HELMİNTOLOGY

TREMATODA

Helminths

- Origin of the word ‘helminth’ is ‘helmins’ in Greek language. It means worm in English
- They are multicellular organisms.
- Helminths live in vertebrates and invertebrates, and some of them can live freely in nature also.
- They are relatively large creatures. Their size can vary from 1 mm to 15m. They can be seen with the naked eye.

Kingdom-Animal

SubKingdom-Metazoa

Phylum

Nematoda

(roundworms)

Class: Secernentea
Class:Adenophorea

Platyhelminthes

(flatworms, flukes, tapeworms)

Class: Trematoda
Class: Cestoda
Class: Turbelaria

Acanthocephala

(thorny-headed worms)
Class: Palaeacanthocephala

Annelida
Class: Hirudinea (Leech)

**Turbellaria (planarians) are mostly free-living carnivorous flatworms and have no Veterinary significance.

Phylum PLATYHELMINTHES

(Flatworms, Flukes, Tapeworms)

- **Platyhelminths have no body cavity (coleom).**
- **They are bilaterally symetrics,**
- **Dorso-ventrally flattened**
- **Hermaphroditic organisms.**
- **Respiratory and circulatory systems are absent.**
- **Organs are placed in parenchyma.**

TREMATODA

Subclass: MONOGENEA ASPİDOGASTREA DİGENEA

Digenea

- The adult digenetic trematodes, commonly called ‘flukes’,
- Live in the bile ducts, alimentary tract and vascular systems of hosts.

- Body surface is covered with tegument which has a large area of contact and metabolic exchanges between host and parasite.

- Usually, there are two muscular suckers for holding on the host:
- Oral sucker located at the anterior-end,
- Ventral sucker located ventrally or caudally.
- ** Genital sucker (Heterophyes heterophyes)

- Alimentary canal is well developed: It has mouth, pharynx and it ends a pair of simple or branched intestinal cecum.

- Digenic trematodes feed on intestinal debris, epithelium, mucus, bacteria, etc.; some species are haematophagous (feding blood).

- They are hermaphrodites (except Schistosomatidae- sexes are separate).

- Cross-fertilization occurs more frequently than self-fertilization.
- Digenic trematodes have an indirect life-cycle.
- Vertebrate (mamalian species) is a definitive host, and and there can be one or two intermediate hosts.
- The first intermediate host always belongs to a species of snails.
- Developmental stages of digenic trematodes;
- Eggs, miracidium, sporocyst, redia, cercaria, metacercaria
- In almost all trematodes, infective stage for definitive host is metacercaria. It is taken by ingestion. There is an one exception; In schistosomatidae family species, cercariae (furcocerceria) infects the host percutaneously. It penetrates the skin and passes in to the host body.

There are many families in the Digenea subclass…

The most important ones in terms of veterinary medicine are;

- Fasciolidae,
- Dicrocoeliidae,
- Paramphistomatidae, and

  Schistosomatidae.

Troglotrematidae and Opisthorchiidae are relatively less important families

Class: TREMATODA

Subclass: Digenea

Family: Fasciolidae

1.Genus: Fasciola

Species: *Fasciola hepatica*

Fasciola gigantica

2. Genus: Fascioloides

Species: *Fascioloides magna*

3. Genus: Fasciolopsis

Species: *Fasciolopsis buski*

GENUS: FASCIOLA

Fasciola hepatica

Definitive hosts: Sheep, cattle, goat, horse, deer, other mammals and man.

Predilection site: Young parasite in liver paranchyma,

Adult parasite in bile duct

Intermediate host: Lymneid snails-- (*Galba, Lymnea, Radix and Stagnicola)*

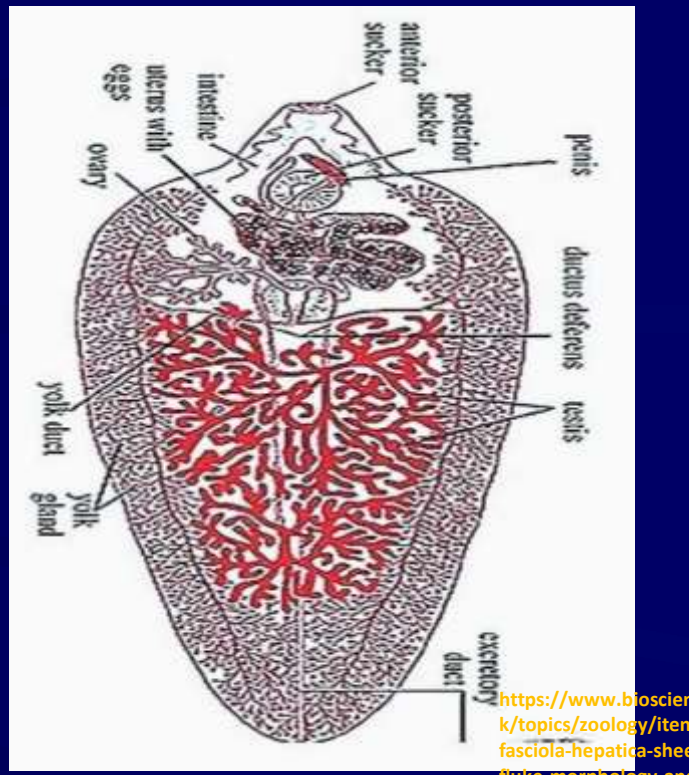
Galba (Lymnea) truncatula is the intermediate host in Turkey. It is an amphibious snail which has capable of movement and life suited for both land and water.

Distribution: Cosmopolitan-Worldwide.

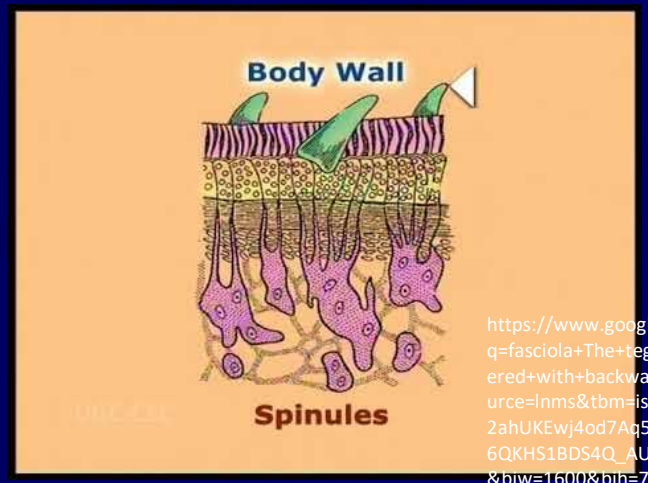
https://www.cdc.gov/dpdx/fascioliasis/index.html

Morphology

- Adults are about 2.5-3.5 cm lenght and 1 cm wide in bile ducts.
- Grey Brown in colour.
- It is leaf-shaped with the anterior-end being broader than the posterior-end.
- The oral sucker is small but powerful and is located at the end of a cone-shape projection at the anterior end.
- The ventral sucker is a larger sucker than the oral sucker and It is located at the anterior region also, but a little behind the oral sucker.
- The tegument is covered with backwardly spines. When the parasite move, spines scratch the epitelial mucosa in their settled area.
- All organs are branched. The ovary is positioned in front of testicles



https://www.bioscience.com.pk/topics/zoology/item/287-fasciola-hepatica-sheep-liver-fluke-morphology-and-physiology



https://www.google.com/search?q=fasciola+The+tegument+is+covered+with+backwardly+spines&source=lnms&tbm=isch&sa=X&ved=2ahUKEwj4od7Aq5fzAhVD-6QKHS1BDS4Q_AUoAXoECAEQAw&biw=1600&bih=757#imgrc=8f1QHdyCAH98HM&imgdii=KE_0IYhQ43e2SM

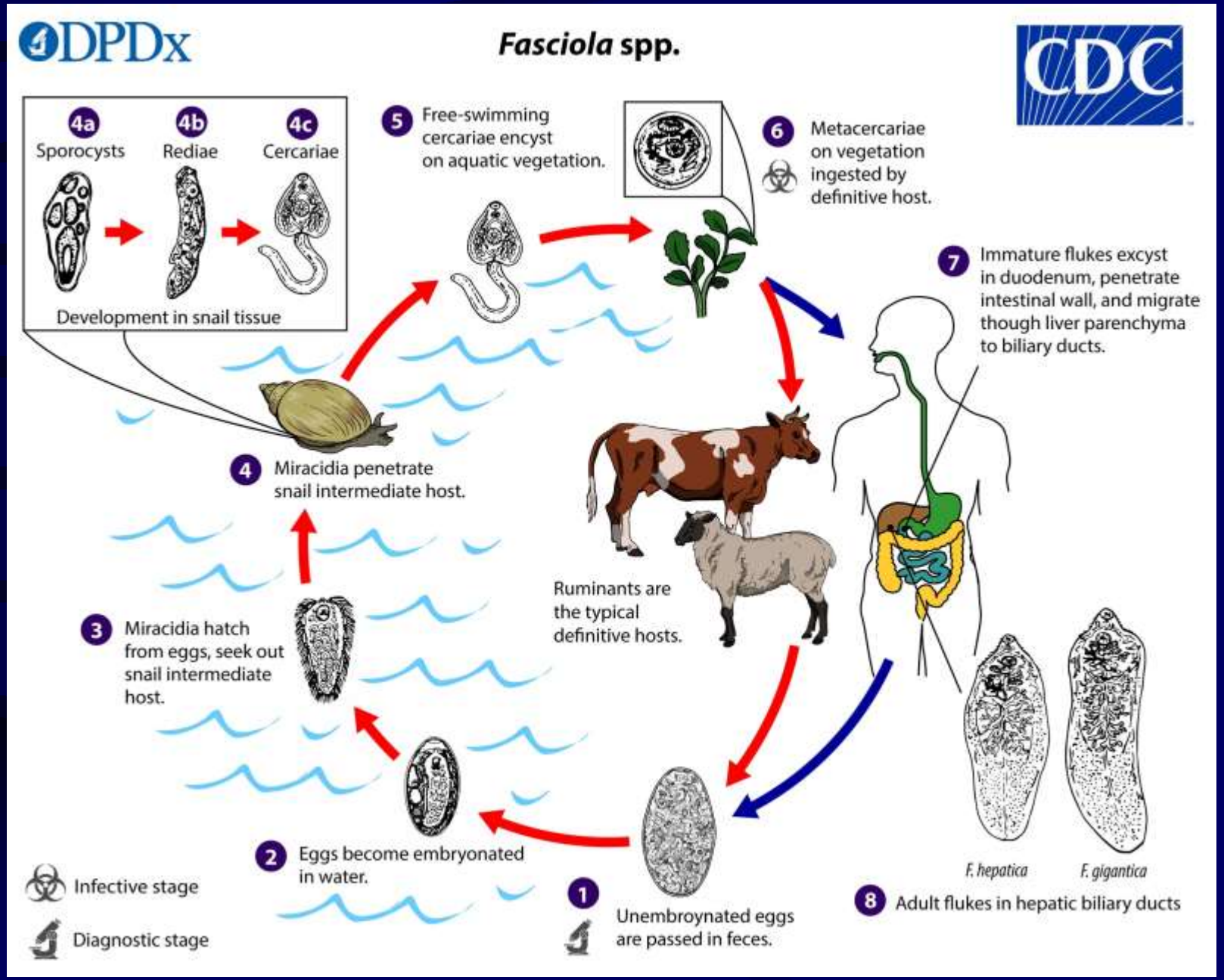
Life cycle of Fasciola and time descriptions

Adult parasites produce up to 20000 eggs per day. Miracidium development within the egg is completed in 8-21 days under suitable external conditions (22-26°C). Temperature drops and increases slow down development. For the miracidium to hatch, it requires a watery, light-rich, oxygen-rich environment and a temperature of 10-40°C.

Progress of Infection in host

Ingestion metacercariae excysts in duodenum. It then burrows through Intestinal Wall (1-4 days) and enters peritoneal cavity and finds the liver (5-7 days), penetrates the liver capsula and starts to migrating the liver (6-8 weeks)

- The minimum period of development from miracidium to cercaria is 5 weeks in the intermediate host
- Cercaria leave the snail and and becomes a metacercaria by getting cysts on the grass.
- Prepatent period (after ingesting metacerceria - existing egs in the host) is 10 – 12 weeks
- The entire developmental period spans (Patent period) 17 - 18 weeks



https://www.cdc.gov/dpdx/fascioliasis/modules/Fasciola_LifeCycle_lg.jpg

Pathogenesis:

- Little damages occure when the juveniles penetrating the intestinal wall and the liver capsule but much pathogenic results take place when immature flukes migrate through the liver parenchyma (6-8 weeks).
- Mature flukes in bile ducts cause inflammation and edema, fibrous tissue production occurs in the walls of bile ducts.
- The ducts can handle less bile.
- Back pressure causes atrophy of liver parenchyma, cirrhosis and possibly icterus.
- In heavy infections the gall bladder is damaged, and walls of the bile ducts are eroded complete
- Fasciola hepatica can cause major economic losses. Infected animals become anaemic and lose significant amounts of weight.

Pathogenesis:

- Fasciolosis could be occured acute or chronic form, Sometimes peracute or subacute forms can be seen

- **Acute fasciolosis** is more common and highly pathogenic in sheep. it is rearely seen in cow (especially seen under 1 year old calf). When 10.000+ metacercariae consumed at one time, the acute infection is generally developed.

- Acute infection is often seen in younger animals and is dominated by the effect of simultaneous migration of immature flukes in the liver causing bleeding and severe liver damage.

- Weakness, abdominal pain, anemic appearance of the eye mucosa.

- Acut form is generally seen in 4-7 month old lambs between September and November.

- If many thousand metacercariae are ingested sudden death can ocur (**Peracute form**).

Pathogenesis

Chronic fasciolosis is a result of prolonged intake of metacercaria and leads to the progressive loss of body condition.

- Chronic fasciolosis is the most common form in cattle and sheep.
- It is seen between December and April in animals older than 1 year.
- Death is rare in well-nourished sheep.

- The clinical signs of chronic fasciolosis are variable and depend upon the number of metacercariae ingested, but often include: Weight loss, Anemia, Bottle jaw, Diarrhea, Constipation

- Cattle develop a specific resistance to the parasite during the course of infection. This non-protective resistance is characterized by hyperplasia and calcification of the bile duct epithelium and develops approximately 12 weeks after infection.

*******Humans can be definitive hosts after ingesting metacercaria (e.g. on contaminated food items-uncleaned raw vegetables) = Zoonotic dis.**

Epidemiology

- **Metacercariae continue to live in damp pastures.**
- **A moist and watery environment (rainy seasons) is required for the development of miracidium in the egg and biological development in the intermediate host.**
- **When the outside temperature drops below 10ºC, the outside biologic development stops.**
- **Eggs and metacercariae die below - 4°C.**
- **The final host and intermediate host population density accelerates the spread of infection.**
- **Treatment against adult parasites in the definitive host reduces the intensity of infection.**

Diagnosis

Diagnosis is based on primarily on clinical signs, seasonal occurrence, current weather condution, prevouis history of fasciolosis on the farm.

- ✓ **Stool Samples** (in chronic form), (No eggs in acute infection)

Fasciola eggs find on sedimentation techniques

- ✓ **Post-mortem examination- Necropsy**

In acute form: Migration routes of the parasite in the liver parenchyma, bleeding, fibrinous membrans in the liver , peritonitis, immature form is found in liver paranchime, fluid collection occur in the abdomen.

In chronic form: Fibrosis and sirosis, thickening of the bile ducts, mature fasciola in the bile ducts

- ✓ **Serological tests:** Antibody can detect after post infeciton 2nd weeks.

Acute fasciolosis

https://www.semanticscholar.org/paper/Liver-fluke-disease-in-sheep-and-cattle-Boray-Love/300894d71e7231567d457bed5e6c7fbdf1e553c0/figure/13

Chronic fasciolosis

https://es.wikipedia.org/wiki/Fascioliasis

Treatment

- Strategic treatment is important. All animals should be treated with appropriate anthelmintic against young parasites 2-3 months after the first grazing.

- In areas where the infection is intense, this treatment should be repeated every 2-3 months.

- It would be useful to do another treatment at the beginning of winter. (before the animals entering the barn)

Treatment

Drugs used in the treatment of fasciolosis

Active ingredient	mg/kg Dose	Parasite age (Week)												
		2	3	4	5	6	7	8	9	10	11	12	13	14
Triclabendazole	20	+	+	+	+	+	+	+	+	+	+	+	+	+
Diamphenethide	100	+	+	+	+	+	+	+	+	+	+	+	+	+
Nitroxynil	4.0								+	+	+	+	+	+
Nitroxynil +Clorsulon	7	+	+	+	+	+	+	+	+	+	+	+	+	+
Closantel	5.3							+	+	+	+	+	+	+
Closantel + Oxfendazole	5.3					+	+	+	+	+	+	+	+	+
Closantel + Albendazole	5.3							+	+	+	+	+	+	+
Albendazole	6.0											+	+	+
Oxyclozanide												+	+	+
Oxyclozanide + Levami-sole	4.0											+	+	+
Clorsulon	7							+	+	+	+	+	+	+
Clorsulon + İvermectin	20											+	+	+
Rafoxanide	7.5					+	+	+	+	+	+	+	+	+

Control and Prevention Methods

Fluke control measures can be divided into 3 sections:

1. **Grazing management**

Avoid grazing high risk pastures

Avoid co-grazing sheep and cattle

Grass with metacercaria should be evaluated by making silage.

2.Snail habitat management (Controls Intermediate Snail Host)

Fence off wet areas

Drainage of wet areas

3.Monitoring for infection Faecal egg counts Coproantigen tests,

Blood serology, Slaughterhouse controls

Animals caring and feeding are important.