Lecture No.9 PARASITOLOGY DR.Raad H.H.

 **Order Srongylida**

 **Family Ancylostomidae**

**Characterized by :**

1. **Hook worm habitats small intestine of mammals.**
2. Small size nematode .
3. Adults are cylindrical grayish yellow tapering interiorly and slightly curved ,with head bent back dorsally forming a **HOOK**
4. The buccal cavity large highly cuticularized **provided with teeth or cutting plates which they used for attachment.**
5. **L3 infects host through skin penetration**.

 **Genus Bunostomum**

Most important spp.***Bunostomum trigonocephalum*** (Male 14 mm

Female 24 mm) and ***B. phlebotomum****.*

1. **habitats small intestine of ruminants**.
2. **Pair of cutting plates** at the anterior edge of the buccal capsule are used to abrade the mucosa during feeding.

  

***Fig****. Bunostomum trigonocephalum* cutting plates seen on the ventral aspect of the mouth.

1. **Direct life** cycle L1→L2 →L3 (molt in environment; L3 infects host through penetration of skin or mouth mucosa) → blood and lymphatic vessels →lungs –molt to L4→ swallowing →small intestine .
2. Adult maturation until lay eggs about 2 months (The prepatent period).
3. *Bunostomum phlebotomum* Infects **Man** ,often causing **CREEPING DERMATITIS or CREEPING ERUPTION**
4. **Symptoms** :

Larval penetration of the lower limbs may cause uneasiness and stamping, particularly in stabled cattle. **Adult** worms cause **anemia** and rapid weight loss. Diarrhea and constipation may alternate. **Hypoproteinemic edema** may be present, but **bottle jaw** is rarely as severe as in haemonchosis. During the patent period, a diagnosis may be made by demonstrating the characteristic eggs in the feces.

1. **Diagnosis**:
2. Flotation fecal test & EPG counts for eggs
3. Fecal culture for larvae.
4. P.M.

On necropsy, the mucosa may appear congested and swollen, with numerous small hemorrhagic points where the worms were attached. The worms are readily seen in the first few feet of the small intestine, and the contents are often blood-stained. As few as 2,000 worms may cause death in calves. Local lesions, edema, and scab formation may result from penetration of larvae into the skin of resistant calves.

1. **General G.I.T.** **Parasites of Ruminants Control & Prevention** :

Effective worm control cannot always be achieved by drugs alone; however, **anthelmintics** play an important role they may be used to reduce pasture contamination, particularly at times when seeding of the pasture with parasite eggs is a prerequisite for the development of an infective challenge necessary to cause clinical parasitism. Coordination with other methods of control, such as **alternate grazing** of different host species, **integrated rotational grazing** of different age groups within a single host species (including creep grazing), and alternation of grazing and cropping, are other management techniques that can provide safe pasture and give economic advantage when combined with anthelmintic treatment.

 **Genus Ancylostoma**

**Identification** :

**Canine hookworm** one of the most common **intestinal** parasites of **dogs and cats (especially puppies and kittens**). It can cause severe disease including **anemia** and serious **diarrhea**.

*** Ancylostoma caninum***

1. **With deep capsule (bent dorsally) and 3 pairs of teeth *.***

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1. *A. caninum* Dog, fox (intestine), possibly humans with females measuring 15-18 mm and males 9-12 mm. and requires a **warmer climate to develop.**
2. **Routs** of L3 infective stage :
3. **eating infective larvae**
4. **skin penetration**
5. **colostral or lactogenic ingestion** to puppies
6. **prenatal infection**
7. infects **man** ,often causing **creeping dermatitis** or creeping eruption.
8. **Diagnosis** is based on **clinical signs** and finding large numbers of hookworm **eggs** (several thousand eggs per gram) in fresh stool samples. **Anemia** may develop before the eggs can be demonstrated to be in the feces, therefore, your veterinarian may have to examine three consecutive fecal samples taken two to three days apart to confirm the diagnosis; Infections usually occur during warm, damp days. These conditions allow for the rapid development and prolonged survival of infective larvae in the soil.
9. **Treatment** program ,Several anthelmintics are available.
10. Remove feces regularly from runs, kennels and any place where dogs are confined. Larval hookworms do not survive desiccation, so keep the ground and pens dry.

 ***Ancylostoma duodenale***  

deep capsule (bent dorsally) and 2 pairs of teeth***; infects human.*** "Old World hookworm***"***



* **Life cycle , pathogenesis , symotoms , diagnosis , prevention as in *A. caninum*.**

 **Genus Uncinaria**

Identification :

1. ***U. stenocephala*** canine hookworm small **intestine of Dog, cat, fox**
2. The smaller species, *Uncinaria stenocephala* (males = 7.0 mm; females = 10.0 mm long) ;buccal cavity with **2 pairs of cutting plates**; tolerates the **temperate &cold** **climates**.
3. Infects **Man** ,often causing creeping dermatitis or creeping eruption
4. Other aspects as in *A. caninum*

**Genus *Necator***

 ***Necator americanus***

Identification:

1. **New World human hookworm**
2. The anterior end of *N. americanus* is armed with a **2 pairs of curved cutting plates.**
3. It is a parasitic nematode worm that lives in the **small intestine of hosts such as humans, dogs and cats.**
4. Can cause severe disease including **anemia** and serious **diarrhea**.
5. Infects Man ,often causing creeping dermatitis or creeping eruption.
6. Other aspects as in *A. caninum*

**Hookworm Zoonotic significance**

1. **Cutaneous larva migrans in man particularly children** , also known as creeping eruption“, is a dermatitis **caused by migrating hookworm larvae that not reach mature stage .** Infection occurs through skin contact with infective larvae and the most common sources of infection are shaded moist sandy areas or soil that has become contaminated via the feces of infected dogs or cats.
2. Sometimes referred to as "**creeping eruption**" or "**ground itch**", in some parts of the Southern USA this condition is also referred to as "**sandworms**," as the larvae like to live in sandy soil
3. The general clinical **symptoms** in **humans** are **erythema** at the sites of infection and intensive **pruritus**. The severity, and also persistence, of the skin lesions are related to the immune status of the individual person. **Hypersensitivity** related to previous infection has been reported. Although a few cases of adult dog hookworms in the intestines of man have been reported, the risk of such infections does not appear widespread.
4. **Systemic** signs include peripheral **eosinophilia** (Loeffler syndrome), migratory **pulmonary** infiltrates, and increased immunoglobulin E (**IgE)** levels, but are rarely seen.
5. **Pathological** Cutaneous Signs of cutaneous larva migrans (CLM) include the following:
	1. Pruritic, erythematous, edematous papules ; vesicles.
	2. Serpiginous (snakelike), slightly elevated, erythematous tunnels that are 2- to 3-mm wide and track 3-4 cm from the penetration site .
	3. Nonspecific dermatitis
	4. Vesicles with serous fluid
	5. Secondary impetiginization.
	6. Tract advancement of 1-2 cm/d.

 **Family Trichostrongylidae**

1. **worm habitates the fourth stomach (abomasums) &small intestine of ruminants &other mammles ; avain and human.**
2. **Thin Small size nematode0.5-3cm .**
3. **Coulatory bursa large specially lateral lobes plus small dorsal lobe.**
4. **The buccal** cavity small or **rudimentary** or **nonexistent** , **without teeth or cutting plates.**
5. **Egg divided embryo 8-32 cells.**
6. **L3 infects host through ingestion**.

 **Genus** ***Trichostrongylus***

**Characters:**

1. Most species in this genus have been described from **ruminants** **abomasums** and duodenum in primitive rodents around the world. Species have also been found in **birds**, **human** and non-human **primates, camel, pigs and equine**s.
2. The genus was first described by Looss in 1905. Over thirty species**.**
3. These are small worms (less than 1 cm long), **rudimentary buccal** cavity. The bursa of the male has large lateral lobes with a relatively short dorsal lobe and additional piece called **Gubernaculm**. The **vulva** of the female is located slightly posterior to mid body **covered** by **Flap**. The uterus is filled with eggs that are thin shelled and of the typical **strongylid type.**

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1. **known commonly as the stomach hairworm**



**Fig**.  **:Trichostrongylidae**·.***A*** **Life cycle** of trichostrongylid of different hosts.  ***1***. **Adults** (see ) live attached to the villi of **abomasum** or small intestine (species-specific) and feed on blood (e.g., ***Haemonchus****)*. ***2***. Smooth-walled **eggs** are passed unembryonated in host's **feces**. ***3***. **Larvae** are developed under favorable conditions inside the eggs. ***4–7*** Except for , the **L1** hatches from the egg and feeds on detritus. After two molts the **L3** stage is achieved, which is infective to final hosts. The third-stage larvae, still wearing the loosely fitting second-stage (= sheath), climb to the top of plants (7) and may even hibernate outside a host. ***8–9*** **If final hosts swallow the L3** with forage, the exsheathment takes place in the stomach. The larvae of some species may **burrow into the mucosa** and there twice; larvae of other species molt when attached to the villi. **In some species (e.g., the fourth-stage larvae may hibernate inside the mucosa for 3–5 months; this phenomenon is described as "Spring Rise" ; In spring these L4 complete their development and become mature after another molt.** The increased excretion of eggs is known as ***B*** The anterior (1) and posterior (2–8) regions of infective larvae (L3) of different genera parasitizing sheep, according to several authors. *ES*, esophagus; *L3*, third-stage larva; *NR*, nerve ring; *SH*, sheath (cuticle of the preceding larval stage).

1. Can cause **mild** intestinal disturbances and chronic **catarrhal gastritis** ;when present in **large numbers**, Lesions within the gastric **mucosa** can cause **haemorrhage**, with loss of plasma proteins and reduced absorption of nutrients.
2. **Spices Trichostrongylus axei , *T.colobriformis* .**

 **Genus Haemonchus**

**Characters:**

1. Species in this genus **infects ruminants (sheep & cattle ) abomasums** and Species have also been found in **camel**.
2. The genus species **called Blood Suckers ;Red In Color. .**
3. These are **small** worms (less than 3 cm long) small a buccal **cavity** with **one small tooth at the base**.. The **copultory bursa** of the male has large **lateral lobes** with a relatively short dorsal lobe like **Y letter shape**. The vulva of the female is located slightly posterior to midbody covered by **Flap**. The **uterus** is **filled** with **eggs** that are **thin** **shelled** and of the typical **strongylid type.**



***e.g. Haemonchus* *contortus*** In this worm the vulva is protected by a flap of the cuticle.

A. *Haemonchus contortus* spicules.
B. *Haemonchus contortus* male bursa.

 ***Haemonchus contortus***,

1. also known as red stomach worm, wire worm or [**Barber's pole**](http://en.wikipedia.org/wiki/Barber%27s_pole) worm, is very common parasite and one the **most pathogenic** [**nematode**](http://en.wikipedia.org/wiki/Nematode) **of** [**ruminants**](http://en.wikipedia.org/wiki/Ruminant). Adult worms are attached to [**abomasal**](http://en.wikipedia.org/wiki/Abomasum) **mucosa** and **feed** on the **blood**. This parasite is responsible for [**anemia**](http://en.wikipedia.org/wiki/Anemia), [**bottle jaw**](http://en.wikipedia.org/wiki/Paratuberculosis), and death of infected [**sheep**](http://en.wikipedia.org/wiki/Sheep) and [**goats**](http://en.wikipedia.org/wiki/Goats), mainly during summer months in warm, humid climates.
2. **Females** may lay over 5,000 **eggs** a day, which are secreted from the animal via the [**faeces**](http://en.wikipedia.org/wiki/Faeces). After hatching from their eggs, *H. contortus* [**larvae**](http://en.wikipedia.org/wiki/Larva) [**molt**](http://en.wikipedia.org/wiki/Ecdysis) several times, resulting in an **L3 form that is** [**infectious**](http://en.wikipedia.org/wiki/Infection) for the animals. They can take up these larvae when eating grass leaves. **The L4 larvae**, formed after another molt, **suck blood in the abomasum** of the animal, potentially giving rise to [anaemia](http://en.wikipedia.org/wiki/Anaemia) and [oedema](http://en.wikipedia.org/wiki/Oedema), which eventually can lead to death.
3. The **adult female** is **18–30 mm long** and is easily recognized by its trademark “**barber pole**” coloration. The **red and white appearance** is due to the fact the Haemonchus contortus is a blood feeder and is due to the **white ovaries** that coil around the **intestines which are filled with blood**. The **male** adult worm is much smaller at 10–20 mm long and displays the distinct feature of a well developed copulatory bursa, containing an **asymmetrical dorsal lobe and a Y shaped dorsal ray.**
4. It is the most important ruminant helminthes specially **young ages**
5. **Pathogenicity** :The nematode **piercing** the **abomasum** causes a number of significant complications in the infected ruminants that can lead to death. The infected animals can display severe **dehydration**, **diarrhea**, unthrifty appearance, lethargy, depressed low energy behavior, rough hair coat and uncoordinated movements. Furthermore, significantly reduced growth and poor reproductive performance has been observed. The accumulation of fluid in the abdomen, gut wall, thoracic cavity and **submandibular** tissue – a phenomenon commonly called "**bottle jaw**”, also is a common association with this infection. **Severe blood loss**, white mucous membranes, and **anemia**/PCV are common complications of the infection.
6. ***Haemonchus placei* ; Barberpole worm Cattle.**
7. General G.I.T. **Parasites of Ruminants control & prevention** as described in Bonustomum

 **Genus *Ostertagia*:**

1. Members of this genus ***Ostertagia ostertagi* in habitats Cattle abomasums**, sheep and goats occasionally**;** ***O. circumcincta , O. trifurcate* sheep and goats abomasums.**
2. known commonly as the **brown stomach worm**.
3. **Ostertagia is the most important endoparasite of cattle worldwide**. Damage to the abdomen can result in **lost productivity** throughout the life of the animal. **Eggs** Once **hatched**, **larvae** undergo **two** **moults** to become **infective** larvae **L3** stage, which migrate onto herbage and are **ingested** by grazing cattle. In the **abomasums** the L3 larvae lose their protective sheaths. They then **burrow into the glands** of the wall of the abomasum. After **moulting** to become early **L4** , larvae (L4) **development** may **continue** without delay **or** be **interrupted** by a **period** of up to several months. The **lining of the abomasum** is significantly **damaged** when the larvae emerge as immature adult worms **turned** to **fibrous tissues forming Nodules** .

**Type I ostertagiasis** form occurs in **calves** **during** their first **grazing** season as a result of maturation of ingested larvae in the abomasum. causes profuse **greensh watery diarrhoea** in calves at grass.

 **Type II ostertagiasis** results when these **inhibited** **larvae** **resume** their **development**, usually from February to May, the emerging larvae causing the same lesions as those causing type I disease.

1. Although **adult cattle acquire immunity** by the age of 18 months, **occasionally** bulls grazing calf paddocks or cows **suffering** from **immunosuppression** due to other diseases , such as [**fascioliasis**](http://www.thecattlesite.com/diseaseinfo/fascio/fascio1.htm), may **suffer** from **type** **II** ostertagiasis.
2. **Diagnostic** Information: Strongyle-type eggs appear in the faeces; third-stage larvae cultured from them may be identified as Ostertagia.

 **Genus cooperia**

1. Members of this genus infects **small intestine of ruminants** rarly abomasums.
2. **No Gebrnaculum** with **notched** **end** , generally resemble Trichostrongylus .
3. Several species of Cooperia occur in the **small intestine of cattle**; **C .punctata , C .oncophora , and C. pectinata** are the most common. The **red, coiled adults** are 5-8 mm long, and the male has a large bursa. They may be difficult to observe grossly. Their **life cycle is essentially the same as that of other trichostrongylids**. These worms apparently **do not suck blood**. Most of them are found in the first 10-20 ft (3-6 m) of the small intestine. The prepatent period is 12-15 days.

1. In **heavy infections** with C punctata and C pectinata , there is profuse **diarrhea**, anorexia, and emaciation, but **no anemia**; the upper small intestine shows marked congestion of the mucosa with small hemorrhages. The mucosa may show a fine lace-like superficial necrosis.

 **Genus Nematodirus**

1. Members of this genus infects **small intestine of ruminants** & **camels**.
2. Thin worms with **rediumantry** buccal cavity ; male with two long **spicules.**
3. ***Nematodirus battus*** a parasite of **sheep**; causes nematodiriasis eggs very **resistant to cold and freezing**.
4. Nematodirus is generally a **spring** infection of lambs. Sever enteritis Outbreaks of the disease are most common in May and June.

**Genus Camelo strongylus**

genus Includes ***Camelo strongylus mentulatus*** (sheep, camel, wild ruminants).it is called ***Ostertagia*** **of camels** ;infects **camels abomasums**; disease resemble ***Ostertagia*** in general.

 **Family Dictyocaulidae**

Characterized by:

1. **parasites of respiratory system of ungulates**
2. caudal bursa round

 **genus Dictyocaulus**

**identification:**

1. **worms habitas in bronchial** tree **system of lung ;called Lung worms**
2. **In ungulates *D. viviparus*** is the most common lungworm of **cattle**& **deer ; D.Filaria** most common lungworm of **sheep and goat , deer camel & In equine *Dictyocaulus arnfeldii*** is the [lungworm](http://en.wikipedia.org/wiki/Lungworm) of [**horses**](http://en.wikipedia.org/wiki/Horse)
3. Associated with **bronchitits** in sheep & cattel and called **Husk**or **verminous bronchitis and pneumonia.**
4. **Eggs** thin shelled with L1
5. **Whitish** nematode thinfilament**ous thread** like5-10 cm**. founded as groups or masses in the air passages like a NET** and from this the name came .
6. Small buccal cavity with **4 lips .**
7. **Male dorsal two rays fusion point site in the cpoulatory bursa it is a matter of interest of classification as follow:**
8. **Complete fusion as in *D.viviparous***
9. **Fused in the middle as in *D.arnfieldi***
10. **Fused at the summit as in *D.filaria***
11. Dictyocaulus has a **direct** life cycle, Cattle grazing then **ingest** the **L3** larvae. These larvae go through the intestinal system and penetrate the intestinal wall. They **use** the [**lymphatic** system](http://en.wikipedia.org/wiki/Lymphatic_system) to reach the mesenteric [lymph nodes](http://en.wikipedia.org/wiki/Lymph_node), where they mature once again into **L4** stage larvae. The L4 larvae **use** the **blood** supply and the lymphatic system to reach the **lungs**, molt to **L5** where they become **adults** and begins to lay eggs which larvated in 1 month to L1 post infection ,the life cyle is completed.
12. **Clinical Signs**
13. In **mild** infections the disease may be **asymptomatic**
14. In **heavy** infections: During the first 25 days of infection there may be nasal discharge , **tachypnea** and coughing.  During days 25 to 55 the lung signs increase in intensity with **harsh** lung **sounds** (bronchi and **emphysematous** crackling) being heard. In **severe** infections, complications may result in the **death** of **20 %** or more of the infected animals.
15. **Young ages more susceptible than older ages which considered as carrier .**
16. **Diagnosis:**
17. using a **Baerman apparatus &** [**Fecal flotation**](http://cal.vet.upenn.edu/projects/dxendopar/techniques/comfecal.html)**(zinc sulfate centrifugation)** **, rarely** found eggs but **mostly L1** **present** identified by 0.5 mm. with **cuticular knob** in the **anterior** end in addition to **brownish food granules** in posterior **mid** half and **bluntly** pointed **tail** for eggs identification of thin shell 70-100 u.
18. Microscope detection of **eggs or larvae in the coughed up** [**sputum**](http://en.wikipedia.org/wiki/Sputum) or [**broncho alveolar lavage**](http://en.wikipedia.org/wiki/Bronchoalveolar_lavage) **fluid** from affected animal
19. Blood serology test for worm antigens
20. P.M. of bronchial tree for adults & larvae .



1. **Prevention and control of lung worm :**
2. Avoid breeding of **young** **ages** with dames.
3. Give a full course of **vaccination** prior to first season (with second dose at least two weeks before worming). In areas of high lungworm risk give single booster dose prior to turnout in second season.
4. Treating Herds using **long-acting/continuous** release **anthelmintics** (including fenbendazole slow release boluses) which give cover throughout the ENTIRE first grazing season.
5. **Preventive** anthelmintics -**Dewormer** prior and in grazing season .
6. Dictyocaulus and Protostrongylus can be **treated** effectively with levamisole (8 mg/kg, SC or PO), ivermectin (0.2 mg/kg, SC or PO), fenbendazole (5-10 mg/kg, PO), moxidectin (0.2 mg/kg, PO or SC), or febantel (5 mg/kg, PO). Ivermectin (0.3 mg/kg, SC or PO), fenbendazole (15 mg/kg, PO, administered twice, 3 wk apart), and albendazole (10 mg/kg, PO) have been reported to be effective in treatment of Muellerius .

 **Genus Muellerius ellerius**

**identification:**

1. ***Muellerius*** *capillaris*

Muellerius have **indirect life cycles** and rely on a variety of **snails** and slugs to serve as intermediate hosts.

1. **Male without copulatory bursa , posterior spirally coiled end provided with sensory papillae around cloaca .**

**Mue** **llerius**

1. **Adult** Muellerius live in **alveoli** and **lung** parenchymal tissue and are considered the **least pathogenic** of the 3 lungworms. Muellerius appears to cause more problems for **goats** **than** for **sheep**.
2. also known as **hair lungworm**, is [nematode](http://en.wikipedia.org/wiki/Nematode) parasite of small [ruminants](http://en.wikipedia.org/wiki/Ruminant). Adult [worms](http://en.wikipedia.org/wiki/Worm) occur in small air passages ([bronchioles](http://en.wikipedia.org/wiki/Bronchioles), bronchioli) and in the alveoli, even in the subpleural tissue. In ruminants, parasite causes chronic [**bronchopneumonia**](http://en.wikipedia.org/wiki/Bronchopneumonia). In case of massive infection or secondary bacterial infection, *M. capillaris* infection can cause [death](http://en.wikipedia.org/wiki/Death) of the host.

**There are two other genera in this family named as Protostrongylus (indirect life cycle** ; have indirect life cycles and rely on a variety of **snails** and slugs to serve as intermediate hosts; **species *Protostrongylus rufescens*** found in **sheep**, goats and deer; cause of chronic [**bronchopneumonia**](http://en.wikipedia.org/wiki/Bronchopneumonia) **) ;** and **genus Cystocaulus .**

 **Family Metastrongylidae**

**Genus Metastrongylus :**

**Members are infects bronchial system of pigs , rarely sheep and cattle ;** **indirect** life cycles and rely on a variety of **earthworm** to serve as intermediate hosts; **clinically as in *Protostrongylus*.**