

INTRODUCTION

Helminth is a general term meaning worm.

They are invertebrates characterized by elongated, flat or round bodies.

They are multicellular organisms that are visible to the naked eye.

DIGENEA

1 . *Family* : FASCIOLIDAE

Genus : Fasciola - Fascioloides - Fasciolopsis

2 . *Family* : DICROCOELIDE

Genus : Dicrocoelium

3 . *Family* : PARAMPHISTOMATIDAE

Genus : Paramphistomum

4 . *Family* : SCHISTOSOMATIDAE

Genus : Schistosoma – Orientobilharzia

5 . *Family* : OPISTORCHIIDAE

Genus : Opistorchis

6 . *Family* : HETEROPHYIDAE

Genus : Heterophyes – Metagonimus

7. *Family* : DIPLOSTOMATIDAE

Genus : *Alaria*

8. *Family* : NANOPHYETIDAE

Genus : *Nanophyetus*

9. *Family* : PARAGONIMIDAE

Genus : *Paragonimus*

10. *Family* : TROGLOTREMATIDAE

Genus : *Troglorema*

11. *Family* : ECHINOSTOMATIDAE

Genus : *Echinostoma* – *Echinochasmus*

12. *Family* : PROSTHOGONIMIDAE

Genus : *Prosthogonimus*

13. *Family* : NOTOCOTYLIDAE

Genus : *Notocotylus*

Phylum

PLATYHELMINTHES

Flatworms

- Worms with dorso-ventrally flattened, bilaterally symmetrical body.
- Body cavity, respiratory and circulatory systems are absent.
- Organs are embedded in specialized connective tissue (parenchyma).

Phylum

Class

PLATYHELMINTHES

This phylum contains the four classes

These are Trematoda - Cestoda

- Monogenea and Turbellaria

Two of them (TREMATODA and
CESTODA) are very important for human
and animal health

We will focus on Trematodes for 3 weeks

TREMATODA

CESTODA

MONOGENEA

TURBELLARIA

(non parasitic types)

MONOGENEA

- It is found in cold-blooded and aquatic animals (fish, amphibia, reptile).
- They usually live as ectoparasites.
- They are vivipar or ovipar.
- The larvae are similar to adults.
- There are sucker and hooks on the back.
- They develop directly.

Class **TREMATODA -- FLUKES**

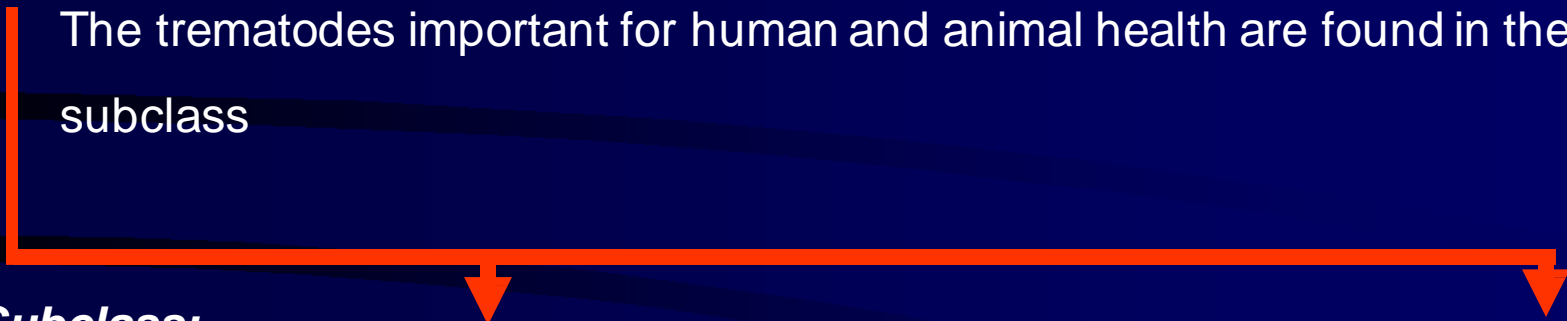
The class Trematoda falls into two main subclasses, These are the Digenea and Aspidogastrea

The trematodes important for human and animal health are found in the digenea subclass

Subclass:

DIGENEA

ASPIDOGASTREA



ASPIDOGASTREA

- They live in fish, slimy crustacea and turtles.

It is morphologically similar to digeneas.

They carry a ventral disc with multiple alveoli or withdrawal rows.

They don't have hooks.

Microtubules are found in the teguments.

In the back of their larvae are shrunken.

They live as ecto and endo parasites.

Subclass: DIGENEAE - FLUKES

The adult digenetic trematodes, commonly called 'flukes', occur primarily in the bile ducts, alimentary tract and vascular system.

- **Body** is leaf-, lancet- or cone-like, not segmented, in length from a few millimeters to 7 to 8 cm. Some of them are short, like rice grain. Some of them are cylindrical

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

There are two muscular suckers for attachment: oral sucker at the anterior end around the anterior mouth and ventral sucker located ventrally or caudally.

DIGENIC TREMATODES - FLUKES

- Alimentary canal is well developed: oral opening is at the oral sucker, pharynx, ending in a pair of simple or branched intestinal caeca.

- They feed on intestinal debris, epithelium, mucus, bacteria, etc.; some species are haematophagous.

-

They are hermaphrodites (except Schistosomatidae where sexes are separate-biseksual fluks).

- Cross-fertilization occurs more frequently than self-fertilization.

Male organs: two testes leading into a vas deferens, then to the terminal cirrus (penis) enclosed in a sac, and terminate at the genital opening common with the female organs; testes are simple or branched.

- **Female organs:** single ovary with an oviduct, a pair of vitelline glands with duets to the part of the oviduct (ootype) where the eggshell is formed, then eggs pass along the uterus and are discharged through the genital opening adjacent to the ventral sucker; the body of an adult fluke is as a rule filled with the winding uterus containing eggs.

Life cycle is indirect

Exchange of the vertebrate definitive and one or two invertebrate intermediate hosts (heteroxeny); the first is always a species of snail.

Exchange of larval generations (heterogony), i.e. flukes develop from egg to the adult stage through several larval stages:

miracidium,

sporocyst,

redia ,

cercaria,

metacercaria

sporocyst and redia are capable of asexual multiplication (parthenogony),

The cercariae may directly penetrate the final host, encyst in a transport host or a second intermediate host or encyst on grass and become **metacercaria**

In almost all trematodes the stage infective to the definitive host is ingested as a metacercarian cyst. In the schistosomes cercariae invade the host percutaneously

There are many families in the class Trematoda, and those which include parasites of major veterinary importance are the

Fasciolidae,

Dicrocoeliidae,

Paramphistomatidae and

Schistosomatidae.

Of lesser importance are the

Troglotrematidae and Opisthorchiidae.

Class: TREMATODA

Family: Fasciolidae

1. Genus: Fasciola

Species: *Fasciola hepatica*

Fasciola gigantica

2. Genus: Fascioloides

Species: *Fascioloides magna*

3. Genus: Fasciolopsis

Species: *Fasciolopsis buski*

Genus : F A S C I O L A

Species : *Fasciola hepatica*

Common name: Liver fluke

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

Predilection site: Young flukes in liver paranchyma, adult flukes in bile duct

Intermediate host: Snails of the genus *Galba* (*Lymnea*) *Galba truncatula* in Turkey

Amphibious snails

Capable of movement and life, both on land and in water

Distribution: Cosmopolitan-Worldwide.

Morphology:

Fasciola hepatica, also known as the common liver fluke or sheep liver fluke

Fasciola hepatica is one of the largest flukes of the world, Adults are about 3 cm long and 1 cm wide.

It is leaf-shaped, pointed at the back (posteriorly), and wide in the front (anteriorly).

The oral sucker is small but powerful and is located at the end of a cone-shape projection at the anterior end.

The acetabulum is a larger sucker than the oral sucker and is located at the anterior end

There are spines facing backwards on the tegument.

All organs are branched. Ovarium in front of testicles

Life cycle of Fasciola

Adult parasites produce up to 25000 eggs per day. Metacercariae excysts in the first part of the small intestine, duodenum.

It then penetrates the intestinal wall and gets into the peritoneal cavity

Progress of Infection

- Ingestion Metacercariae
- Ex-cyst in Duodenum
- Burrows through Intestinal Wall
- Enters Peritoneal Cavity
- Migrates to Liver

The minimum period of development from miracidium to cercaria is 17 days and cercaria can be shed after 36 days (25 days for *F. hepatica*).

The entire developmental period spans 13 - 16 weeks (8 – 12 weeks for *F. hepatica*).

Pathogenesis:

- Fasciola hepatica can cause major economic losses Infected animals become anaemic and lose significant amounts of weight.
- Fasciolosis can be classed as either acut or chronic,
- Sometimes peracut or subacut forms can be seen

- **Acute fasciolosis** is more common and highly pathogenic in sheep.
- 10,000+ Metacercariae consumed at one time
- **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.
- If many thousand metacercariae are ingested sudden death can ocur (peracute).

Pathology and liver damage

Little damage is done by juveniles penetrating the intestinal wall and the capsule surrounding the liver but much necrosis results from migration of flukes through the liver parenchyma

Worms in bile ducts cause inflammation and edema, which in turn stimulate production of fibrous tissue in the walls of these ducts.

Thus thickened, the ducts can handle less bile and are less responsive to needs of the liver.

Back pressure causes atrophy of liver parenchyma, with concomitant cirrhosis and possibly jaundice.

In heavy infections the gall bladder is damaged, and walls of the bile ducts are eroded complete

Chronic fasciolosis is a result of prolonged intake of cysts and leads to the progressive loss of body condition. 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
- Anaemia
- Bottle jaw
- Diarrhoea
- Constipation

Epidemiology

Avoid grazing high risk pastures

Outbreaks of acute fasciolosis in sheep are generally presented as sudden deaths during autumn and early winter

Diagnosis

Stool Samples (**In chronic form**)

Yellow-Brown Eggs

Eggs Don't Show for 4 Months

Post-mortem examination- Necropsi (**In acute form**)

Duodenal or Biliary Aspirate

Antibody Test, Can detect 2 Weeks After Infection

Ultrasound

Visualize Adults in Bile Duct

Active ingredients	SHEEP											
	Age in weeks											
	Early imm.			Immatures				Adults				
	1	2	3	4	5	6	7	8	9	10	11	12
Albendazole												
Clorsulon												
Closantel												
Nitroxinil												
Oxyclozanide												
Rafoxanide												
Triclabendazole												

Active ingredients	CATTLE											
	Age in weeks											
	Early imm.					Immatures				Adults		
	1	2	3	4	5	6	7	8	9	10	11	12
Albendazole												
Clorsulon												
Closantel												
Nitroxinil												
Oxyclozanide												
Rafoxanide												
Triclabendazole												

Weeks after infection (i.e. age of fluke)	Immature fluke									Adult fluke			
	1	2	3	4	5	6	7	8	9	10	11	12	13
Closantel (Subcutaneous injection)	< 50% effective			50-89%						more than 90% effective			
Nitroxynil (Subcutaneous injection)	less than 50% effective					50-89%				more than 90% effective			
Oxyclozanide (Oral drench)	less than 50% effective									50-89%		>90%	
Triclabendazole (Oral drench)										more than 90% effective			

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

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

Abattoir condemnations

NADIS parasite forecast

Genus: Fasciola

Species: *Fasciola gigantica*

The adult fluke is larger than *F. Hepatica* They can reach 7.5 cm

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

Predilection site: Young flukes in liver paranchyma, adult flukes in bile duct

Intermediate host: Snails of the genus *Radix (Lymnea) Radix auricularia* in Turkey

Aquatic sanails only lives in water. similar to the auricle

Distribution: Prevalence of this parasite is more limited than *Fasciola hepatica*

Except to intermediate host, Life cycle is similar to those of *Fasciola hepatica*

Pathogenesis, clinical signs, diagnosis and treatment are similar to those of *Fasciola hepatica*

Class: Trematoda

Family: Fasciolidae

Genus: Fascioloides

Species: *Fascioloides magna*

Definitive hosts: Especially deer, rarely sheep, cattle, goat

Predilection site: liver

Life cycle is similar to those of *Fasciola hepatica*

Pathogenesis: Flukes tend to be encapsulated in the liver by host reaction and are less pathogenic in deer and cattle. However Flukes may migrate in the liver tissue causing traumatic hepatitis in sheep and goats

Class: Trematoda

Family: Fasciolidae

Genus: Fasciolopsis

Species: *Fasciolopsis buski*

Definitive hosts: Man, pig.

Predilection site: Small intestine

Predilection site: *Fasciolopsis buski* is found mainly in Asia and the Indian

Pathogenesis:

Most cases of this parasite are asymptomatic. Disease symptoms include ulceration, hemorrhage and abscess of the intestinal wall, diarrhea, and even death.