



## Lung fluke

At least eight different species of lung flukes, all belonging to the genus *Paragonimus*, are known to infect humans.

### *Paragonimus westermani*

*Paragonimus westermani*: is a lung fluke and is most prominent in Asia and South America (**the oriental lung fluke**), It is a food-borne parasitic infection. Reservoir hosts of *Paragonimus* spp. include numerous species of carnivores including felids, canids, some rodents and pigs. Humans become infected after eating raw fresh water **crabs** or **crawfish** that have been encysted with the **metacercaria**.

❖ Southeast Asia is more predominately more infected because of lifestyles. Raw seafood is popular in these countries.

#### • Morphology

- Adult worms are typically **reddish brown** and ovoid, measuring 7 to 16 mm by 4 to 8 mm.
- The skin of the worm (tegument) is heavily covered with scale like spines.
- The **oral** and **ventral** suckers are similar in size, with the later placed slightly pre-equatorially.
- **Eggs**: range from 80 to 120 mm long by 45 to 70 mm wide. They are **yellow-brown**, ovoid or elongate, with a thick shell, and often asymmetrical with one end slightly flattened. At the large end, the operculum is clearly visible. The opposite end is thickened. The eggs are unembryonated when passed in sputum or feces.
- **Cercaria**: is often indistinguishable between species. There is a large posterior sucker, and the exterior is spined.
- **Metacercaria**: are usually encysted in tissue. The exterior is spined and has two suckers.

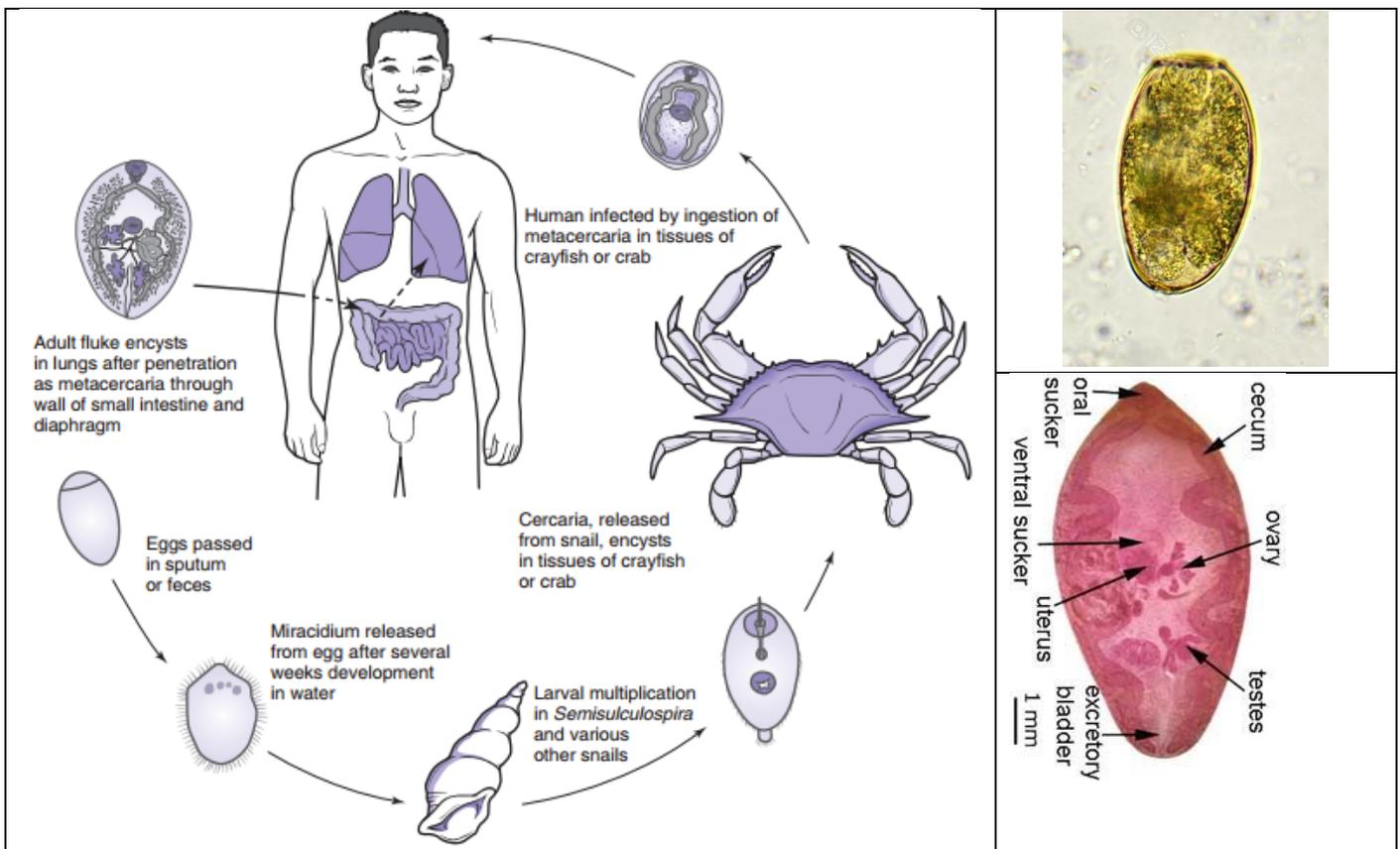
## Infection & Incubation

**Metacercariae** excyst in the small intestine, penetrate through its wall into the peritoneal cavity, and normally make their way to the diaphragm الحجاب الحاجز , through the esophageal hiatus ثغرة, and pleura غشاء الجنب into the lungs.

A **cystlike capsule** surrounds the developing parasite, which grows to maturity in a period of **6 weeks**.

Rupture of the cyst capsule into a bronchiole leads to a discharge of eggs but not of the parasite, which continues to produce eggs for a long time. Chronic infections may persist for many years after the patient leaves an endemic area.

- ❖ **Humans may not be as suitable a host as the normal one for many of these parasites**, and as is often the case under such circumstances, the worm may behave in an abnormal manner.
- ❖ Instead of taking its usual migratory path to the lungs, it may enter other parts of the body such as brain, spinal cord, or abdominal cavity, or wander through the subcutaneous tissues. Time from infection to oviposition (laying eggs) is 65 to 90 days. Infections may persist for 20 years in humans.



## Symptoms

The symptoms are localized in the pulmonary system, which include:

- Bad cough.
- Bronchitis.
- Blood in sputum (hemoptysis).
- Granulation of lung tissues.
- Inflammation.

## Diagnosis:

1. Microscopic demonstration of eggs in stool or sputum, but these are not present until 2 to 3 months after infection.
2. Antibody detection is useful in light infections.
3. Radiological methods can be used to X-ray the chest cavity and look for worms. show a patchy infiltrate with nodular cystic shadows or calcification; pleural effusion may be seen.

## Treatment:

Praziquantel is the drug of choice to treat paragonimiasis

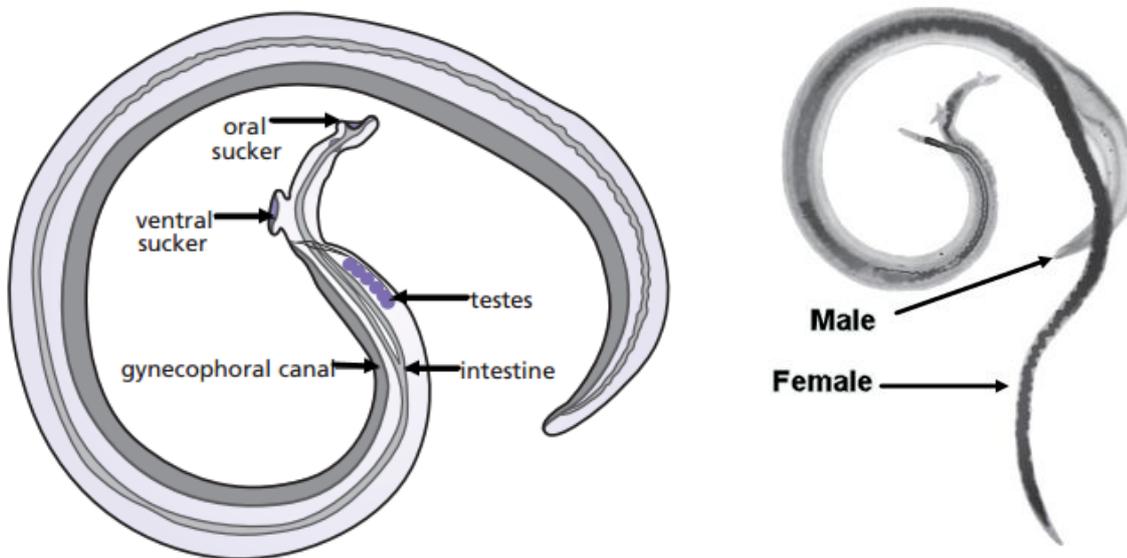
## The Blood Flukes

- Three species of schistosomes that parasitize humans are of major importance: *Schistosoma mansoni*, *S. japonicum*, and *S. haematobium*.
- Less common are *Schistosoma intercalatum* in Africa and *Schistosoma mekongi* in the Mekong Basin. حوض نهر الميكونغ

## *Schistosoma spp*

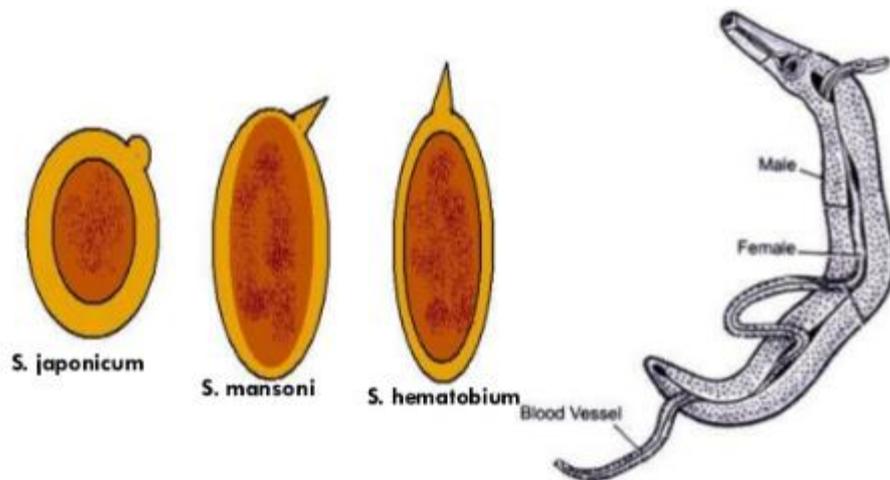
- *Schistosoma*: commonly known as **blood-flukes** and **bilharzia**, includes flatworms which are responsible for the most significant parasitic infection of humans by causing the disease **schistosomiasis**, and are considered by the World Health Organization (WHO) as the second most important parasitic disease, next only to malaria, with hundreds of millions infected worldwide.
- **Schistosomiasis**: (also known as **bilharzia**, **bilharziosis** or **snail fever**) is a parasitic disease caused by several species of the genus *Schistosoma*.

- Although it has a low mortality rate, schistosomiasis often is a chronic illness that can damage internal organs and, in children, impair growth and cognitive development.
- The urinary form of schistosomiasis is associated with increased risks for bladder cancer in adults
- The adult worms live in the blood vascular system, the eggs of *S. mansoni*, *S. japonicum*, *S. intercalatum*, and *S. mekongi* are generally found in the feces. Eggs of *S. haematobium* are occasionally seen in the stool but usually occur in the urine.
- The schistosomes differ in a number of ways from other trematodes. They are dieocious (i.e., **the sexes are separate**), and the two sexes are dissimilar in appearance.
- **Female worms** are long (1.2 to 2.6 cm) and slender, with a body almost circular in cross section and 0.3 mm or less in diameter.
- **Male worms** are 0.6 to 2.2 cm long, and although the body is flattened behind the ventral sucker, it looks cylindrical, as it is characteristically incurved ventrally to form a gynecophoral canal قناة محمل الأنثى in which the female reposes

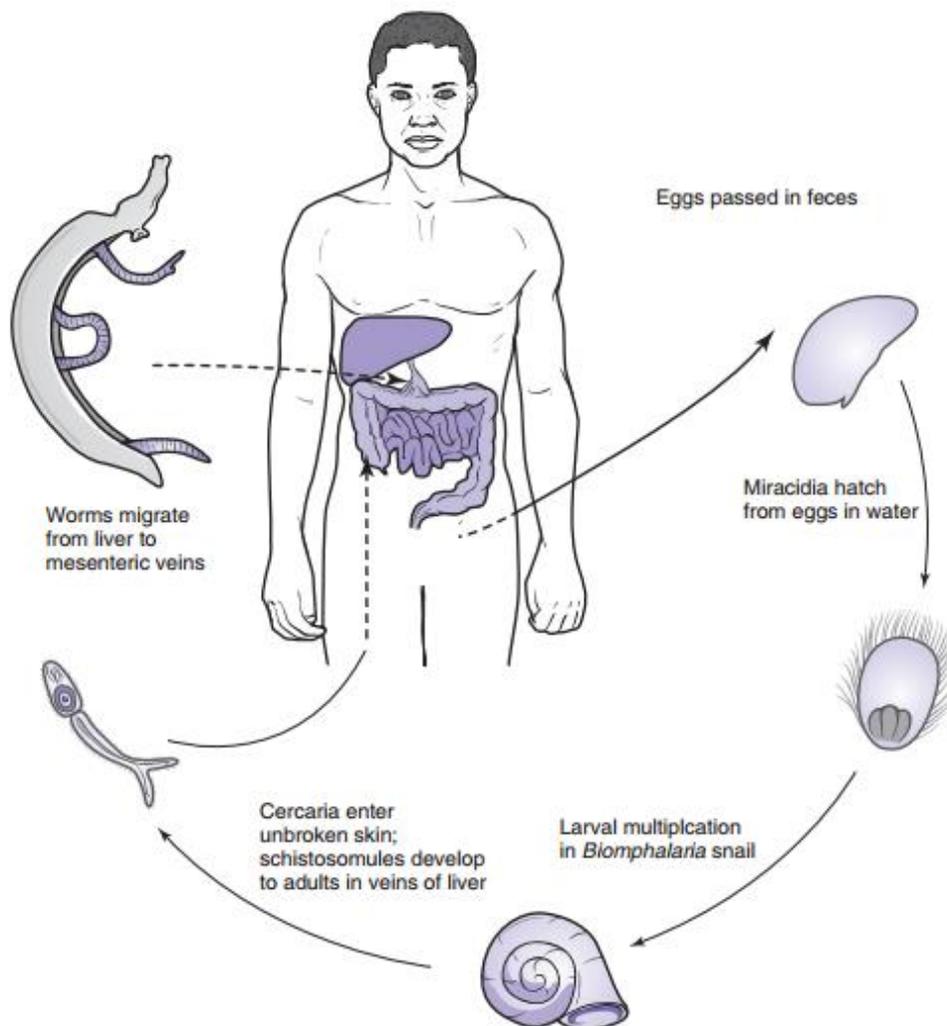


- The body structure of the schistosomes, and particularly that of the long, thin females, seems clearly an adaptation to an intravascular existence. The females leave the male worms to deposit their eggs in small venules الاوردة الصغيرة close to the lumen of the intestine or bladder.
- An enzyme elaborated by the miracidium diffuses through the egg shell and helps to digest the overlying tissue. The action of this enzyme, together with necrosis of the

tissue caused by pressure and the effect of the spine, works to liberate the egg from the tissues into the lumen of the intestine or bladder.



- **Human infection** takes place by direct penetration of the **cercariae** through the skin to **invade the circulatory system**. Cercariae of the schistosome parasites, both of humans and of other animals, have a forked tail and glands at the anterior end that assist penetration through the skin.



## Symptoms:

### 1. Acute schistosomiasis: or (Katayama fever)

Occurs with onset of egg laying, typically 2 to 4 week after heavy exposure.

#### Symptoms include

- 1) Fever. 2) Chills. 3) Cough. 4) Nausea. 5) Abdominal pain. 6) Malaise.
- 7) Myalgia. 8) Urticarial rashes.

Marked eosinophilia, resembling serum sickness.

- ❖ Manifestations are more common and usually more severe in visitors than in residents of endemic areas and typically last for several weeks.

### 2. Chronic Schistosomiasis:

- a) Results mostly from host responses to eggs retained in tissues.
- b) Intestinal mucosal ulcerations caused by *S. mansoni* or *S. japonicum* may bleed and result in bloody diarrhea.
- c) As lesions progress, focal fibrosis تليف بؤري
- d) Strictures تضيق
- e) Fistulas ناسور, and papillomatous ورم حلبيمي growths may develop.

## Symptoms of *S. haematobium*

- a) Ulcerations in the bladder wall may cause dysuria, hematuria, and urinary frequency.
- b) Chronic cystitis develops.
- c) Papillomatous masses in the bladder are common,
- d) Squamous cell carcinoma may develop.
- e) Blood loss from both GI and GU tracts frequently results in anemia.

	<i>S. haematobium</i>	<i>S. mansoni</i>	<i>S. japonicum</i>
The disease	Urinary bilharziasis or Vesical schistosomiasis	Intestinal schistosomiasis	Oriental schistosomiasis
Definitive host	Human	Human, rodents & monkeys	Human, domestic animals, rodents
Intermediate host	Bulinus	Biomphalaria or Australorbis	Oncomelania
Site of infection in human	Urinary & vesicle veins, pelvic plexus	Inferior mesenteric veins & hemorrhoid plexus	Superior mesenteric veins & gastric mesenteric veins
Ova Size Spine Location	(170-192) x (40-70) p Terminal spine Excrete with urine	(114-175) x (45-68) p Lateral spine Throw out with feces	(70-100) x (50-60) p Small lateral spine Throw out with feces
Male Size Tegument Intestine Testes	0.09 x 1.3 cm Fine papillae Joint in 2nd half of body 4-5 large testes	0.11 x 1 cm Coarse papillae Joint in anterior 3rd 6-9 small testes	0.055 x 1.5 cm Smooth Joint in posterior 3rd 6-8 testes
Female Size Ovary Uterus	0.025 x 2 cm In the 2nd half of body Long, 20-30 eggs.	0.016 x 1.4 cm 1st half of the body Short, 1-4 eggs	0.03 x 1.9 cm Middle of the body Long, 50-100 eggs

## Swimmer's Itch

An interesting phenomenon of schistosome biology is cercarial dermatitis, or **swimmer's itch**. While the condition is not life threatening, it can have a negative impact on the economy of regions where outbreaks occur, especially those popular with tourists.

The condition is caused when cercariae of blood flukes that normally parasitize aquatic birds and mammals penetrate human skin, sensitizing points of entry and causing pustules and an itchy rash. Since humans are not suitable definitive hosts for these flukes, the cercariae do not normally enter the blood stream and mature. Instead, after penetrating the skin, they are destroyed by the victim's immune responses. Allergenic substances released from dead and dying cercariae produce a localized inflammatory reaction.

