

# **Pork Tape- worm(*Taenia solium*)**

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# Habit and Habitat:

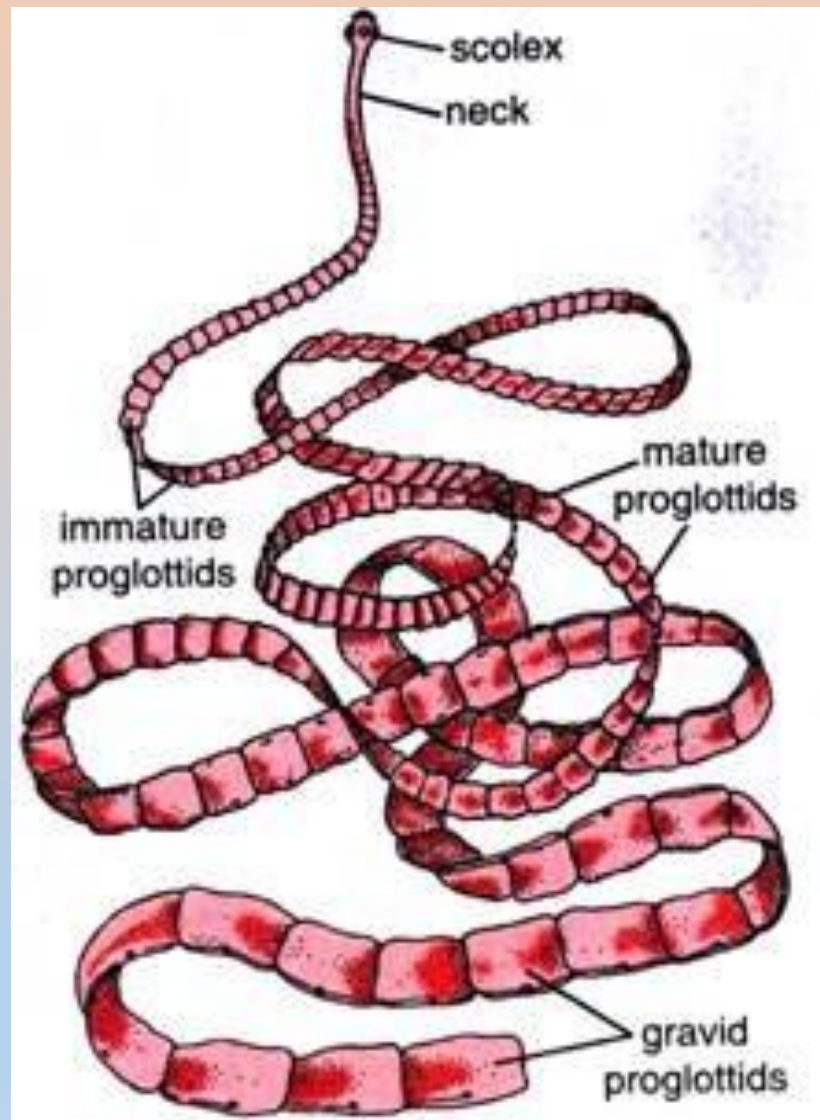
- *Taenia solium* is an endoparasitic long ribbon-shaped tape -worm
- Living in the intestine of human, found attached to its mucosa by scolex while rest of the body lies free.
- It is common in the pork eating population
- It is common in tropical and subtropical regions where pork is utilized as food without being thoroughly cooked.

# External Feature:

- The body of *Taenia* is distinguished into three parts known as Head or Scolex, Neck and Body or Strobila.

## I. **Head or Scolex( Anterior-most part):**

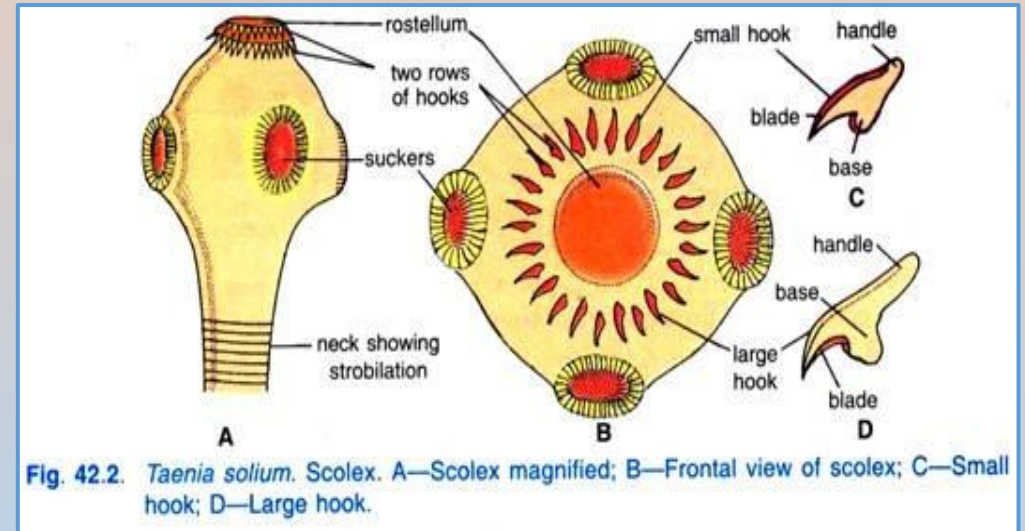
- The scolex is the knob-like anterior most part.
- It is pin-head in size.
- The narrow anterior end of body bears a tiny, knob-like **head or scolex**.
- Scolex is used by the parasite to cling to inner wall of the intestine of the host.
- It is an adhesive organ it also contains the brain
- It is of four sided, pear shaped structure and distinguished into two parts



**Fig. 42.1.** *Taenia solium*.

## a) Rosteller Part:

- The prominent mobile conical part arising anteriorly from the middle of scolex is known as rostellum.
- At its base two rows of curved conical pointed chitinous hooks known as rostellar hooks presents
- The hooks are 28 in number and are of two different sized.
- Smaller hooks alternate with large one.
- Each hooks has three parts
- A base or guard, a conical blade at the tip and a handle projected from the middle.
- When the rostellum is withdrawn the hook become anteriorly directed and get fixed into the host tissue.



## b) **Distal four-sided part:**

- It lies posterior to the rostellum and possesses four cup-suckers known as **Acetabula**,
- **Projecting from the surface slightly behind the circlet of hooks.**
- **One of them is dorsal, one ventral and two are lateral**

## **II. Neck:**

- The scolex is followed by a narrow slender unsegmented neck region.
- The new segments are budded off from this region by the process of budding.
- This is also known as the region of proliferation.
- The segments immediately after neck are not distinct

### **III. Body or Strobila:**

- The rest of the body of *Taenia* is known as strobili or proglotids.
- Which is composed of linear series of reproductive organs
- The youngest segments are present toward the neck region
- The oldest are in posterior most position of the body.

#### **a) Immature segments:**

- These are young undifferentiated segments situated just below the neck region.
- Reproductive organs are either absent or in stage of development.
- They are broader than long and comprise about 200-250 anterior proglotids.

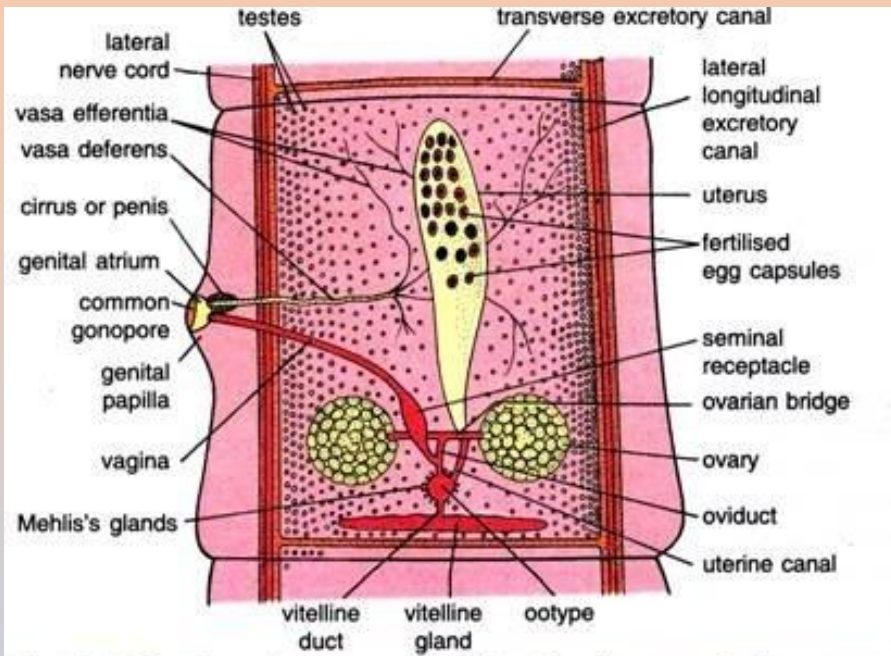


Fig. 42.8. *T. solium*. A mature proglottid to show the reproductive organs.

## b) Mature or Reproductive Segments:

- They are found in middle portion of the body
- They are sexually mature and consisting male and female reproductive organs.
- A few anterior segments contain only male reproductive organs.
- A mature proglottid is a complete reproductive unit and may undergo self or cross fertilization.



### c) **Gravid or Ripe Segments:**

- These are found in the posterior part of the body.
- They are twice as long as broad.
- These are characterized by the possession of large, highly branched pre-embryonic uterus filled with developing embryos.
- The posterior most proglotids are cut off from the body by the process of **apolyxis** and
- Come out to the exterior along with the faeces of the host
- Apolyxis serves a double purpose such as transferring the developing embryo to the outside where they can find secondary host
- And to limit the size of the continuously growing body due to budding of new segments in the neck region

# Life cycle of *Taenia solium*

## Copulation:

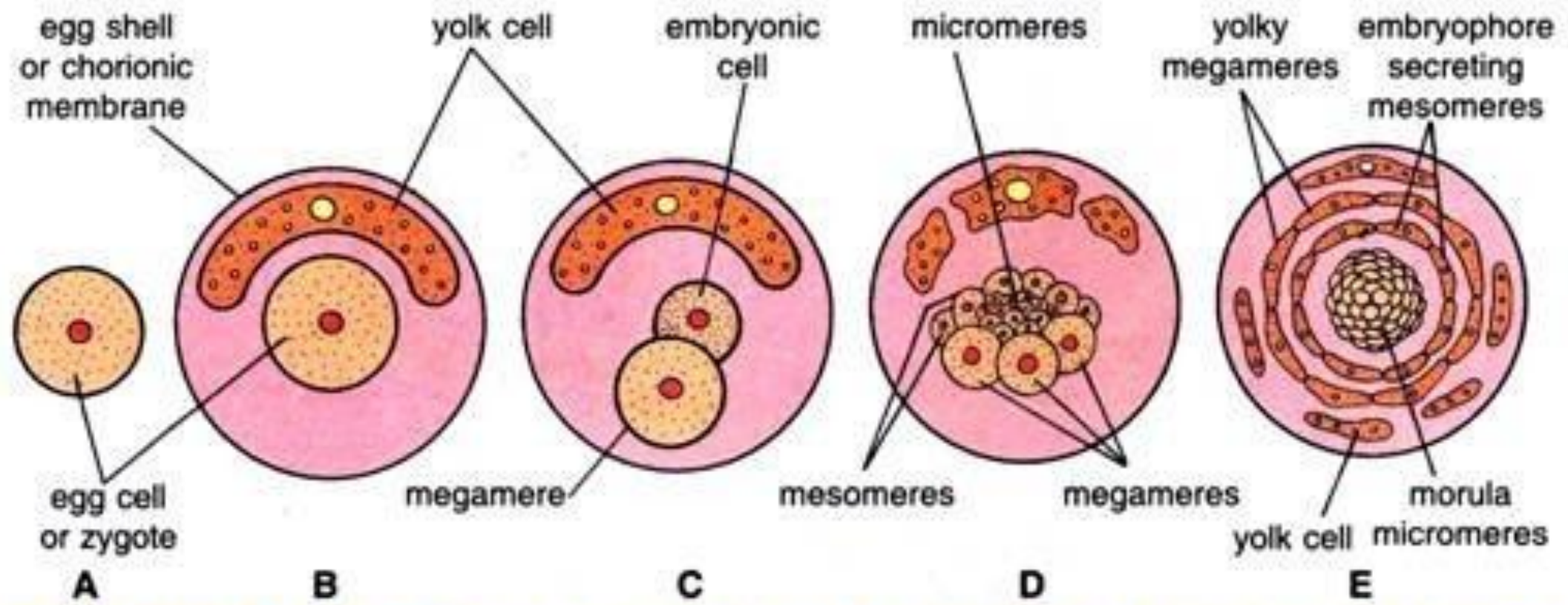
- The mating or copulation takes place when the common gonopores of two mature proglotides come in contact with each other.
- Self-fertilization occurs by the insertion of the cirrus of one proglottid into the vagina of the same proglottid and sperms are deposited there.
- From the vagina the sperms come to lie in the seminal receptacle from where they fertilize the eggs in oviduct.
- But cross-fertilisation between different proglottids of the same tapeworm is very common.
- Actually, *T. solium* is protandrous, i.e., the testes mature first.

## **Fertilization:**

- Hence, after copulation the sperms are stored temporarily in the seminal receptacle waiting for the maturity of the eggs and when such eggs come in the oviduct, fertilisation occurs.
- The eggs of *Taenia solium* are self or cross fertilized.
- After fertilisation, the eggs are transformed into capsules and packed in the uterus.
- Later, the various reproductive organs degenerate and the uterus becomes distended and branched having more than 30,000-40,000 egg capsules..

## **Eggs:**

- These are very small measuring about 40 micron in diameter. These contain a large amount of yolk and each is surrounded by a egg-shell or egg capsule.



**Fig. 42.13.** *T. solium*. A—Zygote; B to E—Stages illustrating the formation of onchosphere.

# Development of Taenia:

It starts when the eggs enter the uterus.

## **Cleavage and Formation of Hexacanth Embryo or Onchosphere:**

- The zygote first divides unequally to give rise a larger megamere with a large yolk filled vitelline cell
- and a smaller embryonic cell.
- The embryonic cell undergoes repeated division and a solid ball of cells known as morula form.
- The megamere divides a number of times to give rise several similar megameres.
- Similarly, the embryonic cell divides repeatedly to give rise three types of cells,
  - i. Two or three large cells or **macromeres**
  - ii. Three or more **mesomeres** and
  - iii. A number of smaller **micromeres**.

- Hence, from zygote, three types of cells are resulted.
- These are larger megameres, medium-sized mesomeres and smaller micromeres which are arranged in a characteristic sequence.
- In fact, the smaller micromeres form an inner ball of cell mass called morula;
- The mesomeres are placed as an envelope around the morula,
- While the megameres as an outer envelope around the mesomeres.
- The megameres fuse to form the outer embryonic membrane which finally disappears
- the mesomeres form the inner embryonic membrane or embryophore which is thick, hard, cuticularised and striated.

- Below the embryophore, a thin basement membrane is also formed.
- The inner cell mass of micromere develops into three pairs of chitinous hooks and a hexacanth or onchosphere larva is formed.

### **Hexacanth Embryo or Onchosphere:**

- This six-hooked embryo is called hexacanth which possesses a pair of penetration glands and is surrounded by two hexacanth membranes.
- The hexacanth embryo, hexacanth membranes, basement membrane, embryophore and the egg shell or chorionic membrane together is known as onchosphere. The gravid proglottids which pass out from the host body contain embryos in onchosphere stage.





Hexacanth.



# Transmission to Secondary Host:

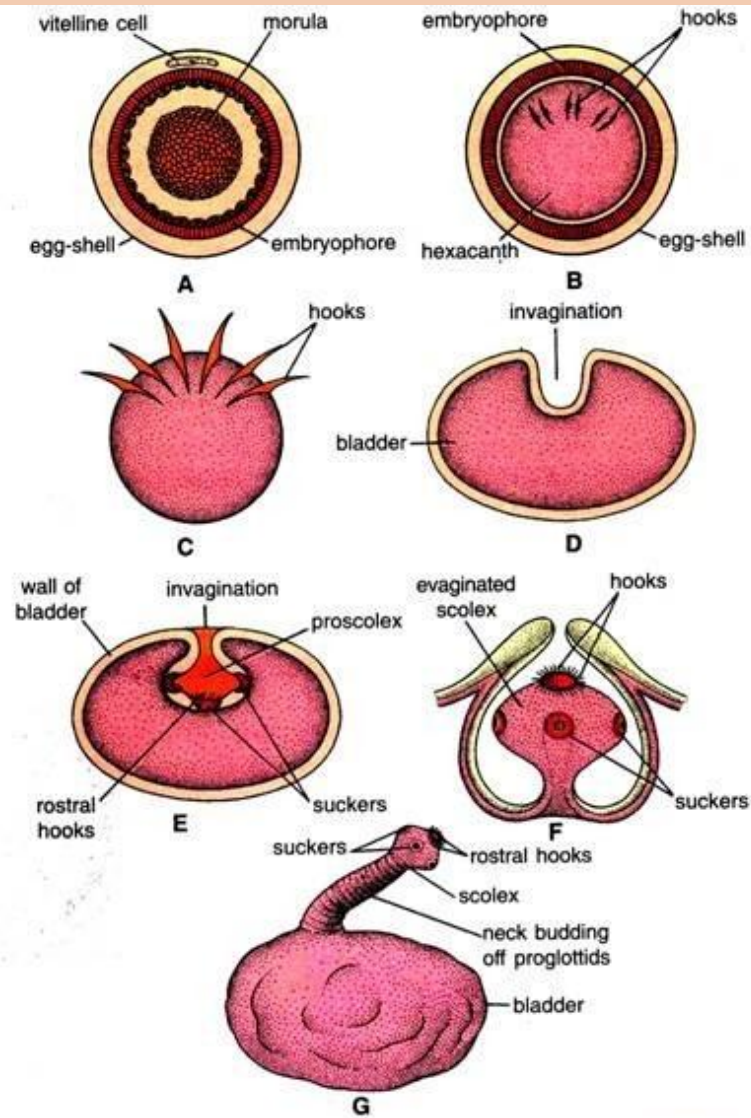
- Further development depends on the eggs being ingested by a pig which serves as the intermediate host.

## **Formation of Cysticercus or Bladderworm stage:**

- The gravid proglottids after sometimes when they disintegrate, the onchospheres are eaten up by the pigs with human faeces due to their coprophagous habit.
- After reaching in the stomach of a pig, the capsule shell and other membranes around the hexacanth are dissolved resulting into the liberation of hexacanth..

- The hexacanth now starts boring through the intestinal wall with the help of a pair of unicellular penetration glands found in it between the hooks.
- The hooks do not play any role in boring the interstitial tissue but they help in anchoring it.
- Thus, the hexacanth enters the blood vessels of the intestine and passes through the heart
- and finally comes to lie in the striated muscles in any part of the body.
- They usually settle in the muscles of the tongue, neck, heart and shoulder.

- After reaching in the muscles, they lose their hooks,
- increase in size and acquire a fluid filled central cavity then they become encysted in a cuticular covering to become cysticerci or bladderworms.
- The cysticercus of *Taenia solium* is called cysticercus cellulosae.
- The flesh of pig or pork containing these cysticerci appears white spotted resembling something like that of measles, hence, it is characteristically called measly pork.
- Thus, the pig becomes infected.



**Fig. 42.14.** *T. solium*. Stages in the life cycle. A—Young onchosphere; B—Mature onchosphere; C—Free hexacanth; D—Bladderworm with invagination; E—Bladderworm with proscolex; F—Bladderworm with evaginated scolex and G—Cysticercus with neck budding off proglottids.

## **Cysticercus or Bladder-Worm:**

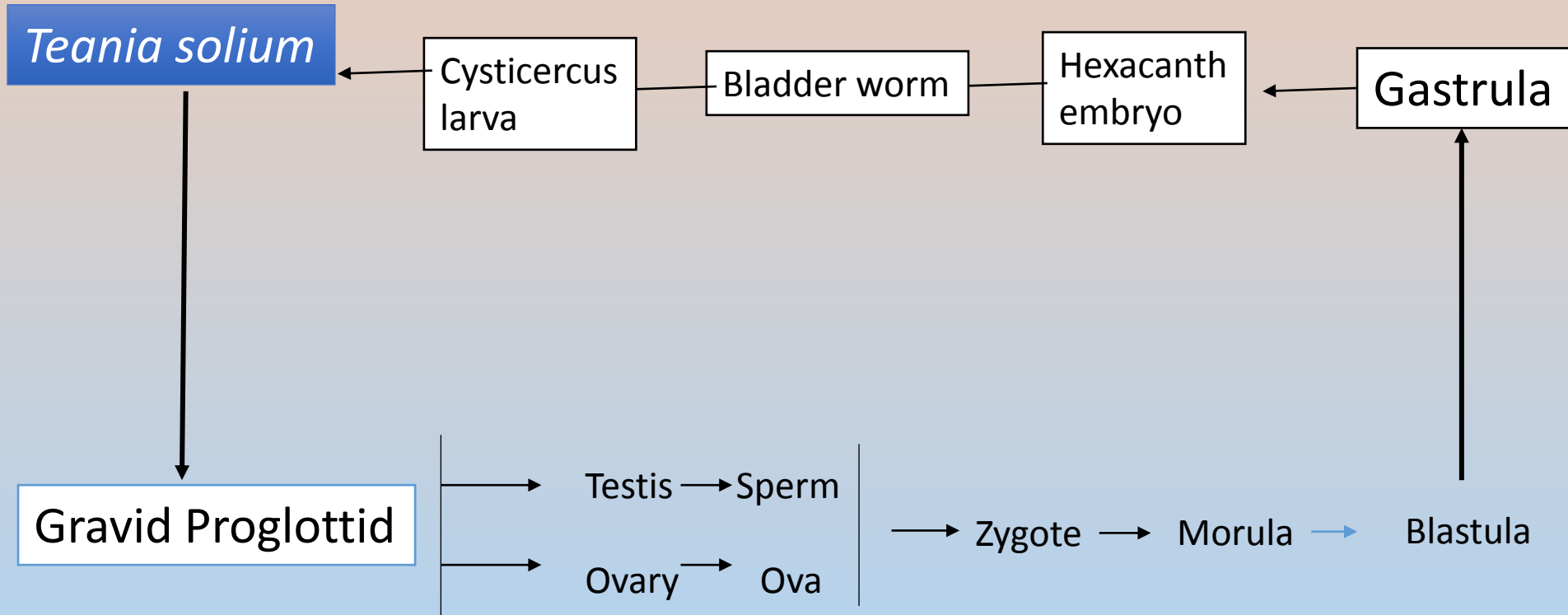
- It is the larval stage of *Taenia Solium* which has been formed by the transformation or modification of hexacanth stage.
- It is a bladder-like sac filled with a clear watery fluid having mostly blood plasma of the host.
- The wall of the bladder consists of an outer cuticle and inner mesenchyme.
- A thickening arises gradually on one side of the bladder which marks the anterior end of the larva.
- The thickened area invaginates as a hollow knob.
- The invaginated knob develops suckers on its inner surface and hooks are developed at its bottom.

- This inverted knob is called prosclex which bears suckers, hooks and rostellum.
- The embryo at this stage is called cysticercus or bladderworm.
- further development of cysticercus does not take place unless it reaches to the main host, the man.

### **Transmission to Primary Host(Human):**

- Further development is not possible inside the pig and can take place if only if taken by definitive host human .
- When taken inside human stomach, the cyst wall dissolves
- The prosclex passes to the small intestine where it is everted with a bladder attached with it.
- The suckers and hooks come out-side and ready for attachment intestinal wall.
- After attachment the bladder is cast off and new proglotids appears by budding.

**Life Cycle of *Taenia solium* is summarized below in schematic form:**



## **Alternation of Generation:**

- The life-cycle of is digenetic because the animal takes two hosts to complete its life-cycle.
- The sexual stage of it is passed in Human the primary host.
- The embryonic stages like hexacanth, systic and bladderworm are passed within pig the secondary host.



## **Process of Transmission:**

- The mode of transfer of parasites from host to host is known as transmission.
- The hexacanth embryos are transferred in many way from host to second one.
  1. Hexacanth embryo after attaining bladder-worm stage within the muscle of pig enters the intestine of human
  2. Man the final host may also be the intermediate host by auto-infection where the gravid proglottids burst by their wriggling movements after reaching into stomach due to reverse peristalsis.
  3. In gonopore the two dissimilar gametes may unite together to form a zygote and produce an adult tapeworm.
  4. The mature egg acquires cysticercus larvae as a result of unclean personal habit with consequent ingestion of eggs.