

Lecture # 22: Overview and Details of the Order Spirurida

(including *Dracunculus insignis*, *Physaloptera* sp., *Thelazia* sp., *Spirocerca lupi*, *Physocephalus*, *Ascarops*, *Habronema* sp., *Draschia megastoma*, *Dipetalonema*, *Dirofilaria* sp., *Onchocerca* sp., *Setaria*, *Elaeophora*, *Stephanofilaria* [except *Dirofilaria immitis* - see lecture # 23, and American Heartworm Society guidelines for dogs and cats <http://www.heartwormsociety.org/>]).

Objective:

1. Describe the requirement for an arthropod intermediate host by the important species in the Order Spirurida and explain how this expands or restricts transmission of infections in particular management situations or geographic locations.

Outline:

- I. Spirurida: the generalized life cycle.
 - A. Infection and development in arthropod intermediate hosts.
 1. Arthropod ingests eggs or free-living L₁ or microfilariae.
 2. L₁ development to infective L₃ **requires** the environment inside the arthropod.
 - B. Routes of infection to the primary host.
 1. Ingestion of the arthropod containing L₃.
 2. Ingestion of a paratenic host (ate an infected arthropod) containing L₃.
 3. Infective larva actively leaves the insect intermediate host while it feeds and enters the primary host.
 - C. Limitations and expansion of transmission potential.
 1. Examples of geographic or habitat restricted vectors are: (a) *Dirofilaria immitis* requires mosquitoes as intermediate hosts such that lack of humidity in a region prevents transmission; (b) *Onchocerca* in horses requires *Culicoides* (midges) as intermediate hosts such that an absence of stagnant water or rotting vegetation in an area precludes transmission.
 2. An example of expansion of range is *Habronema* and *Draschia* use of flies of the genus *Musca* for development and transmission; thereby bringing infective larvae to horses in stables as well as on pasture.
- II. ***Dracunculus insignis***: adult worms are found in the subcutaneous spaces of dogs and raccoons.
 - A. Morphology: The size of adult females at 100 to 400 mm, and their host and site predilection make these easy to identify.
 - B. Life cycle: The adult worm resides in subcutaneous tissue of distal limbs. Females release L₁ larvae into water through hole in the skin while the host is standing in water (can sense when the limb is bathed in water). Water **crustaceans, copepods**, ingest first stage larvae and L₁ develop to infective stage in this arthropod. The dog or raccoon is infected by drinking water containing infected copepods. The prepatent period is 300-400 days.
 - C. Pathogenesis and clinical signs: This usually presents as a swelling on distal limb with a nonhealing skin ulcer.
 - D. Epidemiology and control: This is mainly seen in hunting dogs. Surgical removal of the adult worm is required with care not to release worm material into the host that may be highly sensitized.
 - E. *Dracunculus mediensis* infects man in tropical areas and is called the guinea worm. There is a major world-wide campaign to eradicate this infection by providing filtered drinking water.

- III. *Physaloptera sp.* -- found in the stomach of raccoons, dogs and cats.
- Morphology: These are stout-bodied and 20 to 40 mm long. A collar-like cuticular projection around the anterior end is very apparent.
 - Life cycle: Beetles are required intermediate hosts, but rodent paratenic hosts are the likely source of infection for dogs and cats. Adult worms are present in the canine/feline stomach 2 to 3 months after infection. There is no deep tissue migration beyond the stomach wall.
 - Pathogenesis: The larval stages and adults cause gastritis, bleeding and ulceration of the gastric mucosa.
 - Diagnosis: The eggs are dense and difficult to float, oval and contain a larva when found in fresh feces. Worms in vomit need to be differentiated from mature and immature *Toxocara* or *Toxascaris*. Anterior end cuticular collar present on adult *Physaloptera* not on other nematodes. Increasing frequency of diagnosis may be due to urbanization of reservoir host, raccoons.
 - Treatment and Control: fenbendazole or ivermectin or pyrantel (elevated dose or extended treatment) or dichlorvos have been shown to be effective. Avoid exposure to beetles and paratenic hosts.
- IV. *Habronema musca*, *H. microstoma* and *Draschia megastoma*: found in the stomach of horses.
- Morphology: Adults are 10 to 20 mm long and whitish in color. The buccal capsule morphology is used to differentiate species. Males have a tightly coiled tail.
 - Life cycle: Adult females in the stomach produce eggs containing larvae that pass in feces and hatch immediately to L₁. L₁ is ingested by and develops to L₃ in fly (*Stomoxys* or *Musca*) maggots. When mature flies feed on the horse L₃ are deposited on lips, nostrils, or skin abrasions. These L₃ are ingested by the horse and develop to adults in 60 days.
 - Pathogenesis: Gastritis and erosion of gastric epithelium are associated with *Habronema musca* and *H. microstoma*. In the stomach wall fibrous tumors are formed that contain "nests" of adult *Draschia megastoma*. Cutaneous habronemiasis is the result of ulcerative/granulomatous lesions that develop in skin wounds contaminated with larvae.
 - Diagnosis: Clinical signs are a history of anorexia and/or cutaneous habronemiasis. Fecal exams may not diagnose infection because there are very few eggs. Cutaneous lesions can be scraped for larvae but response to treatment is usually apparent.
 - Treatment and Control: Fly control and composting of stall muck are used to reduce larvae. Anthelmintics, both systemic and topical, such as albendazole, fenbendazole and ivermectin have been used successfully.
- V. *Dipetalonema* (new name = *Acanthocheilonema*): The most significant thing about this worm is that its microfilariae may be confused with *Dirofilaria* since both produce microfilariae that are present in the blood of infected dogs. Adult worms are found in subcutaneous tissue. The intermediate host is fleas or ticks. There are no pathological lesions.
- VI. *Onchocerca sp.*: different species found in ligaments and skin of various mammalian hosts including man.
- Morphology: Typical of filarial nematodes adults are thin-bodied, have practically no buccal cavity and males lack copulatory bursae. Host site for various species of this genus are as follows: (a) *O. cervicalis* is found as adults in the ligamentum nuchae and ligaments and tendons of limbs of horses, whereas microfilariae congregate in skin of the abdomen, chest and neck. Eye lesions apparently due to microfilariae show inflammation in pigmented conjunctiva near the temporal limbus. (b) *O. gutturosa* adults are found in various ligaments and microfilariae in skin throughout the body of cattle. (c) *O. volvulus* adults are found in skin nodules and microfilariae in the skin of man.
 - Life cycle: For the only one of veterinary medical importance in the USA, *Onchocerca cervicalis*, the **intermediate insect host is *Culicoides***. Adults in the nuchal ligament are long-lived and **microfilariae** appear in the ventral abdominal **skin** seasonally to coincide with midge biting activity.
 - Pathogenesis and clinical signs: When midges become active "summer sores" develop on the ventral midline of horses. Diagnosis is made by skin snips showing microfilariae. Ivermectin treatment may lead to ventral abdominal edema (due to local reaction to microfilariae?).
 - Control and treatment in horses: Biting insects may be controlled with repellent. Ivermectin has been successfully used to clear skin lesions. Effect on adult *Onchocerca* not known.