3- CESTODES (THE TAPEWORMS)

- The basic body of the adult cestode comprises a scolex (head), which is adapted for adherence of the parasite in the host, usually the gut . The scole consists of several adhesive structures including hooks, suckers, tentacles or specialized adherence areas, e.g. bothria. The rest of the body, the tape, comprises a series of segments (proglottids) each containing a complete and sometimes doubled set of male and female reproductive organs. Some cestodes, e.g. caryophyllideans that occur in cyprinid fish, lack any segmentation and comprise a uniform, unsegmented monozoic body. Tapeworms lack an intestine and nutritional requirements are met by uptake via the external surface. The life cycle of cestodes involves two or three hosts: a definitive or final host in which the adult parasite occurs and one or two intermediate hosts that contain juvenile stages of the worms, the so-called metacestodes. Fish can serve as both the definative or intermediate host, and can on some occasions harbour a parasite that does not undergo development. The adult worms are usually white in colour and may be very elongated. They are parasitic in the intestine of the host. Larval cestodes are commonly found in fish, often encysted amongst the viscera and musculature.

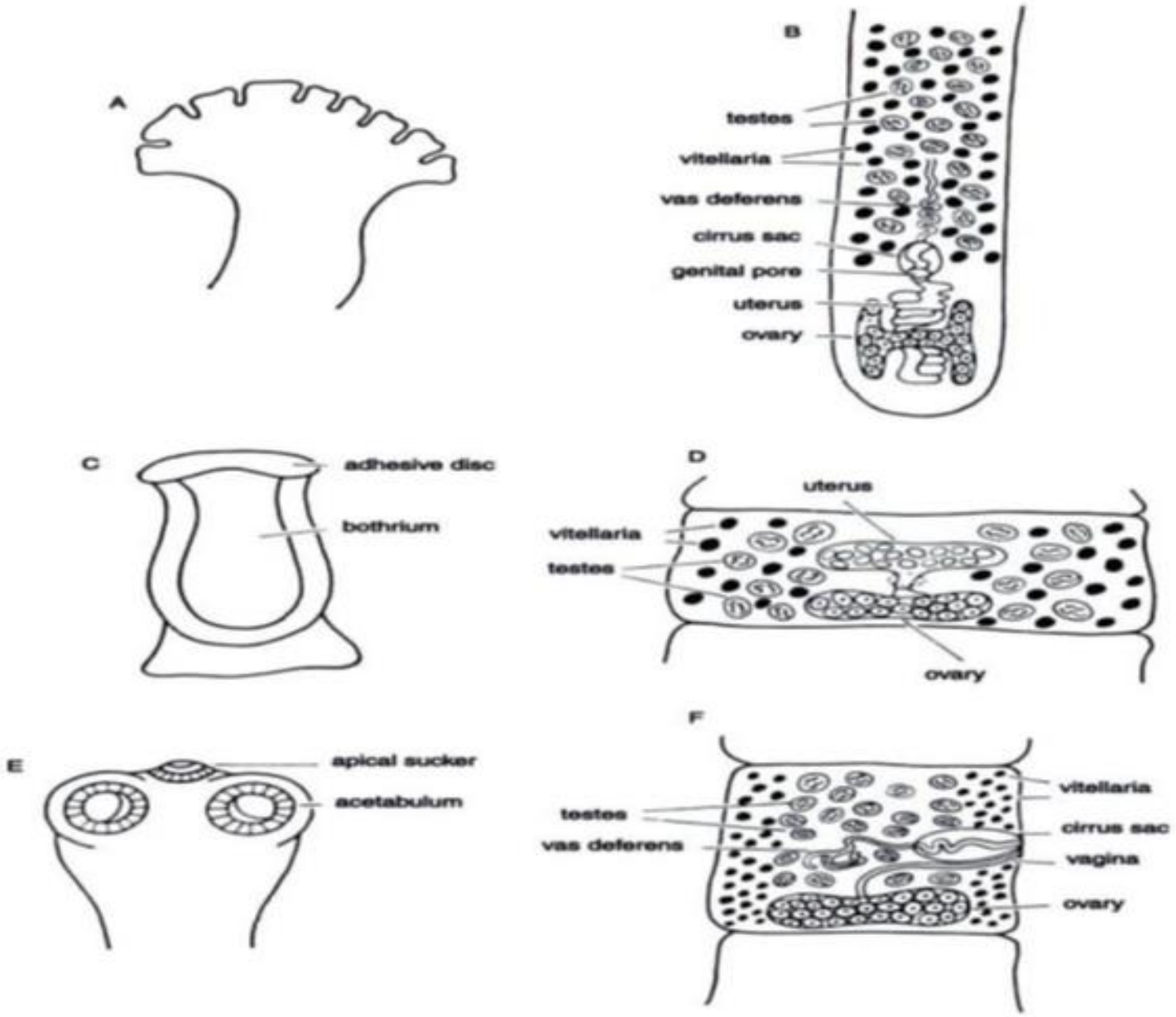
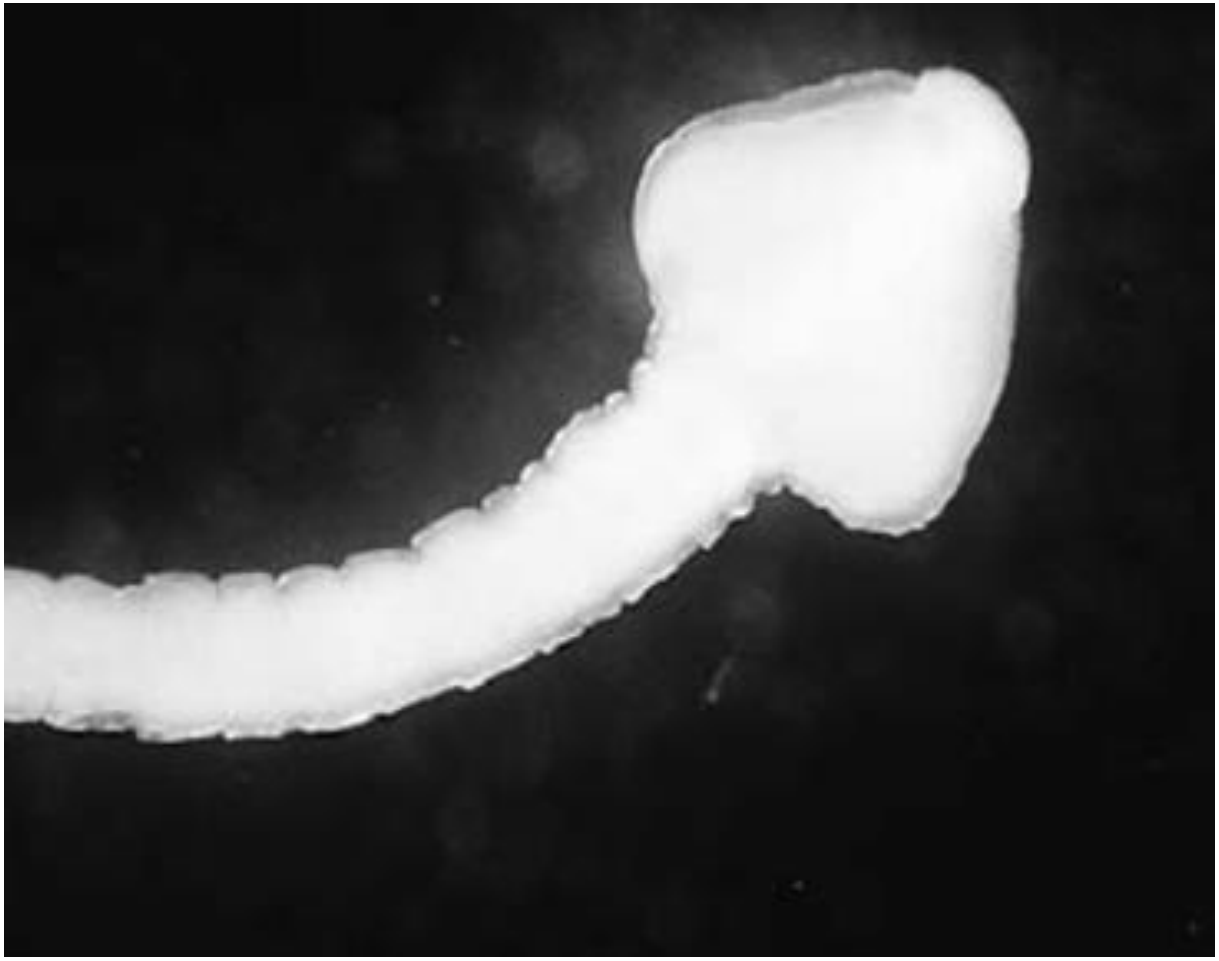


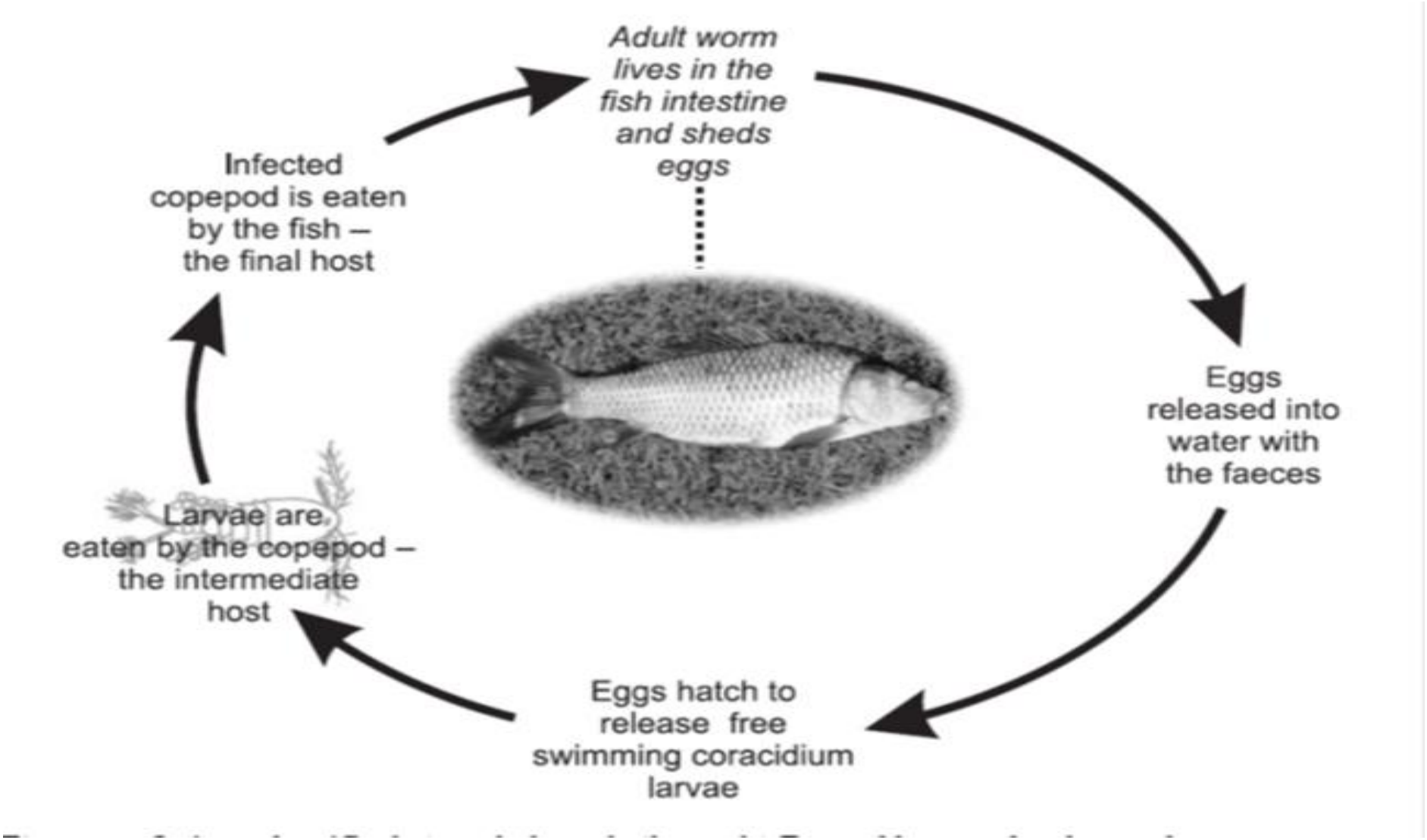
Fig. 7.7. Cestode structure. A, Caryophyllaeid scolex. Note the simple fan-shaped scolex. B, The reproductive system of a caryophyllaeid cestode. Note the absence of segmentation. C, Pseudophyllid scolex. D, Pseudophyllid proglottid. E, Proteocephalid scolex. F, Proteocephalid proglottid.

- **a-Fish as definitive hosts**
- **1-Bothriocephalosis**

- **Causes**:- ***Bothriocephalus acheilognathi*** **(Asian carp tapeworm)**
- **Life cycle:-** The life cycle consists of two hosts . The adult parasite, which grows up to 320 mm in length and 4 mm in width and comprises a characteristic ‘viper-like’ scolex with two long attachment grooves, bothria, occurs in the intestine of the fish . Eggs are shed into the faeces of the definitive host. Development of the larva, the coracidium, enclosed in the egg is dependent on water temperature .The intermediate host, several species of copepod, ingests the liberated larval stage in which the procercoid stage of the parasite develops. The fish becomes infected by eating the infected intermediate host.



Scoleces of *Bothriocephalus acheilognathi*



Life cycle of *Bothriocephalus acheilognathi*..

- **Clinical signs:-** Symptoms associated with bothriocephalosis include sluggish movements, emaciation and swimming close to the surface of the water. Parasites, which usually accumulate at the anterior part of the intestine, posterior to the common bile duct opening, can cause intestinal blockage, enlargement of the abdomen and on some occasions rupture the intestinal wall. At the point of attachment of the parasite the bothria engulf the intestinal folds and induce a local inflammatory response in which separation of epithelial cells or complete loss of the gut epithelium occurs.

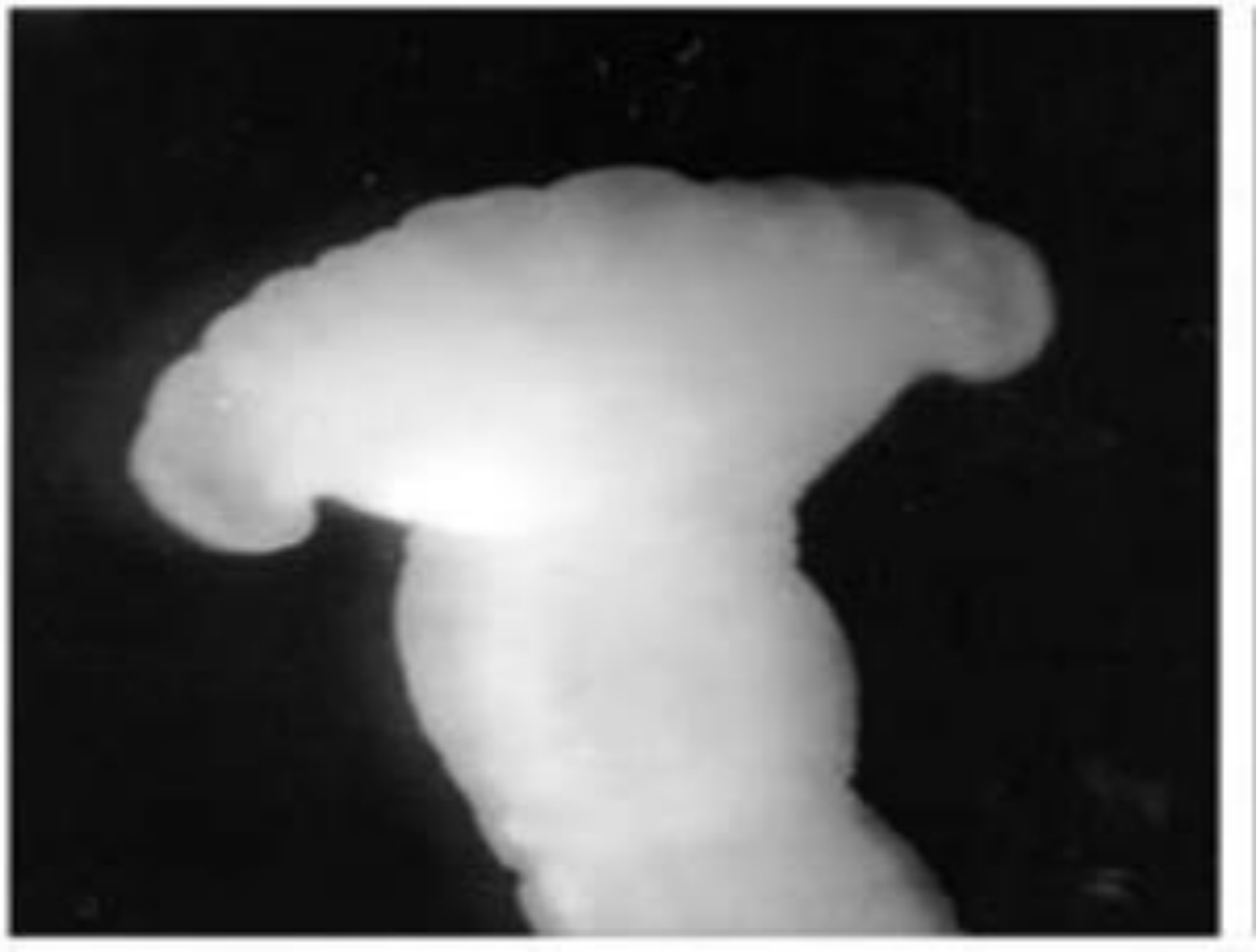
- **Diagnosis:-** Diagnosis of diseased fish entails identifying the tapeworm in the intestine and the preparation of whole specimen mounts for microscopical examination.

- **Control and Treatments**:-

- 1- Ponds can be drained dry and disinfected with lime.
- 2- phenosal 0.5-1 gm/kg B.W for adulte I/M
- Phenosal 0.2 gm/fish for fingerling mixed with feed.
- 3- CaO 1 kg/100 kg feed.
- 4- oral administration of a variety of anthelmintics e.g phenothaizine 3-4gm/1kg B.W

- 2- **khawiosis**

- **Causes**:- ***Khawia sinensis***
- The adult unsegmented tapeworm occurs in the intestine of a variety of fish species. *Khawia sinensis* primarily occurs in common carp, but it may occur in atypical hosts, e.g. tench and goldfish. The scolex of *Khawia* species is typically clover-shaped and is not separated from the rest of the body by a well-defined neck



Scoleces of *Khawia sinensis*

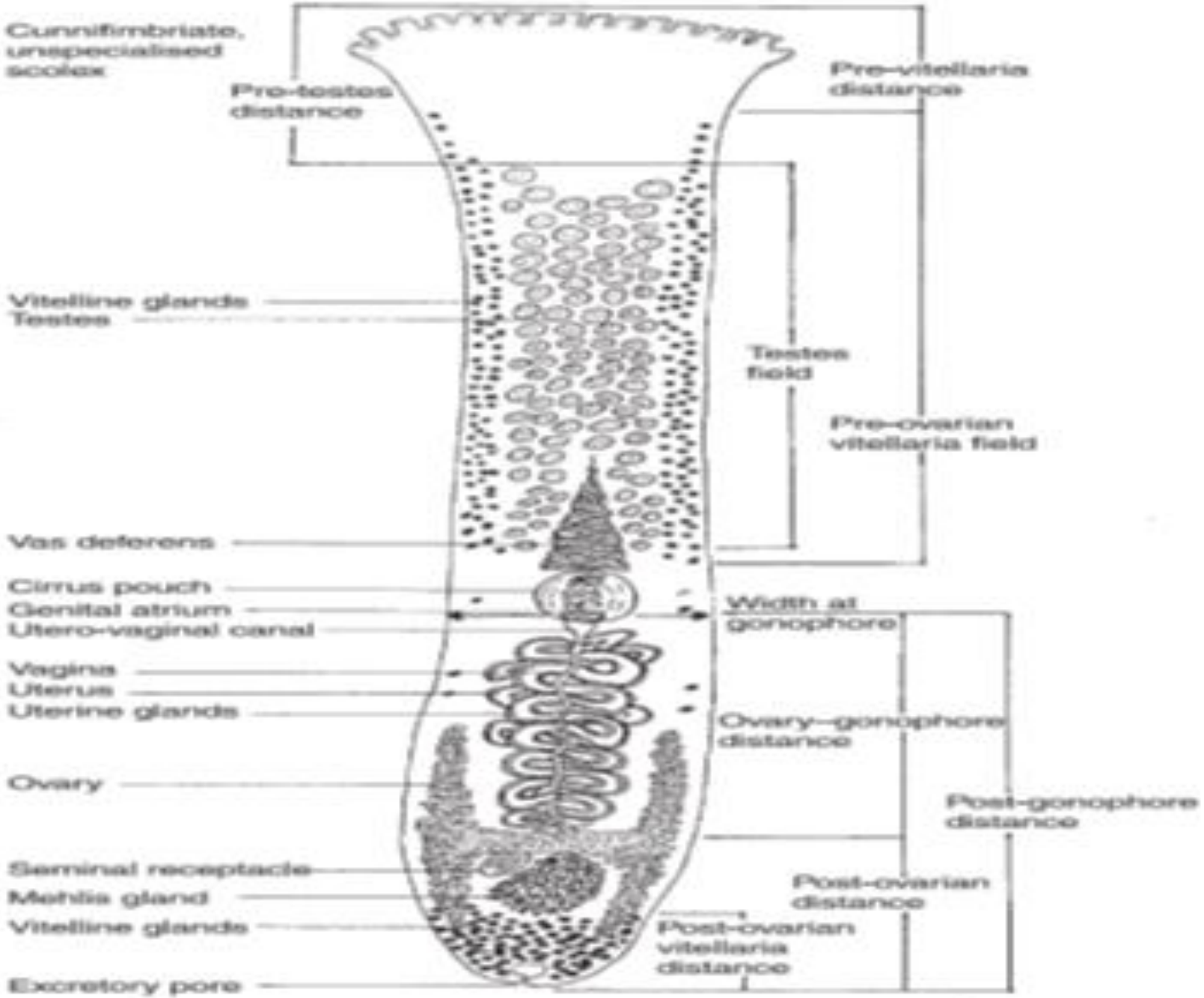
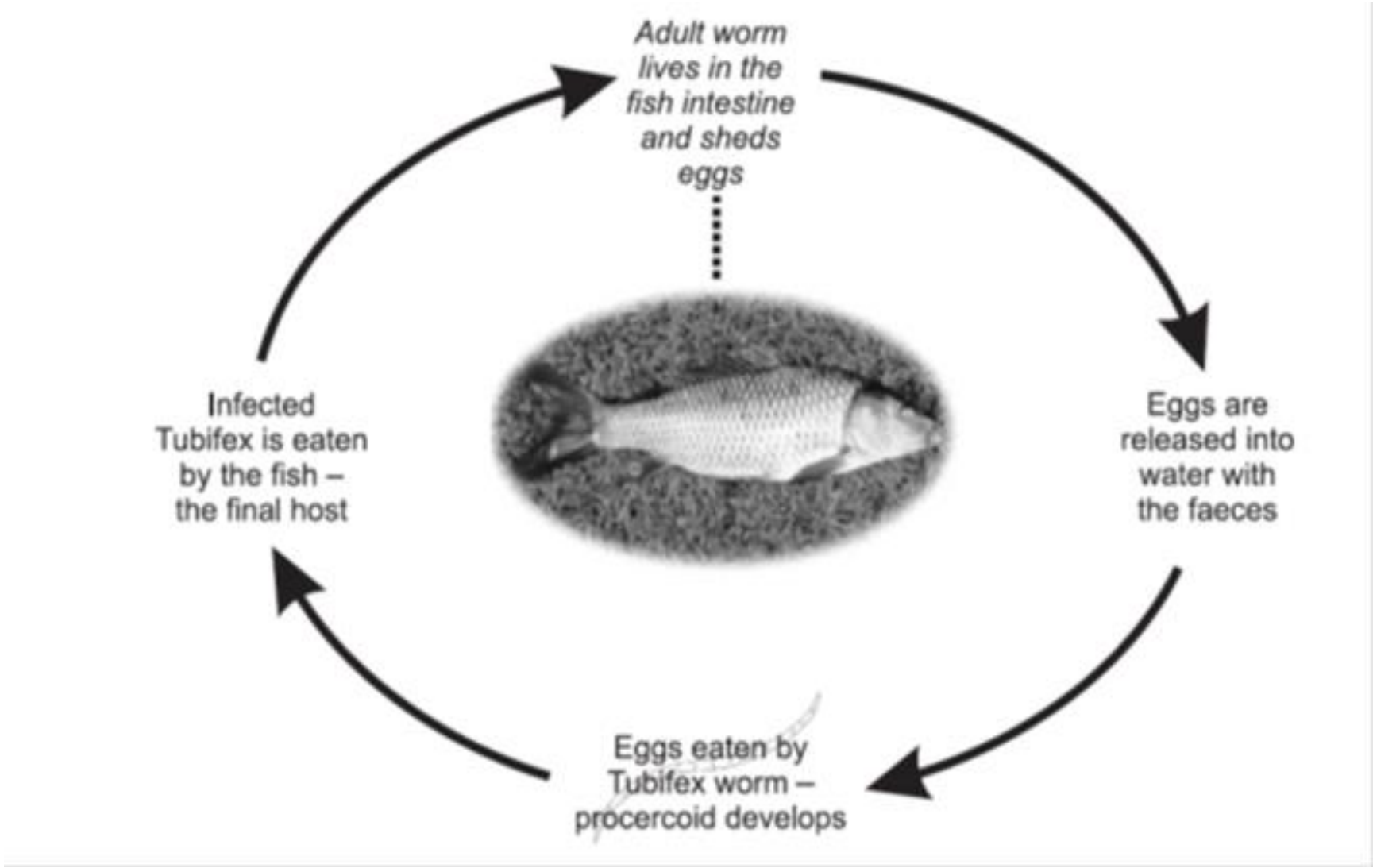


Fig. 5.24 Diagram of the body plan of *Khawia sinensis* (courtesy of Dr Neil Morley.)

- **Life cycle:-** The life cycle of *K. sinensis* comprises two hosts: a definitive host, in the intestine of which occurs the adult tapeworm; and an annelid worm (e.g *Tubifex tubifex*) intermediate host in which the procercoid stage of the parasite resides. Eggs are shed into the gut lumen of the fish and are thence passed out in the faeces. Embryonic development occurs in water or perhaps within the intermediate host. The rate of development is influenced by temperature, e.g. at 23–24°C development takes 16 days whilst at 10–12°C it takes as long as 57 days. When the egg with the fully developed oncosphere is ingested by an annelid, hatching occurs and the larval stage penetrates into the body cavity and develops into a procercoid. Transmission to the definitive host, the fish, occurs when the infected annelid is eaten. Development of the tapeworm can take 2–3 weeks at approximately 20°C . Eggs are produced after 7 weeks, but take slightly longer, e.g. up to 11 weeks, at lower temperatures. Survival of the parasite within the fish varies again depending on temperature and host factors. In summer parasites can survive for 40 days but worms can over-winter for 7–8 months.



Life cycle of *Khawia sinensis*

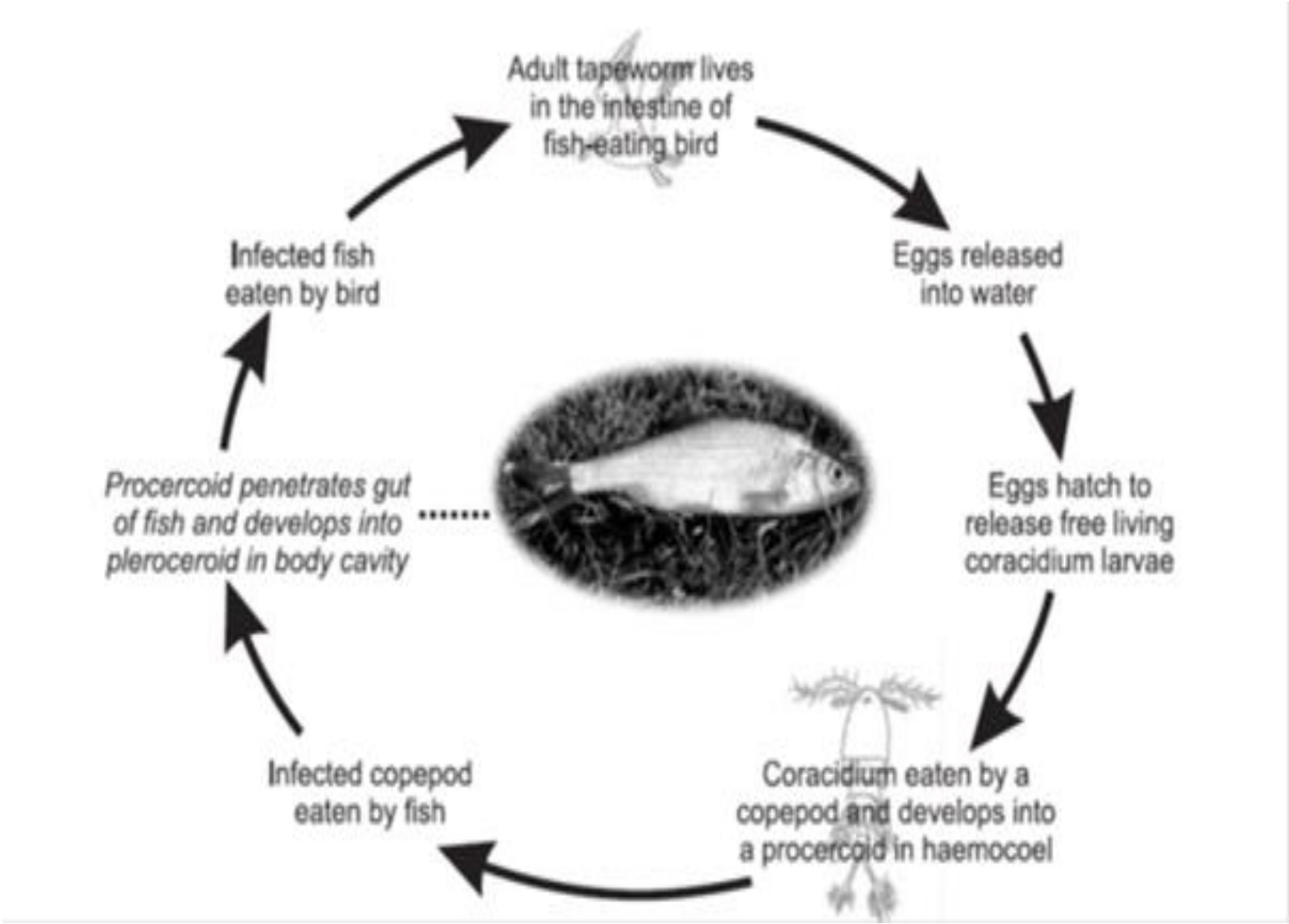
- **Clinical signs:-** The clinical signs of infection include sluggish movements, loss of appetite, emaciation, growth retardation and an anaemic appearance to the skin and gills. In heavy infections the worms can protrude from the anus of the fish and death of the host can occur by the parasites completely obstructing the intestinal lumen. Mortalities have been recorded with infection intensities of 35–45 worms although in carp fry death has been recorded with 3–5 parasites.

- **Diagnosis:-** 1- Clinical signs 2-Lab.examination
- **Control and Treatments**:-1- General control of the parasite usually aims to prevent the formation of new centers of disease and includes the removal of worms from fish before transference. Segregation of fry from adults, control of water supply, surveillance of head ponds and prevention of overcrowding have also been suggested to reduce the effects of the parasite. Destruction of the annelids has also been proposed. Ponds are drained until a soil moisture content of 12% is achieved, the bottom of the pond allowed to freeze and chlorinated lime added.

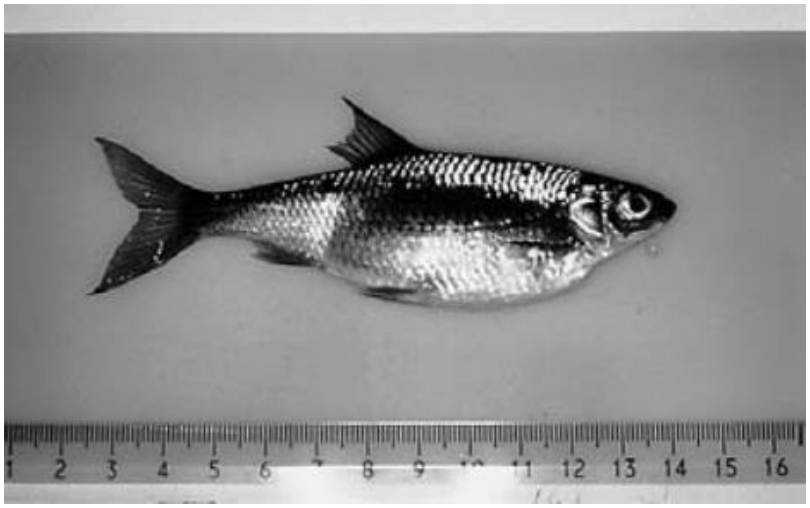
- 2-phenasol 0.1- 0.2 gm/fish mixe with feed.

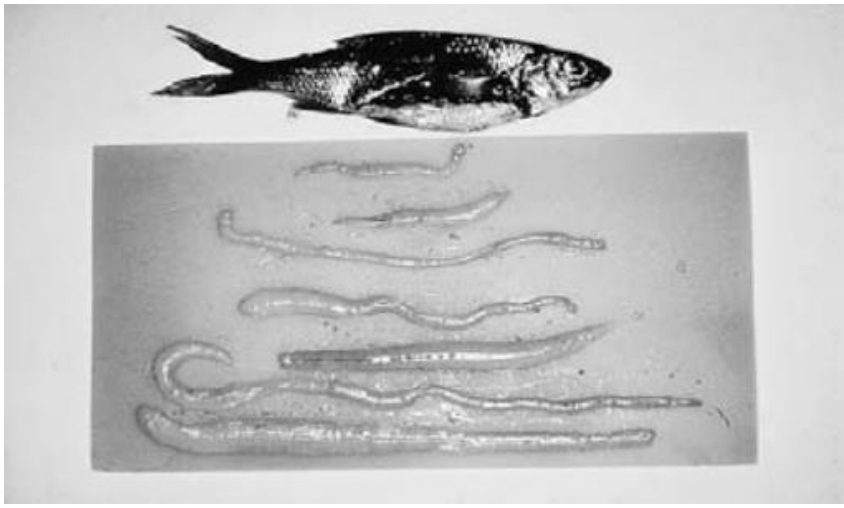
- **b-Fish as intermediate hosts**
- ***Ligula intestinalis***
- This parasite represents probably the most important larval stage of a tapeworm that infects cyprinids.

- **Life cycle:-**
- The adult stage of the parasite lives in the intestine of a piscivorous bird. Although this stage of the parasite is relatively short-lived (2–5 days), vast amounts of eggs are produced within this time period, which enter the water in the bird faeces. Eggs hatch, usually within 5–8 days, and release a free-living larval stage, the coracidium. This short-lived stage is ingested by the first intermediate host, a copepod and develops into the procercoid stage in the host body cavity (haemocoel) . When the infected copepod is eaten by a fish the parasite burrows through the gut wall and develops into a plerocercoid stage in the body cavity of the fish . This stage has been recorded in numerous species of fish and can exist in the host for more than 425 days. The bird definitive host becomes infected by eating the parasitised fish.



Life cycle of *Ligula intestinalis*.





Roach infected with *Ligula intestinalis*. (a) Undissected fish showing gross distension of ventral body and (b) same fish dissected and seven parasites removed (courtesy of the Environment Agency, UK).

- **Clinical signs:-**distension of the body wall, impairment of muscle development and general lowering of condition. The former alteration is very conspicuous and infected fish usually have a very distended body. This probably affects the streamlining of the fish and therefore increases the chances of it being predated by a bird. This increase in the probability of being eaten is further increased by the fact that ligulosed fish usually reside in shallow water adjacent to the bank.

- **Diagnosis:-**
- 1- Clinical signs
- 2-Lab.examination

- **Control and Treatments**:- Control of infection is extremely difficult and although the acquisition of disease-free stock can reduce the possibility of infection it will not prevent the contamination of waters by infected bird faeces.
- Use of several anthelmintics e.g. Praziquantel.