3.2.8 Ichthyophthiriasis

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A. Name of Disease and Etiological Agent

Ichthyophthiriasis is caused by the ciliate *Ichthyophthirius multifiliis*, a hymenostomatid protozoan.

B. Known Geographical Range and Host Species of the Disease

1. **Geographical Range**
   Ichthyophthirius multifiliis is worldwide in distribution.

2. **Host Species**
   This parasite infects virtually every species of freshwater fish. Mosquito fish *Gambusia affinis*, grass carp *Ctenopharyngdon idella*, and sunfishes *Lepomis* spp. appear to be somewhat less susceptible to infection than other species.

C. Epizootiology

The parasite is commonly found in small numbers on wild fish, and natural populations rarely experience heavy infections unless stressed. Disease outbreaks in cultured fish are common when naive fingerlings are brought in contact with older fish that may be carrying a few trophonts (the tissue-dwelling stage of the parasite), and the fish are crowded or otherwise stressed (Figure 1). As water temperatures increase in spring, the life cycle of the parasite proceeds more quickly and the trophonts and theronts (the free-living infective stage) become more abundant, sometimes resulting in disease outbreaks (Figure 2). Estimates of the length of the life cycle in the literature vary a good deal (Figure 3). At 21^{o}C the life cycle is completed in 5 to 7 days and at 10^{o}C in about 30 to 40 days. Water temperatures of 32^{o}C kill the theront. Outbreaks in summer and early fall are uncommon for nonsalmonids. However, the majority of reports of Ich in salmonid culture may occur during this same period, due to the differences in water temperature requirements. Outbreaks with extensive mortalities have also been reported in late winter, even at the time of ice break-up. Such epizootics appear to be associated with the late winter, poor nutritional status of fish and perhaps the existence of cold temperature strains of the parasite. About 10% of the trophonts on a fish may reproduce within the host epithelium, providing an additional mechanism for an increase in the intensity of

infection (Figure 4). Mortality may be high in fingerlings but is usually much lower in older fish that presumably have survived infection and acquired at least partial resistance to the parasite.

D. Disease Signs

1. Behavioral Changes Associated with the Disease

Flashing often results from the irritation the parasite causes in the epidermis. Heavy infections of the gill will interfere with respiratory exchange and may cause such infected fish to gasp or "pipe" for air at the surface.

2. External Gross Signs

Fairly discrete white spots up to 1 mm in diameter can be seen on the skin of the body and fins (Figure 5). In moderate to heavy infections, the skin appears "peppered" with white dots. Upon lifting the operculum, white spots may also be seen on the gills.

3. Internal Gross Signs

White spots sometimes are seen in the lining of the mouth or nares. The white spots (trophonts) have occasionally been observed in the peritoneal cavity.

4. Histopathological Changes Associated with the Disease

In the skin, the trophont may compress the overlying epidermis as it grows. Mixed inflammatory cells are commonly associated with trophonts in infections of more than five days duration (at 21^{o}C). About five days after infection, the overlying, often hyperplastic tissue lifts and tissue fluid accumulation contributes to the appearance of a fluid-filled cyst containing the trophont. Growth of trophonts as well as reproduction of the trophont and active aggregation of trophonts contribute to enlarging the cysts (Figure 4).

In the gill, the growing parasites cause distortion of the lamellae (Figure 6). In heavy infections epithelial hyperplasia is common, as are hyperplasia and hypertrophy of chloride cells. Lamellae may be fused. The exit of mature trophonts from gill epithelium leaves significant holes in the tissue, which contributes to osmoregulatory problems.

E. Disease Diagnostic Procedures

1. Presumptive Diagnosis

a. Detection of the Pathogen
Presence of discrete white spots on skin suggests ichthyophthiriasis.

b. Clinical Signs
The signs described under D.1 through D.3 are characteristic. The absence of the parasite from the skin does not necessarily indicate absence of infection, as some fish may be infected only in the gills.

c. Histopathological Examination
Any or all the changes described under D.4 may be observed.

2. Confirmatory Diagnosis

Squash preparation of gill or skin scrapings examined with at least 40X magnification, e.g., under a dissecting microscope, should reveal larger trophonts. These are uniformly ciliated and contain a horseshoe-shaped macronucleus (Figure 1). Staining is not needed.

F. Procedure for Detecting Subclinical Infection

Very small trophonts, such as those found within the first two days of infection at 21^{o}C, may be observed grossly on the pectoral fins. Scrapings at this stage will reveal the parasite. Examination of gill may be important in detecting subclinical infection although finding trophonts on the gill in very light infections is usually difficult.

G. Procedure for Determining Prior Exposure to the Etiological Agent

Prior exposure of a group of fish may be determined by exposing several fish in isolation to theronts to see whether they become infected. Typically, recovered fish are partially resistant to further exposure.

Alternatively, when a suspension of theronts is mixed with a serum sample from previously exposed fish, theronts are immobilized by specific immune serum.

H. Procedures for Transportation and Storage of Samples to Ensure Maximum Viability and Survival of the Etiological Agent

Infected live fish may be shipped in water or a mixture of water and ice.

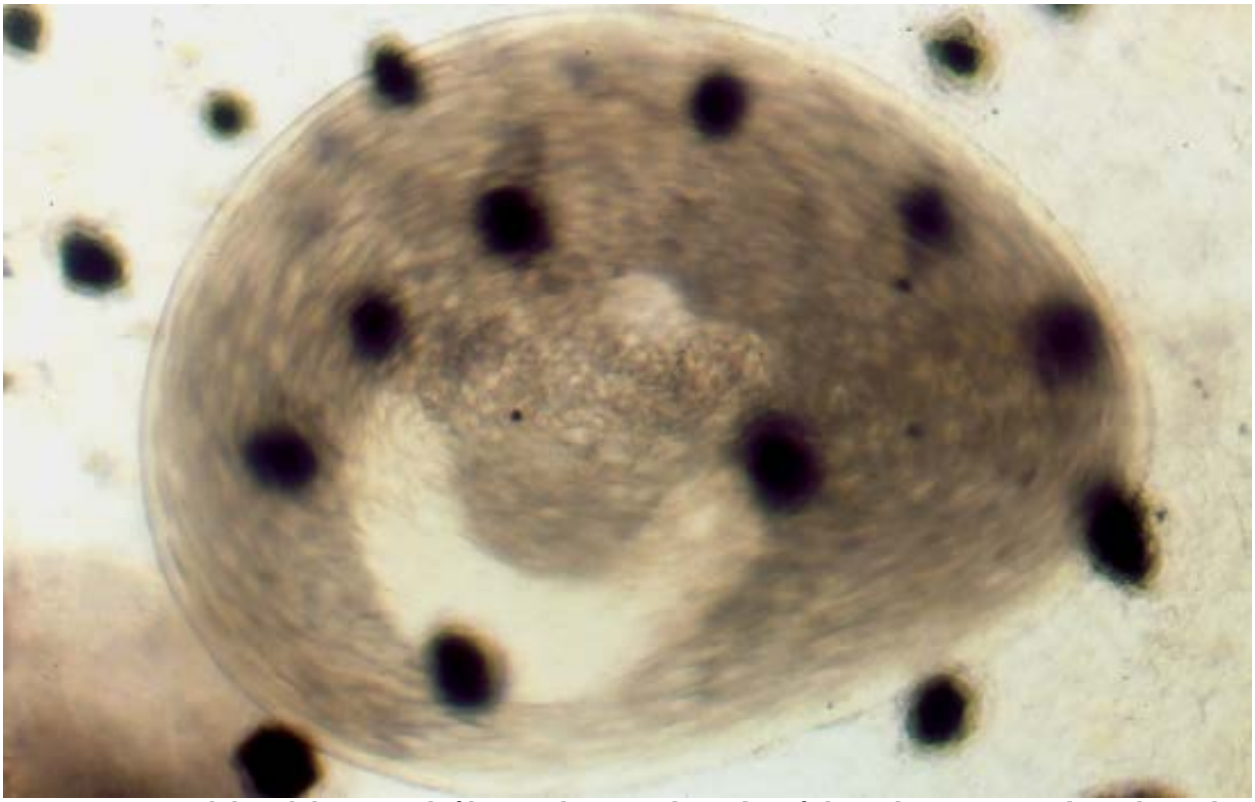

Figure 1. *Ichthyophthirius multifiliis* trophont in channel catfish epidermis. Note large horseshoe-shaped macronucleus, which is pale. Margin is blurred because trophont is moving in this fresh preparation. Black spots are in fish skin.

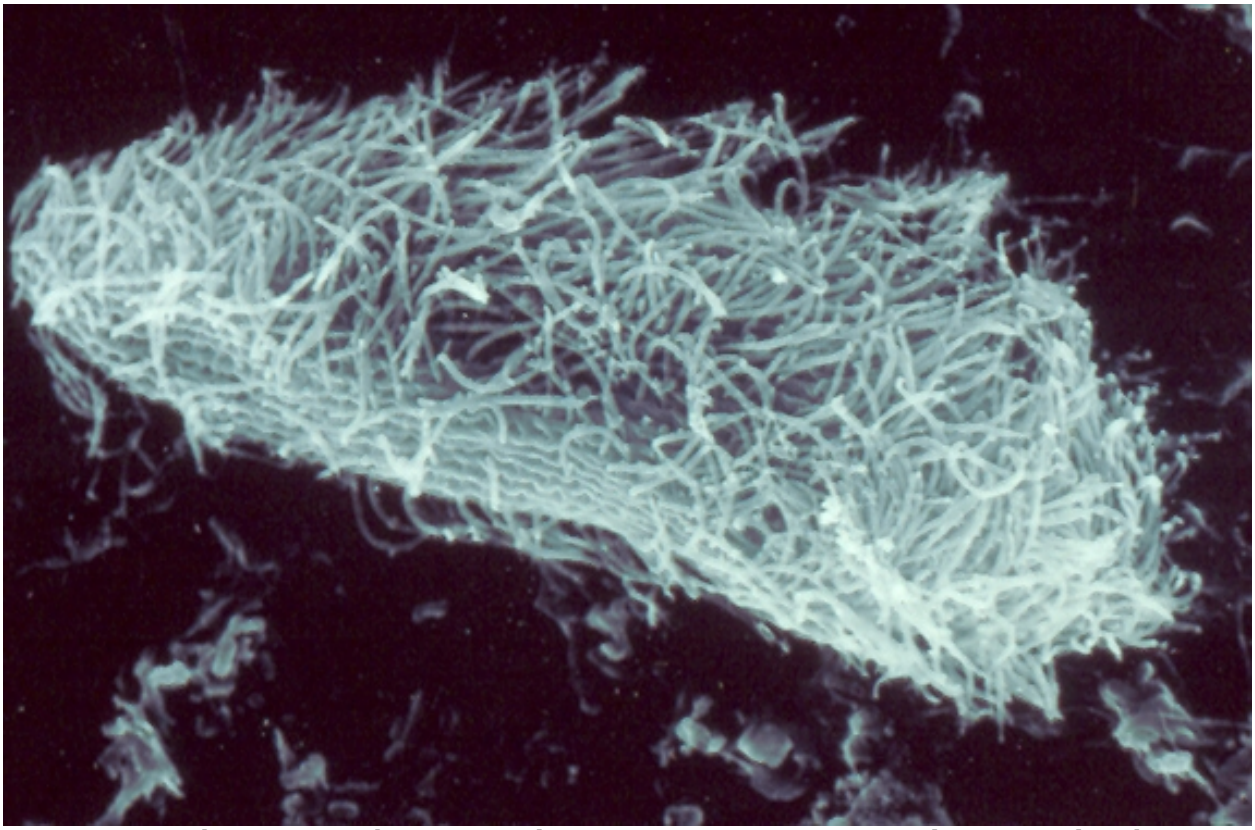

Figure 2. Theront as seen by scanning electron microscopy. Approximately 15 µm in length.

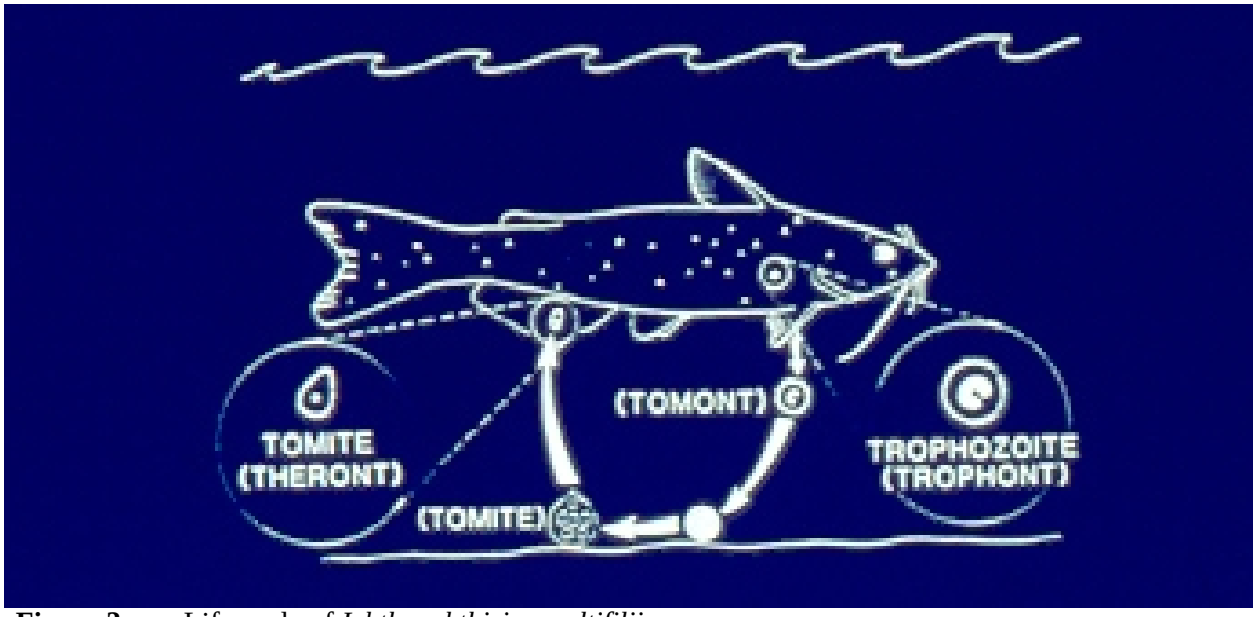

Figure 3. Life cycle of *Ichthyophthirius multifiliis.*

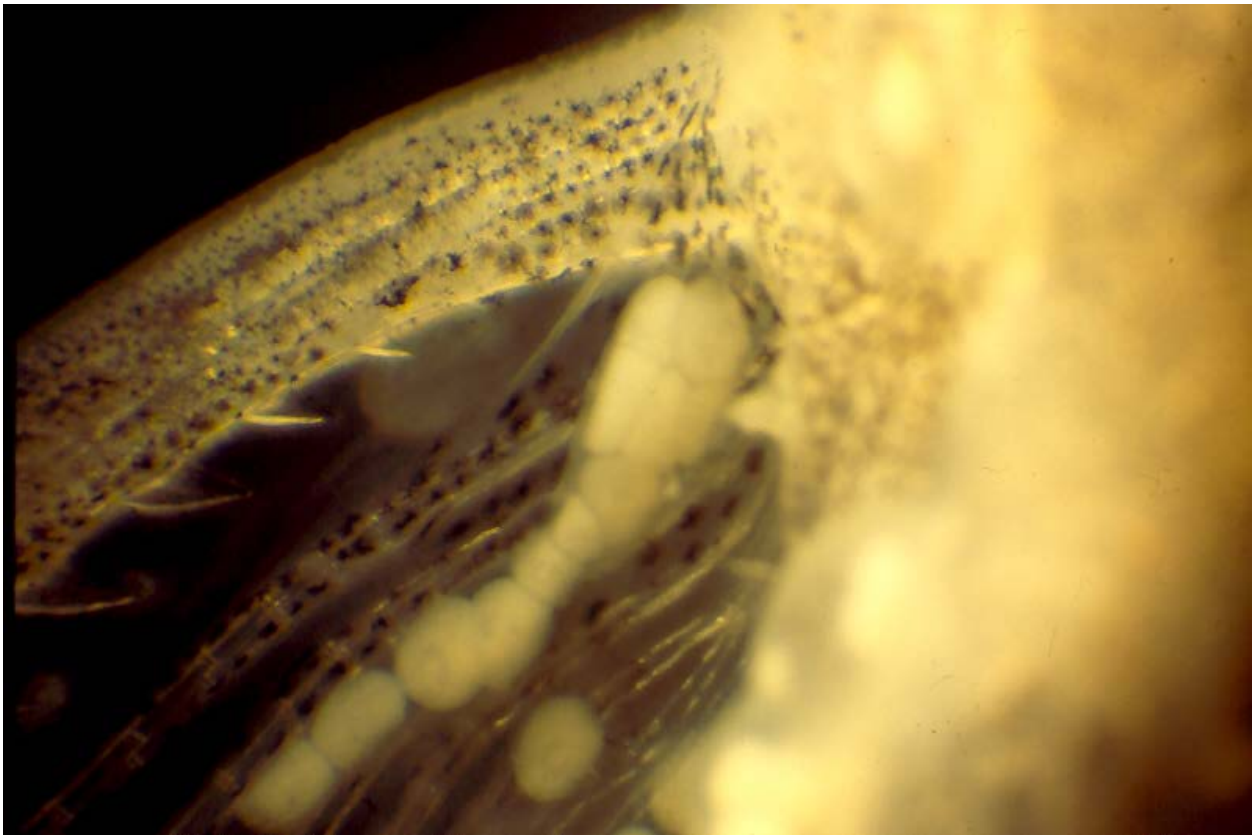

Figure 4. Group of at least 11 trophonts within a single cyst-like space within the epithelium of a channel catfish pectoral fin.

Figure 5. Channel catfish infected with *Ichthyophthirius multifiliis*. White spots are cystlike spaces containing trophonts.

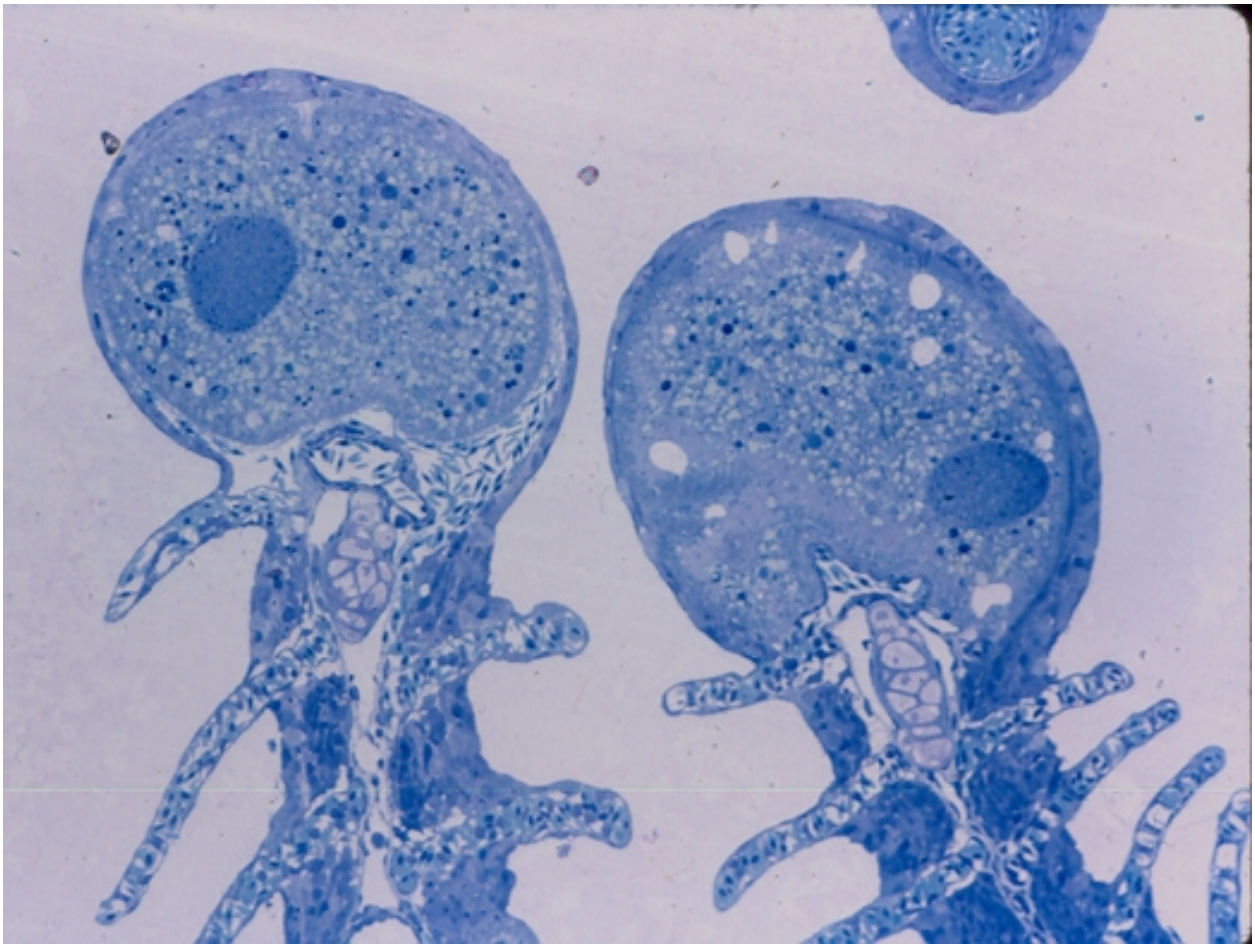

Figure 6. Gill filaments showing distortion caused by growth of the trophont. A small portion of the macronucleus appears in the trophonts in this section, stained a darker blue with Mallory's.

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