



## 46

# TREMATODES

## 46.1 INTRODUCTION

Trematodes are also called Platyhelminths. They are flat leaf shaped helminthes. They are mostly hermaphrodites except for Schistosoma which have separate male and female species. They are commonly associated with aquatic fauna like snails, mollusks and fish.



## OBJECTIVES

After reading this lesson, you will be able to:

- classify blood trematodes
- describe morphology of trematodes
- describe morphology & life cycle of schistosoma, clonorchis, fasciola & Paragonimus
- describe the pathogenesis of schistosoma, clonorchis, fasciola & Paragonimus
- demonstrate identification of schistosoma, clonorchis, fasciola & Paragonimus

They are classified as under

### (a) Blood trematodes

Schistosoma	S hematobium
	S mansoni
	S japonicum



**Notes**

S intercalum

S mekongi

**(b) Hepatic trematodes**

Fasciola F hepatica

F gigantic

Clonorchis C sinensis

Opisthorchis

**(c) Intestinal trematodes**

Fasciola F buski

Metagonimus yokogawi

**(d) Lung trematodes**

Paragonimus P westermani

**2. General Morphological features of Trematodes**

- (a) Have conspicuous suckers, hence termed “Flukes”
- (b) No body cavity
- (c) Oviparous-release only eggs
- (d) Eggs of all Flukes except Schistosoma are oprculated
- (e) Most commonly found in tissue sections
- (f) Sexes are separate and eggs non-operculated
- (g) Male-female paired together
- (h) Eggs differentiated on basis of spine-
  - i. S haematobium-terminal spine
  - ii. S japonicum –no spine
  - iii. S. mansoni-lateral spine
- (i) Cercarial dermatitis, tissue reaction-thrombosis on death
- (j) Expulsion of eggs-eosinophilic granuloma,fibrosis,TCC
- (k) Splendore-hoepli bodies,

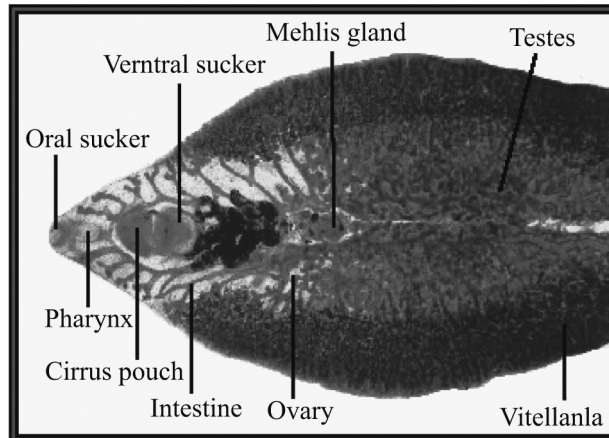


Fig. 46.1



Notes

## 46.2 SCHISTOSOMIASIS

### 1. Introduction

The Schistosoma derive their name from the fact that the males body is split and forms a gynaecophoric canal in which the female worm rests. Schisto (Split) soma (body). The adult worm of schistosoma live in the venous plexus of the definitive host. They inhabit the venous plexus of the urinary bladder (*S. haematobium*), intestines (*S. japonicum* and *S. mansoni*).

### 2. Morphology

#### a) *Schistosoma japonicum* egg

- i. 70-100 x 50-65 microns.
- ii. Oval to rounded, nonoperculate egg.
- iii. Contain developed miracidium.
- iv. Note: Lateral knob.

*S. mansoni*

egg

Fig. 46.2



## Notes

**(b) *S. mansoni* adults**

- i. Adult male 0.6-1.4 × 0.11 cm. in size.
- ii. Grossly tuberculate integument.
- iii. Note: Ventral gynecophoral canal.
- iv. Intestinal ceca unite early, united intestinal long.
- v. 7(3-13) small testes situated dorsal and posterior to the ventral sucker.
- vi. Adult female 1.2-1.6 × 0.016 cm. in size often lie in the gynecophoral canal.
- vii. Smooth integument.
- viii. Slender, pointed end.
- ix. Ovary opposite in anterior half of body.
- x. Short uterus fill with 1-4 ova.



Fig. 46.3

**(c) *S. haematobium* Adult**

- i. Adult female measure 2.0-2.5 × 0.025 cm.
- ii. Cylindrical shape with pointed ends
- iii. Smooth integument.
- iv. The oral and ventral suckers near the anterior end are of equal size.
- v. Elongate ovary situated in posterior half of body.
- vi. Long, voluminous uterus contains 20-30 ova

**(d) *S haematobium* egg**

- i. 112-170 × 40-70 microns.
- ii. Large, spindle shaped with rounded anterior and conical posterior end.
- iii. Yellowish-brown, nonoperculate egg.
- iv. Contains developed miracidium.
- v. Note: Terminal spine.



Fig. 46.4

**(e) *Schistosoma cercaria***

- i. Elongated, pear-shaped body with round ends
- ii. Long tail with a terminal furca.
- iii. Tactile hair are distributed over the body and tail.

**INTEXT QUESTIONS 46.1**

1. Trematodes are also called as .....
2. Trematodes have suckers and hence termed as .....
3. *S. japonicum* has no .....
4. *Schistosoma* means .....



Notes



Notes

### 46.3 LIFE CYCLE OF SCHISTOMA SPECIES

Schistosoma pass their life in two hosts. Man is the definitive host. The mollusks or the snails are the intermediate host. Ova from the sexually mature worms are passed in the intestinal tract or the urinary bladder. The ova are passed in the urine or the stools into fresh water bodies. The miracidium hatch from the ova immediately or after a short period of incubation. The miracidium infects the first intermediate host the snail. Within the snail or mollusks the miracidium transforms into sporocysts. The sporocysts develop into second generation sporocysts (in schistosomes). Miracidium develops into tailed larvae called cercaria. The cercaria mature and leave the snail and become free living in water. In case of schistosoma the cercaria have a forked tail. They infect the man by penetrating the skin of humans who are in water. The immature worm enters the blood stream and eventually reach the veins near the intestines and urinary bladder. The worm reaches sexual maturity in these venous plexus of the intestines and urinary bladder.

### 46.4 PATHOLOGY

#### (a) Penetration of skin by metacercaria

Skin penetration may not be apparent. Human and some non human species of Schistosoma cause cercarial dermatitis (swimmers itch). This manifests with papules, macules, vesicles and intense itching.

#### b) Migration and maturation of immature worms

There are general toxic and allergic symptoms including urticaria with eosinophilia, fever, abdominal pain and tender hepatosplenomegaly. This is known as Katayama or snail fever.

#### c) Damage by eggs in tissue

Resulting damage depends on the severity of the parasite load. An inflammatory granuloma forms with epithelial, giant plasma and eosinophil cells and fibroblasts (Hoepli reaction). There is subsequent fibrosis and calcification. Such damage may be local and/ or ectopic.

#### d) Urinary schistosomiasis

It is caused by Schistosoma haematobium. The initial toxic and allergic symptoms are not marked. The urinary bladder and the ureter are typically involved with hyperemia and terminal hematuria, dysuria and increased frequency of micturation, papules, papillomata and ulceration. Hypertrophy of

the bladder can later lead to contraction. There may be cystitis and calculus formation. This may be followed by calcification and squamous cell carcinoma. Fistula may develop. There can also be hydroureter and hydronephrosis. Ectopic lesions are less severe than in other species of *Schistosoma*. Genital Schistosomiasis may lead to lumpy semen, haemospermia or wart like lesions on the vulva.

**Notes****e) Intestinal schistosomiasis**

It is caused by *Schistosoma mansoni*. There are marked initial toxic and allergic symptoms. The large intestine and the rectum are typically involved with polyposis, papules, abscesses, ulcers, papillomata, fistulae and ova in stools. The bladder is sometimes involved with pathology similar to urinary *Schistosoma* as above. There can be ectopic lesions. The liver is frequently involved (receiving the eggs via the portal vein) with inflammatory reaction and fibrosis leading to periportal (pipe-stem) fibrosis with portal hypertension. This may manifest with oesophageal varices, splenomegaly and ascitis. There can also be lesions in the brain, spinal cord and lungs.

**f) Oriental schistosomiasis**

This is caused by *Schistosoma japonicum*. There are marked initial toxic and allergic symptoms which can lead to myocarditis and death. Intestinal lesion are similar to those with *S mansoni* infection and the small intestine is involved. The liver is involved as in *S mansoni* infection and hepatic lesions are similar and may lead to portal hypertension. The brain may also be become involved.

**5. Laboratory Diagnosis:**

Eosinophili may be present. Ova found in terminal urine by Nucleopore filtration or after centrifugation. Ova may also be found in semen. Ova may also be found in faeces directly or using formol- ether concentration, rectal scrapings or biopsies.

Serology. ELISA tests (using soluble egg antigen) are useful 6-12 weeks post exposure. In many chronic cases, the diagnosis will be made on serology alone.

**INTEXT QUESTIONS 46.2**

1. .... is the definite host of schistosoma
2. Miracidium develops into tailed larvae called .....



Notes

3. Schistosoma causes ..... itch
4. Urinary schistosomiasis is caused by .....
5. Intestinal schistosomiasis is caused by .....
6. Oriental schistosomiasis is caused by .....

**46.5 CLONORCHIS SINENSIS**

**1. Introduction**

These are leaf shaped and flat helminthes. They are hermaphrodites. Twenty eight million people are infected worldwide.

**2. Morphology**

- a) 12-20 x 3-5 mm. in size.
- b) Flat, elongated, aspinous, flabby, tapering anteriorly and somewhat rounded posteriorly.
- c) Note: Lancet appearance.
- d) Small, slightly lobate ovary anterior to the branched testes.

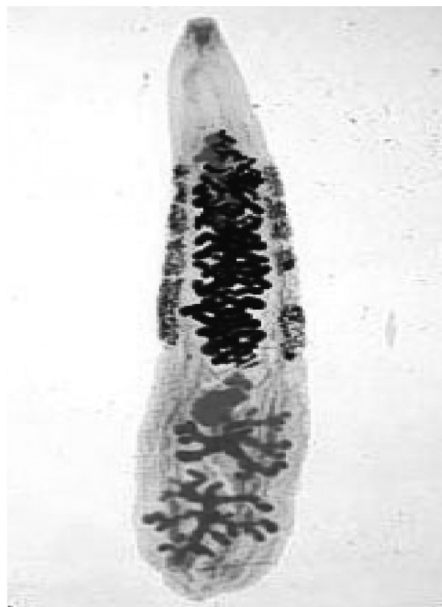


Fig. 46.5



### 3. Life Cycle of Clonorchis species:

Ova from the sexually mature worms are passed in the intestinal tract. The ova are passed in the stools into fresh water bodies. The ova are ingested by the snails and the miracidium hatch from the ova in the first intermediate host the snail. Miracidium develops into cercaria. The cercaria leave the snail. Free swimming cercaria encyst in the fish which is the second intermediate host. Cercaria develop into metacercaria and reach the muscles of the fish. The fish may be eaten by the dogs and cats which serve as the animal reservoir of the disease. Humans get infected by consuming under cooked fish. Encysted metacercaria release the immature worm in the duodenum. The immature worm penetrates the intestinal mucosa and reaches the portal circulation through which it reaches the liver. In the liver the worm lodges in the intrahepatic bile ducts where it reaches sexual maturity.

### 4. Pathology and Clinical features

Adult flukes inhabit the distal bile duct with epithelial proliferation, surrounding inflammatory reaction and ascending cholangitis. Sometimes there is secondary bacterial infection with jaundice and septicemia. There can also be eosinophilia. All this can lead to thick, dilated fibrous ducts with adenomata of epithelium, bile duct stenosis and cholangiocarcinoma. Many cases are asymptomatic. Acute infection may lead to tender hepatomegaly. Chronic infection can result in anorexia, low-grade fever, epigastric pain and tender hepatomegaly.

### 5. Laboratory Diagnosis:

The ova are found in the feces and in the bile duct (via duodenal aspiration or 'string test')

## FASCIOLIASIS

### 1. Introduction

The fluke is found in all sheep-rearing countries. About one million people are infected worldwide. **F.gigantica reside in bile ducts. Larvae might get "lost"**

- Adults are large with cephalic cone, shoulders, cuticular spines
- Only Eggs are seen in stools
- Liver shows coagulative necrosis, abscess, patchy haemorrhage
- Granulomas can form
- Cholelithiasis and cholecystitis are the usual complication in the liver.



Notes



**Notes**

**2. Fasciolepsi buskii**

- a) Adult measure 20-75 x 8-20 mm and is about 2 mm. thick.
- b) They are thick, fleshy, ovate worm.
- c) Two highly branched testes are situated one behind the other in the middle of the posterior half of the body.
- d) Branched ovary is anterior to the testes.
- e) Unbranched ceca is present.



**Fig. 46.6**

**3. Fasciolepsi buskii Egg**

- a) Eggs are 130-140 x 80-85 microns in size
- b) They are Yellowish-brown, ellipsoidal egg.
- c) Thick-shell with a small operculum at one end.
- d) They contain an undeveloped ovum.

**4. Life Cycle of flukes species**

Schistosoma pass their life in two hosts. Man is the definitive host. The mollusks or the snails are the intermediate host. Ova from the sexually mature worms are passed in the intestinal tract or the urinary bladder. The ova are passed in the urine or the stools into fresh water bodies. The miracidium hatch from the ova immediately or after a short period of incubation. The miracidium infects the

first intermediate host the snail. Within the snail or mollusks the miracidium transforms into sporocysts. The sporocysts develop into second generation sporocysts (in schistosomes). Miracidium develops into tailed larvae called cercaria or into rediae (in hermaphrodites like the flukes). In hermaphrodite trematodes the cercaria have unsplit tails and they encyst on vegetables or within a second intermediate host (fish or crab) to form meta cercaria which are the infective form. Humans become infected by ingestion of raw or undercooked vegetables, fish or crabs. The encysted metacercaria excysts in the intestines and migrates to organs and tissue where they mature into worms.

**Notes**

### 5. Fluke (Fasciola) infection:

#### Pathology and Clinical features

Transit of immature worms through the liver can cause mechanical and toxic irritation with toxæmia, necrosis and secondary fibrosis. Development in the bile ducts causes cystic enlargement, endothelial hyperplasia and adenomata and secondary inflammatory infiltration causing fibrosis and cholangitis. There can be secondary bacterial infection causing abscesses. Eosinophilia is marked. Worms can appear ectopically in the lungs, brain, eyes etc. with similar reactions. If raw sheep or goats liver infected by the adult fluke, is eaten there can be local irritation and pharyngeal infection (Halzoun).

Acute infection may present with fever, tender hepatomegaly, epigastric pain, anorexia and vomiting. Jaundice may occur. In chronic infection, there may be no symptoms or epigastric / right upper quadrant pain, hepatomegaly and vomiting

### 6. Laboratory Diagnosis:

The ova are found in the faeces. Serological test (IFAT) is available.

## 46.7 PARAGONIMUS WESTERMANII

### 1. Introduction

They are also called lung flukes. It is endemic in parts of East and South East Asia and Africa.

### 2. Morphology

#### a) Adult

- i. The Paragonimus are plump and coffee bean like.



## Notes

- ii. 7.5-12 x 4-6 mm. in size.
- iii. Note: Coffee bean appearance.
- iv. Spinous cuticle.
- v. Finger-like lobed ovary.
- vi. Irregularly lobed testes oblique to each other, in posterior third of worm.

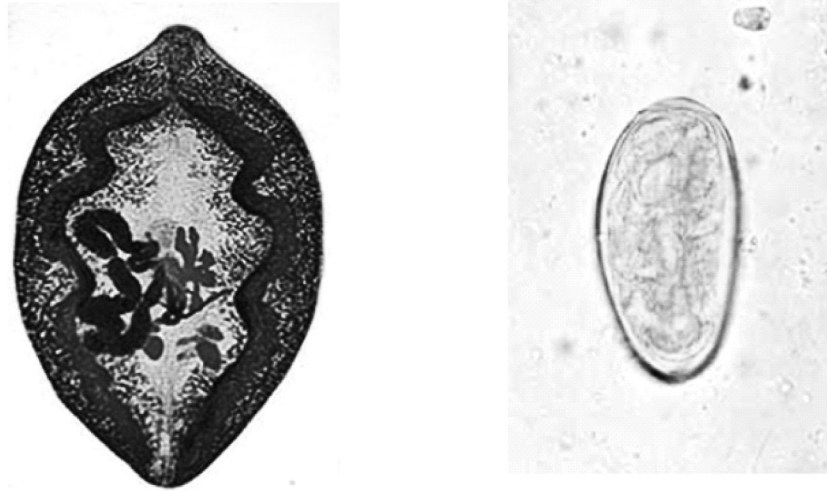


Fig. 46.7

**b) *P westermanii* egg**

- i. They measure 80-118 x 48-60 micrometre.
- ii. They are broadly ovoidal, yellowish brown, thick-shelled egg.
- iii. Thickened operculum.
- iv. Unembryonated at oviposition.

**3. Pathology and Clinical features**

Paragonimus westermanii infection:

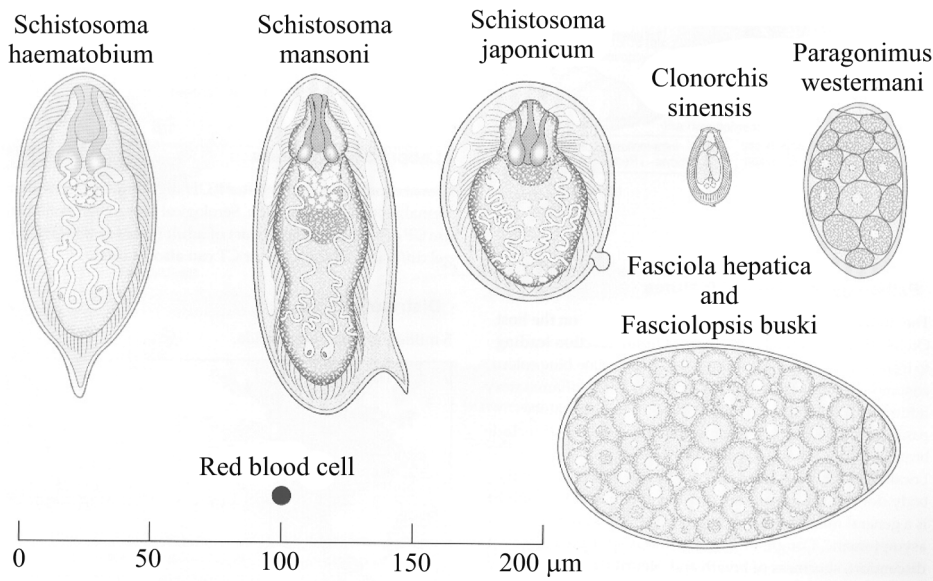
The initial invasion has little pathological effect on the host. On localization in the lungs, there is tissue reaction leading to formation of a fibrous tissue capsule (of slate blue colour) containing worms (generally in pairs, ova and inflammatory infiltrate). The capsule is connected with the respiratory passages. Secondary complication of these lung cysts include bronchiectasis, abscess formation and hemoptysis. Localization in the other sites can cause cysts in any other part of the body (for example the brain, causing epilepsy). Eosinophilia is a general manifestation. Chronic infection may be asymptomatic. Cough, brown gelatinous sputum, chest discomfort, shortness of breath and pleuritic chest pain may occur.

4. Laboratory diagnosis

Ova are found in the sputum after KOH digestion. Ova may also be seen in the faeces after formol – ether concentration. Serological tests consist of ELISA (Using extract of adult fluke as antigen). Complement fixation tests and gel diffusion tests are also available. Imaging studies like X ray chest and CT scan also help in establishing the diagnosis.



Notes



Fig, 46.8: Various ova of Schistosoma and Fasciola



INTEXT QUESTIONS 46.3

1. .... is the intermediate host of flukes
2. Human become infected with flukes by ingesting ..... & .....
3. Paragonimus westermanii has ..... appearance
4. ...., ....., ....., ..... tests are used in identification of ova



WHAT HAVE YOU LEARNT

- Trematodes are also called Platyhelminths. They are flat leaf shaped helminthes

## MODULE

Microbiology



Notes

## Trematodes

- Blood trematodes are Schistosoma, Hepatic trematodes are fasciola, clonorchis & Opisthorchis, Intestinal trematodes are Fasciola, Lung trematodes are Paragonimus
- Schistosoma pass their life in two hosts and Man is the definitive host.
- Schistosoma cause swimmers itch and snail fever



## TERMINAL QUESTIONS

- 1 Classify and enumerate the various species of Trematodes.
- 2 Discuss the life cycle and pathogenicity of Schistosoma haematobium.
- 3 Discuss the morphological difference between the various ova of Schistosoma species.



## ANSWERS TO INTEXT QUESTIONS

### 46.1

1. Platyhelminths
2. Flukes
3. Spine
4. Split body

### 46.2

1. Man
2. Cercaria
3. Swimmers
4. Schistosoma haematobium
5. Schistosoma mansoni
6. Schistosoma japonicum

### 46.3

1. Snails
2. Raw & cooked vegetables and fish /crabs
3. Coffee bean
4. KoH, ELISA, Complement Fixation, Gel diffusion