Practical Parasitology
3rd stage
Lab 12: Schistosomiasis

Helminthes
Blood Flukes
Schistosomiasis
Kingdom: Anemalia

Phylum: Nemathelminthes
- a - body cylindrical.
- b - body cavity is present.
- c - alimentary canal complete.
- d - suckers absent.
- e - sexually differentiat

Sub Kingdom: Metazoan

Phylum: Platyhelminthes
- a - body flattened dorsoventrally.
- b - body cavity absent.
- c - alimentary canal absent or rudimentary.
- d - suckers preset.
- e - mostly hermaphrodite

Class: Nematode
- a - cylindrical, unsegmented.
- b - differentiated into male and female worms.
- c - without hooks but with suckers.
- d - incomplete, without anus.
- e - present.

Class: Trematodea
- a - leaf-like, unsegmented.
- b - hermaphrodite (except, Schistosoma).
- c - without hooks but with suckers.
- d - incomplete, without anus.
- e - absent.

Class: Cestodea
- a - tape like, segmented.
- b - hermaphrodite.
- c - often with hooks and suckers.
- Alimentary canal: d - absent.
- Body cavity: e - absent.
• Trematodes belong to the phylum platyhelminthes. They are found in a wide range of habitats. The great majority inhabit the alimentary canal, liver, bile duct, ureter and bladder of vertebrate animals.

• According to the sites they inhabit, there are four groups of flukes. These are:
  • Blood flukes,
  • Intestinal flukes,
  • Liver flukes,
  • Lung flukes
<table>
<thead>
<tr>
<th>HABITAT</th>
<th>SPECIES</th>
<th>SITUATION OF ADULT</th>
<th>EGGS RECOVERED FROM</th>
<th>SNAIL INTERMEDIATE HOST</th>
<th>OTHER INTERMEDIATE OR TRANSPORT HOSTS</th>
<th>GEOGRAPHICAL DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood</td>
<td><em>Schistosoma mansoni</em></td>
<td>Mesenteric veins</td>
<td>Faeces</td>
<td><em>Biomphalaria</em></td>
<td>None (Active penetration by cercariae)</td>
<td>Africa; Central and South America</td>
</tr>
<tr>
<td></td>
<td><em>S. japonicum</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>China; Japan; S. E. Asia</td>
</tr>
<tr>
<td></td>
<td><em>S. intercalatum</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Central Africa</td>
</tr>
<tr>
<td></td>
<td><em>S. haematobium</em></td>
<td>Vesicular veins</td>
<td>Urine</td>
<td><em>Bulinus</em></td>
<td></td>
<td>Africa; Middle East</td>
</tr>
<tr>
<td>Lungs</td>
<td><em>Paragonimus westermani</em></td>
<td>Cysts in lungs</td>
<td>Sputum and faeces</td>
<td><em>Semisulcospira</em></td>
<td>Edible crustaceans</td>
<td>China; Japan; S.E. Asia</td>
</tr>
<tr>
<td></td>
<td><em>Paragonimus spp.</em></td>
<td></td>
<td></td>
<td><em>Thiara</em></td>
<td></td>
<td>Foci in: W. Africa; S.E. Asia</td>
</tr>
<tr>
<td>Liver</td>
<td><em>Opisthorchis sinensis</em></td>
<td>Bile and</td>
<td>Faeces</td>
<td><em>Bulinus</em></td>
<td>Fresh water food fishes</td>
<td>China; Japan; S.E. Asia</td>
</tr>
<tr>
<td></td>
<td><em>O. felineus</em></td>
<td>pancreatic ducts</td>
<td></td>
<td><em>Parafossarulus</em></td>
<td></td>
<td>East Europe; Siberia</td>
</tr>
<tr>
<td></td>
<td><em>O. viverrini</em></td>
<td></td>
<td></td>
<td><em>Bithynia</em></td>
<td></td>
<td>Thailand; Laos</td>
</tr>
<tr>
<td>Intestine</td>
<td><em>Fasciolopsis buski</em></td>
<td>Bile ducts</td>
<td>Faeces</td>
<td><em>Lymnaea</em></td>
<td>Metacercariae encysted on plants</td>
<td>Mainly temperate areas:</td>
</tr>
<tr>
<td></td>
<td><em>Heterophyes heterophyes</em></td>
<td>Small intestine</td>
<td></td>
<td></td>
<td></td>
<td>China; S. E. Asia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Segmentina</em></td>
<td>Metacercariae encysted on plants</td>
<td>1. Egypt</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>1. Pireneilla</em></td>
<td>Fresh water food fishes</td>
<td>2. China; Japan; S.E. Asia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>2. Cerithidia</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Metagonimus yokogawai</em></td>
<td></td>
<td></td>
<td><em>Semisulcospira</em></td>
<td></td>
<td>China; Japan; S. E. Asia</td>
</tr>
<tr>
<td></td>
<td><em>Gastrodiscoides hominis</em></td>
<td>Caecum and colon</td>
<td></td>
<td><em>Helicobis</em></td>
<td>Probably plants</td>
<td>S. E. Asia</td>
</tr>
<tr>
<td></td>
<td>Echinostomes</td>
<td>Small intestine</td>
<td></td>
<td><em>Planorbids</em></td>
<td>Edible snails or Fresh water fishes</td>
<td>Asia; Europe</td>
</tr>
</tbody>
</table>

**Table 5** Trematodes of medical importance
• **BLOOD FLUKES**

• There are five medically important species:

• 1. *Schistosoma mansoni*: causes intestinal schistosomiasis.

• 2. *Schistosoma haematobium*: causes vesical (urinary) schistosomiasis.

• 3. *Schistosoma japonicum*: causes intestinal schistosomiasis.

• 4. *Schistosoma intercalatum*: causes intestinal schistosomiasis.

• 5. *Schistosoma mekongi*: causes intestinal schistosomiasis.
<table>
<thead>
<tr>
<th></th>
<th>S. haematobium</th>
<th>S. mansoni</th>
<th>S. japonicum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td>10 – 15 mm</td>
<td>6 – 10 mm</td>
<td>12 – 20 mm</td>
</tr>
<tr>
<td><strong>Integument</strong></td>
<td>finely tuberculated</td>
<td>coarsely tuberculated</td>
<td>smooth</td>
</tr>
<tr>
<td><strong>No of testes</strong></td>
<td>3 – 5 (4)</td>
<td>6 – 9 (7) in (cluster)</td>
<td>7 – 9 (7) (in column)</td>
</tr>
<tr>
<td><strong>Ceca</strong></td>
<td>reunite late</td>
<td>reunite early</td>
<td>reunite very late</td>
</tr>
</tbody>
</table>

**Female adult worm:**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td>15 – 20 mm</td>
<td>10 – 14 mm</td>
<td>15 – 30 mm</td>
</tr>
<tr>
<td><strong>Position of the ovary</strong></td>
<td>posterior half</td>
<td>anterior half</td>
<td>middle</td>
</tr>
<tr>
<td><strong>Length of the uterus</strong></td>
<td>long</td>
<td>short</td>
<td>long</td>
</tr>
<tr>
<td><strong>No. of ova in the uterus</strong></td>
<td>20 – 50</td>
<td>1 – 4</td>
<td>50 – 300</td>
</tr>
</tbody>
</table>

**Ova**

<table>
<thead>
<tr>
<th>Spine</th>
<th>terminal spine</th>
<th>lateral spine</th>
<th>short lateral spine (rudimentary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>in urine, less, frequently</td>
<td>rarely in urine</td>
<td>in stool</td>
</tr>
<tr>
<td></td>
<td>in stool</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Habitat in human:**

<table>
<thead>
<tr>
<th></th>
<th>vesicle plexus of urinary bladder</th>
<th>in interior mesenteric vein, superior mesenteric vein, less frequently superior</th>
<th>frequently interior</th>
</tr>
</thead>
</table>

**Snails:**

| (intermediate host) | Bulinus truncatus | Biomphalaria spp. | Oncomelani spp. |
Differential Features of *Schistosoma* spp.
Life cycle of *Schistosoma* spp.
• **LIFE CYCLE OF SCHISTOSOMES**

• Adult worms reside in pairs: the female lying in the gynecophoral canal. After fertilization, eggs are passed into the venules. A larval form – the miracidium - develops within the egg. Its lytic enzymes and the contraction of the venule rupture the wall of the venule liberating the egg into the perivascular tissues of the intestine (*S. mansoni*) or urinary bladder (*S. haematobium*). The eggs pass into the lumens and organs and are evacuated in the feces (*S. mansoni*) or the urine (*S. haematobium*). **On contact with fresh water the** miracidia hatch from the eggs and swim about until they find the appropriate snail, which they penetrate. After two generations of sporocyst development and multiplication within the snail, the fork-tailed cercariae emerge. Infection to man takes place during bathing. The cercariae penetrate the skin, are carried into the systemic circulation and pass through to the portal vessels. Within the intrahepatic portion of the portal system, the worms feed and grow to maturity.
*S. haematobium* Egg
In Urine

*S. mansoni* Egg
In Stool

Schistosoma japonicum Egg
Ova of *Schistosoma* spp.
*Schistosoma mansoni*, female and male

*S. mansoni*, female and male

*In Copula*
S. mansoni Egg
Histopathological section in intestine showing *S. mansoni* eggs
*S. haematobium* Adult Male

*Schistosoma haematobium*

*S. haematobium* female and male
Schistosoma Spp - Cercaria

Schistosoma Spp - Miracidium stages from the life cycle of the Schistosoma spp.
The intermediate hosts of *Schistosoma* spp.
Distended Abdomen

Dilatation of superficial abdominal blood vessels

some clinical sign of schistosomiasis
Symptoms and complications

• Patients infected with *S. haematobium* suffer from *terminal haematuria and* painful micturition. There is inflammation of the urinary bladder (cystitis), and enlargement of spleen and liver.

• Patients infected with *S. mansoni* suffer from *cercarial dermatitis (swimmers itch)* and dysentery (mucus and blood in stool with tenesmus) as well as enlargements of the spleen and liver.

*S. haematobium* causes squamous cell carcinoma in the bladder.
Laboratory Diagnosis

*S. mansoni*, *S. japonicum*
- Microscopic examination of the stool for eggs after concentration by sedimentation method. The egg has characteristic lateral spine.
- Rectal snip

*S. haematobium*:
- Examination of the urine after allowing it to sediment in a conical urinalysis glass. A drop from the sediment is taken and examined for eggs. Egg has terminal spine.
- Biopsy from bladder