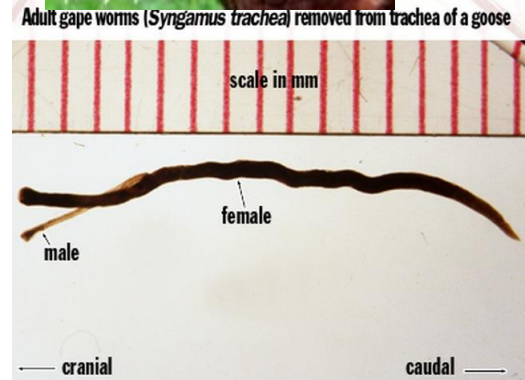
# Syngamus trachea

**Hosts:** Chicken, guinea fowl, turkey, goose, other birds

**Predilection site:** Trachea & lungs

## Morphology

- Reddish
- Two sexes in permanent copulation
- Size: 2 – 20 mm long
- Eggs: Thick operculum in both poles



## Pathogenicity & clinical manifestations

Mucous in trachea, difficult breathing (gaping) death

Emaciation, weakness & anemia

# Nematodes of dogs & cats

Location	Parasite	Host
Oesophagus	<i>Spirocerca lupi</i>	Dog
S/intestines	<i>Ancylostoma caninum</i> <i>A. tubaeforme</i> <i>Toxocara canis</i> <i>T. cati</i> <i>Toxascaris leonina</i>	Dog Cat Dog Cat Dog/Cat
L/intestines	<i>Trichuris vulpis</i> <i>T. Serrata</i>	Dog Cat
Resp/ tract	<i>Filaroides osleri</i> <i>Aelurostrongylus abstrusus</i>	Dog Cat
Cir/system	<i>Dirofilaria immitis</i>	Dog/Cat

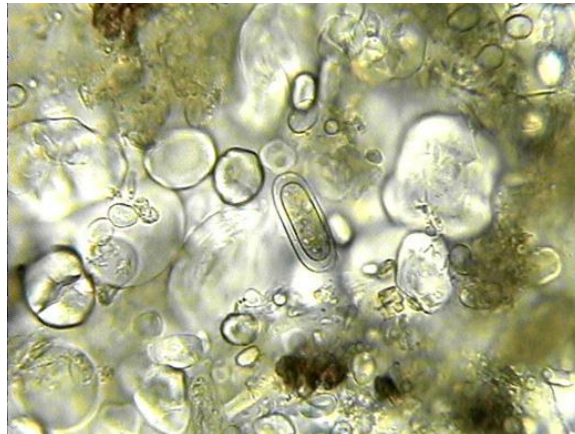
# Spirocerca lupi

## Predilection sites:

- Walls of oesophagus, stomach & aorta,

## Morphology

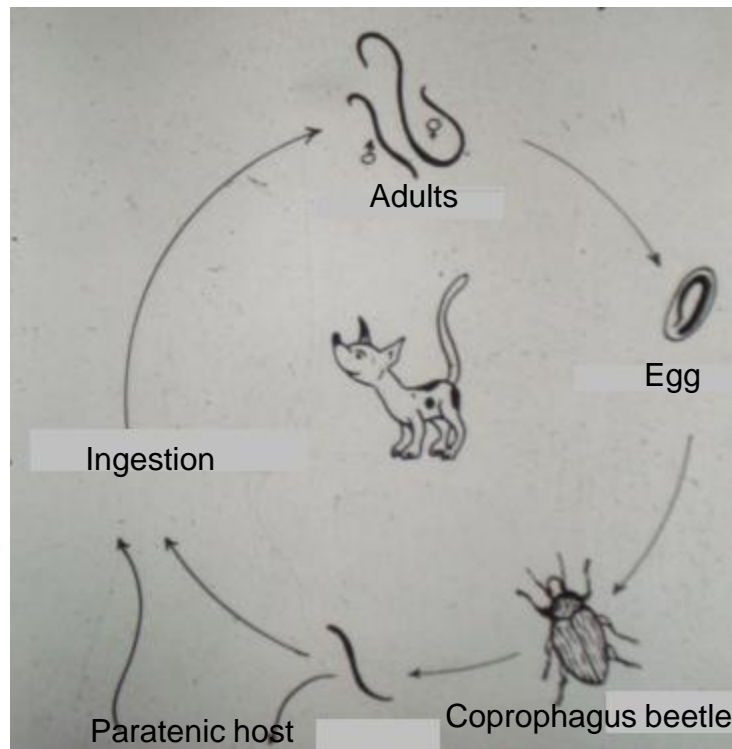
- Pink coloured worms, that are usually coiled into a spiral
- Size: 30 - 80 mm long
- Eggs: Thick walled, contain larvae at time of laying



# Spirocerca cont.

## Transmission

- Eggs ingested by coprophagus beetles
- Develop to infective L<sub>3</sub>
- Dogs infected by ingesting beetles or paratenic host



# Spirocerca cont..

## Pathogenicity & clinical manifestations

1. Migratory larvae
  - Tissue damage: In aorta cause stenosis or aneurysms with possibility of rupture & sudden death
2. Adults: Nodules in oesophagus, stomach & aorta
  - In oesophagus cause obstruct, persistent vomiting & emaciation, may become cancerous (fibrosarcomas or osteosarcomas) & can metastasis to other organs
  - Thickening of long bones



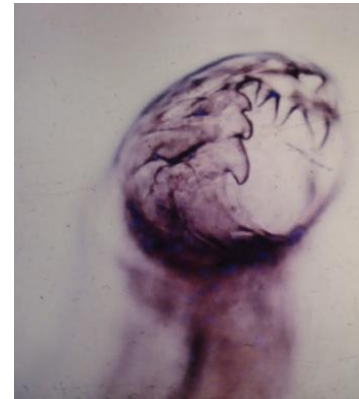
# Hook worms of dogs & cats

## **Ancylostoma caninum**

**Final host:** Include the dog, fox & other wild carnivores

### **Morphology**

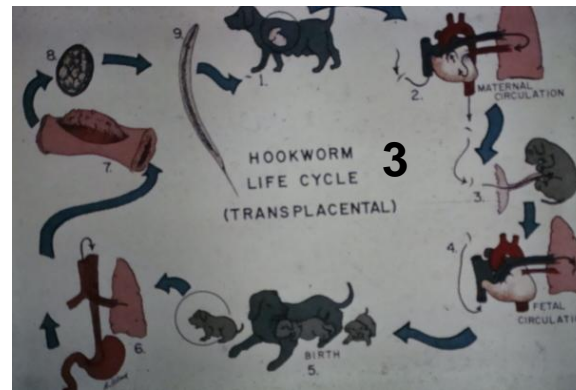
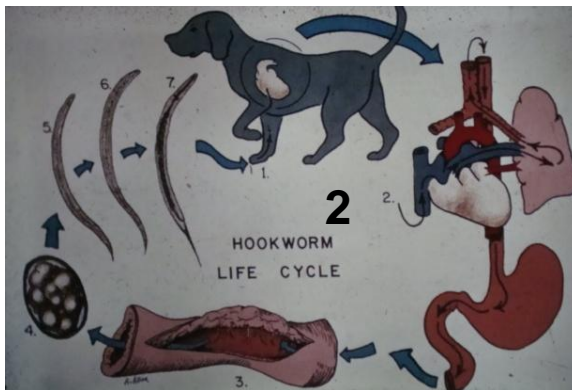
- Grey or reddish coloured worms
- Fairly rigid worms
- Anterior end bent dorsally
- Has deep buccal capsule
- Three pairs of ventral marginal teeth on the buccal capsule
- Size: 10 - 16 mm
- Males are bursate
- Eggs: Typical strongyle



# Ancylostoma caninum cont.

## Transmission

- 1) Oral infection - by ingesting infective L<sub>3</sub>
- 2) Skin penetration - larvae migrate to the lungs, up the trachea, coughed and swallowed
- 3) Prenatal infection of the fetus in utero (L<sub>3</sub> arrested in liver)
- 4) Colostral or lactogenic infection, larvae passed through milk to puppies





# Ancylostoma caninum cont..

## Pathogenesis & clinical manifestations

1. Migrating larvae:
  - Cause dermatitis & verminous pneumonia
2. L<sub>4</sub> to adults:
  - Are blood suckers causing anaemia & hypoproteinaemia (oedema)
  - Irritate intestinal mucosa, causing hypermotility, diarrhoea & vomiting
  - Plug feeders, causing haemorrhagic ulcer & bloody faeces
  - Animals become anorectic & loss weight
  - Death is common especially in young pups



# Ancylostoma tubaeforme

**Final host:** Cats

## **Morphology**

- Resembles *A. caninum* but much smaller
- Size: 9.5 - 15 mm long
- Bursate
- Three pairs of ventral marginal teeth on the buccal capsule longer than those of *A. caninum*
- Eggs: Typical strongyle

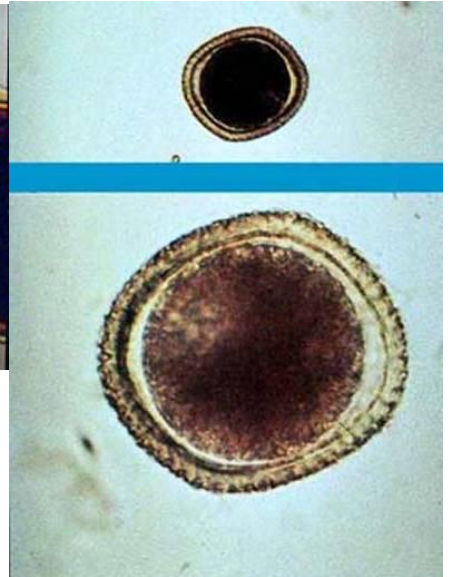
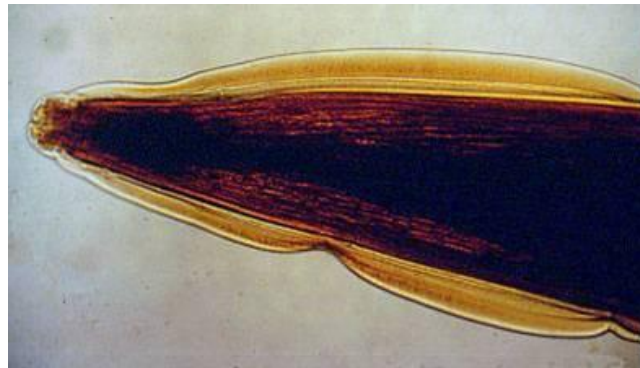
## **Pathogenicity & clinical manifestations**

- As in *A. caninum*

# Toxocara canis

## Morphology

- Have three (3) well developed lips (1 dorsal, 2 sub-ventral)
- Sizes: Up to 18 cm long
- Have large cervical alae giving the anterior end an arrow like appearance
- Eggs: Sub globular with thick finely pitted shell



## Modes of infection

- 1) Direct oral infection
- 2) Prenatal (uterine) infection
- 3) Lactogenic (colostral or neonatal) infection
- 4) Paratenic host infection

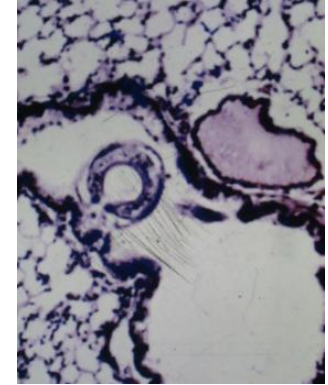
# Toxocara canis cont.

## Pathogenicity & clinical manifestations

- Infections are more severe in young puppies, especially in kennels with poor hygiene

### A. migrating larvae

- Damage tissues & verminous pneumonia

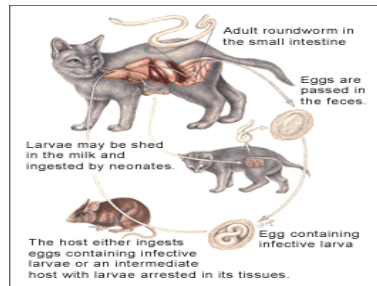
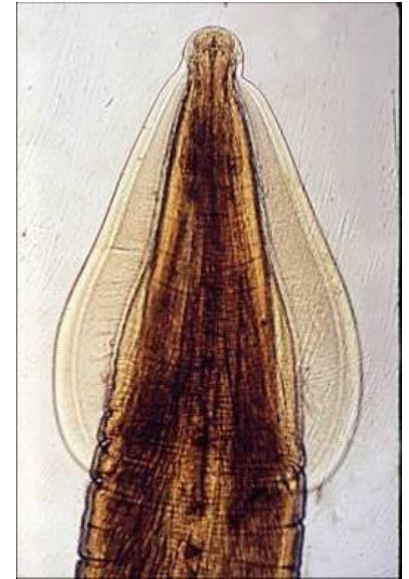


### B. Adult worms

- Irritate intestines causing diarrhea, vomiting, anorexia, aspiration pneumonia & deaths
- Intestinal obstruction & possible rupture
- Mild infections cause general unthriftiness, pot-belly appearance, intermittent diarrhea

# Toxocara cati

- Commonly affects kittens
- Size: 3 – 10 cm
- Cervical alae may be very broad & striated



## Transmission

- Direct oral
- Lactogenic
- Paratenic host (most important)
- Paratenic hosts include, rodents, chicken, earthworms, cockroaches & sheep

## Pathogenicity & clinical manifestations

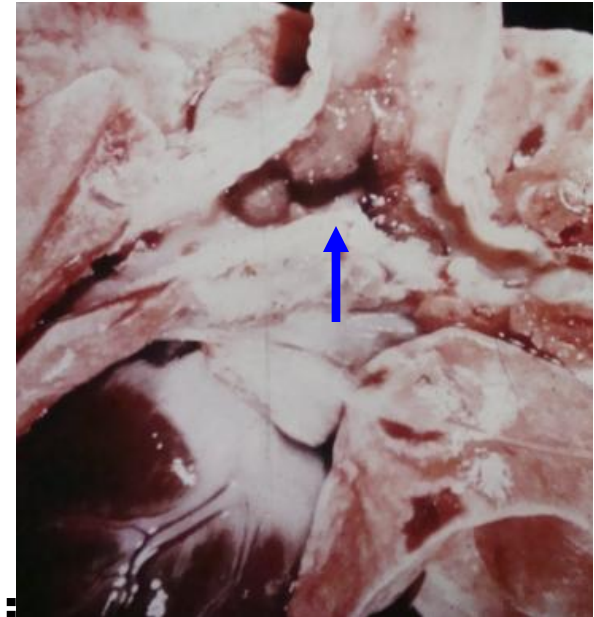
- Unthriftiness, pot-belly, intermittent diarrhea
- Adults may cause intestinal obstruction

# Filaroides (Oslerus ) osleri

**Final host:** dog

## **Morphology**

- Generally slender worms
- Size: 5 - 15 mm
- Larvae: Short, S-shaped tail



## **Pathogenicity & clinical manifestations**

- Development of granulomatous nodule
- Tracheo-bronchitis
- Chronic rasping coughs

# 2. *Aelurostrongylus abstrusus*

**Final host:** Cats

**Intermediate hosts:** Snails / slugs

## **Morphology**

- Males are bursate
- Size: 7.5 - 9.9 mm

## **Pathogenicity & clinical manifestations**

- Adults lead to the development of typical sub-plural nodules
- Chronic rasping coughs
- Fatal in heavy infections

# **Dirofilaria immitis**

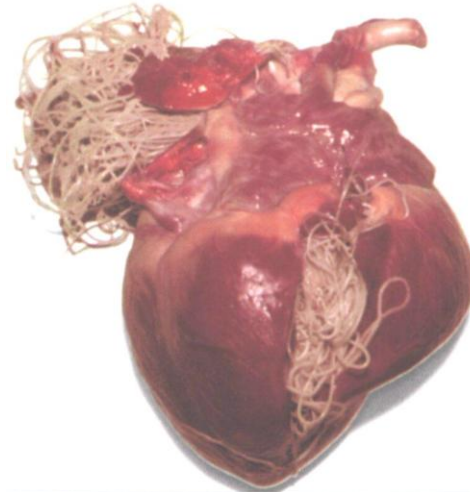
**Final host:** Dogs, cat, fox, wolf, horse & man

**Intermediate hosts:** Mosquitoes

**Predilection sites:** Right ventricle, Pulmonary artery

## **General Morphology**

- Slender whitish worms
- Size: 12 - 30 cm

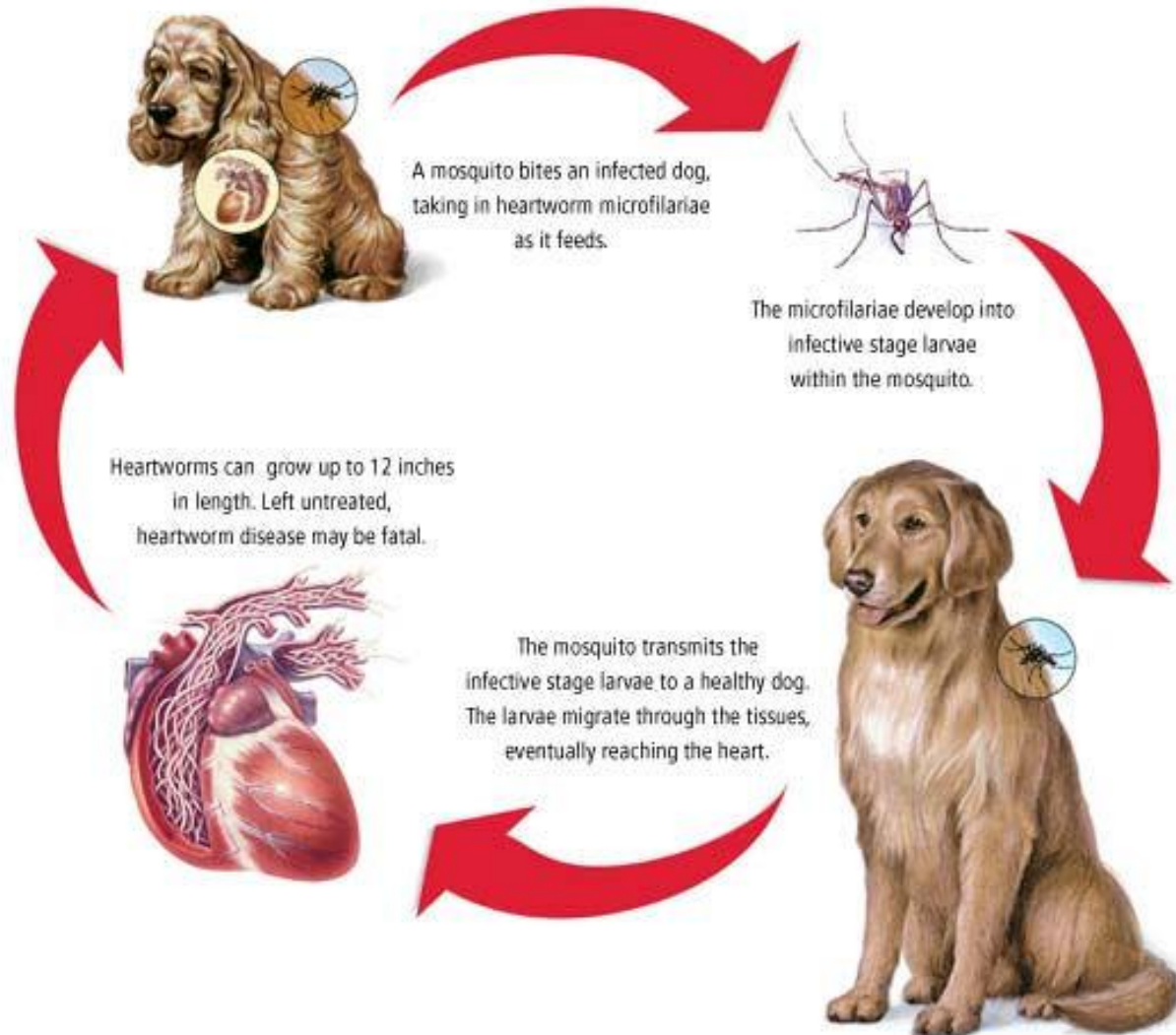




# Dirofilaria immitis cont.

## Heartworm Life Cycle

The life cycle of the heartworm begins when a mosquito bites and feeds on the blood of an infected dog that is carrying tiny immature heartworms in its blood. During the next two to three weeks, the larvae develop into the infective stage within the mosquito. When the infected mosquito feeds again, it can transmit heartworm larvae to a healthy cat or dog.



# **Dirofilaria cont..**

## **Pathogenicity & clinical manifestations**

Chronic disease resulting in multi-system dysfunctions

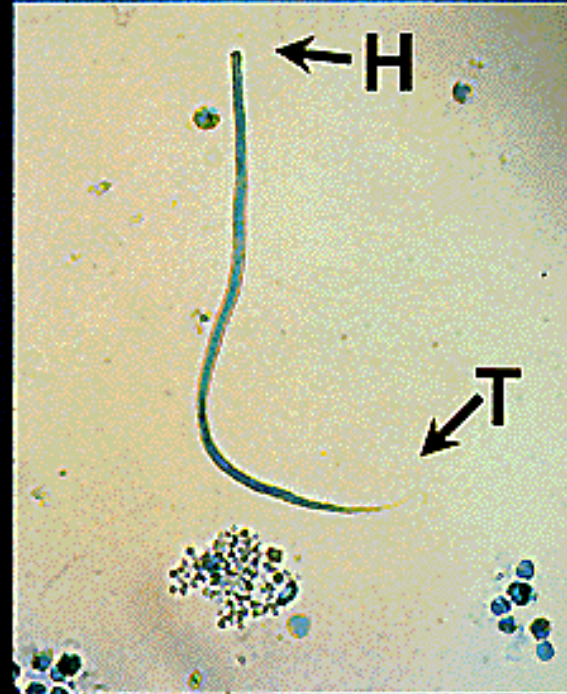
- 1. Heart:** Interfere with valvular function
- 2. Lungs:** Pulmonary hyper-tension:
  - Increased resistance to pulmonary circulation, congestive heart failure, ascitis, anasarca & hydrothorax
  - Clinically: Coughs, dyspnoea, tiring or collapse on exercise or death
- 3. Liver:** Acute hepatic injury:
  - Anorexia, anaemia & icterus (dark brown urine)
  - Sudden death due to hepatorenal failure
- 4. Kidney damage:**
  - Due to deposition of immune-complex substances in the kidney (ab-ag) & products of rbc breakdown

# Dirofilaria immitis microfilaria

## Identification of the Microfilariae of the Dog



*Dirofilaria immitis*



*Dipetalonema reconditum*

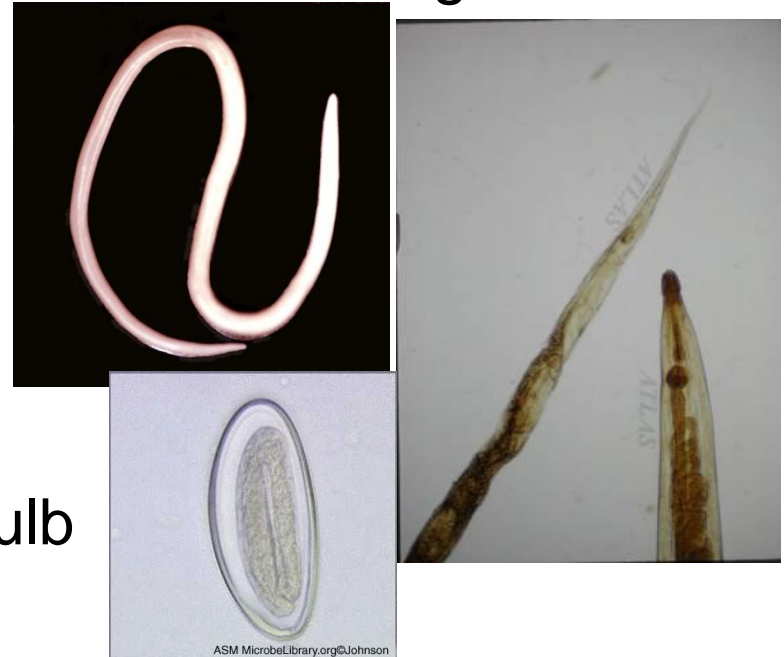
# Enterobius vermicularis

**Host:** Man / other primates

**Predilection sites:** Caecum, appendix ascending colon

## Morphology

- Cream coloured
- Males: single pin like spicules
- Females : Long pointed tails
- Size: 2-13 mm
- Oesophagus: large posterior bulb



## Pathogenicity

- Irritate intestinal mucosa & skin when depositing eggs especially at night
- May invade female genitalia

# Human filariasis

- One of the neglected diseases of man (WHO)
- Adult worms range from 2 to 50 cm in length

## 1. *Onchocerca volvulus*

**Vector:** Simulium



**Predilection sites:** Adults inhabit the sub-cutaneous & connective tissues

**Pathogenicity:**

- Dead micro-filaria: Severe allergic reactions
  - In the eye causes blindness (river blindness)

## 2. *Wuchereria bancrofti*

**Vector:** Mosquitoes

**Predilection sites:** Adults inhabit the lymphatics

**Pathogenicity:** Causes elephantiasis

- Obstruct of lymphatics is the primary cause of the disease
- Mostly involves upper & lower limbs, scrotum, vulva & breasts



# 3. Dracunculus medinensis

**Vector:** Crustaceans – Cyclops

**Morphology:** Female up to 1 m long, 0.9 – 1.7 mm wide

**Predilection sites:**

- Interstitium, subcutis & connective tissues
- Mostly affects limbs

**Pathogenicity:**

- Vesicle is formation
- Ulceration of affected skin
- Can be disabling

