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. unit - II
. B.Sc. I yr

Phylum - Platyhelminthes

★ General characters

1) Platyhelminthes includes flatworms. (Gk. platy = Flat & helminth = worm).

2) They are dorsoventrally flattened like a leaf.
3) They show organ grade of organization.
4) They are acoelomate animals. The cavity between the body wall & the gut is filled with parenchyme or mesenchyme.
5) They are triploblastic animals. They contain three layers — ectoderm, mesoderm & endoderm.
6) They are bilaterally symmetrical animals. And having definite polarity of anterior & posterior ends.
7) Some members have segmented body. The segmentation in platyhelminthes is called pseudometamerism.
8) Many of the parenchyma cells gives rise to muscle fibres, which are arranged in circular, longitudinal and vertical layers.
9) The digestive stystem is completely absent from Coestoda and Acoela. The alimentary canal is branched in turbellarians. The anus is absent from them.
10) The respiratory organs are absent. In parasites, respiration is anaerobic.
11) The circulatory system is absent.
12) The excretory system is formed of pseudonephridia. (Flame cells).

13) The nervous system is well developed.
14) They are hermaphrodites i.e both male and female reproductive organs are present in the same animal.
15) Fertilization is internal in them. self or cross Fertilizat^{n} takes place in them.
16) Their development is direct or indirect.
17) They are free living or parasitic. In parasitic worms adhesive organs like hooks, spines, suckers and adhesive secretions are present.

★ Classification of Platyhelminthes

Phylum Platyhelminthes is divided into three classes, namely –

1) Turbellaria
2) Trematoda
3) Cestoda

Class 1. - Turbellaria

Turbellaria includes free living flatworms with a ciliary covering. They have following characters.

1) They are free living flatworms. Some are commensals or parasitic.
2) The outer layer of the body wall is epidermis which is cellular or syncytial.
3) The body is covered with cilia.
4) The body is unsegmented.
5) The mouth is ventral.
6) The pharynx is protrusible.
7) Intestine is present. Suckers are absent.
8) Life cycle is simple.

Examples – planaria, convoluta, Bipalium

Class 2. - Trematoda

Trematoda includes flukes. They have spiny skin. They have following characters –

1) All tremadoes are parasites.
2) The body is covered by a cuticle.

3) Epidermis, cilia are absent.
4) The body is unsegmented.
5) The mouth is terminal.
6) The pharynx is not protrusible.
7) Suckers are present.
8) The life cycle is complicated by larval forms and intermediate hosts.

Examples - Fasciola, Polystomum, paramphistomum.

Class 3. Cestoda

Cestoda includes tapeworms. They are parasitic & segmented. They have the following salient features -

1) Cestodes are parasites.
2) The body is covered by a cuticle.
3) The epidermis, cilia are absent.
4) The body is segmented and each segment is called a proglottid.
5) The mouth and alimentary canal are absent.
6) Suckers are present.
7) The life cycle is complicated by larval forms & intermediate hosts.

Examples - Taenia solium, Echinococcus, Taenia saginata.

Class - 4 → Monogenea

- This class includes flatworms which are mostly ecto- or endoparasites of aquatic vertebrates such as fishes, amphibians and reptiles (turtles).
- Their body is dorsoventrally flattened and composed of a head, trunk and haptor.
- Suckers are either absent or weak. Instead of it is a pair of adhesive glands are present.
- Excretory pores are paired & situated anteriorly on the dorsolateral sides.
- Male & Female gonopores are usually separate.
- Life cycle is including only one host.

Examples - i) Polystomoidella oblongum
[parasite in urinary bladder of turtles]

ii) Polystoma integerrimum &
[Endoparasite of urinary bladder of frog]

iii) Benedenia melleni [ectoparasite of fish]

Taenia Solium (Tape worm)

Phylum - Platyhelminthes
class - cestoda
subclass - Eucestoda
order - cyclophyllidea

Structure

I) Shape, size and colouration

Taenia solium is usually opaque white in colour but cremish, yellowish or greyish colouration is also common. Body is 1 to 5 meters long, and flattened like a ribbon or tape. They are dorsoventrally flat but from external examination it is not possible to identify them. Internal view reveals that surface closer to testes is dorsal & nearer the female reproductive organs, the ventral surface. Elongated body is extremely narrow anteriorly and gradually broadens towards the posterior end.

II) Segmentation

Elongated body of tapeworm is divided into a great number of parts or segments, called Proglottids, possibly upto 800 to 1,000. Entire body is divided into three distinct parts: i) an anterior scolex or head ii) a short unsegmented neck & iii) a segmented strobila.

III] Scolex

- It represents the anterior end of body. It is knob like, bilaterally symmetrical and 0.6 mm to 1 mm wide.
- From frunt view it appears roughly quadrangular.
- At the apex is a prominent rounded mobile cone, the rostellum. It is armed with 22 to 32 curved chitinous hooks, arranged in two rows or circles around its base.
- ~~Hooks~~ The broadest part of scolex bears four hemispherical highly muscular suckers, one at each angle of quadrangle.
- The scolex with the help of its hooks & suckers, lies buried in the host's intestinal mucosa. And it is thus an organ of attachment. It play no role in perceiving or catching food. The term 'head' frequently used for the scolex is thus inappropriate.

IV Neck

- It is well-defined, short, narrow and unsegmented region behind scolex,
- It is dorsoventrally flattend.
- It is termed as budding zone, growth zone, area of proliferation and area of segmentation because it is this region where the segments or proglottids are formed and pushed backwards.
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V Strobila

- It form the main bulk of body. It consists of 800 to 1,000 segments or proglottids arranged in a linear ~~serise~~ series in a chain-like fashion.
- A proglottid is a unit part of the body enclosing a complete set of genitalia.
- Proglottids are budded off in the neck region and pushed backwards due to addition of more proglottids in front.
- Thus, in a strobila, anterior proglottids are youngest, while those at the posterior end are oldest.
- Adjecent proglottids remain attached together by longitudinal muscles, excretory ducts and nerve cords, which extend along the entire body length.
- According the degree of development, the strobila includes the three kinds of Proglottids: immature, mature and gravid.

i) Immature Proglottids

They composed about 200 anterior Proglottids just behind the neck. They are youngest, sexually immature and without reproductive organs. They are short, broader than long and rectangular in outline.

2) Mature proglottids

There are about 450 mature proglottids forming middle part of strobila.

- These are large and squarish in outline.
- The anterior 100 to 150 proglottids contain only male reproductive organs, while the posterior 250 mature proglottids develop both male and female reproductive organs making them hermaphrodite.
- Each mature proglottid, on one side bears a tiny genital pore. These pores in the successive proglottids are situated alternately on the right and left sides.
- Fertilization is occure in this proglottids.

3) Ripe or gravid Proglottids

- The oldest and the last 150 to 350 proglottids, upto the posterior end of body are termed as ripe or gravid proglottids.
- They are longer than broad in outline.
- All male & female reproductive organs have degenarated except the highly branched uterus ful of fertilized eggs.

IV] Apolysis

- small group of gravid proglottids regularly detach from the posterior end of strobila and pass out with the host's faeces.
- sheedding of gravid proglottids is termed as apolysis.

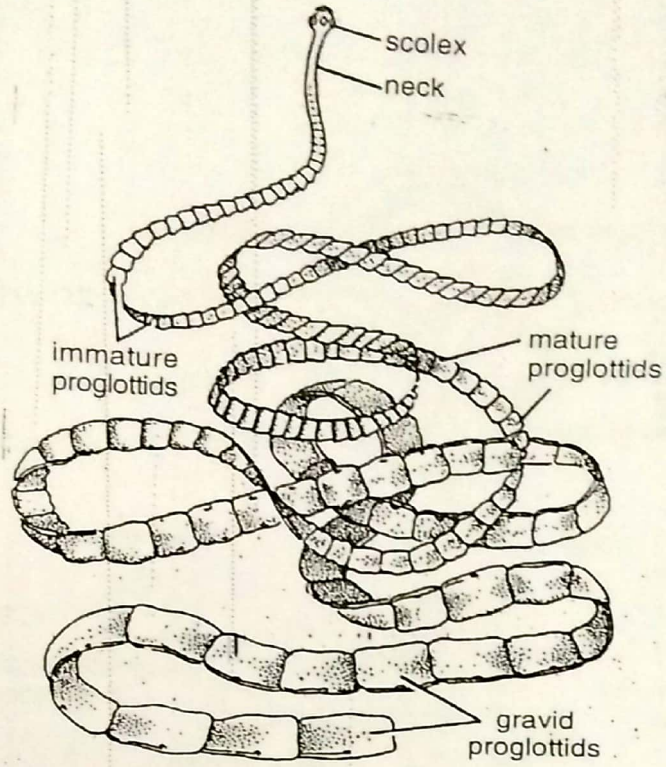


Fig. 26.1. *Taenia solium*. An adult tapeworm.

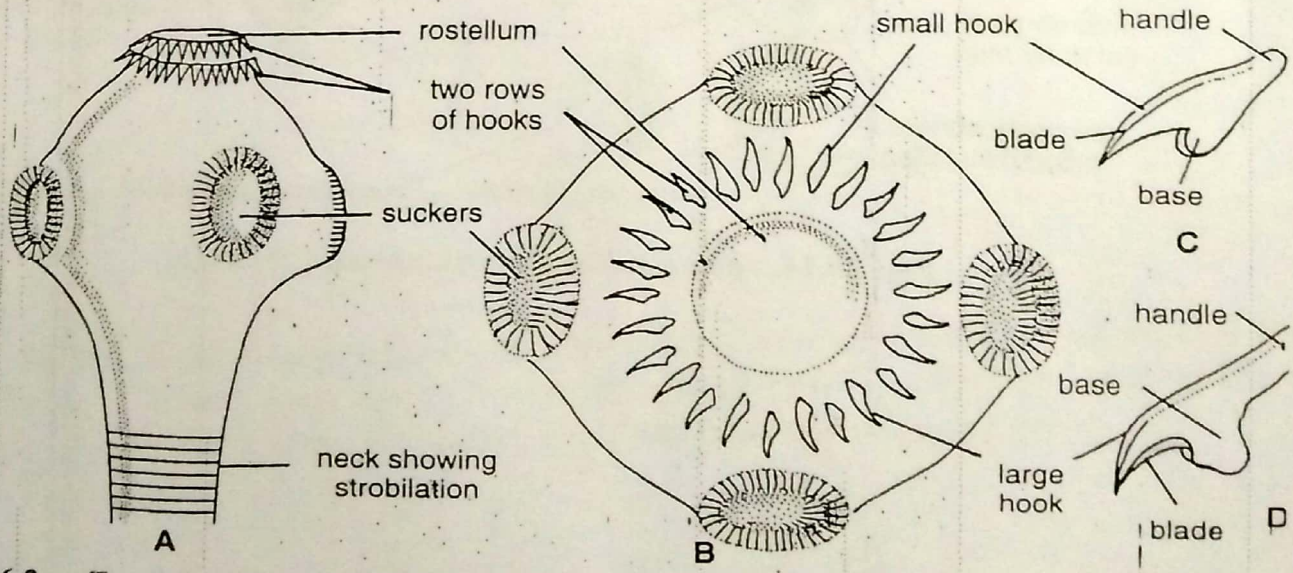


Fig. 26.2. *Taenia solium*. Scolex. A—Scolex enlarged; B—Frontal view of scolex; C—Smal D—Large hook.

★ Life cycle of Taenia solium

I) Copulation & Fertilization

- Life cycle of T. solium is digenetic, involving two hosts. as in case of ~~a~~ f
- Fertilization proceded by copulation which is accomplished by insertion of cirrus into vagina of the same or other proglottid to release spermatozoa.
- It becomes possible when the common genopores of two mature proglottids come in contact due to folding of strobila.
- Fertilization, following copulation between two different proglottids, is sometimes termed coross-fertilization to distinguish it from that occuring between gametes of the same proglottid. (self fertilization).
- In the fertilization duct male spermatozoa and egg of female fuse & form zygotes, Thus, fertilization is internal.

II) Capsule formation

- zygotes or egg cells become associated with a large yolk cells or vitelline cells.
- Two become enclosed in a thin shell or chorionic membrane & form capsule.
- The capsule formed is then passes into uterus where ferther development take place.
- More and more capsules passes into the uterus.

III] Onchosphere formation

- zygote or egg cell undergoes cleavage when the capsule is in uterus. cleavage is holoblastic and unequal.
- Megamere divides further & form morula stage.
- A thick, hard, cuticularized & radially striated shell known as embryosphere or inner embryonic membrane surrounding morula. Beneath this is a thin basement membrane present.
- Morula at its morphologically posterior end, develops three pairs of chitinous hooks. This six-hooked embryo called hexacanth.
- It is surrounded by two hexacanth membrane & now it is called as onchosphere.
- By the time onchospheres are formed, the proglottid become gravid & increses in size.
- This gravid Proglottids containing branched uterus and onchosphere shed of from the body.

IV] Infection to secondary Host (Pig)

- Gradid Proglottids at the posterior end of strobila detach (apolysis) in groups of 4-5 and pass out with the host's faeces.
- On ground, proglottids eventually disintegrate, setting free thousands of onchospheres.
- Pig, which feeds on human excreta is the usual secondary host, but dog, monkey and sheep are also known to get the infection.

V] Migration within secondary Host:

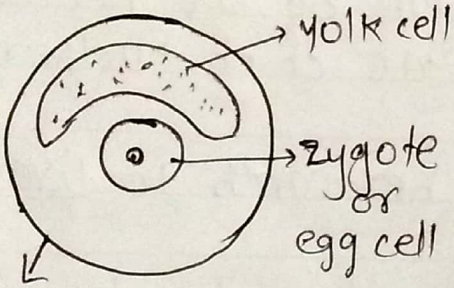
- In the stomach of 2° host (pig) onchosphere loses its embryophore and basement membrane by action of acidic juices.
- The free hexacanth embryo then passes into the small intestine, where the two persisting hexacanth membranes are also lost by the action of alkaline juices.
- Hexacanth, now activated by the presence of bile salts & bores its way through intestinal wall to reach a blood or lymph vessel, with the help of six hooks.
- After which the hooks, are of no further use, and are shed off.
- Blood & lymph carries hexacanth to liver via hepatic portal vein.
- From liver it reaches heart and enters the arterial circulation.
- It finally reaches muscles usually tongue, shoulder, neck, thigh, heart etc. where it settles to develop into bladder-worm or cysticercus.

VI] Infection to Primary host (man)

- Man gets infection by eating undercooked measly pork.
- cysticercus becomes active on reaching the small intestine.
- The invagination, which looks like a hollow

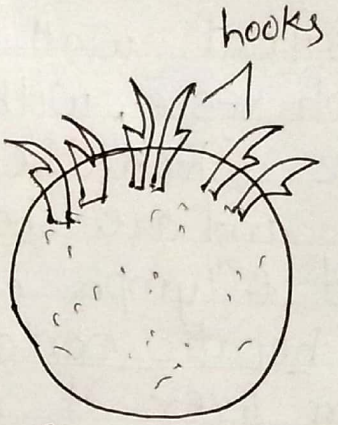
knob, differentiates into an inverted scolex possessing suckers, hooks and rostellum, it is called as proscolex.

- Neck begins to proliferate proglottids and the bladder, sooner or later get detached and digested.
- In 10 to 12 weeks the parasite attains adulthood and possesses gravid proglottids ready for apolysis.

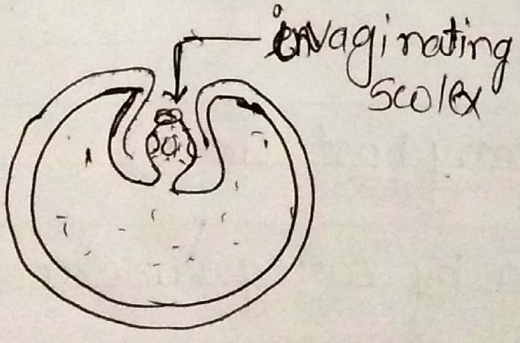


egg shell or capsule

Fig. zygote in egg shell



Free Hexacanth



Invagination

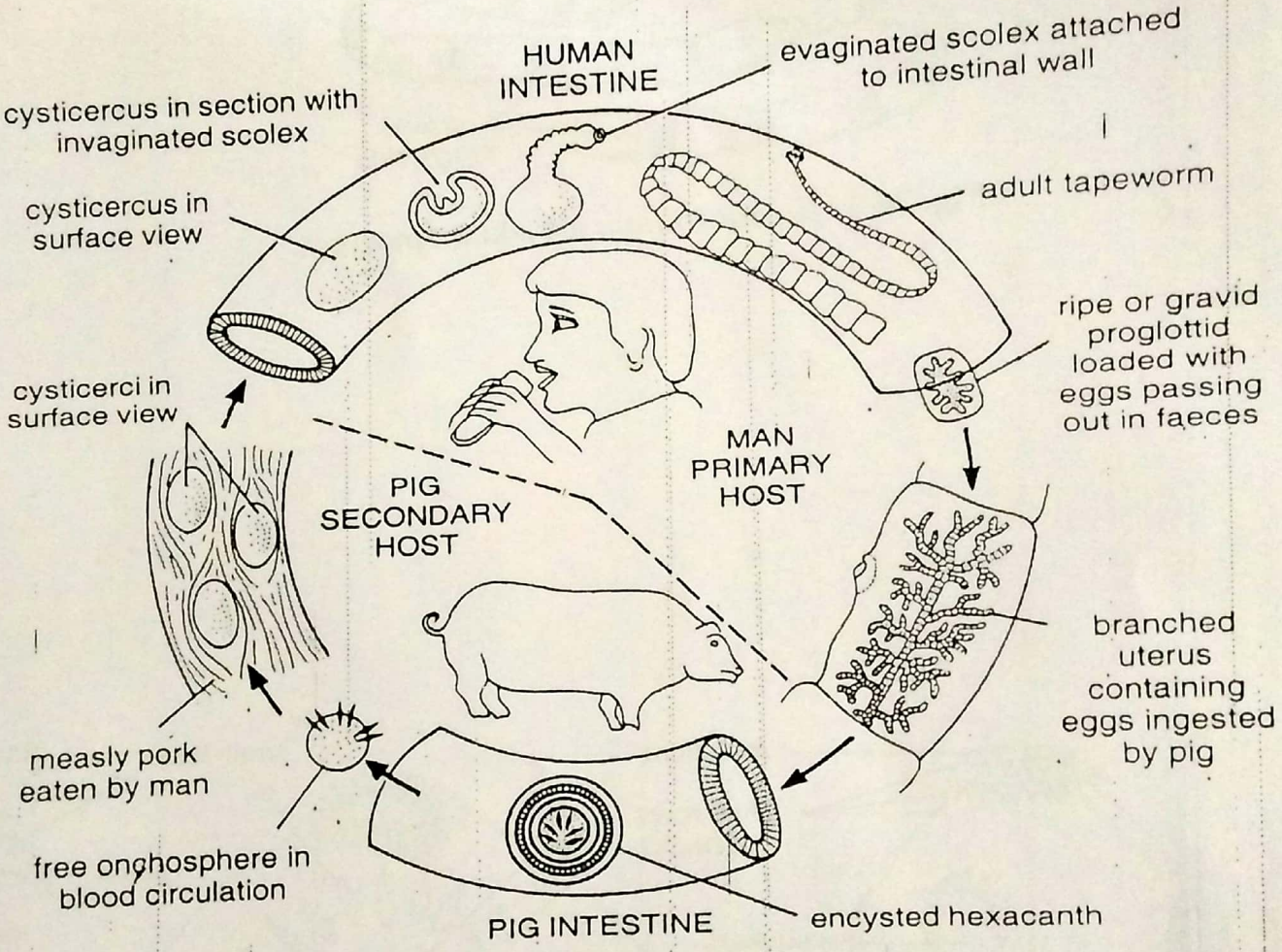


Fig. 26.14. *Taenia solium*. Diagrammatic life cycle.

Infection

Human beings get infected by eating raw and inadequately cooked measly pork containing cysticerci of tapeworm.

Pathogenesis

Man may fall a victim to adult tapeworm as well as its cysticerci.

- Effects of the former are referred to as taeniasis and those of the latter as cysticercosis.

a) Taeniasis

It is indicated by variety of symptoms including pain in the abdomen, nausea, anaemia, increased appetite, indigestion, increase of eosinophil cells in blood.

- Nervous disorders.
- These serious disorders are caused by toxins produced by the parasite.
- Hooks and suckers may cause mechanical irritation in intestine, which may initiate reverse peristalsis leading to auto-infection.

b) Cysticercosis

- It is more dangerous than taeniasis.
- Entry of bladder worm may take place in the host's voluntary muscles, cardiac muscles and even in some more delicate vital organs like liver, eyes and brain.
- Removal of cysticerci from these delicate tissues is extremely difficult.
- cysticercosis of brain results in several degenerative changes and necrosis in the brain and the patient shows epileptic behaviour.

Therapy (treatment)

- Infection of tapeworm can be tackled by several antihelminth drugs.
- Drug for human tapeworm is Praziquantel or Biltricide.
- Drug for neurocysticercosis is Albendazole.
- Under the action of drugs, strobila is removed but the embeded scolex persists which again bud off a new strobila.
- Removal of scolex can be brought about by surgery.
- Removal of cysticerci from delicate organs like brain, eyes & liver is very difficult process.

Prophylaxis (Prevention)

- Consumption of undercooked measly pork should be avoided.
- Faeces of infected persons should be properly disposed off & destroyed.
- Preventing pigs having access to them & ingesting hexacanth embryos.