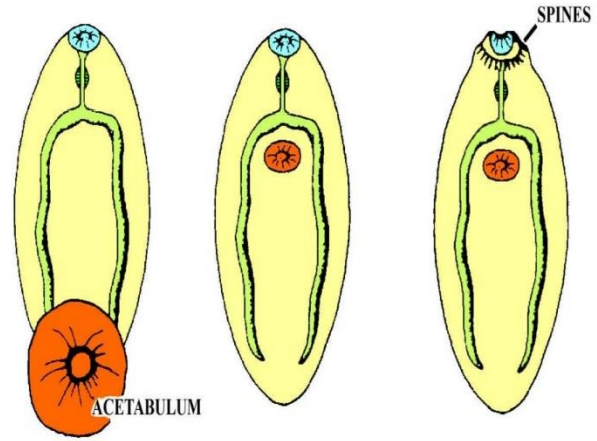
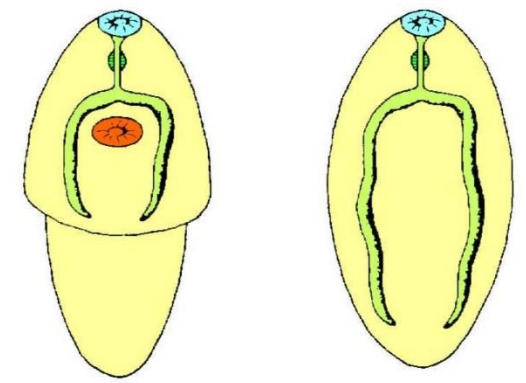


Subclass: Digenea

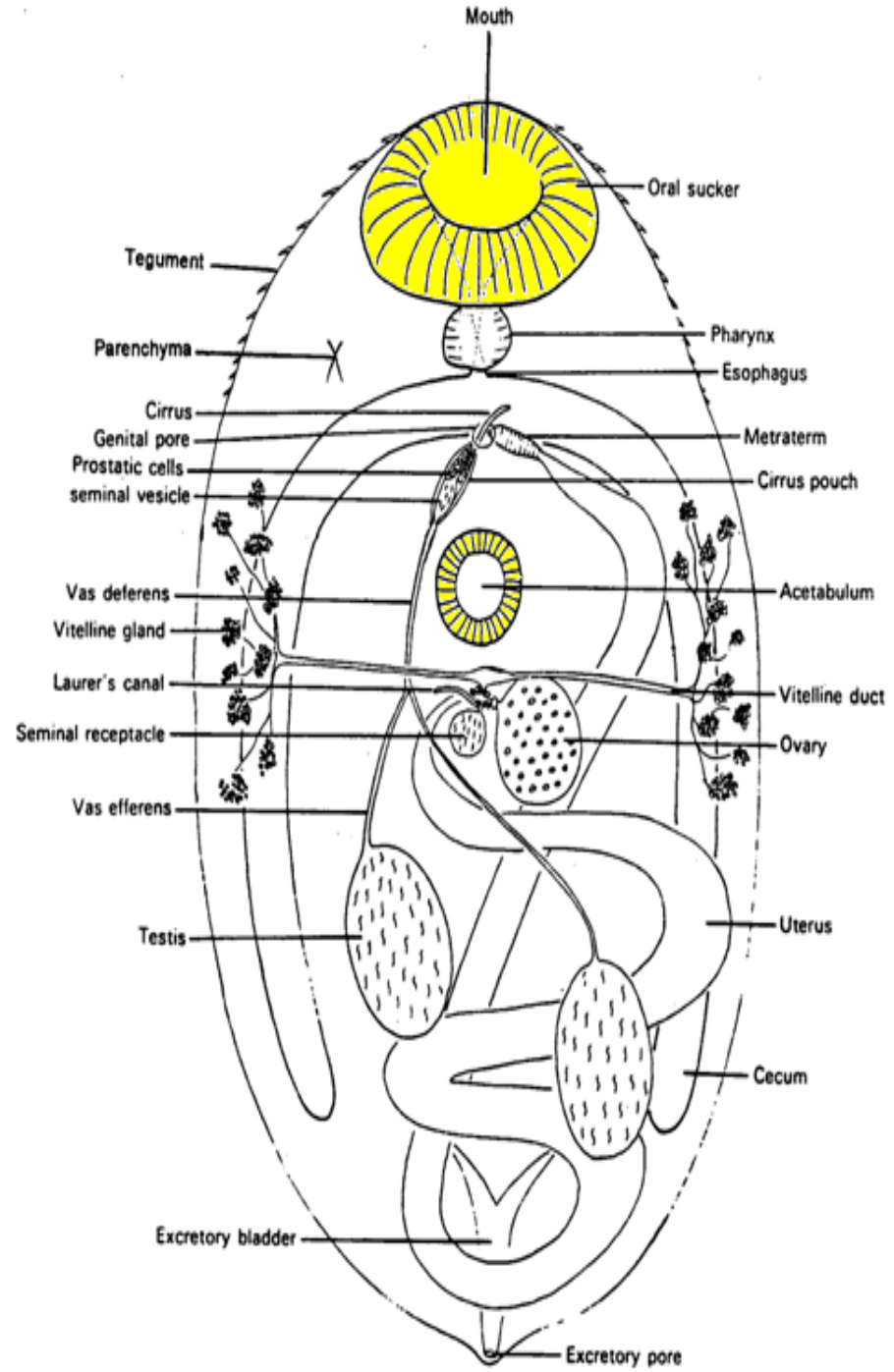
MORPHOLOGICAL TYPES OF DIGENES



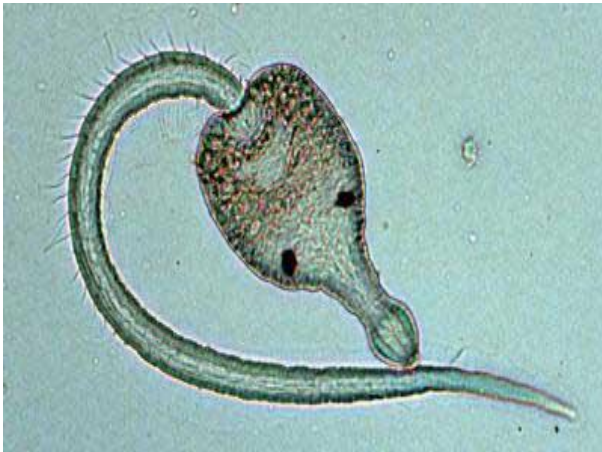
AMPHISTOME DISTOME ECHINOSTOME



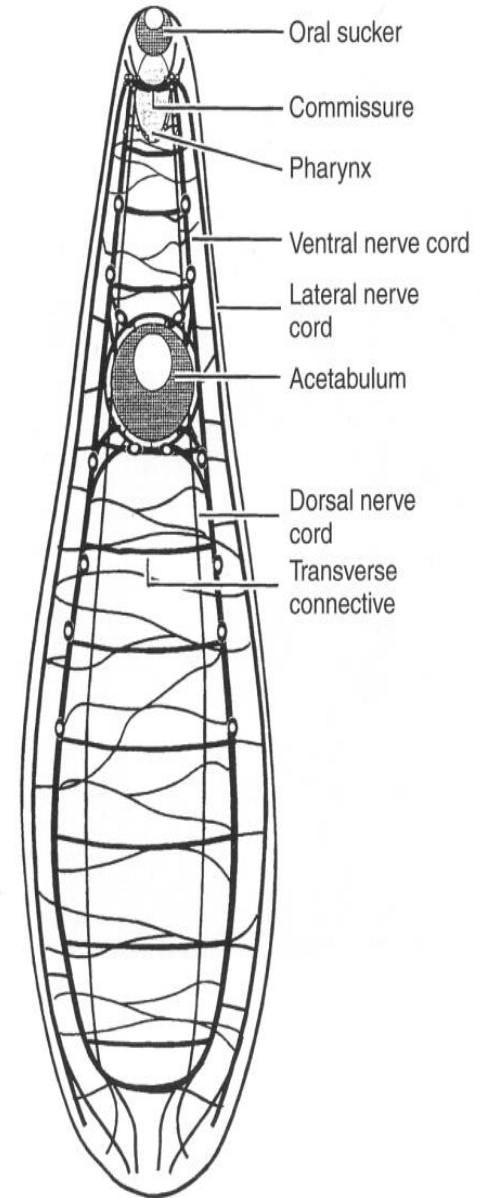
HOLOSTOME MONOSTOME



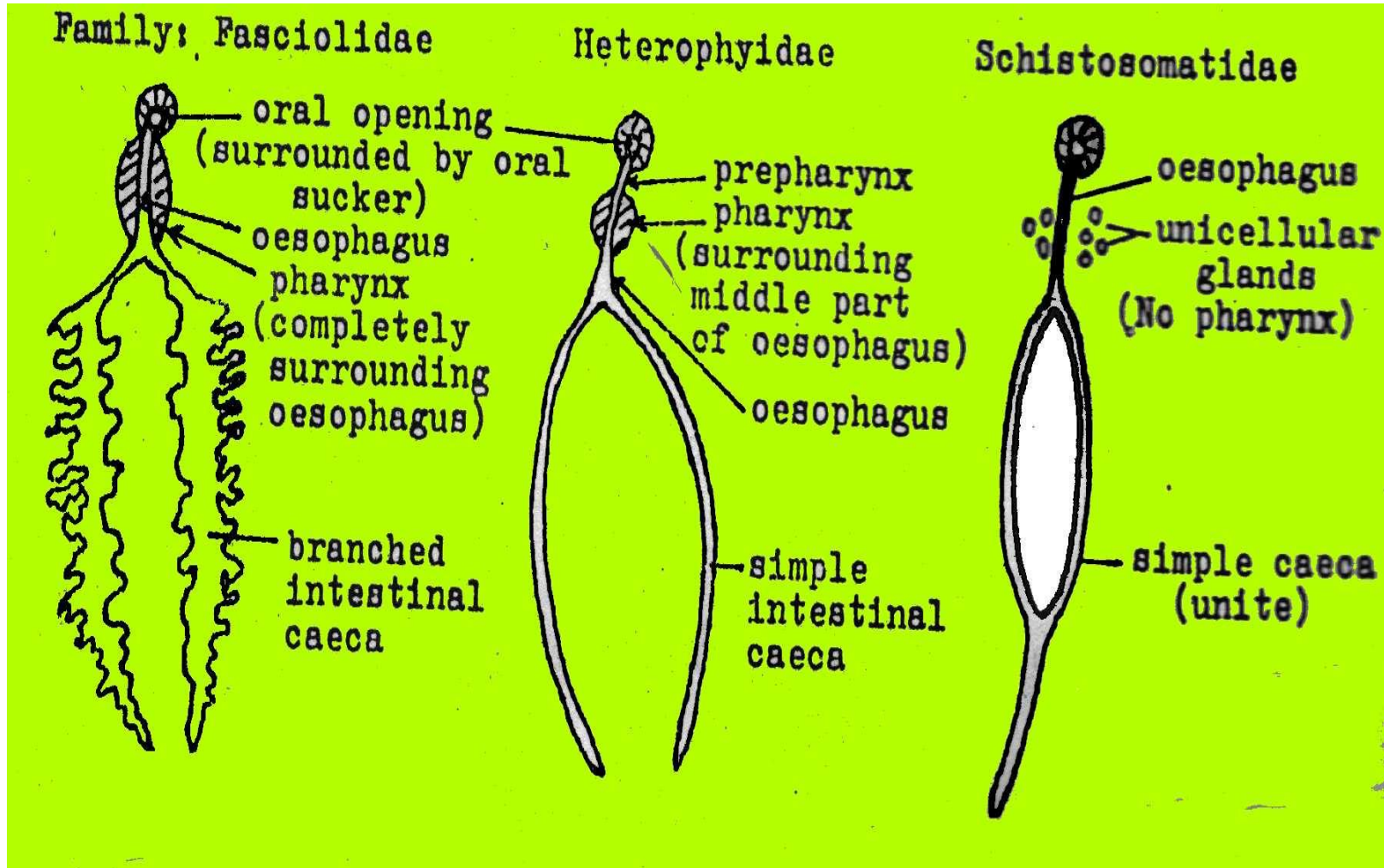
Nervous system



sense organs
Eye spot

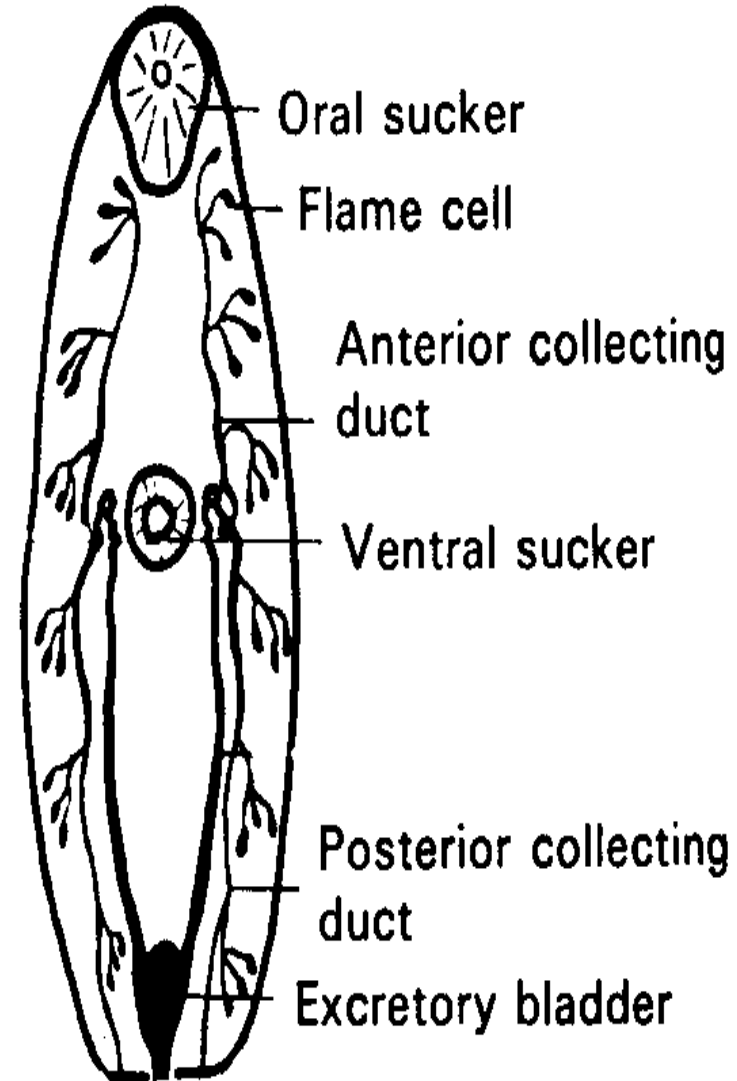
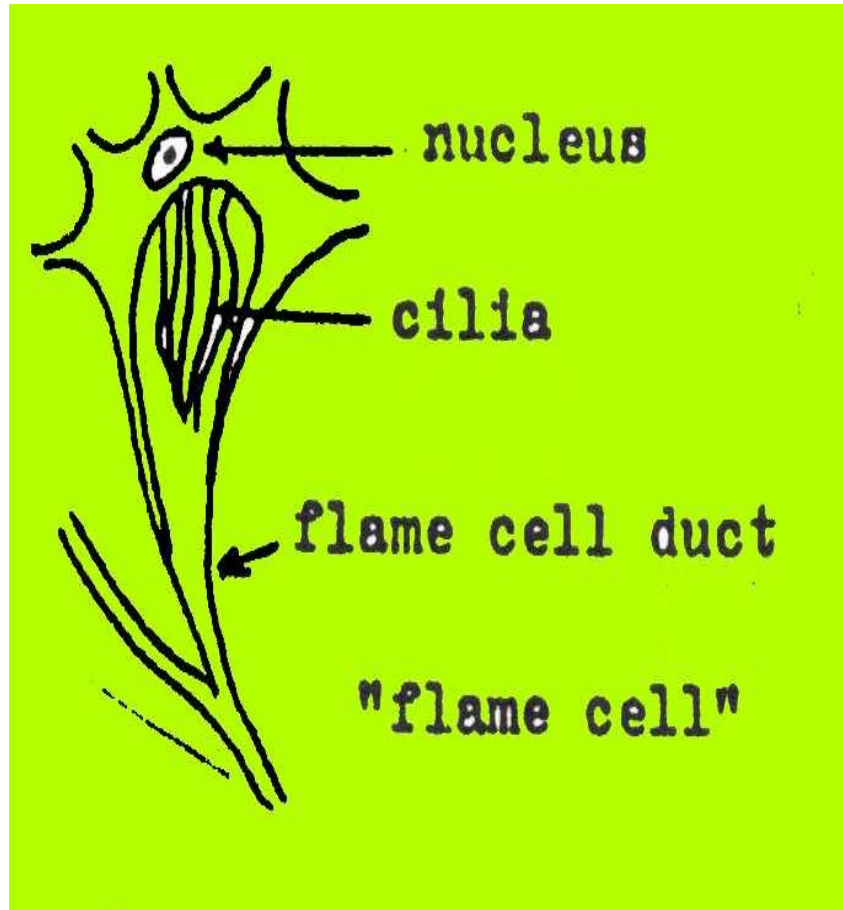


Digestive system



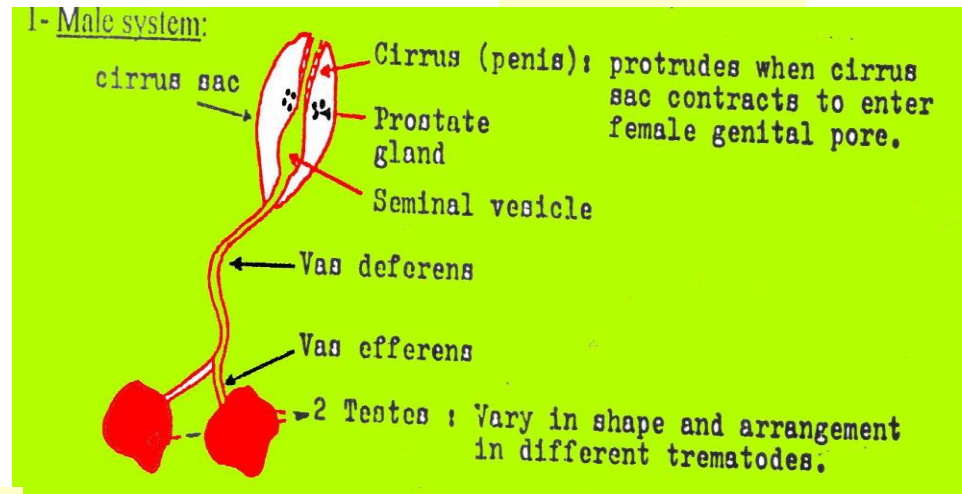
Simple without anus

The excretory system

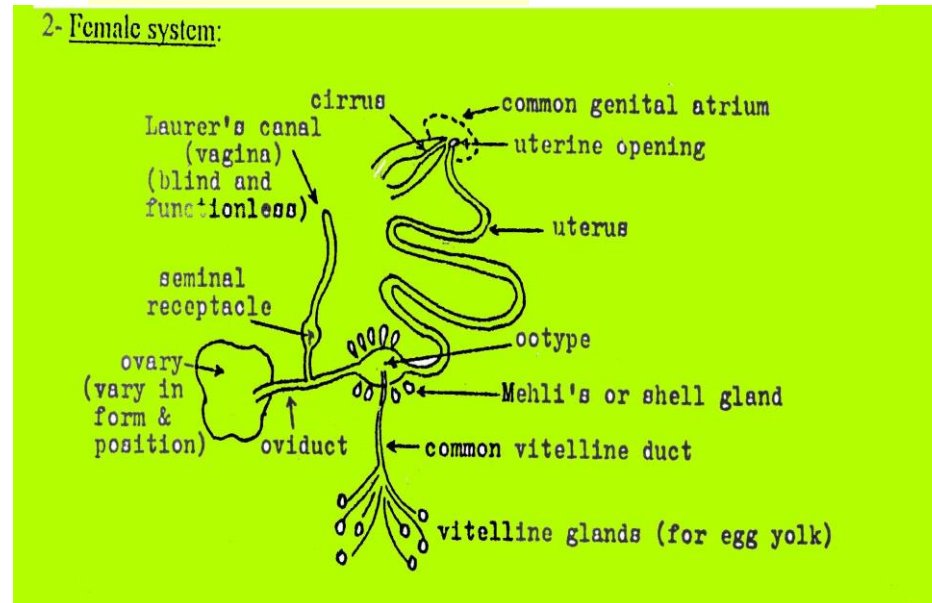


Reproductive system

Male

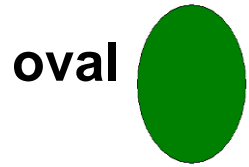


Female

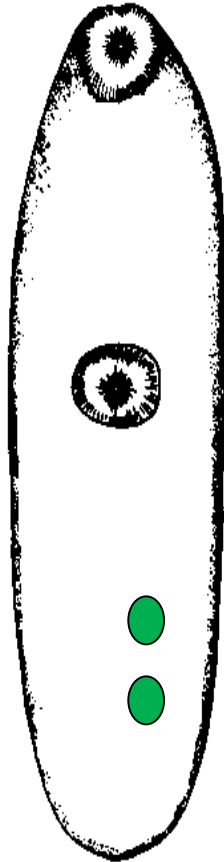


Male reproductive system
Shape and position of the 2 testes are important taxonomic characters

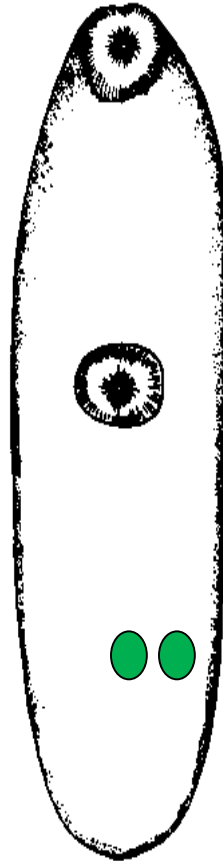
Shape:
Position:



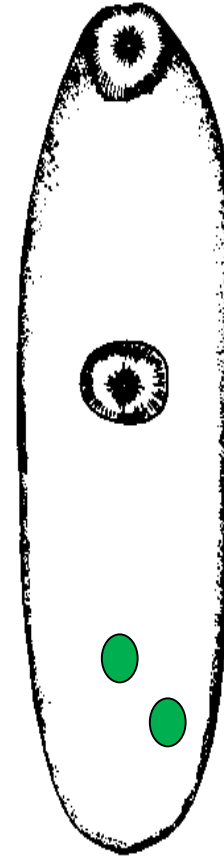
branched



Tandum



Horozonital



One obliquely behind the other

Female reproductive system

Shape and position of the ovary in relationship to testes important in identification

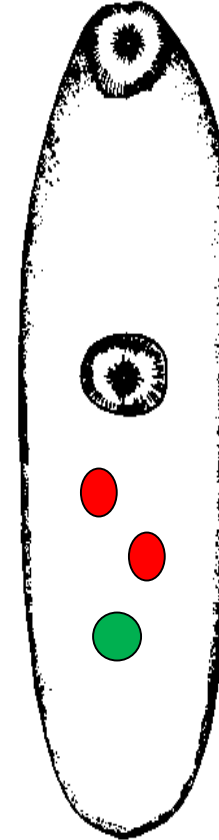
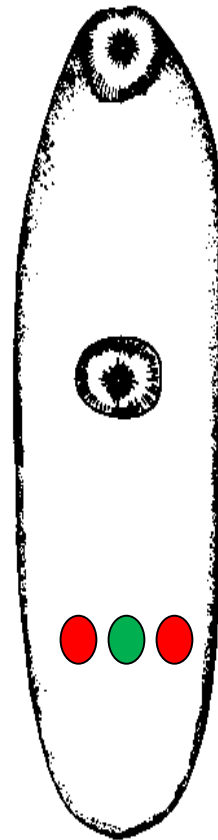
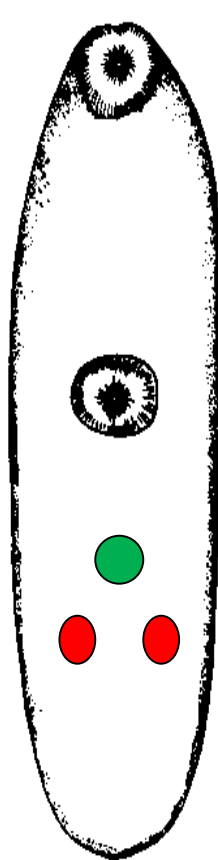
oval



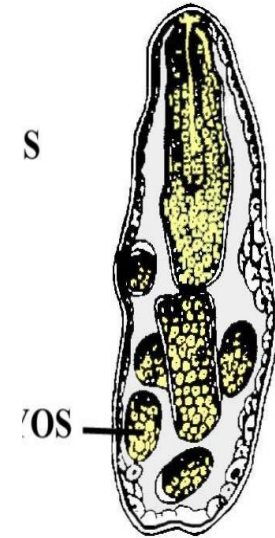
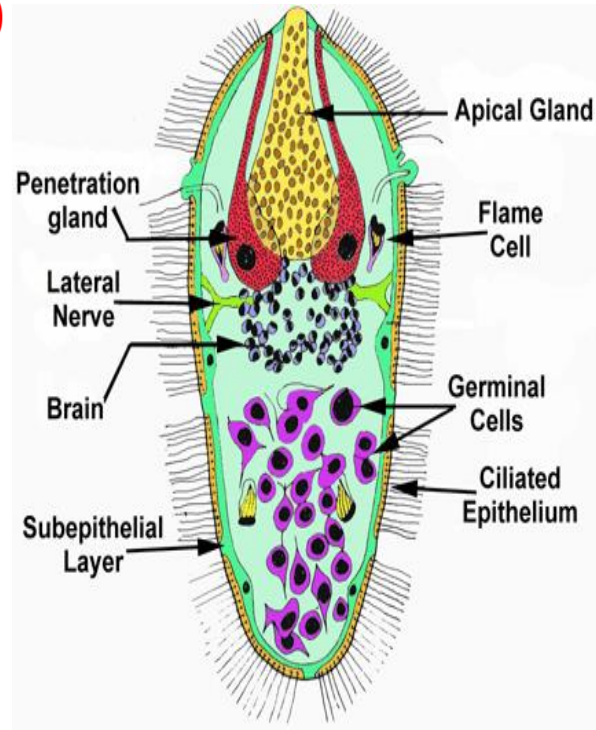
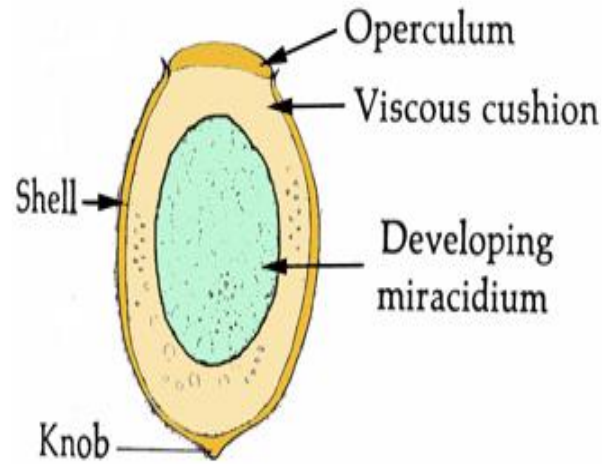
lobed



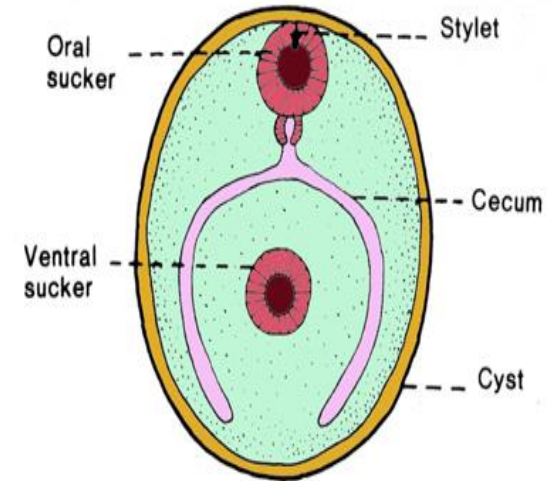
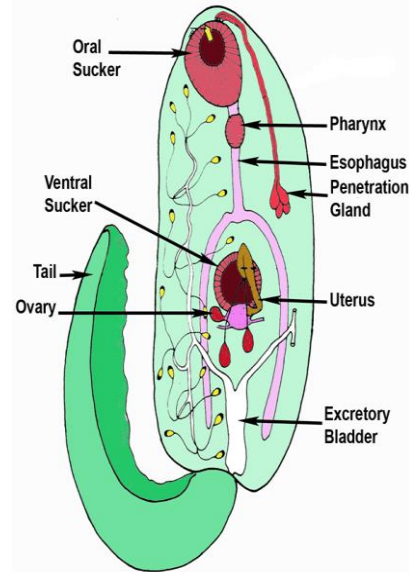
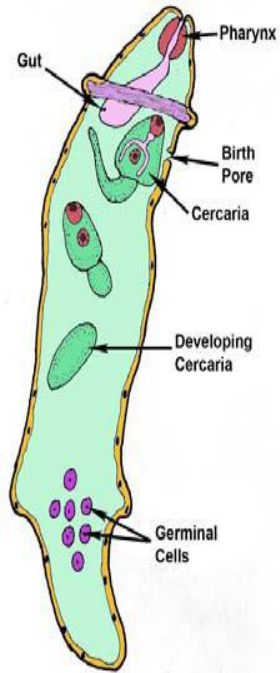
branch



Development of trematodes



SPOROCYST



Type of cercaria

Cercaria are divided according to

❖ type of tail

❖ character of adult worm which appear in it into

1. Leptocercus cercaria

In this type the tail is simple

a. Gymnocephalus as in *Fasciola* species

b. Echinostome as in case of *Echinostome revolutum*, which characterized by the presence of collar of spines around the anterior end.

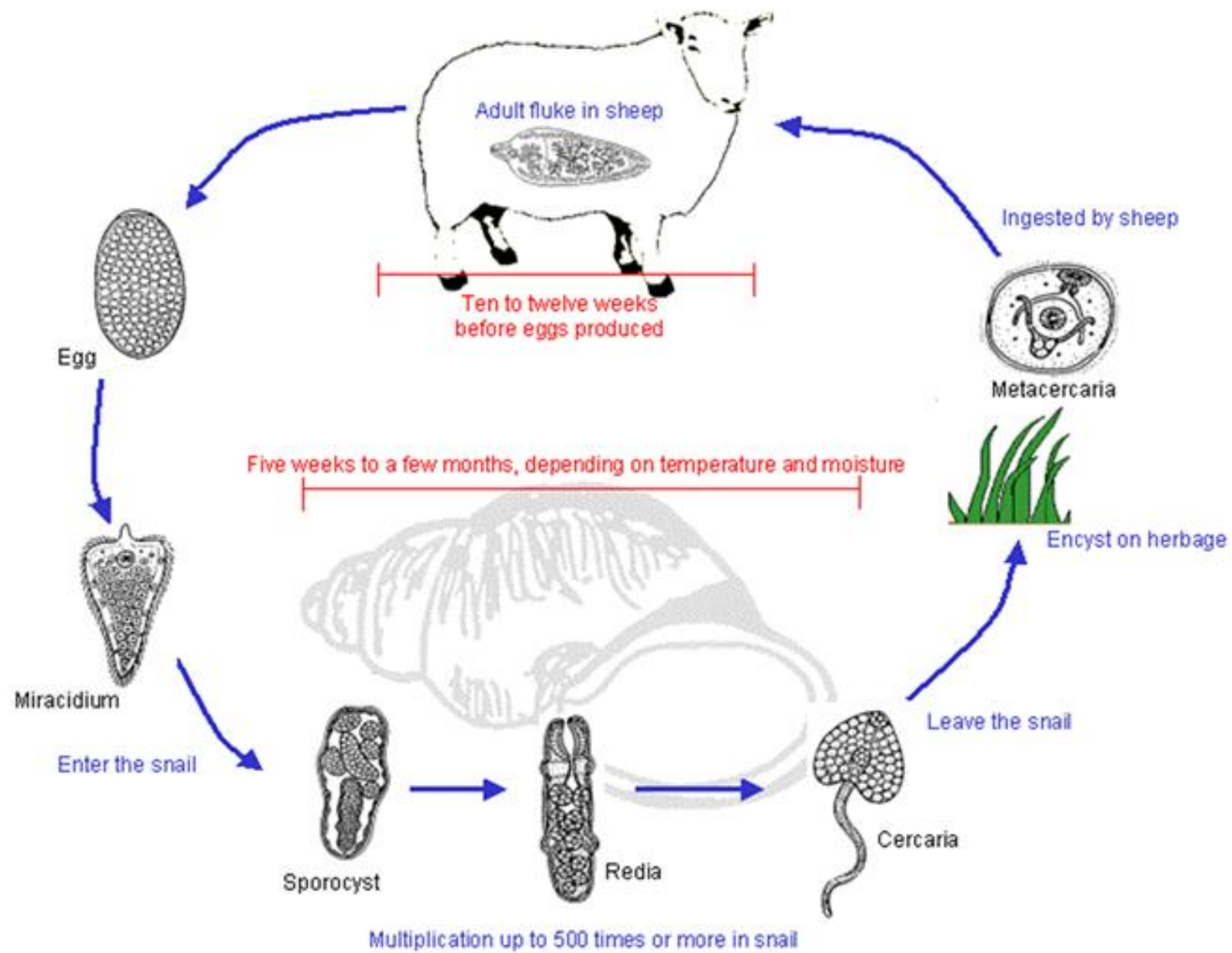
c. Xiphidio as in case of *Dicrocoelium dendriticum*, which characterized by the presence of stylet near the oral sucker.

2-Lophocercus cercaria as in case of *Heterophyes heterophyes* cercariae, which characterized by the presence of membranous sheath around the tail.

3-Furcocercus as in case of *Schistosoma* species which characterized by furcked tail (divided)

4-Amphistome as in case of Paramphistomum species, which characterized by the presence of pigment and has a eye spots in addition to the presence of the ventral sucker at the posterior end of body i.e. near the tail root.

5-Distome characterized by the presence of ventral suckers anterior to hind end of body and well separated from the base of tail



Trematode

```
graph TD; Trematode --> Fasciolidae; Trematode --> Dicrocoeliidae; Trematode --> Schistomatidae;
```

Family
Fasciolidae
Paramphistomatidae

Family
Dicrocoeliidae,
Heterophidae,
Echinostomatidae

Family
Schistomatidae

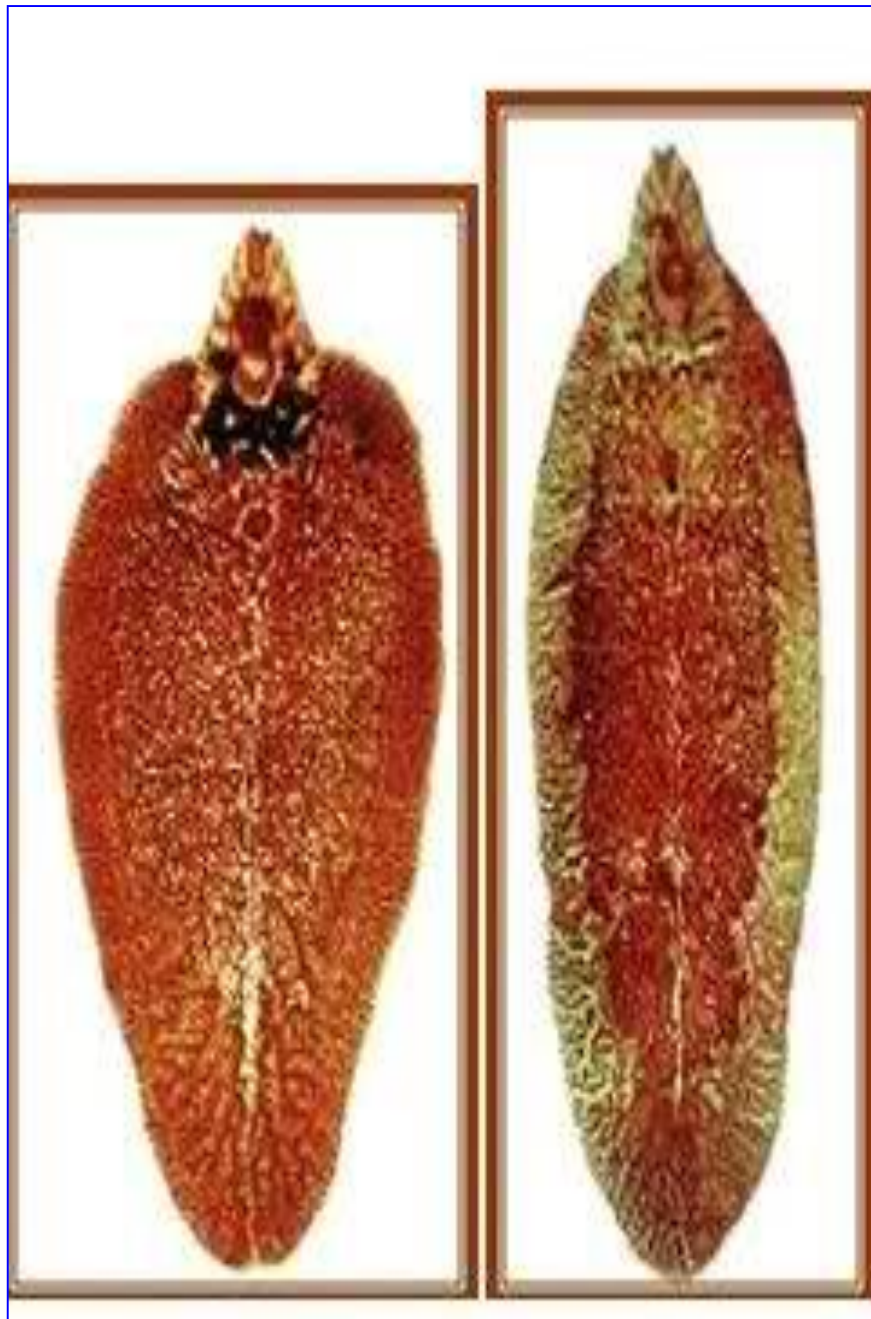
Class: Trematoda
Subclass: Digenea
1- Family: Fasciolidae
Genus: Fasciola
F. gigantica & F. hepatica

*** General characteristics:**

- Leaf-shaped with parallel side (*F. gigantica*) or V-shaped (*F. hepatica*).
- The cuticle is covered with scales.
- The oral and ventral suckers are close together or away from each other with the same size or vary.
- No genital sucker is present.
- The pharynx surrounds the oesophagus.
- The intestinal caeca are branched externally and internally.
- The intestinal caeca extend to the posterior part.
- The two testes are branched and tandem in position.
- The ovary is branched and located anterior to the testes.
- The common genital pore is median, anterior to the ventral sucker.
- The vitelline glands are follicular and occupy the whole lateral fields.
- Eggs: oval, thin shell, large size, golden yellow, operculated and ill developed embryo

***Habitat: Bile ducts.**

***Host: cattle, sheep, goats, equines, camel & man.**



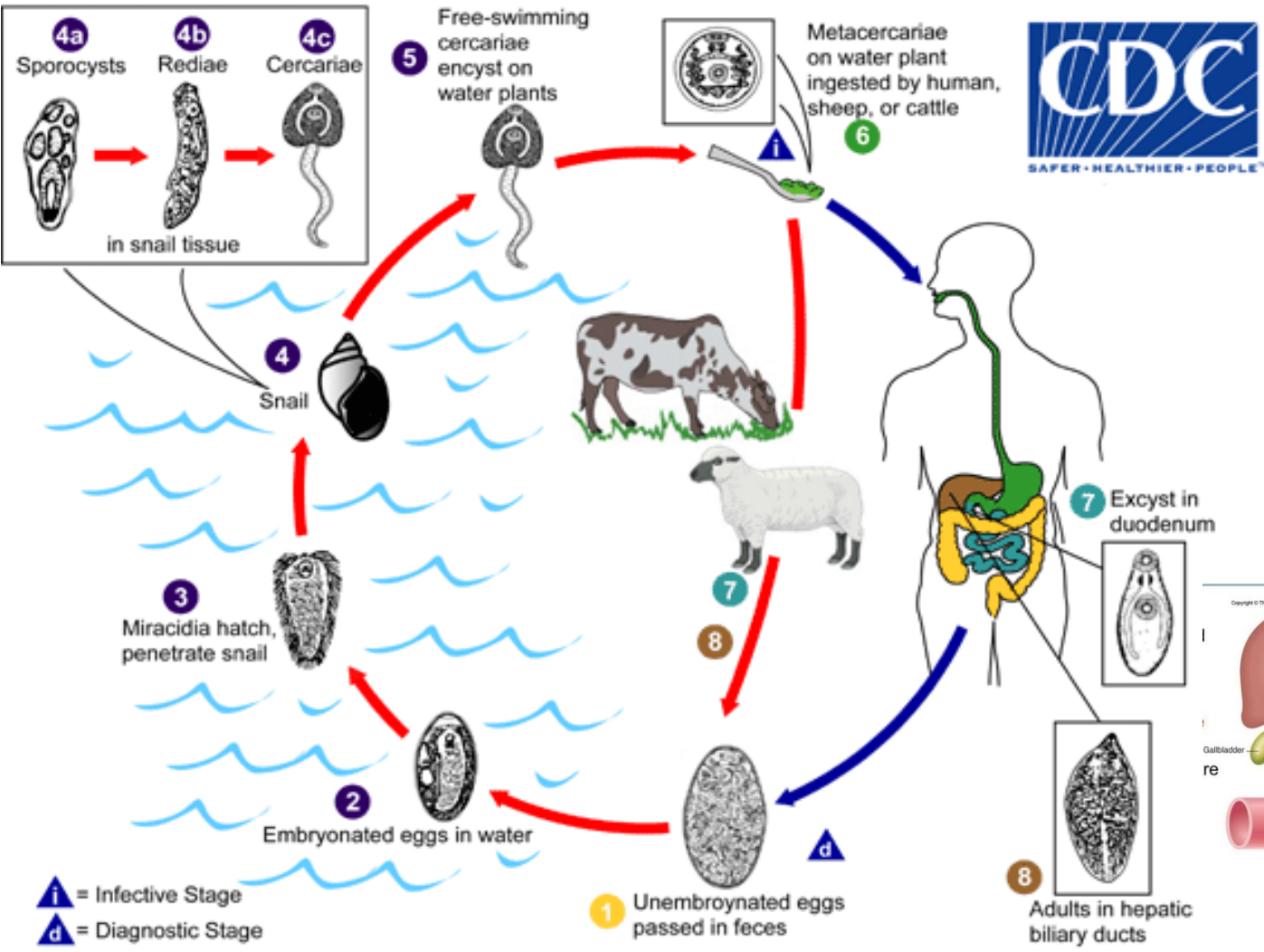
Fasciola.
spp

Life cycle of *Fasciola spp*

Gymnocephalus leptocercus cercaria

Snails
Fasciola gigantica :
Lymnaea cailliaudi
Lymnaea stagnalis

Fasciola hepatica:
Lymnaea



Infection occur through ingestion of encysted metacercaria with grass or green feeders

* Pathogenicity:

* In Animals:

- The pathological manifestation depends on the number of metacercariae ingested.
- Essentially the disease entity can be divided into acute and chronic forms.

(I) Acute Fascioliasis:-

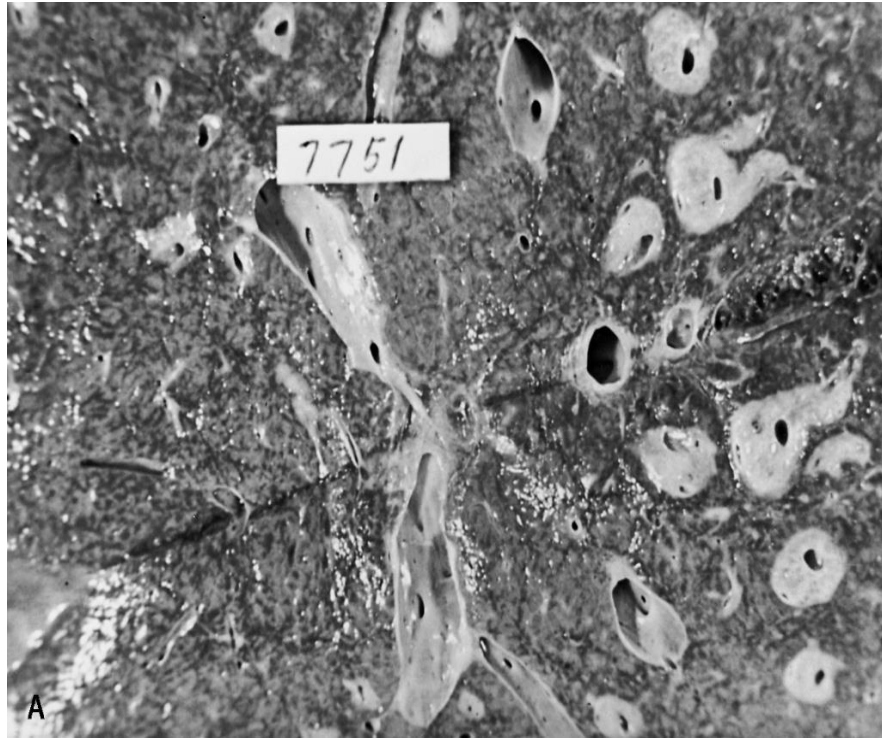
- The animal dies suddenly, blood-stained froth appears at the nostrils and blood is discharged from the anus.
- This is less common than the chronic entity and almost seen in sheep
- Enteritis.
- Diarrhea usually alternative.
- Traumatic hepatitis produced by the simultaneous migration of a large number of immature Trematodes and is seen mainly toward the end of summer (10.000 cysts must be given to produce the syndrome in sheep).
- Extensive destruction of liver parenchyma and marked haemorrhage occur.
- Rupture of the liver capsule may occur with haemorrhage in the peritoneal cavity.
- Animals are unable to move anorexia and show a distended abdomen which is painful to touch.
- Death may occur rapidly or within several days according to the age and state of nutrition of the animals.

*In P.M.

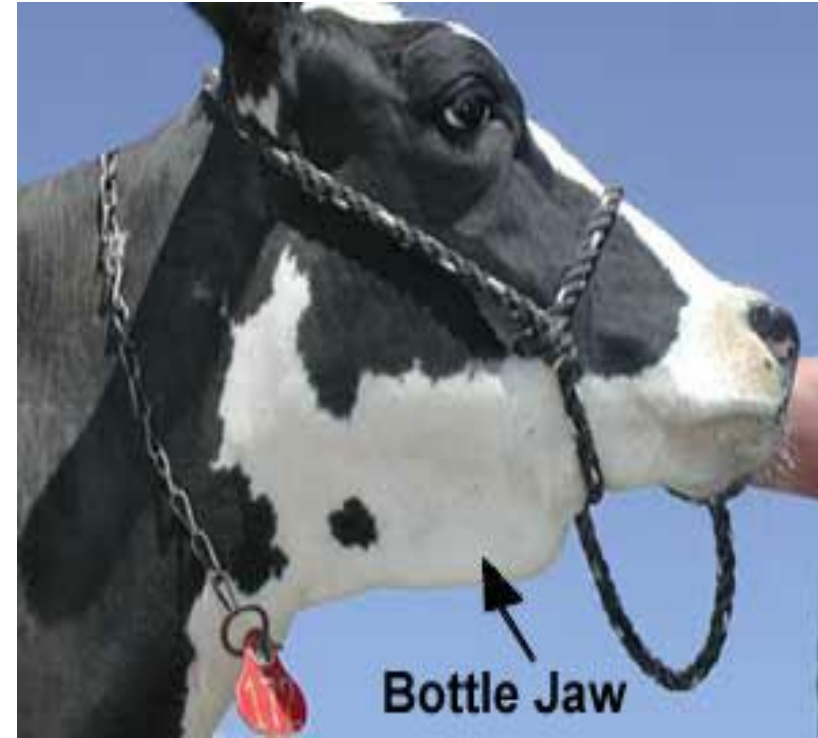
- The liver is enlarged pale and friable.
- It shows numerous hemorrhagic tracts.
- Immature parasite may be seen.
- The liver is covered with migratory tracts.
- Complication of the acute condition is “Black disease” caused by “Clostridium novyi”

(II) Chronic Fascioliasis:-

- It occurs 4- 5 months after ingestion of moderate number of metacercariae (200- 500).
- Anemia Laugh, Loss of appetite, the mucous membranes become pale and edema develop.
- **Edema is more conspicuous in some breeds than in others and it may appear especially in the intermandibular space, the name “Bottle- Jaw” being then given to it.**
- The skin becomes dry and doughy to the touch.
- The wool is dry.
- Emaciation and general depression increase.
- Diarrhea or constipation and slight fever.
- Chronic Fascioliasis affect on liver functions producing hypo-albuminaemia, hyperglobulinaemia and increase in GPT & GOT due to degenerative and necrotic changes in the liver. Increase also in the total bilirubin in the diseased animals.
- This is the most common form of infection in sheep, cattle and other animals as well as human.
- Progressive biliary cirrhosis, hard fibrotic liver.
- Bile ducts are prominent. Thickened, fibrous and calcified.
- **The walls of the bile ducts commonly calcified in cattle, they protrude markedly from the surface and are difficult to cut with a knife “Pipe-stem liver**
- In cattle the parasite are often found in other organs especially the lungs, in a hazel-nut sized cysts containing a brown purulent gelatinous material.



Pipe-stem liver



*** In Man:-**

- A trematode disease commonly infests the bile ducts and liver of man where they cause inflammatory and obstructive changes.
- Usually it is a mild infection.
- There are 3 clinical syndromes:

1-Acute: associated with migration of immature larvae (worms) through the liver, enlarged and tender liver, chills, high fever, esinophilia, jaundice.

2-Chronic latent: many are free of symptoms; others have hepatomegaly and some of acute syndrome.

3-Chronic obstructive: when the hepatic bile ducts are occluded.

*Diagnosis:

a) Acute Fascioliasis: Difficult to diagnose and is based on clinical signs, seasonal occurrence and serological tests. Sudden death usually occurs and diagnosis is post-mortem.

b) Subacute and chronic Fascioliasis: Diagnosed by several trials of faeces examination for characteristic eggs (Large-sized, oval, thin-shelled, operculated, greenish yellow and with one cell stage embryo).

- However, it is difficult to find the eggs because of irregular shedding.
- Immunodiagnosis can be done by estimating serum for specific Fasciola antibodies or by estimation of faeces for specific Fasciola



Halzoun

- It is a form of acute laryngopharyngitis which occurs in man in the Middle East.
- It is thought to result from consumption of raw liver of sheep or cattle that contain immature worms of *Fasciola* spp.
- The worms attach themselves by their strong ventral suckers to the mucosa of the larynx and pharynx, causing hoarseness of voice, dysphagia, dyspnoea and suffocation due to mechanical oedema.
- The same syndrome may occur after ingesting the nymphs of *Linguatula serrata*, commonly present in the liver of herbivorous animals.
- The syndrome is treated by antihistaminic ,alcholic drinking and in severe cases by tracheostomy.

Differences between *F. hepatica* and *F. gigantica

| <i>F. hepatica</i> | <i>F. gigantica</i> |
|--|---|
| 1. Length 2- 3 cm | 3- 8 cm |
| 2.Lateral sides converging (have a shoulder) | Parallel |
| 3. Suckers equal or ventral slightly bigger than oral. | Ventral sucker about twice the size of the oral |
| 4. Inner intestinal branches rudimentary | T or Y-shaped |
| 5. Smaller eggs (130- 150 μ) | Bigger (150- 180 μ) |
| 6. Intermediate host <i>Lymnaea truncatula</i> | <i>Lymnaea cailliaudi</i> and <i>L. Stagnails</i> |

****Treatment:**

- Triclabendazole is the drug of choice. It is effective against mature and immature worms. Other drugs can be used like:
 - **Bilevon injection (Niclofolan):**
 - - 3mg/kg b.w. S/C.
 - **Ranide (Nitroxynil):**
 - - 7.5 mg / kg b.w. orally.
 - **Flukanide (Rafoxonide):**
 - - 3 ml/75kg b.w.
 - **Dertil - B (Niclofolan):**
 - - One tablet 100 kg b.w.
 - **Dovenix**
 - - 1 ml (25% solution) 25 kg b.w S/C injection.
 - **Ivomec-F: (1 % Ivermectin & 10 % Clorsulon):**
 - - 1 ml / 50 kg b.w. S/C injection have no side effects.
 - **Fasinex 100 (5%):**
 - - 10 mg / kg b.w. orally.
 - - No side effects of the drug were noticed either in pregnant animals or on animals in any conditions (old, young, exhausted, debilitated & weak).
 - **Fasciolid:**
 - - 4 ml/ 100 kg b.w.
- *Mass treatment 3 times / year should be done for all animals' species "particularly ruminants".
- *Prophylaxis dose should be given for the animals.

Family Paramphistomatidae

Rumen Flukes

*General characters:

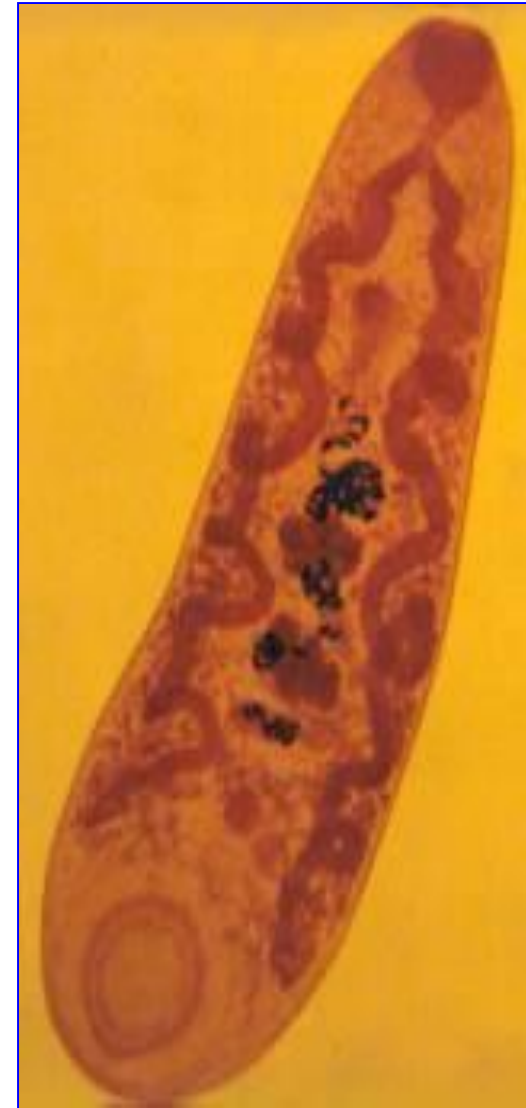
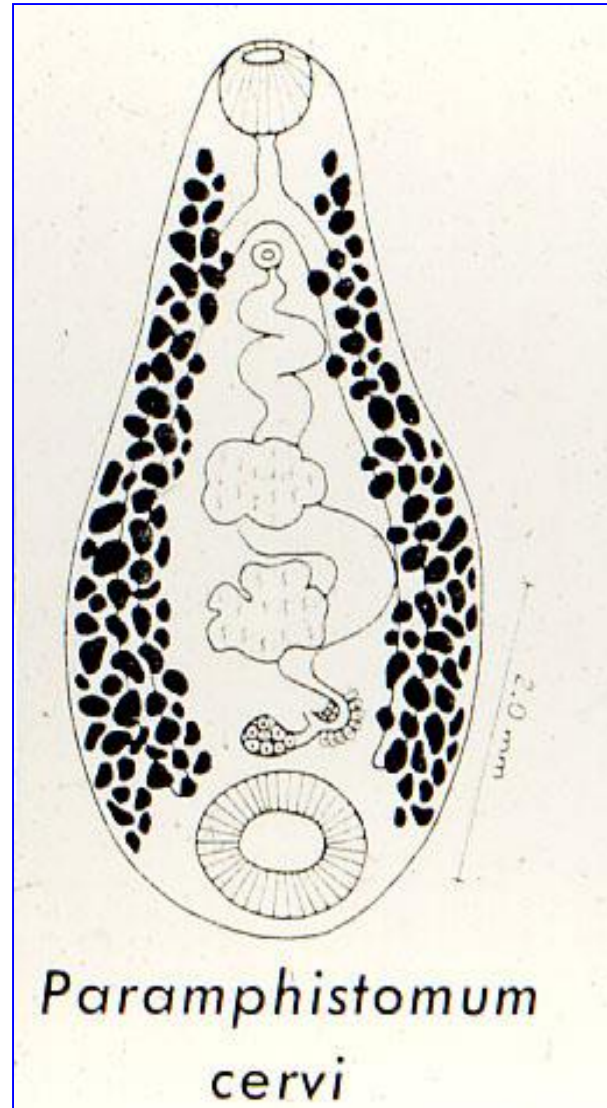
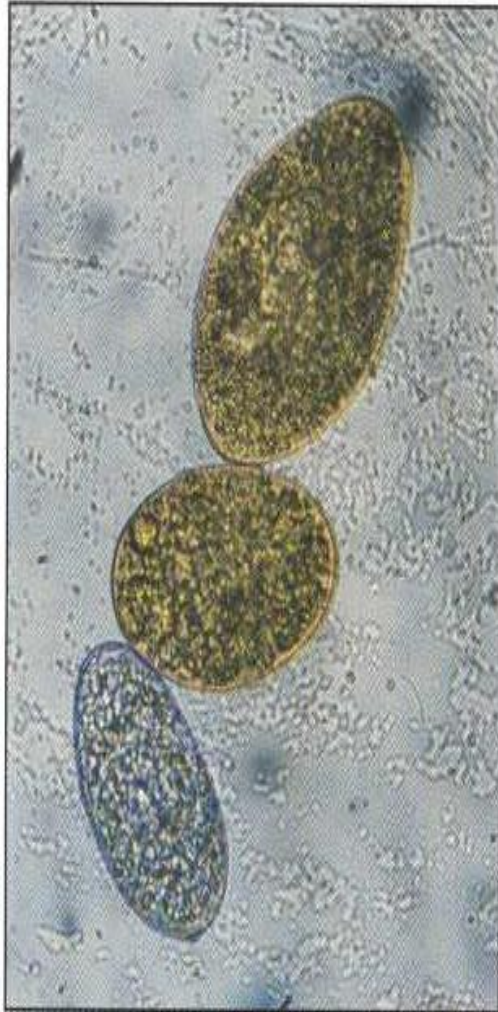
- Trematodes with thick fleshy body, conical in shape, circular in transverse section and some are discoidal in shape.
- The cuticle is smooth.
- They are pink in colour when fresh.
- The ventral sucker occur at the posterior part ventrally, hence it is called **posterior sucker**.
- The pharynx is absent.
- The oesophagus is present.
- The intestinal caeca are simple.
- The testes are lobed, tandem or obliquely tandem.
- **The ovary is lobed and present posterior to the testes.**
- The uterus runs forwards.
- The common genital pore is in the anterior third of the body.
- There is no cirrus.
- Vitelline glands are well developed and occupy the whole lateral fields.
- **The eggs are large, transparent, thin shelled, with distinct operculum, a short knob at the other pole and with ill-developed embryo.**

1-Paramphistomum cervi

P. microbothrium

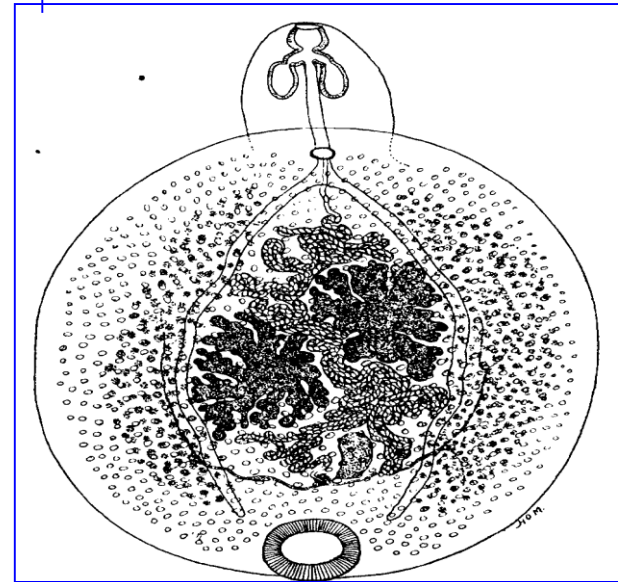
- Adult *P. cervi* is conical in shape, the anterior end tapering and the posterior being broad, and pink in colour.
- They are 5–13 mm long, 2–5 mm wide, with the ventral side somewhat concave while the dorsal side is convex.
- It has two suckers, an anterior oral sucker and a posterior larger ventral sucker, hence the generic name (Greek: *para* meaning "besides", *amphi* meaning "on both sides", and *stoma* for "mouth").
- The genital pore is situated at the anterior third of the body.
- As hermaphrodite, both male and female reproductive systems are present towards the posterior region of the body.
- Testes are slightly lobed and are located anterior to the ovary. Eggs are clear shell and measure about 140 x 80 μ; barrel-shaped with operculum at one end

Paramphistomum cervi adult

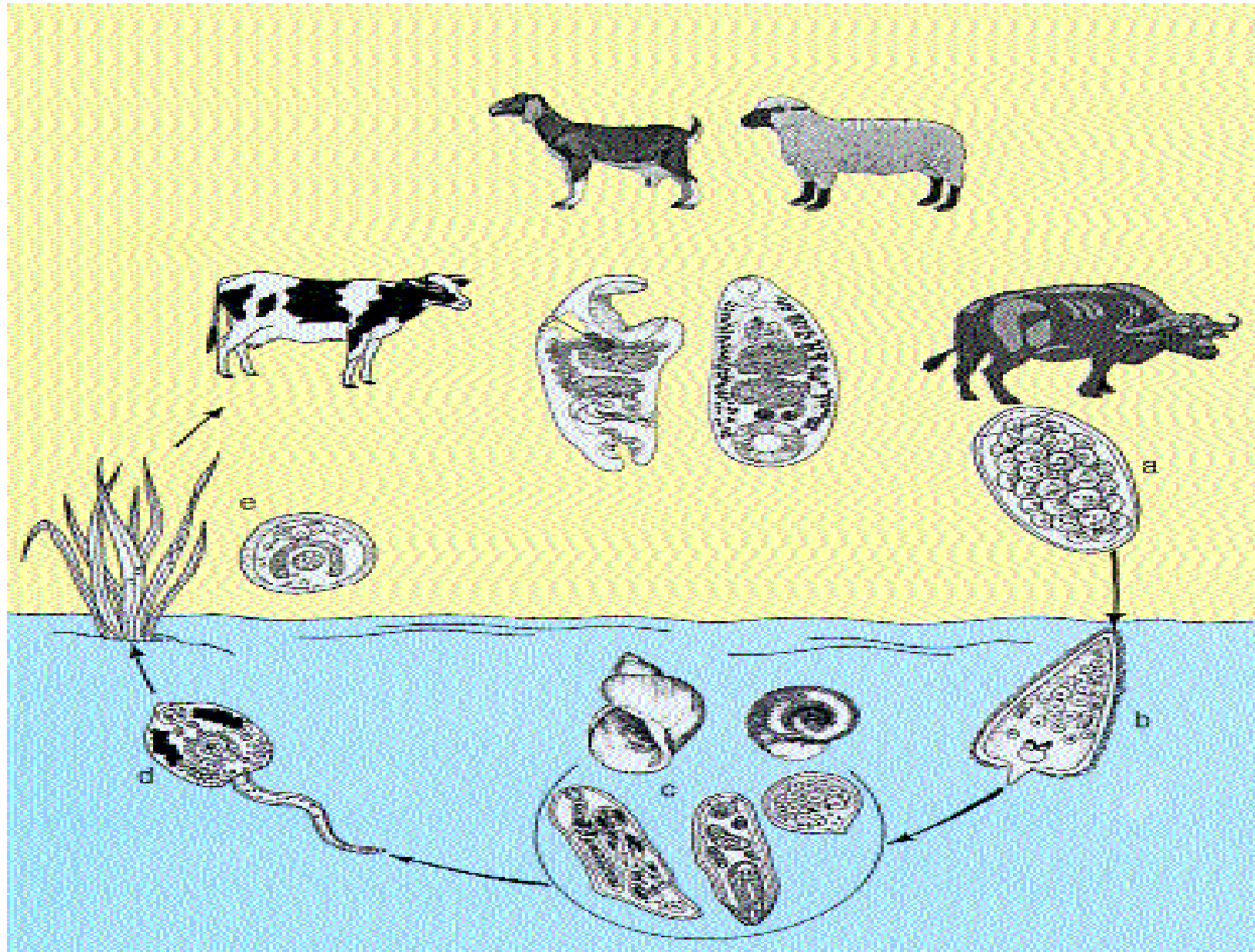


5- Gastrodiscoides hominis

- ***General characters:**
- - The worm is pear-shaped. It measures 5-10 x 4-6 mm.
- - They are reddish orange in colour when fresh.
- - The anterior part of the worm bears a small globular oral sucker and a prominent **genital sucker**, while the ventral sucker at its posterior border.
- - **The pharyngeal tube has two lateral pouches.**
- - The intestinal caeca extend to the middle of the discoidal region.
- - The testes are two in number, lobed and situated obliquely in the anterior part of the disc just posterior to the bifurcation of the caeca.
- - The ovary is rounded and lies posterior to the testes near the middle.
- - The eggs are rhomboidal. Operculated measuring 150-170 U x 60-70 U., greenish brown in colour.
- ***Habitat:**
- - **(small and large intestine)Caecum and colon of pigs and equine accidentally man at India. Malay & China.**



Paramphistomes life cycle



Pathogenicity of animal Paramphistomes:

- The adult forms in the fore stomach are essentially non pathogenic even though large number present.
- At the most there may be a localized loss of rumen papillae.
- The immature stages of the Paramphistomes in the duodenum and upper ileum are responsible for severe pathological changes.
- These are embedded in the mucosa and by drawing pieces of the mucosa into the sucker pinch them off causing necrosis and hemorrhage.
- In heavy infection a frank, haemorrhagic duodentis may be produced with immature flukes deeply embedded in the mucosa. sometimes reaching the muscular coat.
- Clinical signs consists of profuse fluid diarrhea, marked weakness and frequently death.

| The parasite | <i>P. cervi</i> | <i>C. cotylophrum</i> | <i>C.gregarius</i> | <i>G.aegyptiacus</i> |
|-------------------|--|---|---|--|
| Host | Ruminants | Ruminants | Ruminants | Equines and Pigs |
| Habitat | Rumen and reticulum | Rumen and reticulum | Rumen and reticulum | Small and large intestine |
| morphology | <ul style="list-style-type: none"> Oval, pyriform in shape, thick fleshy worms, intestinal caeca simple, reach to the post end, testes tandem position, ovary lies behind, measures 7-11mm and 3-5thickness | <ul style="list-style-type: none"> Resembel s <i>P. cervi</i>, but it has genital sucker surroundi ng the genital pore | <ul style="list-style-type: none"> Resembel s <i>P. cervi</i>, but it the two testes lies at the posterior part and opposite to each other, also the intestinal caeca ends short distance before the end | <ul style="list-style-type: none"> It is discoidal in shape, measures 12-17mm and 4mmwidth, has anterior cylindrical part and posterior discoidal portion, also ventral surface covered with large number of papillae The testes are lobe and diagonal The oral sucker has 2 posterio lateral pouches |
| Eggs | <ul style="list-style-type: none"> Oval, thin shelled, embryonic cells clear, transparent | same | same | |