

• **6- CRUSTACEA**

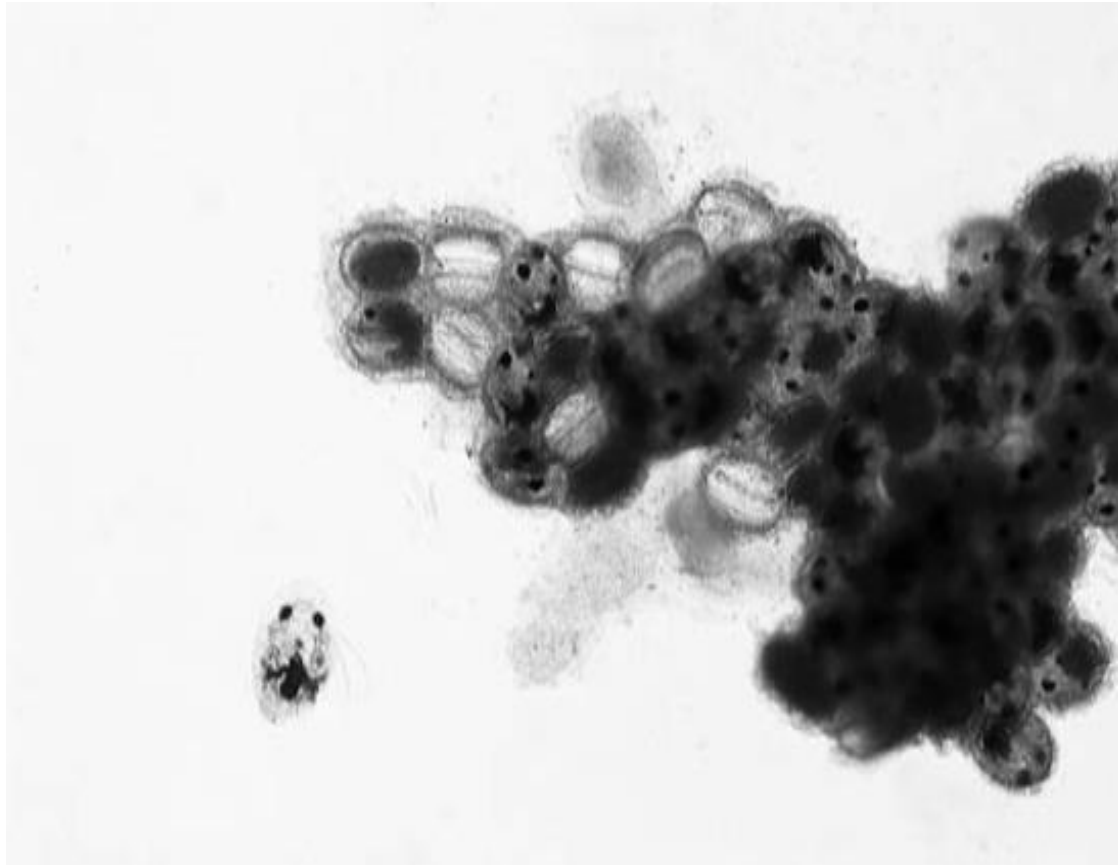
- Crustacean parasites are exclusively ectoparasitic, most primary pathology is associated with the skin, fins and gills, the severity being directly related to the intensity of infection.
- The life cycle of crustacean parasites is direct involving only one host . Reproduction involves separate sexes.
- Crustacean parasites display an incredibly wide morphological diversity, so describing a ‘typical’ crustacean is a near impossibility , most obvious of all is their large size, the adults of most species being easily seen with the naked eye, and their hard exoskeleton.
- Most crustacean parasites of significance to cyprinids are representatives of the classes Branchiura and Copepoda. Within the class Copepoda there are two families, Ergasilidae and Lernaeidae and within the class Branchiura there are two families, Dipteropeltidae and Arguluidae.

- a-Argulosis
- **Causes:-** *Argulus* spp. e.g *Argulus foliaceus* (*carp louse*)
- *Argulus foliaceus* is one of the most common, boasting an extensive distribution, low host specificity and well documented pathogenicity to both wild and farmed cyprinids. It present in most temperate regions of the world.



The crustacean parasite *Argulus foliaceus*. Note carapace (arrowed), black eye spots (e), attachment suckers (s), proboscis (p) and swimming legs (l). Magnification $\times 12$ (courtesy of the Environment Agency, UK).

- **life cycle:-** After copulation, females leave the fish host to deposit eggs in gelatinous ‘strings’ on any suitable substrate, before returning to the same or new host. The whitish oval eggs, of which there may be over 500 in a single strip, undergo temperature dependent development, taking as little as 8 days at 26°C, and hatch to release directly parasitic ‘metanauplii’. Measuring little more than 0.6 mm, these metanauplii must find a host quickly to secure survival.



Egg strip of *Argulus foliaceus*. In bottom left hand corner is a newly hatched parasite. Magnification $\times 20$ (courtesy of the Environment Agency, UK).

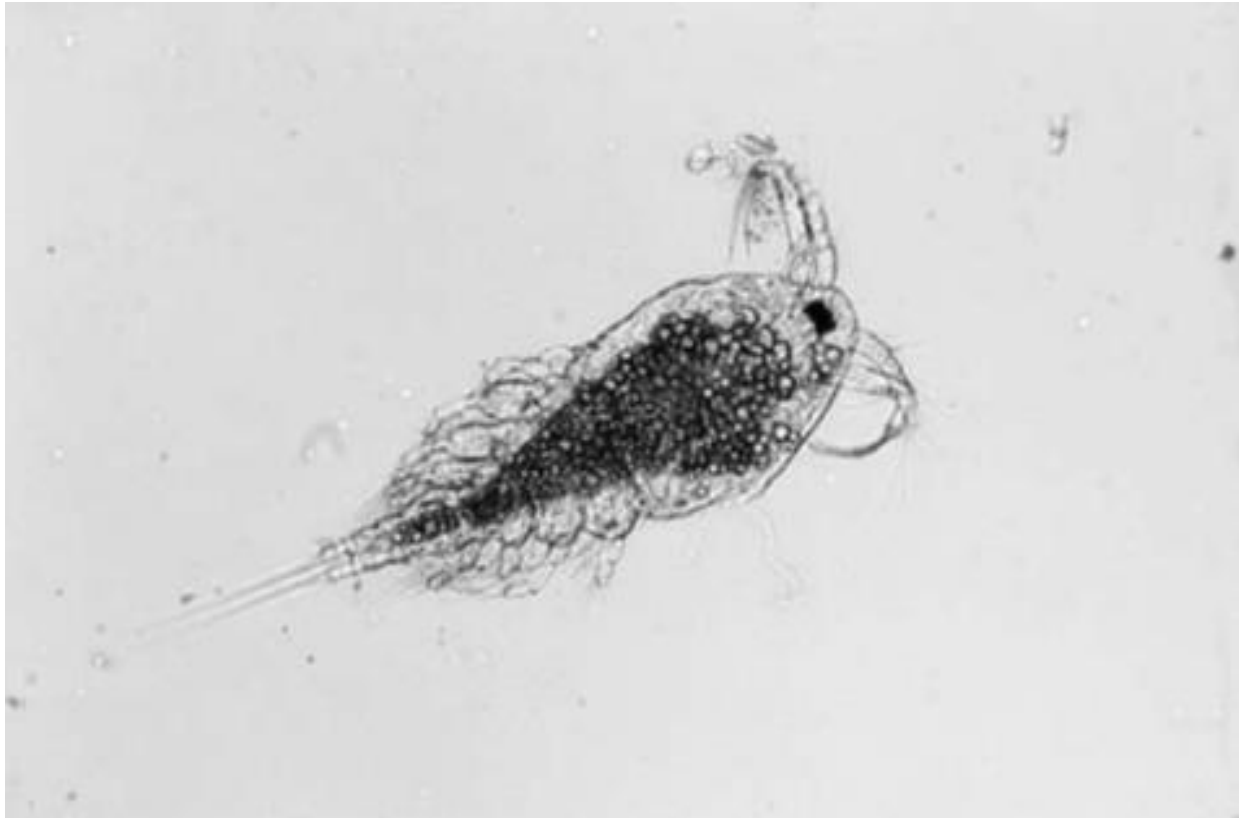
- **Clinical signs** :- Fish suffering argulosis often exhibit behavioural abnormalities during early infestations, including lethargy, irritation and loss of appetite. In heavier infections these changes may be accompanied by excessive mucus, small petechial haemorrhages at the sites of parasite attachment and fin erosion. In severe cases, skin loss may occur, as well as larger lesions, osmoregulatory distress, anaemia and secondary fungal and bacterial infections. Such infestations can severely debilitate individual fish, and quickly decimate heavily infested populations. Besides the destructive behaviour, it has been confirmed that *Argulus* sp. Acts as a vector for other pathogens, including the viral disease SVC.

- **Control and Treatments: -**

- 1-The control of argulosis in the culture situation still focuses firmly on the use of chemotherapeutics, particularly organophosphate insecticides.
- 2- Lysol 0.2% for 5-15 second.
- 3- Chlorophos 100 mg/litter water for 1 hr.

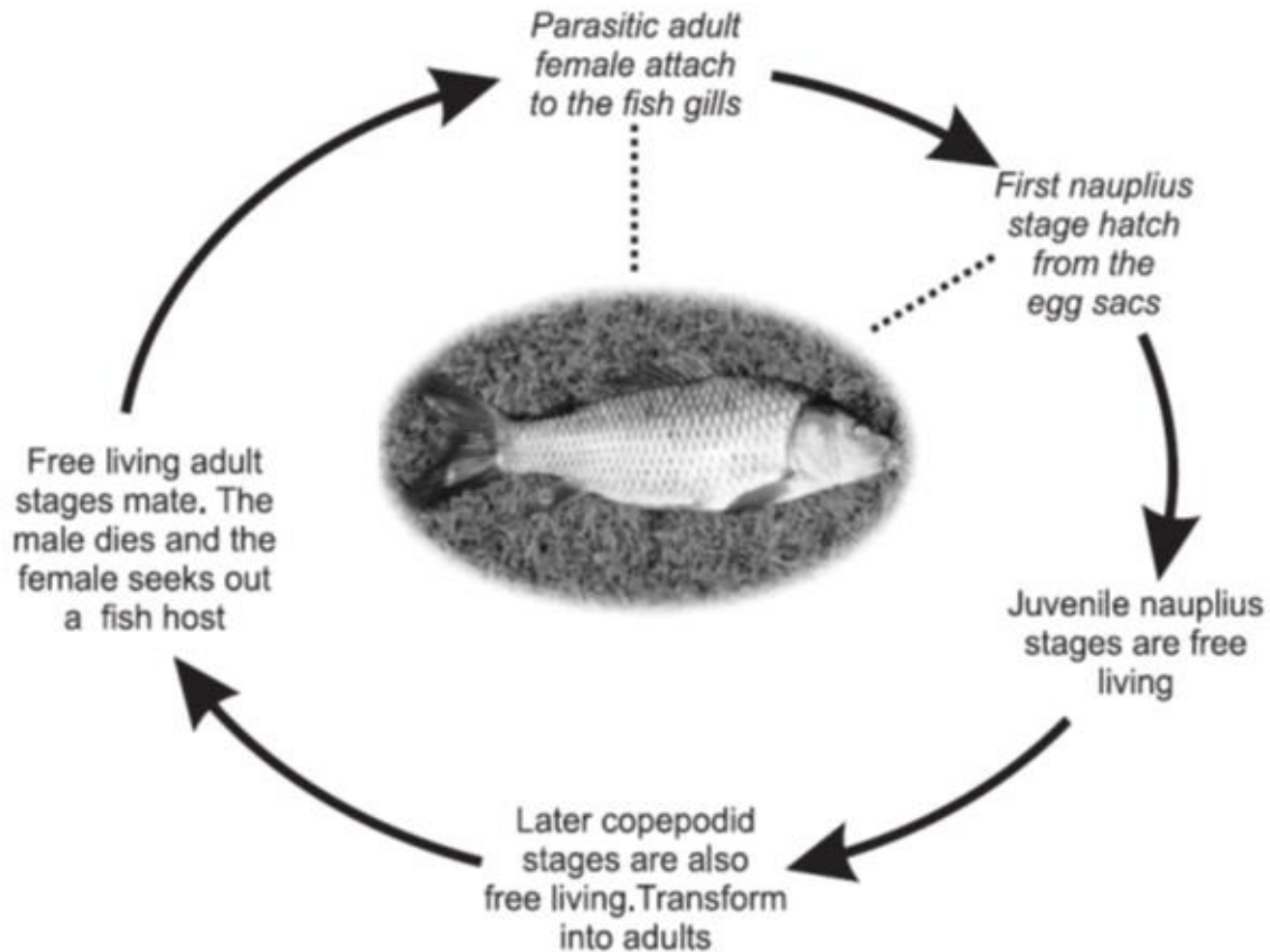
- **b-Ergasilosis**

- The family Ergasilidae comprises over 100 species, almost all of which are parasites of fish, and many of which parasitise cyprinids. Two thirds of all ergasilid species are found in freshwater . *Ergasilus sieboldi* is commonly called the ‘gill maggot’ because the large white egg sacs can clearly be seen by the naked eye . The adult female is about 1 mm in length. *Ergasilus sieboldi* is widely distributed throughout the world and can be found infecting a very wide variety of fish species.



Paraergasilus longidigitus from the nasal cavity of a cyprinid fish.
Magnification $\times 40$ (courtesy of the Environment Agency, UK).

- **life cycle:-** For most of its life cycle *E. sieboldi* is free-living with six nauplii stages and five copepodid stages leading to free-swimming adult males and females. After mating the male dies while the female seeks out a host fish. After attachment the mated adult female is reported to lose the ability to swim although she can move about the gill surface. The pair of large antennae have robust claws, which are thrust into each side of a primary lamella. The parasite feeds by damaging the epithelium with rasping mouthparts or scraping legs and then ingesting the debris and mucus. In addition, there may be some extra-buccal digestion using secreted enzymes. Two egg sacs contain 100–300 eggs in which the first nauplius stage develops and hatches out into the water.



Life cycle of *Ergasilus sieboldi*. Dotted lines and italics indicate stages in which the fish is involved.



Fig. 7.35. *Equiseta labracis* on the gills of a striped bass. Notice the white egg sacs of the gravid females. (By courtesy of Dr I. Paperna.)

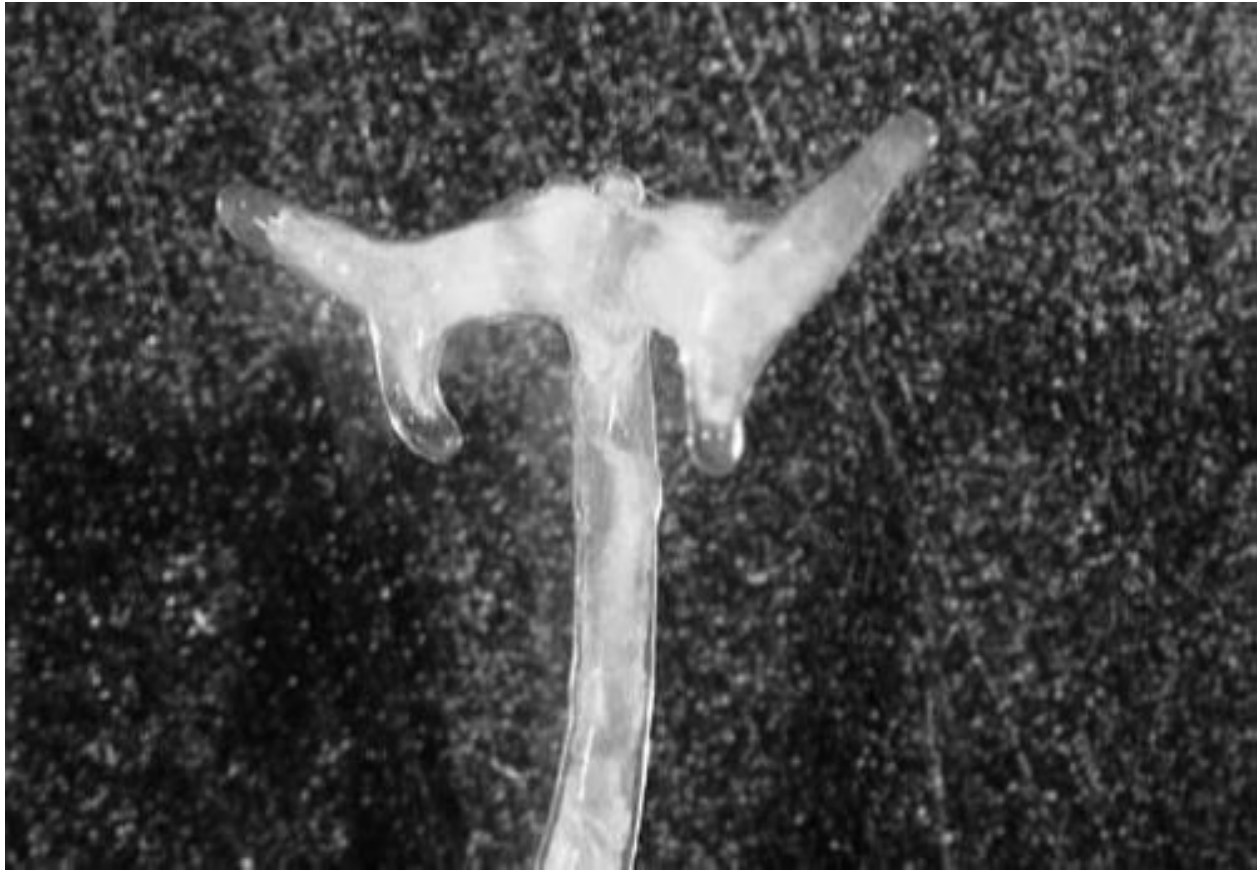
- **Clinical signs** :- Pathology is caused by the aggressive attachment mechanism and feeding action. Both lead to gill hyperplasia, necrosis of tissues and reduced blood flow. Secondary infections of fungus and bacteria are common. Hosts suffer osmoregulatory problems and are very vulnerable to lowered dissolved oxygen levels in the summer months.

- **Control:-**

- 1-The best method of control is to avoid infection by imposing tight restrictions to prevent the import of infected fish into any system.
- 2-The most effective method of eradicating *E. sieboldi* from a lake or fish pond is to remove the water completely, apply lime and leave dry for at least 6 months including one spring period.
- 3-To limit the impact once these parasites have become established in a water body researchers have suggested reducing the stock level of the more susceptible fish species (e.g. bream and tench). Also increasing the growth of aquatic vegetation can limit the infestation rate as free living stages of *E. sieboldi* prefer open water. Biological control has been proposed in which flagellate forms of parasitic euglenoids, e.g. *Paradistigma* spp., are used. These invade the eggs of *Ergasilus* sp. and then multiply in the newly hatched first nauplius stage, killing it after 2 or 3 days. This can give a 90% reduction in surviving nauplius stages.

- **Treatments: -**
- 1-Organophosphate insecticides are used to treat ergasilid infections.
- 2-Potassium permanganate 0.1 gm/Liter water for 5-10 min.

- **c- *Lernaea cyprinacea* (anchor worm)**
- The family Lernaeidae comprises over 50 species in nine genera. The type species *Lernaea cyprinacea* has been recognised as a problem in carp aquaculture for hundreds of years and is commonly called the ‘anchorworm’. *Lernaea cyprinacea* has a worldwide distribution and has been reported infecting over 40 cyprinid species. It has a very wide host range having been found infecting members of most freshwater fish including cyprinids, salmonids, eels and catfish. It has often been recorded causing heavy losses in a variety of situations. The main characteristics used for speciation include the size and shape of the holdfast .



Attachment organ (holdfast) of the crustacean *Lernaea cyprinacea*.
Magnification $\times 10$ (courtesy of the Environment Agency, UK).

- **life cycle:-** The life cycle of *L. cyprinacea* begins with three free-living nauplius stages. The following five copepodid stages are all parasitic on the gills of fish but remain mobile. Mating occurs on the fish and mated females either remain on the same host or swim off to find another host. Some lernaeids need two hosts to complete their life cycle but *L. cyprinacea* can complete its whole life cycle on only one host. Attachment can occur anywhere on the fish. The female burrows into the skin of the host and metamorphoses into a long thin worm-like organism with a holdfast buried deep within the host's tissue and its rear end protruding from the fish. The parasite can be up to 12 mm in length and easily seen with the naked eye. Female parasites start producing eggs even before metamorphosis is complete and at water temperatures above 35°C the first nauplii can hatch within two days of initial attachment.



Fig. 7.34. *Lernaecia polymorpha* parasites on a naïve bighead carp. (By courtesy of Dr S. Mohammed.)

- **Clinical signs** :- Although the nauplius stages apparently do not feed, the parasitic copepodid stages feed by grazing the gill tissue. This causes tissue damage and necrosis of the gills and the presence of large numbers, especially on small cyprinids, can cause mortality. The metamorphosing female initially causes a puncture wound as she burrows into the tissue of the host. A scale is often lost and there is more damage to the underlying muscle tissue in which the cephalic horns of the anchor grow. Muscle necrosis, haemorrhaging, inflammation and suppuration are common. Acute pathology is worse if, as often happens, several parasites settle close together. The necrosis of tissues can cause serious lesions that can become secondarily infected by bacteria or fungi. Mortality of hosts caused by adult females is generally the result of physical destruction of tissues or secondary bacterial infections.

- **Control:-**

- 1- The best method of control is to avoid infestation by preventing the introduction of infected fish into a system.
- 2- Quarantining fish for at least three weeks at 25°C (where tolerated by the fish) will allow time for any females present on the gills to mature and attach to the skin making them easily recognizable by the naked eye.
- 3- The most effective method of control of *L. cyprinacea* is to drain the lake or pond and treat with lime.
- 4-Biological control of larval stages of *L. cyprinacea* by using predatory free-living cyclopoid copepods has been reported as a possibility in Japan.

- **Treatments:**

- 1- Organophosphate insecticides can be used, but they are only effective against the copepodid stages so treatment must be repeated every seven days for at least a month at 27°C to kill all the females.
- 2- Chlorophos (Dipterex) 100 mg/liter water for 1 h.
- 3-potassium permanganate 1 gm /50 liter water for 1-2 h.