Order: STRONGYLIDA II.

Continue ...

- gastrointestinal worms
- lung worms

prof. Alica Kočišová, DVM, Ph.D.

Order: STRONGYLIDA

Superfamily: STRONGYLOIDEA

ANCYLOSTOMATOIDEA

TRICHOSTRONGYLOIDEA

METASTRONGYLOIDEA

Superfamily: TRICHOSTRONGYLOIDEA

Family: **Amidostomatidae** (***Amidostomum, ...***)
Trichostrongylidae (***Cooperia, Graphidium, Haemonchus, Hyostrongylus, Marshallagia, Ostertagia, Teladorsagia, Trichostrongylus, ...***)
Molineidae (***Nematodirus, Ollulanus, ...***)
Ornithostrongylidae (***Ornithostrongylus***)
Helligmonellidae (***Nippostrongylus, Heligmosomoides***)
Dictyocaulidae (***Dictyocaulus***)

Trichostrongylosis of rabbits and hares

- ***Graphidium strigosum*** - stomach
- ***Trichostrongylus retortaeformis*** - duodenum
- ***Obeliscoides cuniculi*** – hares (US)

- *Graphidium strigosum* a *Obeliscoides cuniculi* (both worms feed on blood), occasionally *Trichostrongylus retortaeformis;*

- *Graphidium strigosum* worms are reddish in color with sexual dimorphism, the females (11-20 mm) are larger, the males (8-16 mm) have a well-developed double spicules exchange (1.1-2.4 mm).
- Development is direct, with no intermediate host. The patent period is 42-44 days, while the patent period lasts at least 13 months.
- *Obeliscoides cuniculi* are brown-red worms without buccal capsules, males 10-16 mm, females 15-18 mm long.
- The development cycle is direct. Prepatent period is 16-20 days.

LC: *Obeliscoides cuniculi*

Pathology
Both worms are located in the mucosa of the stomach, causing massive or haemorrhagic inflammation in a massive infection.

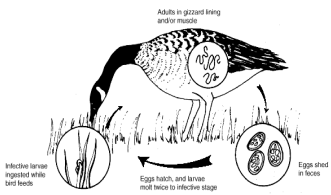
Clinical signs
The course of the disease is usually asymptomatic, in case of a strong infection we observe haemorrhagic or chronic bluetongue gastritis, anemia, diarrhea, weight loss, non-wormed pups may die.

Dg:
- eggs, coprology
- necropsy – worms

Te:
- Fenbendazolum 10-20mg/kg, ivermectin 0,4 mg/kg;

- **BIRD TRICHOSTRONGYLOSIS** (***Trichostrongylus tenuis***)/ small intestine of Galliformes and aquatic birds

- **AMIDOSTOMOSIS** (***Amidostomum anseris***)/stomach of aquatic birds



- Direct development
- Prepatent period: 14 až 25 days.

Location: Under the keratinin layer of the stomach, in the proventricule or in the esophagus.

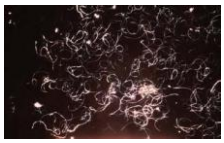
Amidostomum anseris

- The adult worm is slim and red. Male: 10-17 mm Spicules are the same; Female: 12-24 mm. Large eggs, 100 x 50 µm.

Clinical signs and pathogenicity:

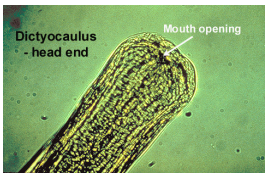
- loss of appetite,
- exhaustion,
- weakness and anemia;
- diarrhea
- Worms are very pathogenic to young animals, while older animals become carriers.
- severe inflammation, haemorrhages and necrosis.
- Extremely blood loss can occur with heavily infected birds.

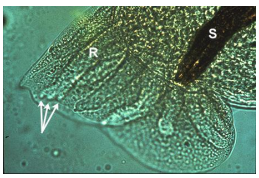
Te: benzimidazols, ivermectin



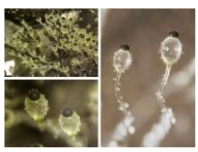
Family: DICTYOCAULIDAE

Nematode species	Host species	Predilection site
Dictyocaulus filaria	sheep and goats	trachea and bronchi
Dictyocaulus viviparus	cattle and deer	trachea and bronchi
Dictyocaulus arnfieldi	donkeys and horses	trachea and bronchi



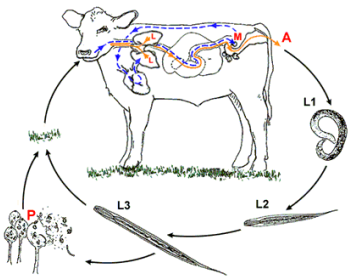


Life cycle



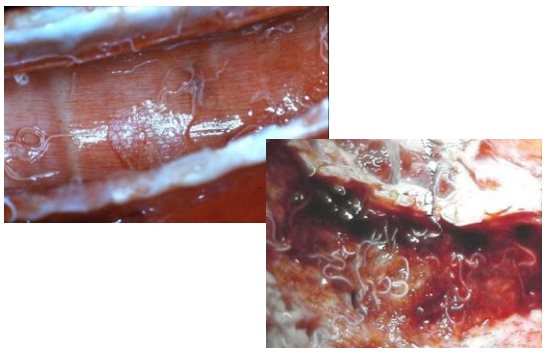
Larvae utilize *Pilobolus* (**P**), a fungus that grows readily in cattle faeces and can be seen approximately 7 days after faeces are deposited on the ground.

***Dictyocaulus viviparus* - Life Cycle**



The prepatent period is between **3 and 4 weeks.**

Dictyocaulus viviparus in the bronchi and lung

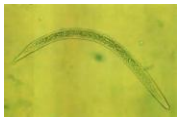


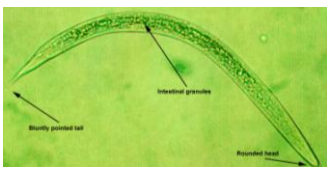
Clinical signs

- inflammation and coughing, even with only a small number of worms
- growth retardation
- 500 worms = critical for calves
- bad performers
- chronic problems
- heavily infected adult cattle may harbour several thousand lungworms.

Diagnosis:

Larvoscopic methods : larvae L1



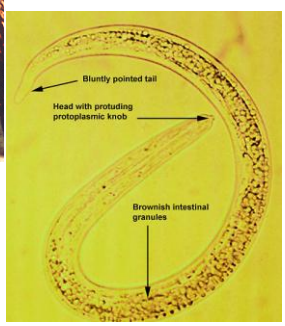


Therapy:
macrocyclic lactones , levamisole, benzimidazole derivates

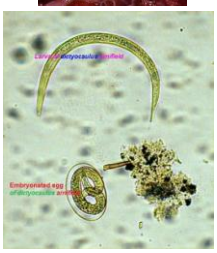
Prevention

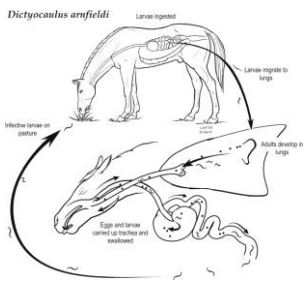
- turn out on a clean pasture that has been mown in the past year.
- never overcrowd a pasture; determine the number of razing calves in function of pasture area and grass quality.
- move to clean pasture about 12 weeks after turnout

Dictyocaulus filaria / large lungworm of small ruminants



Dictyocaulus arnfieldi / equids





Superfamily: **ANCYLOSTOMATOIDEA**

Family: **ANCYLOSTOMATIDAE**

Subfamily: Ancylostomatinae (*Ancylostoma, Globocephalus, Uncinaria*)

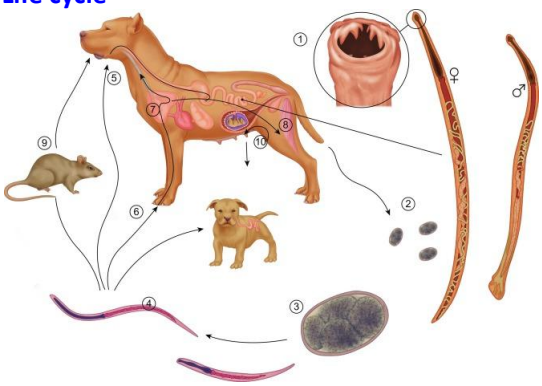
Bunostominae (*Bunostomum Grammocephalus, Monodontella, Necator*)

- medium-sized nematodes;
- 5-30 mm long; large buccal capsule with smooth-edged cutting plates;
- males – bursa copulatrix, spicles, gubernaculum;
- **Major veterinary importance**:
- Carnivores: *Ancylostoma caninum; A. tubaeformae; Uncinaria stenocephala*;
- Ruminants: *Bunostomum stenocephala; B. phlebotomum*;

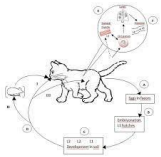
Ancylostoma caninum

7 - 10 mm

Life cycle



A. tubaeformae

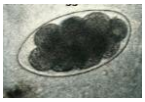


Clinical Signs

- Most clinical signs are due to adults and L4 taking blood from the intestines.
- In young pups, blood loss **anemia** can be severe and accompanied by **black tarry diarrhea**.
- **Depression** and **anorexia** may result from the blood loss and low oxygen supply due to anemia.

Diagnosis

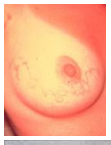
- Base on historyclinical signs
- Coprological examination



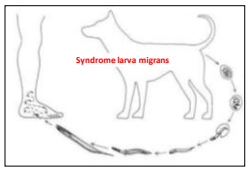
Treatment

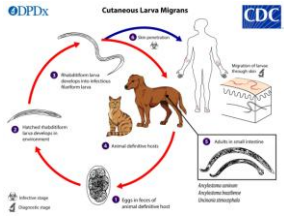
- ivermectin, milbemycin xoime, pyrantel pamoate, dichlorvos, butamisole
- Supportive care and transfusion necessary if severely anemic

Creeping eruption or cutaneous larva migrans

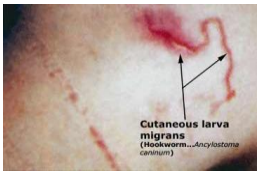


- Humans occasionally get infected by L3 larvae of dog and cat hookworms (e.g. *Ancylostoma caninum or A. brasiliensis* again by skin penetration)
- The larvae can not establish a productive infection in humans, but wander about in the subcoutaneous tissue, causing significant inflammation and painful swelling
- Responds well to treatment





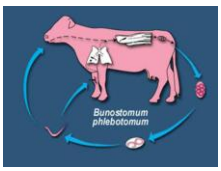
Larva migrans cutanea



Larva migrans cutanea

Uncinaria stenocephala

Bunostomum trigonocephalum



- a large funnel-shaped oral capsule;
- Bursa copulatrix
- small intestine

Acylostoma duodenale
Necator americanus - human hookworms

- Small nematodes (1-1.5 cm)
- Head is slightly bend (hook) and the 'mouth' carries characteristic teeth (Ancylostoma) or plates (Necator, note that these are not real teeth but cuticular formations of the 'buccal capsule)
- The posterior end of the male worm is elaborated into a copulatory bursa

Infectious L3

- Adult worms live in the small intestine and female lay 5-10000 eggs a day over 5 years
- Eggs are passed with the feces
- Larvae develop outside the body and molt twice
- The filariform or L3 larvae move to the surface in search for a host
- If they come into contact with the host they penetrate the skin, enter blood vessels and leave the circulatory system into the alveoli
- The lavae move up the trachea into the esophagus, are swallowed and finally reach the intestine, where they molt twice more before they reach maturity

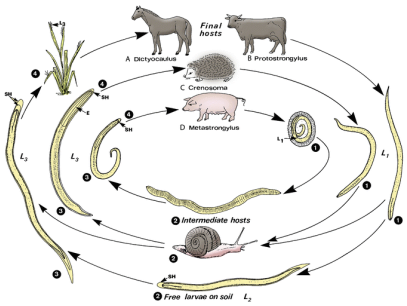
- Skin penetration and associated secondary bacterial infection can result in "ground itch"
- Pulmonary phase is usually asymptomatic
- Intestinal phase: worms attach to the mucosa and feed on blood. Worms continuously move to new places exacerbating bleeding

- The main concern with hook worm disease is blood loss
- 0.03 ml (N.a.) to 0.26 ml (A.d) per worm, up to 200 ml per day in heavy infections
- Chronic heavy infection results in anemia and iron deficiency
- Together with malnutrition infection can severely stunt growth and development in children
- Anemia leads to weakness and fatigue in adults
- Antihelminthic treatment with mebendazole

Superfamily: METASTRONGYLOIDEA

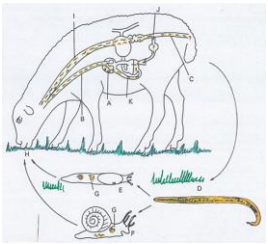
Family:
- Metastrongylidae (*Metastrongylus*)
- Protostrongylidae (*Cystocaulus, Elaphostrongylus, Muellerius, Protostrongylus, Neostrongylus, Verestrongylus, ...*)
- Crenosomatidae (*Crenosoma, Otosrongylus, Troglostrongylus*)
- Angiostrongylidae (*Angiostrongylus, Aelurostrongylus*)
- Filaroididae (*Filaroides, Oslerus*)
- Pseudaliidae (*Pseudalius, Halocercus*)

- hairy nematode of ruminants, suis, carnivores and lagomorphs
- lung worms - bronchi, lung parenchyma, sub pleural tissue
- indirect development sexual exchange developed, reduced or absent in some species
- spicula thin



Protostrongylidae / PROTOSTRONGYLOSIS

Protostrongylus rufescens **(syn. *P. kochi*) –** bronchi, bronchiols - sheep, goats, mouflon;
P. brevispiculum; **(bronchi, bronchiols) – sheep**
P. commutatus **(syn. *P. pulmonalis*) – rabbits, hares**



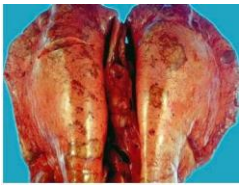
- 16-46 mm; 25-35 mm
- mouth without capsule

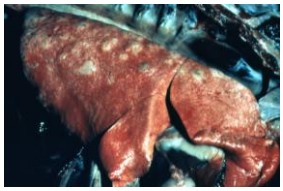
Prepatent period: 25-37 days

Pathogenesis, clinical signs

- asymptomatic course
- local inflammation - nodules
- lobular pneumonia
- pleuritis

Dg: larvoscopic method - L1 in faeces; postmortem - the adult;
Te: benzimidazols, ivermectin;





MUELLERIOSIS / *Muellerius capilaris*

- small ruminants
- interstitial pneumonia, hatching node formation in the pulmonary parenchyma;
- indirect development (IH - snails));
- the most widespread pulmonary worm from 6 months of age;

Pathogenesis and clinical signs

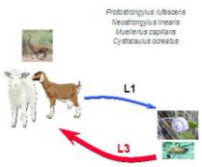
- in parenchyma - nodules (about 3 cm),
- calcify lung tissue - hyperemic nonspecific symptoms
- worsened condition - secondary bacterial resp. viral infection

CYSTOCAULOSIS / *Cystocaulus ocreatus*

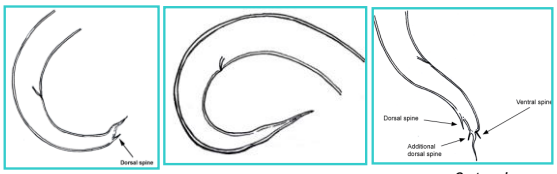
- formation of millions of hatcheries under the pleura and in the lung parenchyma;
- sheep, goats, mouflons;
- 18-45 mm; 30-95 mm;

- development similar to *P. rufescens*; (IH - snails), prepatent period: 65 days;

- spread in foothill areas
- L_1 are highly resistant to drying, cold;
- Diagnosis, therapy and prevention - as in protostrongylidosis



Diagnosis



Muellerius
Length 300-320 µm
Posterior end of body often curled

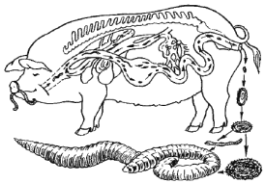
Protostrongylus
Length
320-400 µm
Posterior half of body may be curled

Cystocaulus
Length 340-480 µm
Additional dorsal and ventral spines on middle part of tail

METASTRONGYLOSIS / *Metastrongylus*

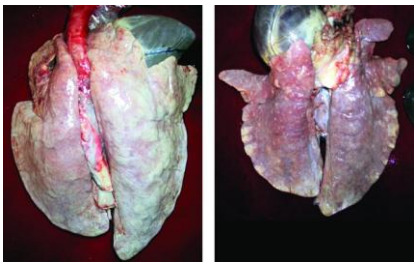
- ***Metastrongylus pudentotectus***
- ***M. apri*** (syn. *M. elongatus*)
- ***M. salmi***
- ***M. confusus***

- **pigs**



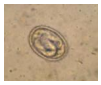
- thread-like nematode, white; spicules are of varying length
- Biohelmints (MH: earthworms);
- Prepatent period: 28-30 days;

- mechanical damage - migrating larvae - mucous membranes of the intestine, LN, blood vessels, pulmonary alveoli, bronchial wall and bronchioles;
- bronchitis
- anemia
- cachexia



- Poor immunity
- non - specific clinical symptoms
- in case of severe infection - respiratory syndrome - accelerated,
- severe, vesicular breathing,
- cough,
- anemia,
- inappetence,
- weight loss;
- in feral pigs - difficulty wheezing, coughing;
- accompanying phenomenon - **delayed hair change**;

- Dg: ovoscopically; post mortem - autopsy, finding worms;
- Te: benzimidazoles;



LUNG STRONGYLATOSIS OF CARNIVORES
(*Filaroides, Aelulostrongylus, Crenosoma, Angiostrongylus*)

Family: **Angiostrongyllidae**
- pulmonary artery + right heart small worms,
- small bursa or missing
- **biohelminths** (IH: snails/unvertebrates)

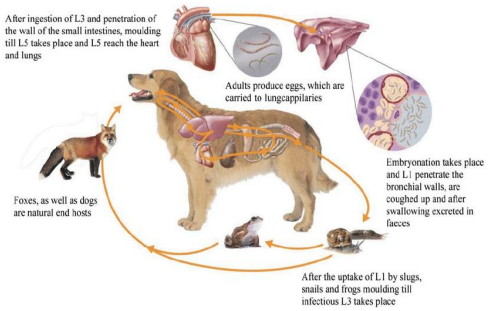
- *Angiostrongylus vasorum*
- *Aelurostrongylus abstrusus*
- *Crenosoma vulpis*
- *Filaroides hirthi, F. milksi, F. osleri* - ovoviviparous female, development without IH!

Angiostrongylus vasorum / ANGIOSTRONGYLOSIS

- endemic areas in Western Europe, Canada;
- Since 2010, however, findings from Hungary, Poland, the Czech Republic and Slovakia have also been reported;
- These are slim nematodes reaching a length of 18-25 mm for females and 14-18 mm for males.
- L1 larvae measure 330 µm and feature a wavy tail section with dorsal thorn;

- arteria pulmonalis + right ventricle;
- females: ovoviviparous;

L_3



Prepatent period: 40-60 days.

Pathogenesis and clinical symptoms

- Clinical symptoms occur when more than 50 larvae are found in the sample
- usually chronic course, persistent months or even years;
- Pathogenic effects - presence of adult worms in large vessels and ova and larvae in pulmonary arterioles and capillaries;
- Congestion leads to circulatory disorders - heart failure;
- Weaker infections are latent;
- In more severe infections, tachycardia, tachypnoea, productive cough sometimes with admixture of blood, nasal discharge and the like.
- Chronic conditions are accompanied by anemia, fatigue, anorexia and weight loss;

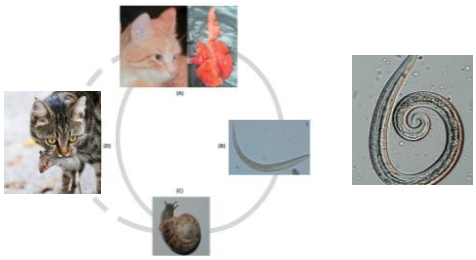
Dg:
- Larvoscopic Baermann method;
- L1 larvae can also be confirmed in sputum;

Te: **fenbendazole**
- **moxidectin**
- **milbemycin oxim**

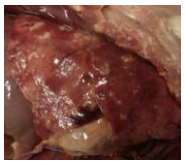
Aelurostrongylus abstrusus / AELUROSTRONGYLOSIS

- cat lung worms;

- pulmonary parenchyma and peribronchial tissues;
- thin and very fine nematodes with a body length of 0.5 - 1 cm;



Pathogenesis and clinical signs
- small, greyish nodules or larger consolidated granulomas;
- sporadic cough;

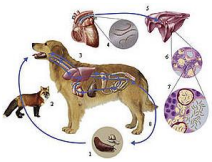


Dg:
- standard flotation or larvoscopic Baermann method;
- Finding about 100 larvae in the sample is considered a mild infection;
- Clinical symptoms are noticed until 500 or more larvae are detected;
- Interstitial and peribronchial nodules - X-ray examination;

Te:
- **Fenbendazole**
- **Moxidectin**
- **Selamectin**

Crenosoma vulpis / CRENOSOMOSIS

- foxes, dogs, wolves and other canines;
- fox farms;
- The highest incidence of clinical crenosomosis - in the autumn;
- The parasite is located in trachea, bronchi and bronchioles;
- Body length 3.5 - 8 mm for males and 12 - 15 mm for females;



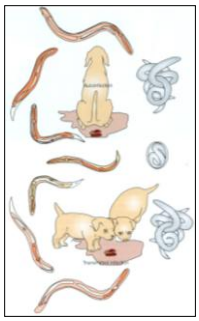
Pathogenesis and clinical signs
- Infections with a small number of worms often occur without clinical signs;
- Massive infections - non-specific symptoms: chronic cough, sneezing, nasal discharge, trachea and bronchitis or bronchopneumonia;
- exceptionally death;

Dg:
- Baermann method / flotation method;
- sputum examination;
- endoscope;
- Finding more than 50 larvae - a strong infection.

Te:
- fenbendazole
- moxidectin

Filaroides osleri / FILAROIDOSIS

Filaroides osleri (syn. Oslerus osleri) parasitizing in bronchi;
- Males are about 5 mm long and females 9 - 15 mm;
- Development - direct, females are ovoviviparous and most eggs lay in the trachea;
- The larvae are coughed up, swallowed by the host and subsequently eliminated with faeces to the outside environment, where they become a source of infection for other hosts.
- Another method of transfer is from bitch to puppies when cleaning and licking or ejecting food.



Pathogenesis and clinical signs
- Worms are found in fibrous nodules in the trachea in the bifurcation area and in adjacent bronchi;
- The infection is often inapparent;
- Respiratory problems accompanied by dry cough;

Dg:
- Larvoscopic methods of faecal examination are not reliable, bronchoscopy and subsequent nodule biopsy is recommended;

Te:
- fenbendazole
- albendazole