

Morphology

-Adult are diecious (male and female worms are separate organisms), and the sexes have different morphologies.

-The adult worms are bilaterally symmetrical and have both a digestive system and oral and ventral suckers for attachment and stabilization.

-Male worms are .6-2.2 centimeters in length and rather thick, they possess a structure known as a gynecophoral canal running the length of the body in which the 1.2-2.6 centimeter-long female remains during much of the life cycle .

-The thinner female separates from her mate to migrate to the venules bordering the intestine or bladder in order to deposit eggs .

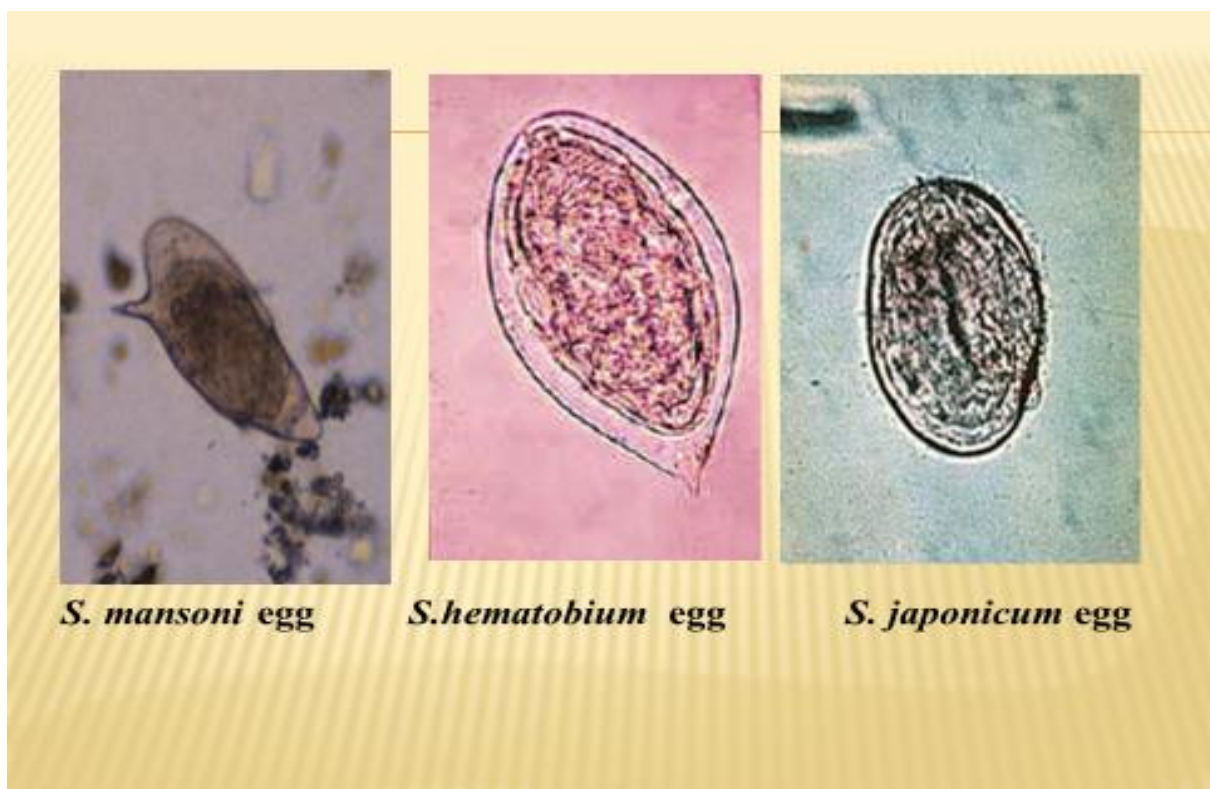
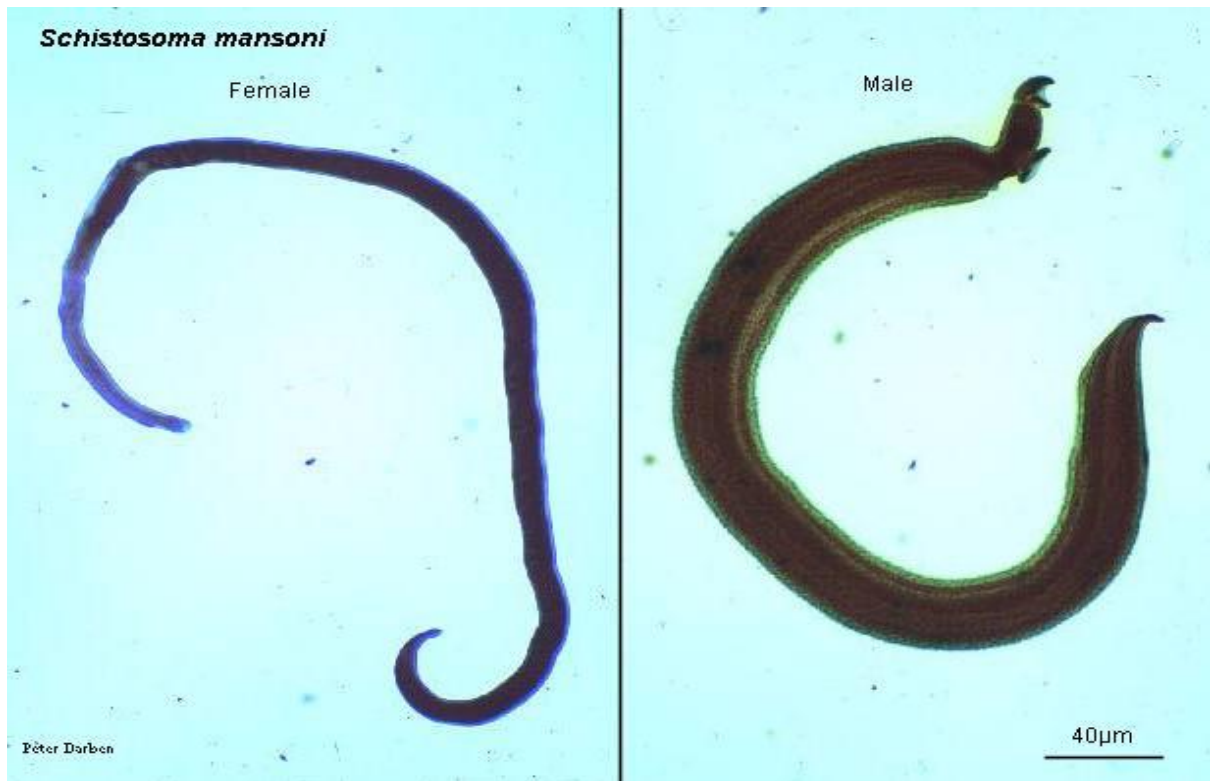
-These eggs are responsible for the clinical manifestations of schistosomiasis, and the eggs of each species are easily-distinguishable, have spine .

S. haematobium produces rather ovoid eggs with a straight terminal spine.

S. intercalatum eggs are ovoid as well, and have a curved terminal spine.

S. japonicum eggs are more circular, and have no spine.

-Development stage :Egg,



Blood Flukes (Schistosomiasis ; Bilharzia)

Species of *Schistosoma* that can infect humans:

1-*Schistosoma mansoni* and *S. intercalatum* cause intestinal schistosomiasis.

2-*Schistosoma haematobium* causes urinary schistosomiasis

3-*Schistosoma japonicum* and *S. mekongi* cause Asian intestinal schistosomiasis

Species of *Schistosoma* that can infect animals:

1-*S. bovis* infects cattle, sheep and goats in Africa, parts of Southern Europe and the Middle East .

2-*S. mattheei* infects cattle, sheep and goats in Central and Southern Africa.

3-*S. curassoni* infects domestic ruminants in West Africa

4-*S. rodhaini* infects rodents and carnivores in parts of Central Africa.

Intermediate Host

Intermediate Hosts: Three genera of freshwater snails host miracidia of the important human schistosomes.

Bulinus (*S. haematobium*)

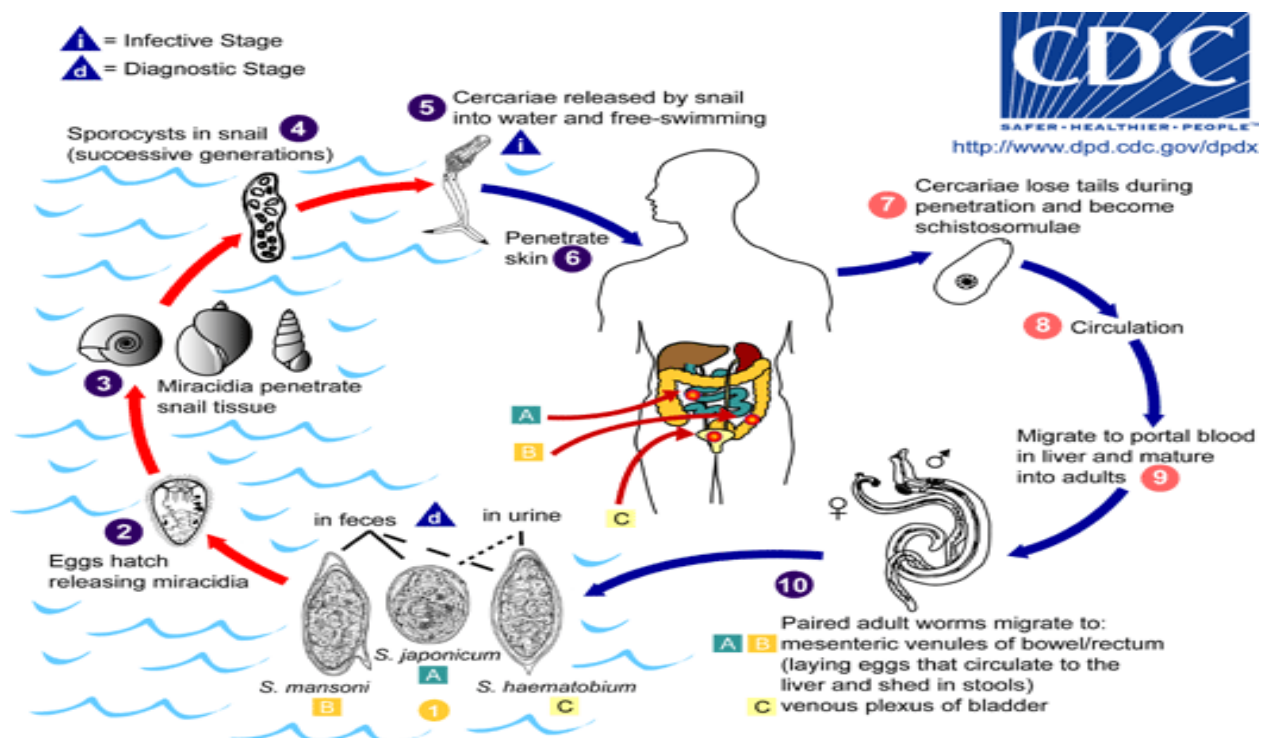
Biomphalaria (*S. mansoni*)

Oncomelania (*S. japonicum*)

Life cycle

- Parasite eggs are released into the environment from infected individuals, hatching after contact with fresh water to release the free-swimming miracidia.
- Miracidia infect fresh water snail by penetrating the snail's foot.
- After infection, the miracidium transforms into a primary (mother) sporocyst,
- Germ cells within the primary sporocyst will then begin dividing to produce secondary (daughter) sporocysts, which migrate to the snail's hepatopancreas.
- At the hepatopancreas, germ cells within the secondary sporocyst begin to divide again, this time producing thousands of cercariae, which are the larvae capable of infecting mammals.
- The cercaria penetrates the skin and transforms into a migrating schistosomulum stage.
- The newly transformed schistosomulum may remain in the skin for 2 days before locating a post-capillary venule ; from here the schistosomulum travels to the lungs where it undergoes further developmental changes necessary for subsequent migration to the liver.
- 8 to 10 days after penetration of the skin, the parasite migrates to the liver sinusoids.
- S. japonicum* migrates more quickly than *S. mansoni*, and usually reaches the liver within 8 days of penetration.

- Juvenile *S. mansoni* and *S. japonicum* worms develop an oral sucker after arriving at the liver, and begins to feed on red blood cells.
- The mature worms pair, with the longer female worm residing in the gynaecophoric channel of the shorter male.
- Adult worms are about 10 mm long.
- Worm pairs of *S. mansoni* and *S. japonicum* located the mesenteric or rectal veins.
- S. haematobium*..... schistosomula migrate to the perivesical venous plexus of the bladder, ureters, and kidneys .
- Parasites reach maturity in 6-8 weeks, at which time they begin to produce eggs.
- Worm pairs can live in the body for an average of 4.5 years, but may persist up to 20 years.



Epidemiology

More than 200 million humans are infected; It is widely distributed throughout Africa, South America and some parts of Asia .

Transmission

occurs in fresh water, where the cercaria (larval stage of *Schistosoma*) come in contact with and penetrates skin.

Clinical signs

Schistosomiasis is a chronic disease

-Many infections are subclinical, with mild anemia and malnutrition being common in endemic areas.

Acute schistosomiasis

- M-y occur weeks after the initial infection, especially by *S. mansoni* and *S. japonicum*. Manifestations include:

-Abdominal pain , cough, fever , fatigue and hepatosplenomegaly {enlargement of both the liver and the spleen}.

- Eosinophilia —high number of eosinophils .

-Some individuals get symptoms related to other stages.

-Skin invasion by cercaria -----dermatitis.

-Early systemic circulation of schistosomules -- fever, lymphadenopathy.

-Most important pathology is as a result of the host reaction to the eggs.

-Eggs trapped in tissues or embolizing to liver hepatic fibrosis, portal hypertension, bladder mucosa dysplasia and cancer.

- Colonic polyps, fibrosis .

-Continuing infection may cause granulomatous reactions and fibrosis in the affected organs, which may result in manifestations include:

-Colonic polyposis with bloody diarrhea (*Schistosoma mansoni* mostly);

-Portal hyperplasia with splenomegaly (*S. mansoni*, *S. japonicum*).

-Cystitis (*S. haematobium*) with hematuria, which can progress to bladder cancer.

-Pulmonary hypertension (*S. mansoni*, *S. japonicum*, more rarely *S. haematobium*).

-Glomerulonephritis , Bladder cancer.

Central nervous system lesions.

Occasionally central nervous system lesions occur cerebral granulomatous disease may be caused by ectopic *S. japonicum* eggs in the brain, Granulomatous lesions around ectopic eggs in the spinal cord from *S. mansoni* and *S. haematobium* infections may result in a transverse myelitis with flaccid paraplegia.

Diagnosis

1- Microscopic identification of eggs in stool or urine is the most practical method for diagnosis { detection will be enhanced by centrifugation and examination of the sediment} .{The eggs of *S. haematobium* are ellipsoidal with a terminal spine , *S. mansoni* eggs are also ellipsoidal but with a lateral spine, *S. japonicum* eggs are spheroidal with a small knob. }

2- Investigation of *S. haematobium* should also include a pelvic x-ray (bladder wall calcification is highly characteristic of chronic infection).

3- Serological testsELISA ---etc.

4- Tissue biopsy (rectal biopsy or bladder biopsy).

5- Molecular (polymer chain reaction).

Prevention

1- Education of people in endemic areas, Proper disposal of urine and feces.

2- Eliminating the water-dwelling snails (Acrolein , copper sulfate) can be used for this purpose.

3- Control of snails and sewage treatment and disposal .

4- There is an extensive research into developing a *Schistosoma vaccine* that will prevent the parasite from completing its life cycle.

Treatment

-Schistosomiasis is treated by using Praziquantel .

-A drug available exclusively for treating *Schistosoma mansoni* (Oxamniquine) and for *S. haematobium* (Metrifonate) .