

Saprolegnia in Fish and Methods of Treatment (Review)

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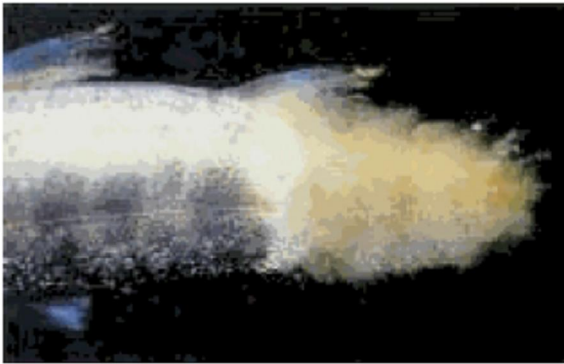
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Abstract: Saprolegnia, the fungus appears as focal white to brownish cotton-like patches on the surface of the skin and/ or gills. Early lesions consist of pale foci with peripheral areas of erythema and a central zone of lifted scales which frequently becomes ulcerated, exposing underlying musculature. Systemic infections are characterized by mycelia masses in the gut and surrounding viscera causing peritonitis with extensive hemorrhage, necrosis and adhesions. In smaller juvenile fish external signs of bloating caused by gut obstruction may progress to perforation of the abdominal wall. In the present review we focus how to treat Saprolegnia.

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Keywords: Saprolegnia; Fish; Method; Treatment

Introduction

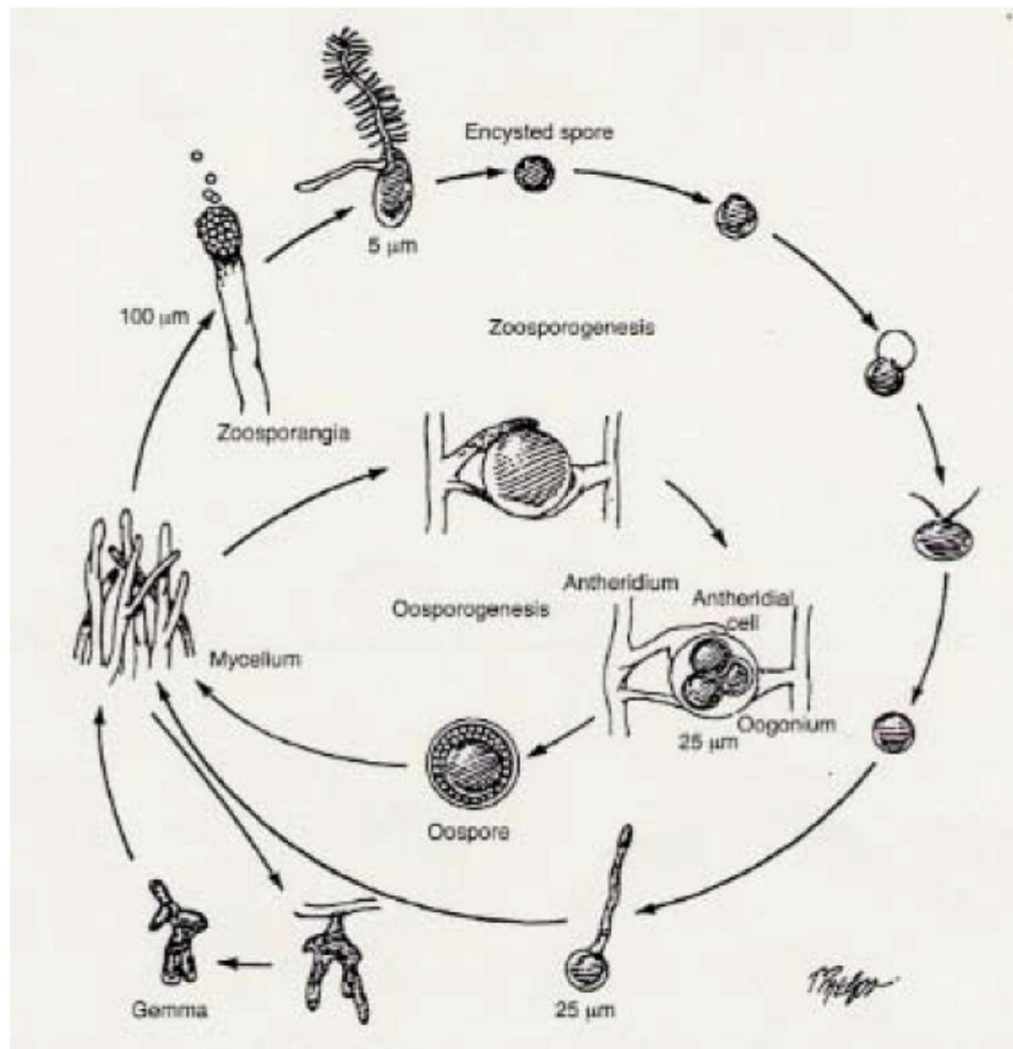


Bruno and Poppe, (1996)

Economic Information on Saprolegnia Disease is the single largest cause of economic losses in aquaculture (Meyer, 1991), and fungal infections are second only to bacterial diseases in economic importance. Fungal infections are generally restricted to chronic, steady losses (Bruno and Wood, 1999; Pickering and Willoughby, 1982). Hatai and Hoshiai (1994) indicate that in Miyagi Prefecture, Japan, there is an annual mortality rate of 50% in coho salmon (*Oncorhynchus kisutch* Walbaum) due to *Saprolegnia parasitica* Coker. Fifty percent per year losses have also been reported in elver (*Anguilla anguilla*) culture in Japan (Bruno and Wood, 1999). And in the southeastern United States, major financial losses occur in channel catfish farming due to a condition called "winter kill." Some catfish farmers have reported losses of up to 50%, an economic loss of \$40 million (Bruno and Wood, 1999).



Typical skin lesion due to Saprolegnia fungus Bruno and Poppe, (1996)



The *Saprolegnia* life cycle is presented in the diagram (Neish and Hughes, 1980)



Hyphae and sporangia of *Saprolegnia* fungus, phase contrast microscopy Bruno and Poppe, (1996)

How *Saprolegnia* Affects Fish

Saprolegnia has a large impact on salmonids, especially those in aquaculture (Beakes et al., 1994;

Hatai and Hoshiai, 1994; and others). However, it can also infect a number of other teleosts as well (Bruno and Wood, 1999). Channel catfish (Howe et al., 1999), pike (Willoughby, 1985), bass (Noga, 1996), elver and suckers (Roberts, 1989), roach, orfe, carp, tench, lamprey, sturgeon, barramundi, tilapia, and mullet (Bruno and Wood, 1999) have been infected with *Saprolegnia*. It has also been associated with tropical fish, including the kissing gourami, guppy, swordfish and platyfish (Roberts, 1989; Willoughby, 1994).

Causative Agent and Disease

The disease saprolegniasis is caused by freshwater fungi usually in the genus *Saprolegnia*. These fungi are classified in the family Saprolegniaceae, otherwise known as water molds. Saprolegniasis often is used indiscriminately to describe any cotton-like growth of fungus adherent to

skin or gills which may include any one of several genera of molds. The fungi are found worldwide in freshwater, although some species may occur in brackish water less than 2.8 parts per thousand salinity. Most species are saprophytes naturally present in the environment (water, sediment) and are considered opportunistic pathogens and secondary invaders requiring prior injury of external tissues from mechanical abrasion or other primary pathogens. Some species of *Saprolegnia (parasitica)* can produce a systemic mycosis and are considered primary pathogens.

Transmission

External fungal infections are transmitted through ambient water by infectious biflagellated zoospores released from hyphal sporangia. Systemic infections in cultured fish occur by ingestion of uneaten food that has been colonized by fungal hyphae. Factors of environmental stress play an important role in the etiology of the external disease. Outbreaks occur primarily after minor injury from handling or during crowded conditions when environmental quality is suboptimal. Adult salmon migrating to spawning areas have weakened immune systems and often have external infections of *Saprolegnia*. Also, cold water temperatures predispose fish to fungal disease because development of zoospores and sexual stages are favored while host tissue repair and the inflammatory response are slowed by the lower host metabolism.

Human Health Significance

There are no human health concerns associated with *Saprolegnia*

Treatment of Saprolegnia

Fungal infections are difficult to prevent and treat. Therefore, proper use of chemicals may be necessary when a *Saprolegnia* is diagnosed. However, there are few chemicals approved for use in aquaculture in the United States (Fitzpatrick et al., 1995; Meyer, 1991; and others). Malachite green is considered the most effective chemical for controlling *Saprolegnia* (Bruno and Wood, 1999; Willoughby and Roberts, 1992; and others). However, because of concerns about potential carcinogenicity, i.e., its teratogenic (Fitzpatrick et al., 1995) and/or mutagenic properties (Bruno and Wood, 1999), malachite green is banned in the United States and some other countries (Marking et al., 1994; and others). Formalin, a solution of 37% formaldehyde (Van Waters and Rogers, 1988), is effective in treating *Saprolegnia* (Fitzpatrick et al., 1995; Mitchell and Collins, 1997; and others), and is the only fungicide registered for use in aquaculture in the United States (Bruno and Wood, 1999; Marking et al., 1994). However, there are concerns about its affect on both the environment and personnel who handle it (Fitzpatrick et al., 1995;

and others). Hydrogen peroxide is a promising chemical for the treatment of *Saprolegnia* (Fitzpatrick et al., 1995; Marking et al., 1994; and others) with minimal impact to the environment (Bruno and Wood, 1999; Mitchell and Collins, 1997). However, it is important to consider the species, life stage and water temperature when treating *Saprolegnia* with hydrogen peroxide (Rach et al., 1997). Sodium chloride at high concentrations, i.e., sea water at 29 gm/liter and salt water at 15 gm/liter, is lethal to *Saprolegnia* (Marking et al., 1994; Pickering, 1994), and effective for controlling *S. parasitica* (Willoughby, 1994). Currently, the most effective strategy for controlling and preventing *Saprolegnia* infections is a combination of good fish management and husbandry techniques, combined with chemical treatment (Bruno and Wood, 1999), especially during the 2 to 4 day period after handling (Hatai and Hoshiai, 1994). Meyer (1991) states "well-nourished fish reared in highly favorable environmental conditions will be resistant to most pathogens." The reduction of stress appears to be the single greatest factor to help fish resist saprolegniasis.

Economic Information on Saprolegnia

Disease is the single largest cause of economic losses in aquaculture (Meyer, 1991), and fungal infections are second only to bacterial diseases in economic importance. Fungal infections are generally restricted to chronic, steady losses (Bruno and Wood, 1999; Pickering and Willoughby, 1982). Hatai and Hoshiai (1994) indicate that in Miyagi Prefecture, Japan, there is an annual mortality rate of 50% in coho salmon (*Oncorhynchus kisutch* Walbaum) due to *Saprolegnia parasitica* Coker. Fifty percent per year losses have also been reported in elver (*Anguilla anguilla*) culture in Japan (Bruno and Wood, 1999). And in the southeastern United States, major financial losses occur in channel catfish farming due to a condition called "winter kill." Some catfish farmers have reported losses of up to 50%, an economic loss of \$40 million (Bruno and Wood, 1999).

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