

Parasitology

Cestodes Lecture: 3

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Diphyllobothrium latum (Page 1-9)

Objectives of this lecture:

At the end of this lecture the 3rd year student is able to:

1. Describe the characteristic features of pseudophyllidean orders.
2. Describe *Diphyllobothrium latum* and *Spirometra spp.* morphology, life cycle pathogenesis, clinical symptoms, treatment and control measures.
3. Define sparganosis and their causes.

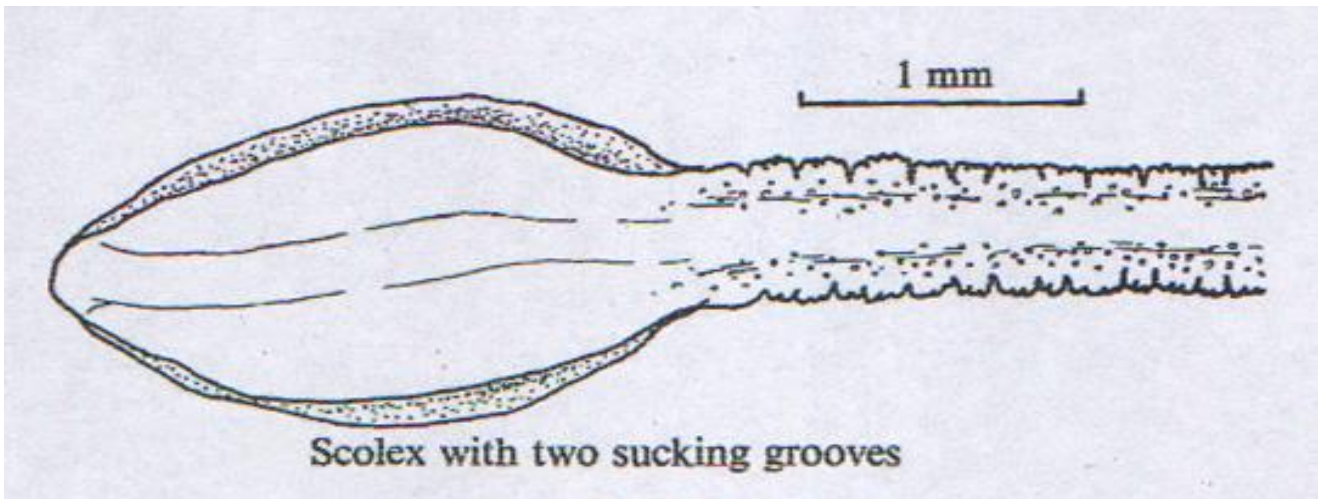
Diphyllobothrium latum

Disease: Diphyllobothriasis or the Fish Tapeworm infection

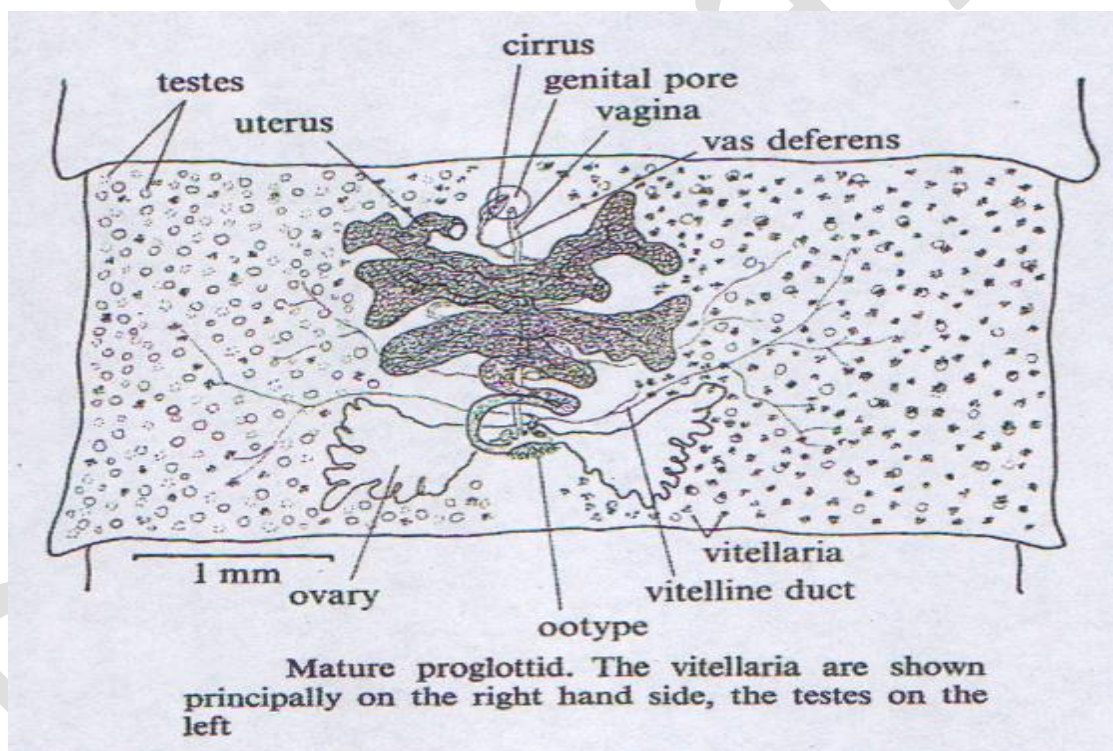
The adult worm is a member of the order Pseudophyllidea. Prevalence worldwide, where freshwater or brackish water fish are consumed raw.

Morphology:

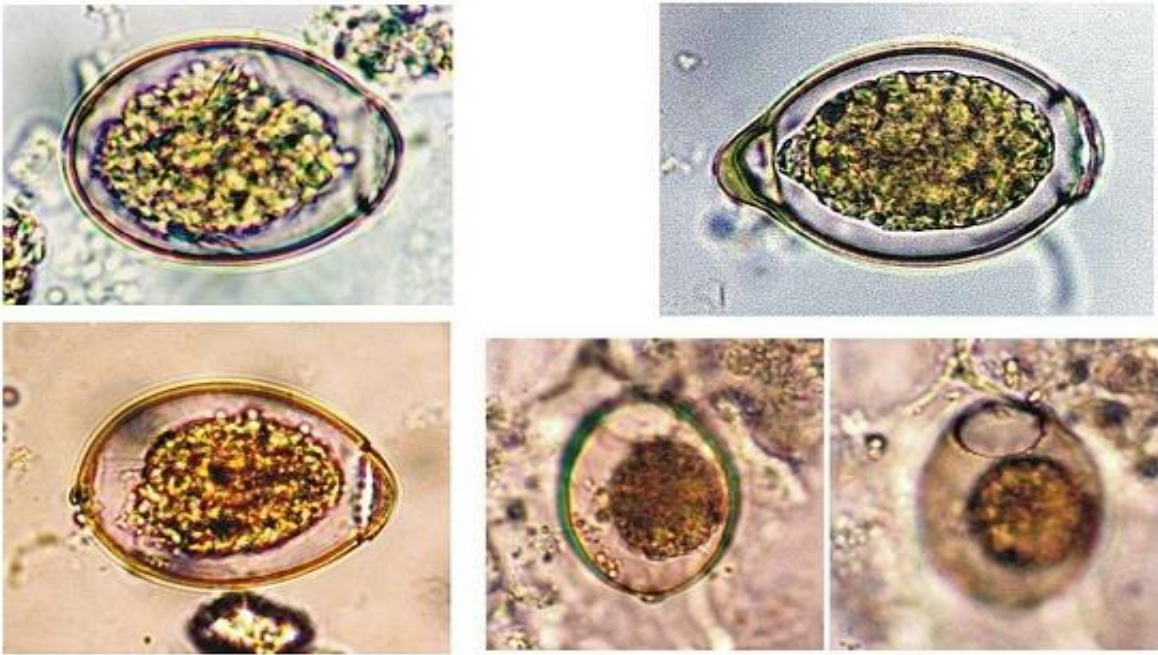
- ▶ *Diphyllobothrium latum* is the largest parasite of humans reaching lengths up to 10 m or more and consisting of a chain of 3,000 to 4,000 proglottids, each up to 2 cm wide
- ▶ Scolex elliptical or spatula-like or almond in shape, long 2 – 3 mm and provided with a pair of linear sucking grooves (bothria).
- ▶ It has a rosette-shaped uterus connected to the outside by a uterine pore through which the eggs are passed. Hence, mature segments produce eggs until they die and are shed, rather than by breaking off as intact egg-filled segments, as in *Taenia*.
- ▶ Up to a million eggs can be produced daily.



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- ▶ Eggs are 30 x 50 micrometers in size, ovoid, light golden-yellow and have an operculum at one end with a small thickening of the shell at the opposite end. They contain an embryo with 3 pairs of hooklets.
- ▶ The egg does not float in saturated solutions of common salt. A single egg gives rise to a single larva. It is not infective to man.
- ▶ Fully developed eggs are discharged through the uterine pore, terminal proglottid gradually become exhausted and disintegrate.



■ **Larva:**

- **Passed first in water and then in the respective intermediate hosts 3 stages.**

- **First stage larva**

- **Coracidium: Ciliated oncosphere that develops from egg in water.**

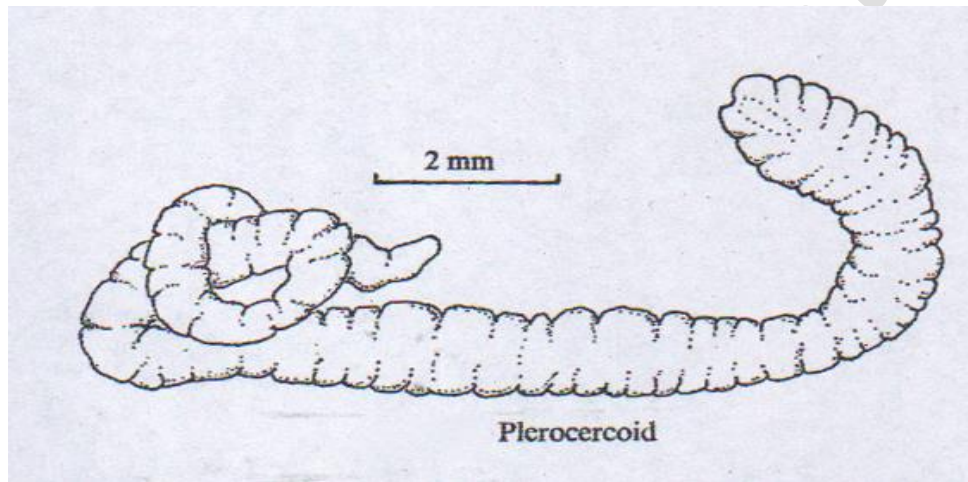
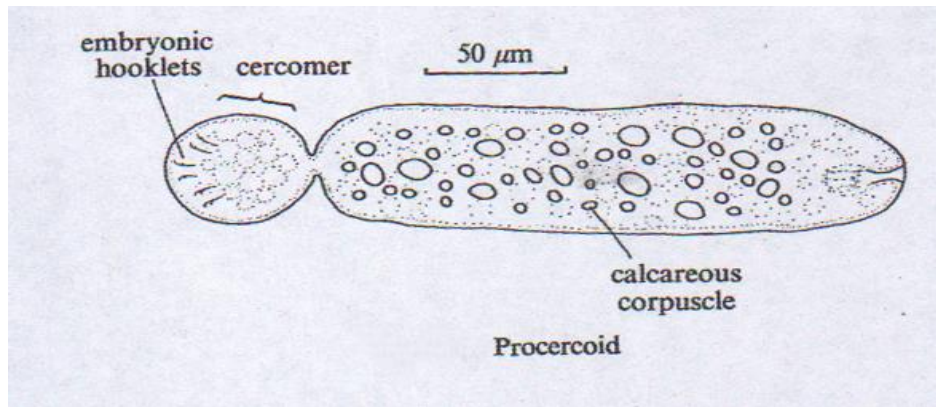
- **Second stage larva**

- **Proceroid: Spindle-like solid body with cephalic invagination. Found inside the *Cyclops* (the first intermediate host).**

- **Third stage larva**

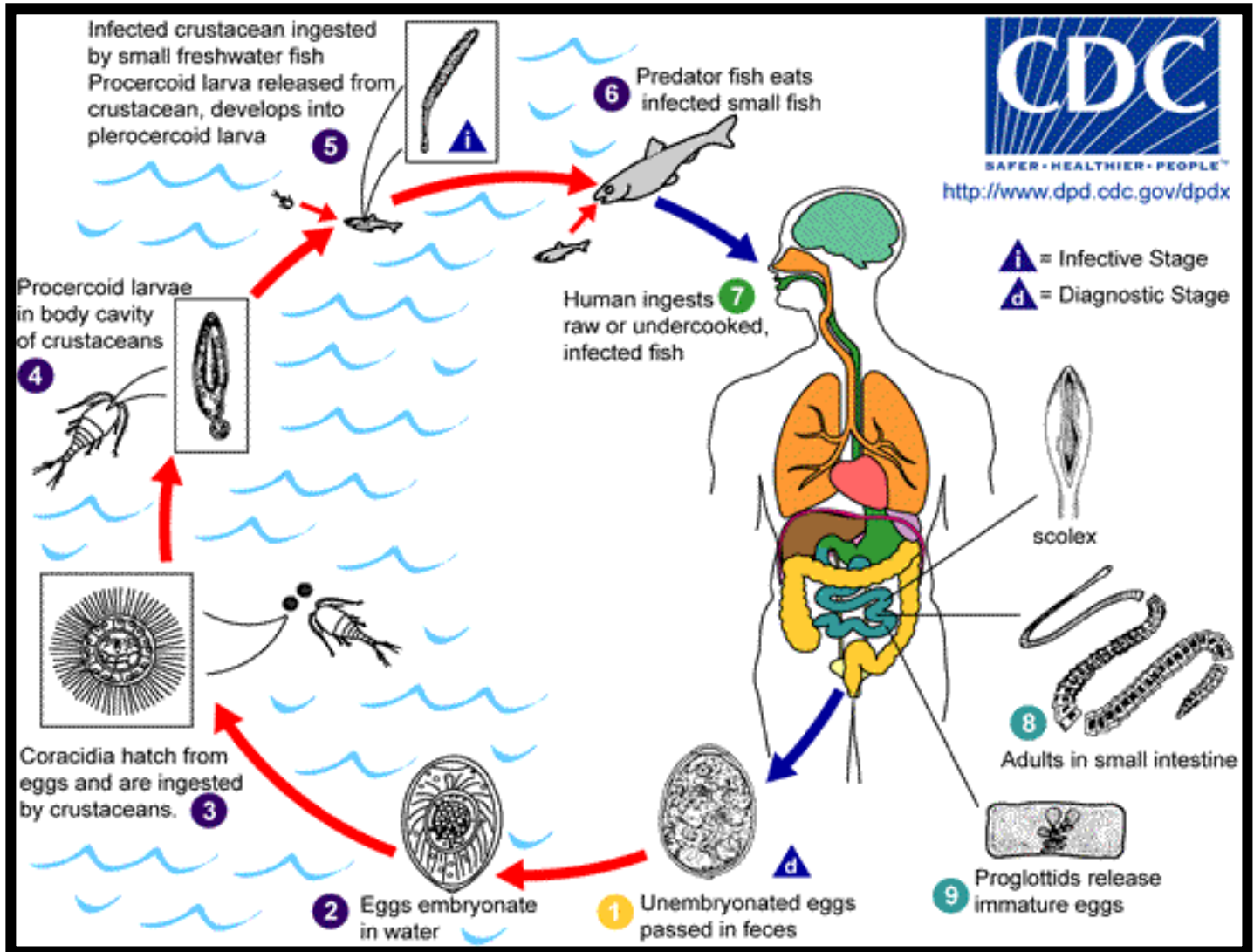
- **Plerocercoid: Head is invaginated in the neck. Found in the fresh water fish, the second intermediate host.**

Proceroid and plerocercoid, larval stages of *D. latum*, both solid organisms lacking a bladder.



Life cycle:

- Man and other animals are infected by eating uncooked fish that contains plerocercoid larvae (15 x 2 mm)(sparganum) which attach to the small intestinal wall and mature into adult worms in 3 to 5 weeks.
- Eggs discharged from gravid proglottids in the small intestine are passed in the feces.
- The egg hatches in fresh water to produce a ciliated oncosphere (coracidium) which needs to be ingested by a water flea (Cyclops) where it develops into a proceroid larva.
- When infected Cyclops are ingested by the freshwater fish (plankton feeding fish), the proceroid larva penetrates the intestinal wall and develops into a plerocercoid larva (sparganum), infectious to man, cat, dog, or bear.



Immature eggs are passed in feces **1**. Under appropriate conditions, the eggs mature (approximately 18 to 20 days) **2** and yield oncospheres which develop into a coracidia **3**. After ingestion by a suitable freshwater crustacean (the copepod first intermediate host) the coracidia develop into proceroid larvae **4**. Following ingestion of the copepod by a suitable second intermediate host, typically minnows and other small freshwater fish, the proceroid larvae are released from the crustacean and migrate into the fish flesh where they develop into a plerocercoid larvae (sparganum) **5**. The plerocercoid larvae are the infective stage for humans. Because humans do not generally eat undercooked minnows and similar small freshwater fish, these do not represent an important source of infection. Nevertheless, these small second intermediate hosts can be eaten by larger predator species, e.g., trout, perch, walleyed pike **6**. In this case, the sparganum can migrate to the musculature of the larger predator fish and humans can acquire the disease by eating these later intermediate infected host fish raw or undercooked **7**. After ingestion of the infected

fish, the plerocercoid develop into immature adults and then into mature adult tapeworms which will reside in the small intestine. The adults of *D. latum* attach to the intestinal mucosa by means of the two bilateral grooves (bothria) of their scolex ⑧. The adults can reach more than 10 m in length, with more than 3,000 proglottids. Immature eggs are discharged from the proglottids (up to 1,000,000 eggs per day per worm) ⑨ and are passed in the feces ①. Eggs appear in the feces 5 to 6 weeks after infection. In addition to humans, many other mammals can also serve as definitive hosts for *D. latum*.



Note:

- Eggs must be discharged into cool fresh water where they embryonated and hatch.
- The emerging ciliated embryo must be eaten by a copepod (Cyclops) in which the embryo transforms into a proceroid.
- The infected copepod must then be eaten by a plankton-feeding fish in the flesh of which the proceroid transforms into a plerocercoid (sparganum).
- The infected fish must be eaten raw by the definitive host in whose intestine the larva develops into the adult worm.
- Although dogs and bears are reservoirs of *D. latum*, man is primarily responsible for maintaining the life cycle of *D. latum*.

Pathogenesis & Symptoms:

- Infection with *Diphyllobothrium latum* is usually asymptomatic, although occasional diarrhea, abdominal pain, fatigue, vomiting, dizziness, loss of appetite, anorexia and nausea.
- Bothriocephalus anemia (anemia and neurological problems associated with vitamin B₁₂ deficiency are seen in heavily infected individuals).
- The infection accompanied by peptic ulcer and appendicitis.
- The infection may be multiple.

Diagnosis:

Stool examination

Diagnostic stage:

Egg with operculum

A single worm may produce up to 15000 eggs/ gm. of feces.

Treatment:

- ✓ Praziquantel is the drug of choice.
- ✓ Niclosamide (yomesan).

Control:

- ❖ Freezing for 24 hours, thorough cooking or pickling of fish kills the larvae.
- ❖ Fish reservoirs should be kept free of raw sewage.

Larval tapeworm infections

Sparganum of *Spirometra* species

Disease: Sparganosis

- ✧ It's a common parasite of dogs and cats in the orient and in other parts of the world.
- ✧ Several species of *Spirometra* are intestinal parasites of canine and feline host.
- ✧ These are pseudophyllidean tapeworm.
- ✧ *Cyclops* is the first intermediate host.
- ✧ The second intermediate hosts are various species of vertebrates such as fish, frog, snake, birds and mammals.
- ✧ **Sparganosis:** The term sparganosis is used for ectopic infection by sparganum (plerocercoid larva) of *spirometra* and some *Diphyllobothrium* spp.
- ✧ The sparganum (L3 larva) are liberated from the cyclops.
- ✧ In the human intestine. They penetrate the intestinal wall and migrate to subcutaneous tissue, where they become encysted and develop into spargana.
- ✧ The sparganum is usually found in the subcutaneous tissues in various parts of the body, but may also be present in the peritoneum, abdominal viscera, or brain.
- ✧ Definitive host: Dog and cat.
- ✧ Adult worms live in the intestinal tract of dogs and cats and produce large number of eggs which pass out along with feces in water.
- ✧ Man acts as an accidental host and gets infection by:
 - Ingestion of *Cyclops* containing proceroid larva.
 - Ingestion of plerocercoid larva present in uncooked meat of animals or birds, frogs.
 - Local application of raw flesh of infected animals on skin or mucosa.
- ✧ The life cycle of *Spirometra* species follows the same pattern as that of *Diphyllobothrium* species.

- ★ A large majority of human infection with unbranched spargana occur in the China sea area.

Pathogenesis and symptoms:

- Early infection with little host tissue reaction, but eventually the parasite provokes an infiltration of eosinophils and other inflammatory cells.
- Later the parasite may die, causing an intense inflammatory reaction with eosinophils and Charcot-Leyden crystals.

Ocular sparganosis: is characterized by intense pain, irritation and palpebral edema with excessive lachrymator. If the worm lodges under the conjunctiva it is likely to provoke nodule formation.

Diagnosis:

- ✓ Clinical symptoms in endemic areas.
- ✓ Sparganum recovered intact in the living condition and feed to a young cat or dog then it will be grow to the adult stage.

Treatment:

- Surgical removing.

Note:

Human infection with sparganum of *Spirometra* species result from:

- ▶ Drinking pond, lake or stream water containing procercoid-infected *Cyclops*.
- ▶ Eating a raw infected frog, snake or possibly small mammals.
- ▶ Applying plerocercoid-infected flesh of frogs, snakes or others as a poultice on an inflamed eye or finger.
- ▶ A spargana are known to develop in pigs, so human infection may be acquired by eating raw pork.

Control:

- Sparganosis can be avoided by drinking only safe water.
- Eating only well-cooked flesh or animals.
- Use no flesh poultices.