Lecture No.11 PARASITOLOGY DR.Raad H.H

 **order spirurida**

contains **families** of :

Spiruridae ; Thelaziidae ;Acuariidae ; Filariidae ; Setariidae ;Druncunculidae

**Characterized** by :

1. Habitats **GIT**, **subcautanous** tissue , **lymph** ,**blood**
2. General form Different size worms
3. Mouth shape With **2 lateral pseudolabia &6 lips** .
4. Esophagus form cylindrical
5. **Male** reproductive system No cpoulatory bursa ; but have posterior **coiled end with 2 unequal spicules**
6. Egg shape eggs of worms with L 1
7. Life cycle **Indirect**
8. Infective stage **L3****Swallow** **insect** intermediate host or **injecting** L3 by insect intermediate host.
9. Classified to **3 Super families** Spiruroidea :Filaroidea ; Dracunculidea.
10. **Super family Spiruroidea:**

**Characterized** by :

* + - * 1. Minute nematode
				2. Mouth contain **2 lateral lips each divided to 3 lobes**
				3. **Indirect life cycle start by swallowing L3 in intermediate host .**

**Family Spiruridae**

**Genus Habronema**

1. Habitats **equine** **stomach**; The adults are 6-25 mm in size.
2. *spices* ***Habronema muscae***; **Musca** spp. intermediate host; **pharynx cylindrical shape**
3. ***H. microstoma ,* Stomoxys** spp.intermediate host; **pharynx inverse funnel shape pharynx**
4. ***Habronema (Draschia) megastoma*; Musca** spp.intermediate host; **pharynx wide funnel shape pharynx**
5. **Horses** are **infected** by **ingesting** **flies** that contain **infective larvae** **or** by **free** larvae that **emerge** from flies as they feed around the **lips**.
6. ***Life cycle indirect* :**

**The** [**adult worms**](http://en.wikipedia.org/wiki/Parasites) **lay** [**eggs**](http://en.wikipedia.org/wiki/Egg_%28biology%29) **within the horse's stomach. The eggs are later excreted through the** [**feces**](http://en.wikipedia.org/wiki/Feces)**. The eggs hatch quickly after they are passed out of the horse. After the eggs are hatched in the feces, the** [**larvae**](http://en.wikipedia.org/wiki/Larva) **are ingested by the** [**maggots**](http://en.wikipedia.org/wiki/Maggots) **of different types of** [**flies**](http://en.wikipedia.org/wiki/Flies) **that lay there in the feces (such as** [**houseflies**](http://en.wikipedia.org/wiki/Houseflies)**, and** [**stable fly**](http://en.wikipedia.org/wiki/Stable_fly)**). The larvae infect the maggots for about one week, or when the maggots mature into the** [**adult fly**](http://en.wikipedia.org/wiki/Fly)**. The larvae migrate into the** [**mouthparts**](http://en.wikipedia.org/wiki/Insect_mouthparts) **of the fly, where they are passed on to the horse when they feed around the horse’s moist areas such as** [**wounds**](http://en.wikipedia.org/wiki/Wounds)**,** [**nostrils**](http://en.wikipedia.org/wiki/Nostrils)**, lips, and** [**eyes**](http://en.wikipedia.org/wiki/Eyes)**. If the larvae are deposited into the open wounds, or broken skin they can cause** [**ulcerated**](http://en.wikipedia.org/wiki/Ulcer_%28dermatology%29) **irritation called “**[**summer sores**](http://en.wikipedia.org/wiki/Summer_sores)**”. They may also invade the eye and the** [**eye membrane**](http://en.wikipedia.org/wiki/Eye_membrane) **causing a persistent** [**conjunctivitis**](http://en.wikipedia.org/wiki/Conjunctivitis) **case. If the larvae find their way up through the nose they can migrate into the** [**lungs**](http://en.wikipedia.org/wiki/Lungs) **and cause tiny** [**abscesses**](http://en.wikipedia.org/wiki/Abscesses) **around where they imbed themselves in the lungs tissue. When the larvae are licked and swallowed by the horse they travel to the stomach and imbed themselves into the** [**mucus exudates**](http://en.wikipedia.org/w/index.php?title=Mucus_exudates&action=edit&redlink=1)**. If the larvae make it into the stomach, after they are in the lungs or in the skin, they begin to mature. Once the larvae are imbedded in the stomach, they begin to mature. Once they are matured, the adults begin to migrate through the horse and begin to make eggs which will start the** [**Life cycle**](http://en.wikipedia.org/wiki/Biological_life_cycle) **again**

1. **General** Pathological effects ; due to

**Larvae** :

in **Skin** : If the larvae which are in the mouthparts of the [intermediate host](http://en.wikipedia.org/w/index.php?title=Immediate_host&action=edit&redlink=1) are deposited in the open skin well the fly feeds it can cause **Cutaneous Habronemiasis** "**summer sores**". Summer sores are ulcerated irritations. These [lesions](http://en.wikipedia.org/wiki/Lesions) can cause soreness and itchiness and become covered in a reddish-yellow tissue.

In **eyes** : If the worms get deposited into the eye or the area around the eye it can cause a persistent case of **Granular conjunctivitis** .

**In Respiratory System**: If the larvae travel through the nose, into the [pulmonary system](http://en.wikipedia.org/wiki/Pulmonary_system) and then the lungs, they can cause **abscesses** in the lung tissue where they imbed themselves in the lungs tissue.

**Adults** worm : In **Digestive** System When the adult worms imbed themselves into the [**mucus** lining of the stomach](http://en.wikipedia.org/wiki/Stomach) in large numbers digestion can be affected ; A **catarrhal gastritis** may result from heavy infections with adult ; worms With even larger numbers the passing of food can be completely blocked.

1. **Special** Pathological effects :

**Draschia** are found in **tumor-like swellings** in the **stomach** wall. produces the most severe lesions—tumor-like **enlargements** up **to 10 cm** in diameter. These are filled with necrotic material and a large number of worms and are covered by intact epithelium, except for a small opening through which the eggs pass. **Rarely**, these nodules **rupture** and cause fatal peritonitis.

**Larvae of Habronema spp and Draschia** have been found in the **lungs** of **foals** associated with **Rhodococcus equi abscesses** ( [***Rhodococcus equi pneumonia***](http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/121307.htm)**)**. Clinical **signs** usually are **absent** **except** when granulomas **associated** **with Draschia** infection lead to **mechanical** **obstruction** or **rupture**.

1. **Diagnosis** : **Antemortem** diagnosis is **difficult** because the thin-shelled **eggs** or **larvae** are easily **missed** in fecal examinations. Worms and eggs may be **found by gastric lavage**.
2. **Treatment** :starting with fasting the horse then give **drench** of 8-10 liters of **2%NaHCO3 solution** to **dissolve** **tumors** **then** give **anthelmintics** (Most **anthelmintics** have **not** been tested against Habronema spp or Draschia sp , although **ivermectin** is **effective** against their cutaneous larvae and against adults of H muscae . Moxidectin is effective against adult H muscae ).
3. **Control**: There are **two ways** to control Habronema. The **first** way was stated earlier, by proper **disposal** of **manure**, since the eggs are excreted through the feces. The **other** way was **control** of [**fly** population](http://en.wikipedia.org/w/index.php?title=Fly_population&action=edit&redlink=1). The larvae are picked up by flies when they feed in the feces. The flies act as in intermediate host for the parasites, until they can find a permanent [host](http://en.wikipedia.org/wiki/Host_%28biology%29). Proper control of the fly population ([house flies](http://en.wikipedia.org/wiki/House_flies), [horse fly](http://en.wikipedia.org/wiki/Horse_fly), and [face fly](http://en.wikipedia.org/wiki/Face_fly) can all carry Habronema) can decrease the possibility of your horse being infected by habronema. Those are the two most efficient ways to control the parasite habronema.



 **Genus Spirocerca**

1. ***Spirocerca lupi*** is the name of a slender **reddish** worm about 40 mm in length that stays in the **dog's esophagus**.
2. **Eggs** of *Spirocerca* are excreted in the faeces of infested dogs whence they are ingested by **dung beetles** **(coprophagous beetle).**
3. **Infective stage L 3** inside the intermediate host **beetles** and will infest other **dogs eating** the beetles. If other animals such as **lizards** or **birds** eat the dung beetles, these animals may also **harbour** the worms and will infest dogs if **eaten** by them.
4. Inside the dog's stomach the worm larvae break out of their cysts and begin their long **migration** **via** the **arteries** to the **aorta** just behind the heart.  They carry on through the wall of the **aorta** into the wall of the **esophagus** where they develop into adults thus completing the process.  Their life cycle may be completed in about six months, but it may take anything up to two years!
5. **Pathological** effects **(in dogs mostly ; in goat equine rarely.):**

**Once** in the **aorta**, **aneurisms** (saclike protrusions in the artery wall) may develop that can lead to thrombosis and embolism of the back legs presenting as pain and lameness in the affected limb.  These aneurisms may also rupture leading to sudden death in an affected animal.

**Inside** the wall of the **esophagus** the constant irritation of the worms on the tissues leads to thickened growths of the wall. (**granulomas**)  The presence of these granulomas cause regurgitation or vomiting in a large number of cases.  Regurgitation is a passive backflow of ingested material from the **esophagus**, whereas vomiting entails the active contraction of the stomach muscles to expel food already in the **stomach.**

 **Family Thelaziidae**

***Thelazia*** is a **genus** of [nematode](http://en.wikipedia.org/wiki/Nematode) worms which **parasitize** the **eyes** and associated tissues e. **lacrimal** sac of various [**bird**](http://en.wikipedia.org/wiki/Bird) and [**mammal**](http://en.wikipedia.org/wiki/Mammal) hosts, including humans. They are often called "**eyeworms**," and infestation with *Thelazia* species is referred to as "[**thelaziasis**](http://en.wikipedia.org/wiki/Thelaziasis)" (occasionally spelled "thelaziosis"). Adults are usually found in the eyelids, [tear glands](http://en.wikipedia.org/wiki/Lacrimal_gland), [tear ducts](http://en.wikipedia.org/wiki/Lacrimal_canaliculi), or the so-called "third eyelid" ([nictitating membrane](http://en.wikipedia.org/wiki/Nictitating_membrane)). Occasionally, they are found in the eyeball itself, either under the [**conjunctiva**](http://en.wikipedia.org/wiki/Conjunctiva) (the membrane that covers the white part of the eye) or in the [vitreous](http://en.wikipedia.org/wiki/Vitreous) cavity of the eyeball.

All species of *Thelazia* for which the life cycle has been studied are **transmitted by species of** [**Diptera**](http://en.wikipedia.org/wiki/Diptera) **(flies)** which do not bite, but which feed on tears.

* ***Thelazia lacrymalis*** (Gurlt, 1831)
	+ Definitive hosts: [Horse](http://en.wikipedia.org/wiki/Horse) (*Equus caballus*) and [Cattle](http://en.wikipedia.org/wiki/Cattle) (*Bos taurus*)
	+ Intermediate hosts: Face fly ([*Musca autumnalis*](http://en.wikipedia.org/wiki/Musca_autumnalis)) and [*Musca osiris*](http://en.wikipedia.org/wiki/Musca_osiris)
	+ Distribution: Asia, Europe, Middle East.
* ***Thelazia rhodesii*** (Desmarest, 1828)
	+ Definitive hosts: mainly [bovids](http://en.wikipedia.org/wiki/Bovid), [Cattle](http://en.wikipedia.org/wiki/Cattle) (*Bos taurus*), [Buffalo](http://en.wikipedia.org/wiki/Water_Buffalo) (*Bubalus bubalis*), [Zebu](http://en.wikipedia.org/wiki/Zebu) (*Bos indicus*), [Bison](http://en.wikipedia.org/wiki/Bison) (*Bison bonasus*), and sometimes [Horse](http://en.wikipedia.org/wiki/Horse) (*Equus caballus*), [Domestic sheep](http://en.wikipedia.org/wiki/Domestic_sheep) (*Ovis aries*), [Dromedary](http://en.wikipedia.org/wiki/Dromedary) (*Camelus dromedarius*), and [Goat](http://en.wikipedia.org/wiki/Goat) (*Capra hircus*)
	+ Intermediate hosts: Flies (Face fly ([*Musca autumnalis*](http://en.wikipedia.org/wiki/Musca_autumnalis), *Musca larvipara*, and *Musca sorbens*)
	+ Distribution: Africa, Asia, and Europe.

 **Family Acuariidae**

1. most of which **are** [**parasites**](http://en.wikipedia.org/wiki/Parasite) **of** [**birds**](http://en.wikipedia.org/wiki/Bird) **gizzard** sometimes esophagus.
2. with special character of **Cordons** (cords) in cephalic anterior part of the worm.
3. **Genus** **Acuaria**
4. **Infective stage L 3** inside the intermediate host **dung beetles** **(coprophagous beetle) ; flies grasshopper .** whence they are ingested by **birds it causing digestion process impairment .**
5. **Super family Filarioidea**
6. These are **long** and relatively **thin** worms.
7. As a rule the mouth is small and **not** surrounded by lips, and there is neither a buccal capsule nor a pharynx.
8. The **oesophagus** has anterior **muscular** and posterior **glandular** part.
9. **Female are viviparous (microfilaria ).**
10. **Habitats lymph ,blood , C.T. ,body caivity of definitive host.**
11. **L3 infective stage live in the saliva of arthropod** intermediate host**.**
12. The filaroids are tissue dwelling parasites found in all groups of vertebrates **except fishes.**
13. **Microfilariae** of ***W. bancrofti***in the Caribbean, SA, **Africa**, and Asia are **nocturnal**; **while** those of the **strain** endemic to the South **Pacific** Islands are **diurnally subperiodic –** while they are present in the peripheral circulation throughout a 24 h period, their numbers increase during the day time**.**

 **Family Filariidae**

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Filariidae·Fig. 1.  of human filarial worms. ***A*** adult worms ( = male 3.5 cm, female 7 cm) wander subcutaneously and may pass the anterior chamber of the eye (1). ***B*** adults (male 4 cm, female 10 cm) and adults (male 3 cm, female 9 cm) live in lymph vessels and lead to a late-stage disease called (1). ***C*** adults (male 2–4 cm, female 70 cm) are knotted together in groups in the subcutaneous tissues. Because of host reactions these groups are encapsulated, leading to palpable Microfilariae may induce ***1*** Visible signs of diseases. ***2*** Microfilariae; the long-living females produce (after copulation) thousands of first-stage larvae daily, which measure about 260 × 8 μm. Their shape (2.1), structure (2, 2.2) and diurnal occurrence are species specific: they may or may not be sheathed (2.2); their terminal nuclei have a species-typical appearance (2, 2.2); they can be found in blood vessels *(Loa,* or in lymphatic gaps (); their occurrence in the peripheral blood can be periodical *(Loa*, during the day; *Wuchereria*, during the night; some subperiodic strains also exist), or may not be *(Onchocerca*, always present, but in lymph vessels). ***3*** Intermediate hosts: Depending on the periodic appearance of microfilariae in the host's skin, insects with different biological behavior are involved as . Daytime-feeding vectors (deerflies, spp., spp.) transmit *Loa loa* or *Onchocerca volvulus*, whereas night-feeding may be vectors of the nocturnal strains of *Wuchereria* and *Brugia*. When microfilariae are ingested by the intermediate hosts during the blood meal, they penetrate the intestine and enter the abdominal cavity and the thoracic muscles. After a the L2 is formed, which has a stumpy shape (sausage stage). Another molt finally leads to the filariform infectious L3. ***4–5*** L3 reach a length of about 1.5 mm and migrate to the from which they escape when the vector is feeding. They enter the skin through the wound channel made by the biting insect (5, *arrow)*. Inside the final host (man) the larvae migrate until they reach their favorite site of location, where they mature (after another two molts) within 1 year (prepatent period; ). *AD*, adult worms (in section); *AN*, anus; *E*, esophagus; *ER*, erythrocyte; *IN*, intestine; *L3*, third larval stage; *N*, nuclei (their arrangement at the poles of microfilariae is species specific); *SH*, sheath**.**

 **Genus *Parafilaria***

***Parafilaria bovicola***

**This filarial parasite of cattle causes subcutaneous lesions that resemble bruising** causes **hemorrhagic** **nodules** in the **skin** of **cattle** and buffalo. **;** The invertebrate hosts are **face flies** of the genus M. autumnalis M .lusoria and M. xanthomelas in South Africa, and M. vitripennis in Asia.

 **Parafilaria multipapillosa**

P. multipapillosa is found in the **subcutaneous** tissues of **horses** in various parts of the world; Blood-sucking **Haematobia** spp are thought to be the invertebrate hosts.

causes hemorrhagic nodules (“**summer bleeding**”) in the subcutaneous and intermuscular tissues of horses. The nodules break open and discharge blood and then heal. They reappear each summer.

 **Genus *Dirofilaria***

***Dirofilaria immitis***

**Heartworm** is a [parasitic](http://en.wikipedia.org/wiki/Parasitism) [roundworm](http://en.wikipedia.org/wiki/Roundworm) (***Dirofilaria immitis***) that is spread from [**host**](http://en.wikipedia.org/wiki/Host_%28biology%29) to host through the bites of [**mosquitoes**](http://en.wikipedia.org/wiki/Mosquito). The heartworm is a type of [filaria](http://en.wikipedia.org/wiki/Filariasis_%28domestic_animals%29), a small thread-like worm. The definitive host is the [**dog**](http://en.wikipedia.org/wiki/Dog) but it can also infect [**cats**](http://en.wikipedia.org/wiki/Cat), [wolves](http://en.wikipedia.org/wiki/Wolf), [coyotes](http://en.wikipedia.org/wiki/Coyote), [foxes](http://en.wikipedia.org/wiki/Fox) and other animals, such as [ferrets](http://en.wikipedia.org/wiki/Ferret), [sea lions](http://en.wikipedia.org/wiki/Sea_lion) and even, under very **rare** circumstances, [**humans**](http://en.wikipedia.org/wiki/Human). The parasite is commonly called "heartworm"; however, that is a **misnomer** because the adult actually resides in the **pulmonary** **arterial** **system** (lung arteries) for the most part, and the primary insult to the health of the animal is a manifestation of damage to the lung vessels and tissue. Occasionally, adult heartworms **migrate** to the **right** **heart** and even the great veins in heavy **infections**. Heartworm [infection](http://en.wikipedia.org/wiki/Infection) may result in serious disease for the host.

**Other genera are :**

***Wuchereria bancrofti***

This filarial worm is parasitic only to humans **elephantiasis**

***Brugia malayi*** humans **elephantiasis**

***Loa loa*** inflammatory **conjunctiva** ; **subcutaneous** tissues nodules

***Mansonella*** **Subcutaneous** Filariasis

 **Famliy Setariidae**

 **Genus *Setaria***

***Setaria******digitata*** :

a filarial **parasite of urinary bladder of cattle sheep goat ; brain ,spinal cord sometimes .**

***Setaria equina*:**

 a species that is a common parasite of **horses** and other equids in all parts of the world; they are slender whitish filaments, several inches in length, usually found free in the [**peritoneal cavity**](http://wrongdiagnosis.pubs.righthealth.com/topic/Peritoneal%20cavity?as=clink&ac=1437&afc=2168586466&p=&dqp.cache.mode=PMBypass), but occasionally reported in the **pleural** cavity, **lungs**, [**scrotum**](http://wrongdiagnosis.pubs.righthealth.com/topic/Scrotum?as=clink&ac=1437&afc=2168586466&p=&dqp.cache.mode=PMBypass), **eye**, and intestine.

Infective larvae **L3** develop in **culicine** **mosquitoes**, including Aedes and Culex species.

 **Genus Dipetalonema**

**Dipetalonema reconditum** :

is a parasite you will not hear much about since it rarely causes significant disease. Its importance lies in the fact that its immature form (slender larvae called **microfilariae**) can be easily **confused** with those of [Dirofilaria immitis (**heartworm**)](http://www.peteducation.com/article.cfm?cls=2&articleid=743). D. reconditum **lives** in the **body** **cavity** **and** **subcutaneous** (just below the skin) tissues of **dogs** and is found throughout the United States.

**Dipetalonema evansi:**

**Host** one-humped camels (Camelus dromedarius) Arabian Camel

**observed in either liver,lungs or both of these organs of in 17.5% camels of Iran .** **nodule formation in the blood vessels.ovaries and testis leading to sterility.**

 **Family Onchocercidae**

 **Genus *Onchocerca***

1. **3 species of Onchocerca** currently recognized

**O. cervicalis** is found in the **ligamentum nuchae** and possibly other sites in **Equidae.**

In **cattle, O. gutturosa** locates in the **ligamentum** nuchae ; **O .lienalis in the gastrosplenic ligament**

**Adults** are associated with **connective** tissues and are very thin and 3-60 cm long. Microfilariae are found in the **dermis** and on rare occasions circulating in peripheral blood. The microfilariae lack a sheath and are 200-250 µm long with a short, sharply pointed tail. **Culicoides** spp are the intermediate hosts for O. cervicalis , and **Simulium** spp. for O.  gutturosa and O. lienalis

**fistulous** **withers,** poll evil, **dermatitis**, and **uveitis** , **fibrosis** in the **ligamentum** nuchae, lesions often include areas of scale, crusts, **ulceration**, alopecia, and depigmentation; they may be pruritic. **Allergic** reactions in **horses**

1. ***Onchocerca volvulus*  Human river blindness**; fibrous **nodules** located under the skin called **onchocercomas**.
2. **Super family Dracunculoidea**

**Genus *Dracunculus medinensis* – 'The Guinea Worm'**

1. The disease called Drancuculuiasis .
2. The worms also called "Ancient Egyptians" or "Guinea worms " infection.
3. Reported in Nile valley , Africa , Iraq ,Iran ,Saudi , India & other regions in Asia .
4. The worm look like Filaria; the male 70 - 120 cm. long x 0.9 - 1.7 mm. diameter ; the female 40mm. long x 0.4 mm. diameter ( rarely recover from lesion) .

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The female migrate from deep somatic & visceral connective tissue to the subcutaneous tissue near skin (within 12 months) ; papule formed turn to blister which sloughs in water when the anterior end of the worm ruptures ; then its uterus prolapsed & eject a swarm of

**1st. stage** larvae which enter the **copepod** (**Cyclopes** ; intermediate host) to the **3rd. infective stage** larvae ; if digested by final host they migrate from intestines to the connective tissues.

1. **Pathogenesis & symptoms :**

a. Skin blistering ; abscess ; ulceration ; necrosis due the existence of underlying worm.

b. Edema ; indurations due to release toxic substances & persistent inflammation .

c. Nausea ,vomiting , diarrhea , dyspnea &syncope.