

## Cestodes (Tapeworms)

### *Hymenolepis nana*

The disease caused by this parasite named as: hymenolepiasis nana. This parasite commonly known as the dwarf tape worm.

*H. nana* is the smallest and the most common tape worm found in human intestine. The name hymenolepis refers to the thin membrane covering the egg (Greek hymen-membrane, lepis-rind or covering) and nana to its small size (nanus-dwarf). It is cosmopolitan in distribution but is more common in the warm than in cold climates. It is unique that it completes its life cycle in one host, the parasite being maintained by transmission between humans and even in a single individual, who can act as both the intermediate and definitive host.

### Morphology

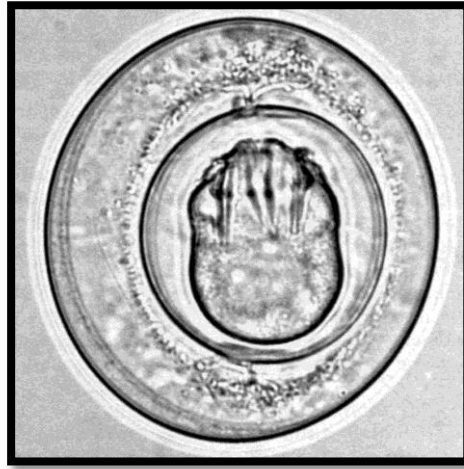
The adult worm lives in the human intestine, often in large numbers. The scolex has 4 suckers and a retractile rostellum with a single row of hooklets. The long slender neck is followed by the strobila consisting of 200 or more proglottids which are much broader than long. The mature segment are wider than long with a single genital pore situated laterally toward the anterior border on the same side of each segment. Each segment contains three dorsally located testes, vas deferens, ovary, mehlis gland, uterus and vagina. The gravid segment the sacculated uterus which holds from 80-180 ova. Eggs are released in the intestine by disintegration of the distal gravid segment.



The eggs are roughly size, with a thin colorless

spherical as ovoid, 30-45 um in outer membrane and inner

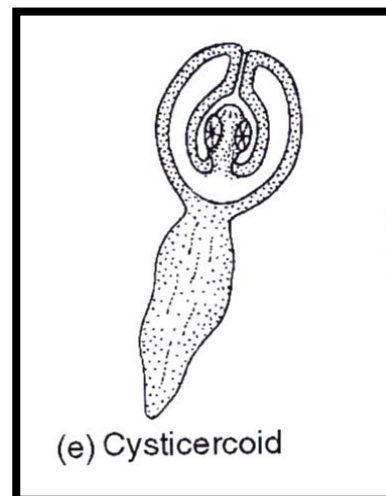
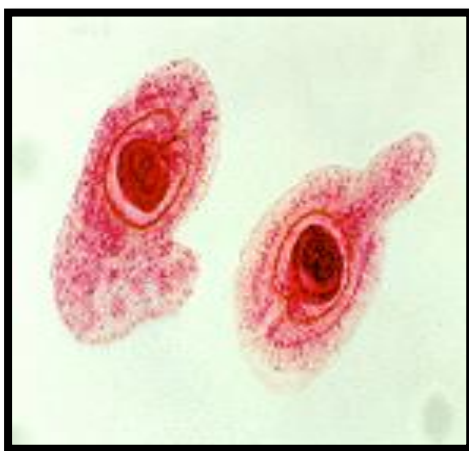
embryophore enclosing the hexacanth oncosphere. The space between the two membranes contains yolk granules and 4-8 polar filaments arising from two knobs on the embryophore.



### life cycle:-

Infection occurs by ingestion of the eggs by fecal oral transmission from person to person or in the same individual. Internal autoinfection may also occur when the eggs released in the intestine hatch there itself. No intermediate host is required. *H. nana* is unusual in that undergoes multiplication in the body of the definitive host.

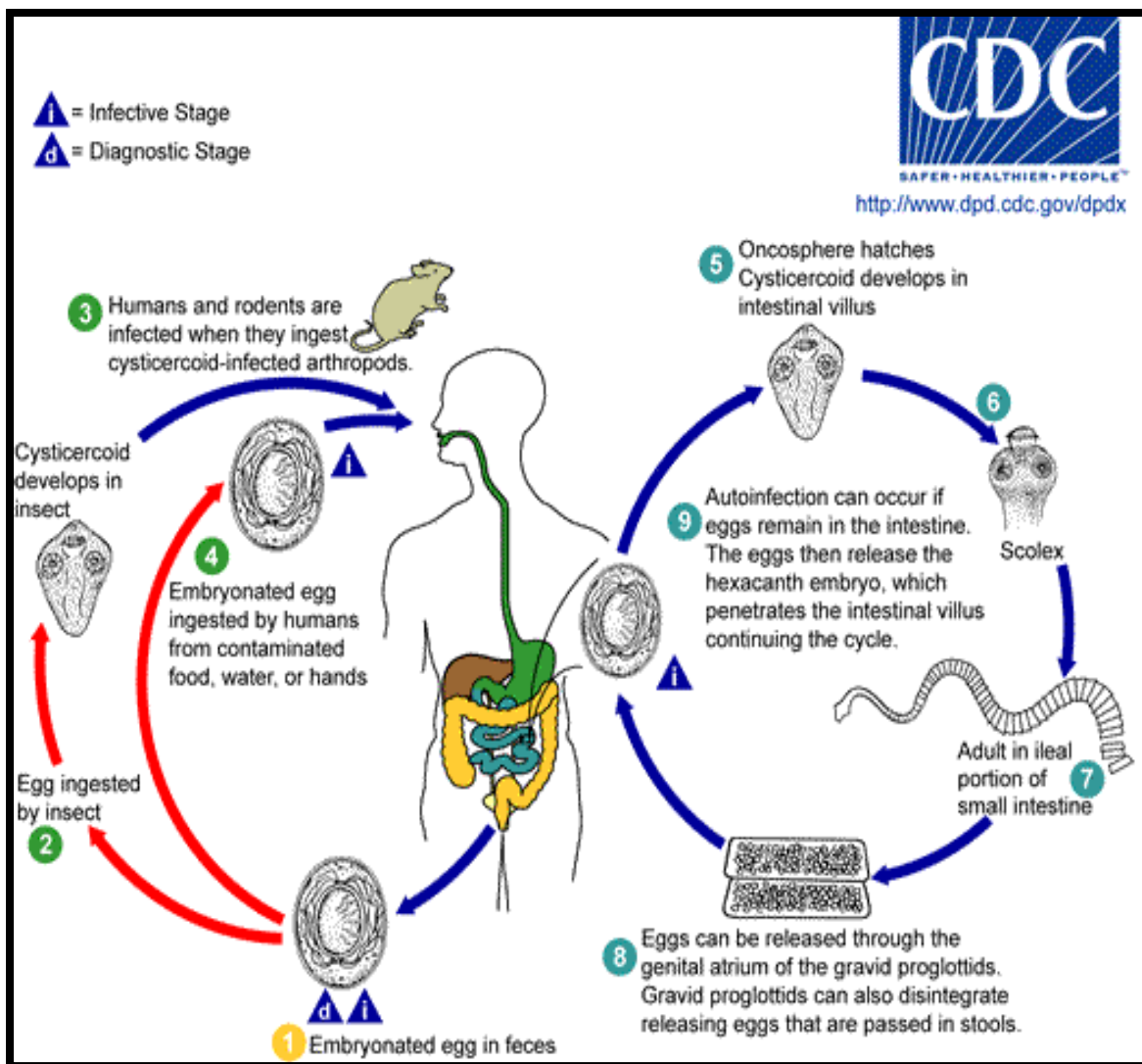
When the eggs are swallowed, or in internal autoinfection they hatch in the duodenum or jejunum. The hexacanth embryo penetrates a jejunum villus and develops into the cysticercoid larvae.



This pyriform structure with a vesicular anterior portion containing the invaginated scolex and a short conical posterior end. After about is portion

4 days the mature larvae emerging out of the villus evaginated its scolex and attach to the mucosa. It starts strobilization to become mature worm which being producing eggs in about 25 days.

A different strain (murine strain) of *H. nana* such as *H. nana* fraterna infects rats and mice. The eggs passed in rodent faeces are ingested by rat fleas (*Xenopsylla cheopis*) and others which act as the intermediate host. The eggs develop into cysticeroid larvae in the haemocoel of these insects. Rodent gets infected when they eat these insects. Man gets infection by ingestion of contaminated food by these insects. The immune response in the case of *H. nana* fraterna infection is less than *H. nana*.



### Symptomatology and pathology:-

In light infections, symptoms may be absent or be limited to vague abdominal discomfort. In heavy infections, particularly in children, abdominal pain

nausea, vomiting, weight loss, nervousness, headache, diarrhea with nose and anal pruritis and urticaria and other toxic manifestations may be present. Since the cysticercoid larvae develop in the villi, extensive erosion may be caused by overwhelming infections. Fortunately, however, no blood stream invasion occur, extra intestinal cysticercosis does not ensure.

**Diagnosis:**

Recovery of identification of the eggs in the faeces establishes the diagnosis.

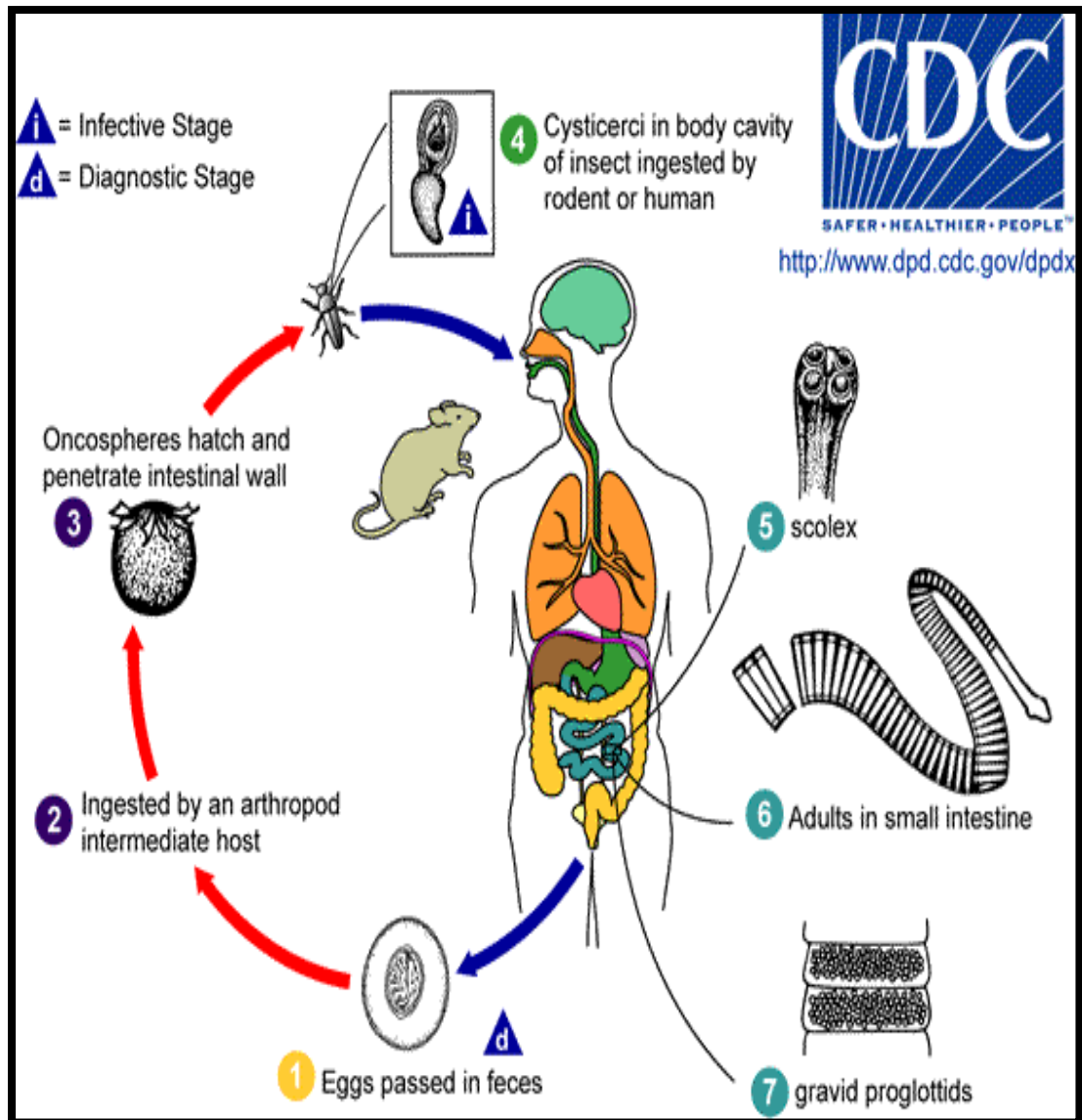
**Treatment:**

Praziquantel and niclosamide are effective in treatment.

***Hymenolepis diminuta***

- Rat tapeworm.
- Egg/cysticercus larva in flea or grain beetle.
- Rat/flea (human accidental host)
- Humans accidentally ingest the flea or grain beetle
- The head is small and cuboidal with a rudimentary unarmed rostellum with 4 small suckers. The mature segment is similar to that of *H. nana*.
- *H. diminuta* produces the same pathology and symptoms of *H. nana*.
- The life cycle is similar to that of murine strain of *H. nana*. Rarely human infection follows accidental ingestion of infected rat fleas.





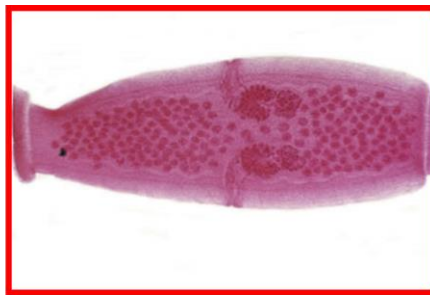
### *Dipylidium caninum*:-

Disease caused by this parasite named as dipylidiasis. Dog tape worm infection.

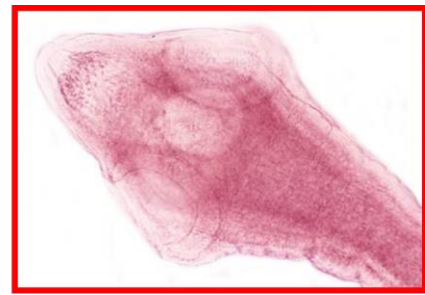
### Morphology and life cycle:

The adult worm in the intestine is about 10-70 cm long. The scolex has 4 prominent suckers and retractile rostellum with up to 7 rows of spines depending on the age of the worm. The neck is short and slender shape. The mature and gravid proglottids are typically pumpkin-seed like shape. Mature segment provided with double set of reproductive organs with a genital pore on each lateral margin.

Male reproductive organ consists of testes as rounded follicles (200 in number) distributed along the segment, from testes extend vas deferens and opened into genital pore. Female reproductive organ represented by ovary, which composed of two lobes, and on the top of each ovary there is vitelline gland, the vagina extend from ovary to the genital pore. Gravid proglottids are filled with polygonal uterine blocks (egg pocket) contain 8-15 eggs enclosed in an embryonic membrane. The egg is round, thin shell 30-40  $\mu\text{m}$  in diameter and has delicate hooklets.



Mature proglottid of *Dipylidium caninum*



Scolex of *Dipylidium caninum*



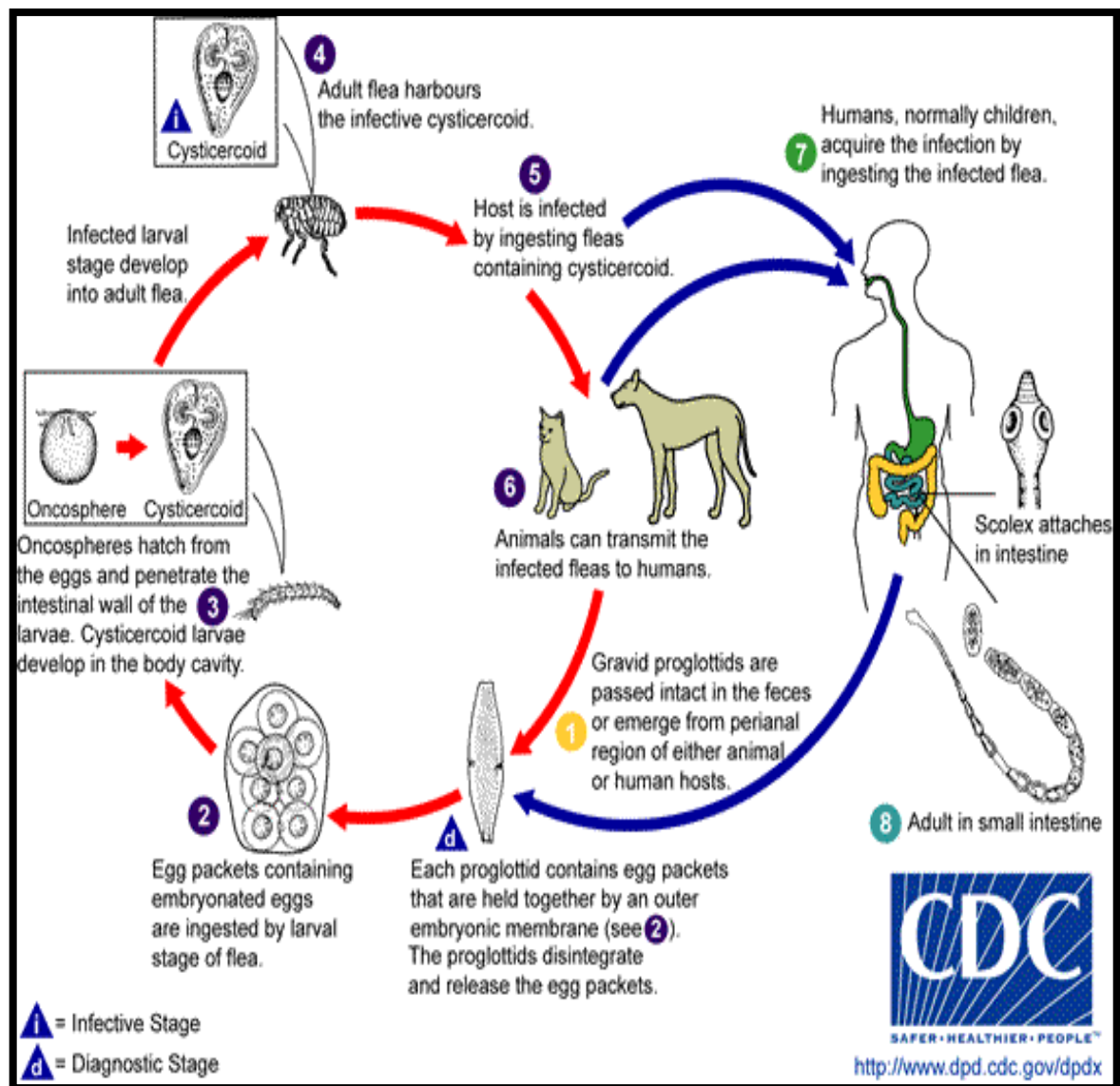
Egg of *Dipylidium caninum* (Egg pocket)

### Life cycle:-

This common parasite of dogs and cats may rarely cause humans infection, mainly in children, Gravid segments are passed intact in the feces of human or other animals host, the egg pockets containing embryonated eggs are ingested by the larval stage of dog flea, cat flea, and human flea, hatching in the intestine of the insect, the released onchosphere penetrate the intestinal wall and develop to cysticercoids larvae in the haemocoel. The adult flea are swallowed by the dog and infective cysticercoids evaginate their scolex, attach to the intestinal wall and then becomes mature adult worm within 20 days, man is accidental host due to the swallowing of adult flea.

## Symptoms and pathology:

Most cases are asymptomatic and the degree of pathogenicity is associated primarily with the number of worms present the symptoms are abdominal pain diarrhea , irritability and anal pruritis (actively motile proglottids passed in stools may cause alarm ) urticaria, indigestion and loss of appetite.



## *Diphyllobothrium latum*:-

Commonly named as fish tape worm (broad fish tapeworm). Human are the optimal definitive host, though dogs, cats and other fish eating animals also act

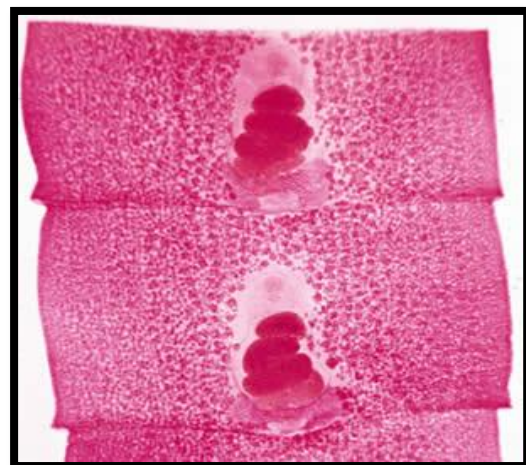
as definitive host. The adult worm found in the small intestine, usually in the ileum, where it lies folded in several loops, in contact with the mucosa. It is ivory colored and very long measuring up to 10 meters or more. The scolex is spatulate or spoon-shaped. It carries two slit-like longitudinal sucking grooves (bothria) one dorsal and the other ventral. After the scolex is the thin unsegmented neck region, then the proglottids (3000 or more), immature, mature and gravid segments. The mature segments contain male and female reproductive organs. These proglottids tend to be passed in strands of variable length in the stool. The proglottids tend to be broader than long.



**Scolex of *Diphylobothrium latum***

The male reproductive organ consists of the testes are minute, multiple follicles situated in both lateral field of the segment, the vas deferense proceeds as coiled tubule extend to the upper border of the common genital atrium.

**Mature proglottid of *Diphylobothrium latum***



The female reproductive organ includes ovary is consisting of two lobes , between them the ootype which surrounding by mehlis gland, the vagina proceeds directly up from the ootype and opens externally just below the genital pore. The vitelline glands are minute multiple follicles and situated ventral to the testes in the lateral field.



The uterus extend from the ootype as rosseted coiled shape and found in the middle of the mature segment.

The eggs are passed in the stool in large number, they are ovoid , light brown shell ,has operculum at one end and often small knobe at the other , they are not infective to human.The eggs are passed in the stool unembryonated. Size range: 58 to 76  $\mu\text{m}$  by 40 to 51  $\mu\text{m}$ .

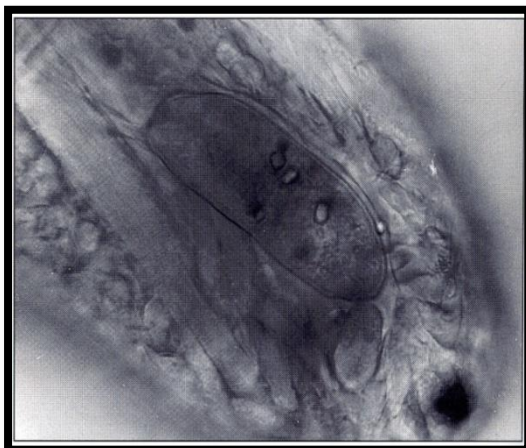


*Egg of Diphyllobothrium latum*

### **Life cycle**

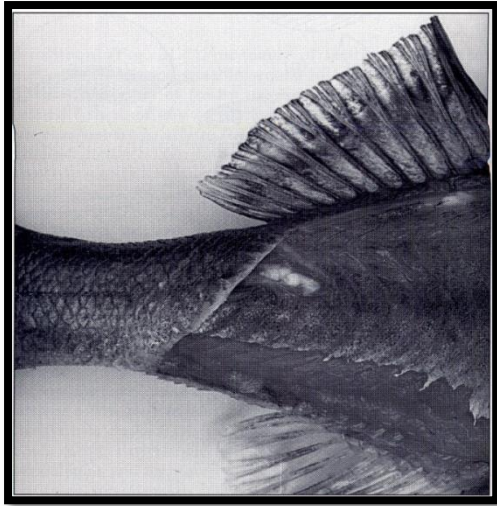
The passed egg contain immature embryo surrounded by yolk granules, in water, the hexacanth embryo mature and emerges through the operculum as the ciliated larval stage , called coracidium which swims and can survive in the water until ingested by the first intermediate host ,fresh water copepods like Cyclops. In the mid gut of Cyclops the coracidium casts off its ciliated coat and by means hexacanth embryo penetrates in to the body cavity and develop to second larval stage which is called proceroid larva, it has arrounded caudal appendage (cercomer) which bears useless hooklets.

If the infected Cyclops ingested by the second intermediate host, fresh water fish, the proceroid larva penetrate the intestine of the fish and grows in to third larval stage called plerocercoid larva or sparganum (this is the infective stage for human), when fish containing plerocercoid larva is eaten uncooked or undercooked, the larva develops to the adult worm in the small intestine.



❖ The coracidium is eaten by the copepod (First Intermediate Host) ,looses its ciliated coat

and once through the intestine and into the hemocoel, it develops into the proceroid in 3 weeks with a cercomer at the posterior end. The copepod is weakened by the parasite and less motile



❖ The larvae penetrate the small fish gut (Second Intermediate Host) and migrates in the muscle. Here it grows and matures into the plerocercoid. Mature plerocercoids can be easily seen as white masses in uncooked fish

### **Pathogenicity:-**

The pathogenic effects of diphyllobothriasis depend on the mass of the worm, absorption of its products by the host and deprivation of the host essential metabolic intermediates.

The worm is attached to the wall of ileum, some people show no evidence of its pathogenicity, in other may be cause mechanical obstruction of the bowel; by the large number of the worms that become tangled together or at times produce diarrhoea, abdominal pain, nausea and anaemia.

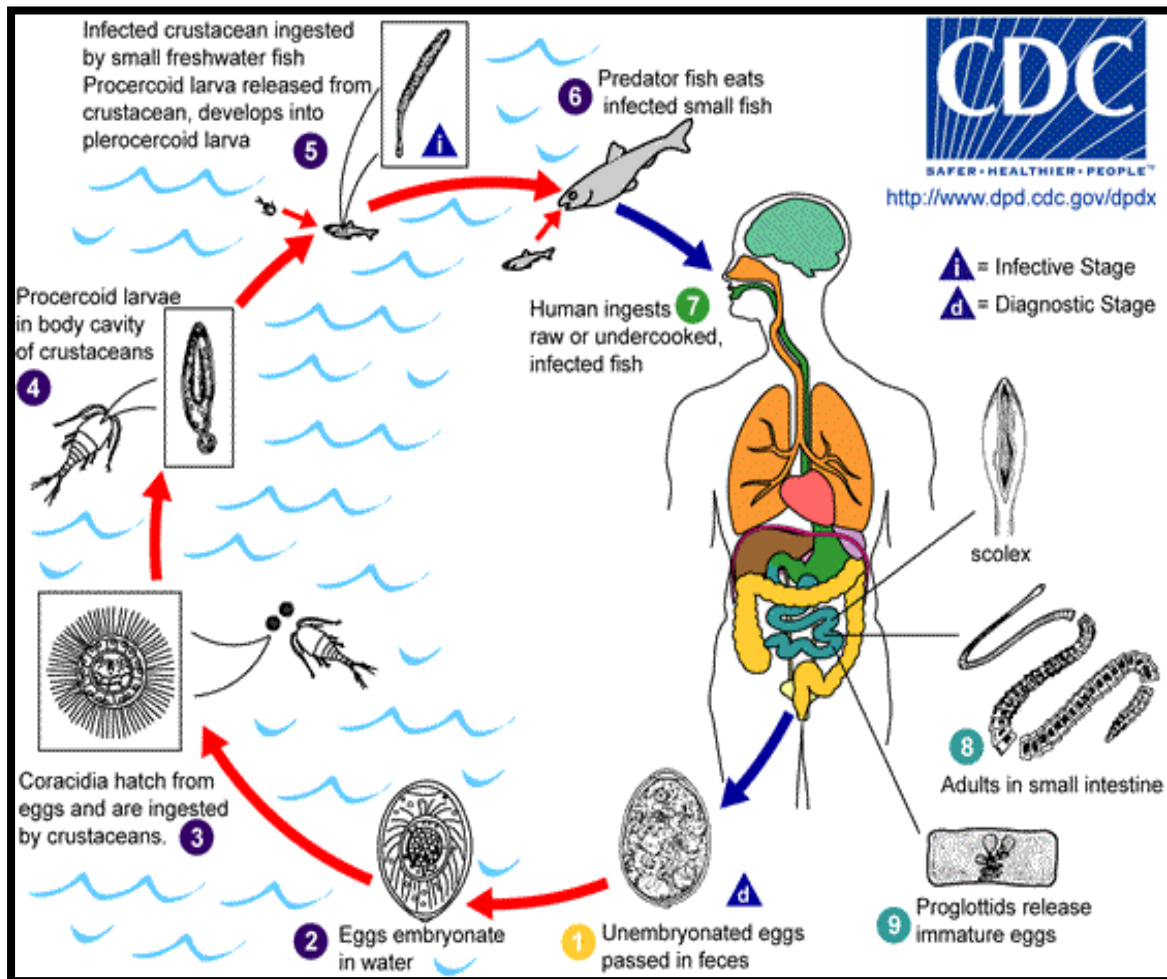
In patients with genetic deficiencies in Vitamin B12 uptake the parasite competes effectively for the entire vitamin leading to severe pernicious anemia.

### **Diagnosis:-**

By recovery the eggs or segments in the feces by general stool examination.

### **Treatment:-**

Niclosamide, praziquantel, quinacrine hydrochloride.



### Sparganosis:-

Infection of humans by plerocercoid larvae of various diphyllobothroid tapeworms belonging to the genus *Spirometra* is known as Sparganosis.

Man is an acceptable second intermediate host for certain species that normally develop to the adult stage in other mammals. Sparganosis in human is cosmopolitan, though it is rarely seen in most parts of the world.

The infection may be acquired by drinking water containing copepods infected with larval stage of the parasite, in which the larva penetrate the gut wall and works its way into the muscles or subcutaneous tissues, where it grows into the sparganum larva. These larvae may migrate actively in the subcutaneous. In

various areas snakes or tadpoles are consumed raw for medicinal reasons. If they happen to be infected with plerocercoids, these parasites may be capable of penetrating the intestinal wall to infect humans, causing Sparganosis.

Another manner in which human infections have been known to take place is through the practice of placing poultices of frog or snake flesh on open wounds or other lesions, especially of the eyes. If the flesh is infected with plerocercoid larvae, these may actively crawl in to the poultice lesions and established itself.

In the early stage there is apt to be relatively little host tissue reaction but more prolonged residence of the parasite provokes an infiltration of eosinophils, epithelioid cells and lymphocytes. As the infection become chronic there develops an extremely tender, swollen area around the parasite , filled with the chylous fluid in which the larvae are elongating and contracting, later the parasite may die causing an intense inflammatory reaction.

Ocular sparganosis is usually very serious , it is characterized by intense pain ,irritation and palpebral edema with excessive lacrymation . If the worm lodge under the conjunctiva it is likely provoke nodule formation, if its position is retrobulbar, lagophthalmos and corneal ulcer are characteristic.

A single sparganum in superficial tissues is easily removed after incision under procaine anesthesia and withdrawal the worm by gentle traction.

Ocular sparganosis is more serious and requires proficiency to remove the parasite without additional damage to the tissues of the eye.