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Management of Amyloodiniosis (Marine velvet disease) in fish

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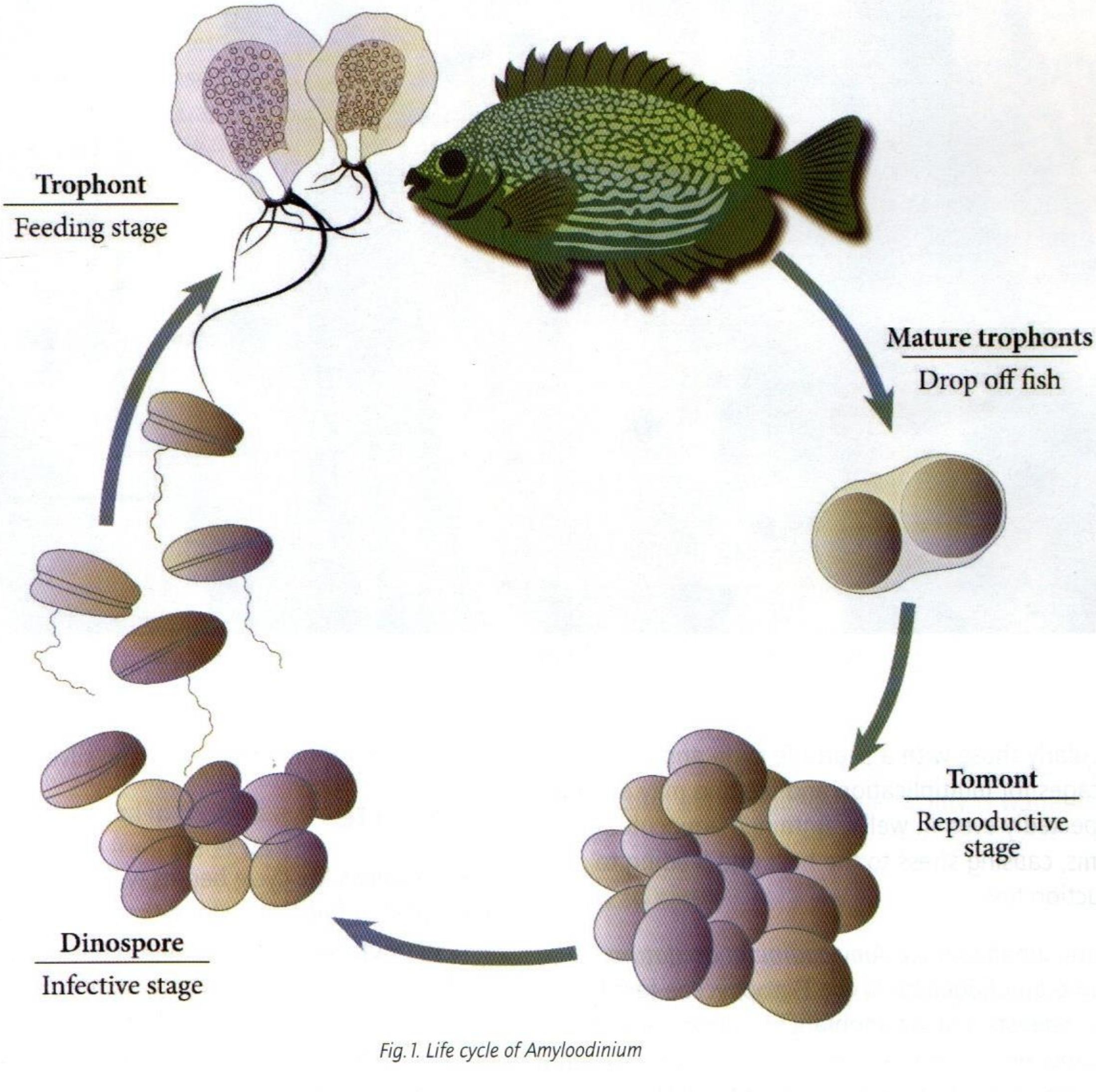

Fig. 1. Life cycle of Amyloodinium

Introduction

Aquaculture is a major source of animal protein, with fish and shellfish being farmed in a variety of aquatic habitats. These farming practices often attract infectious agents due to high stocking and crowded environments. Despite the widespread application of biosecurity and better management techniques, parasites, bacteria, and viruses have become common in fish and crustacean culture systems. Pathogens can sometimes outsmart surveillance systems, allowing disease to establish and manifest. Marine parasites

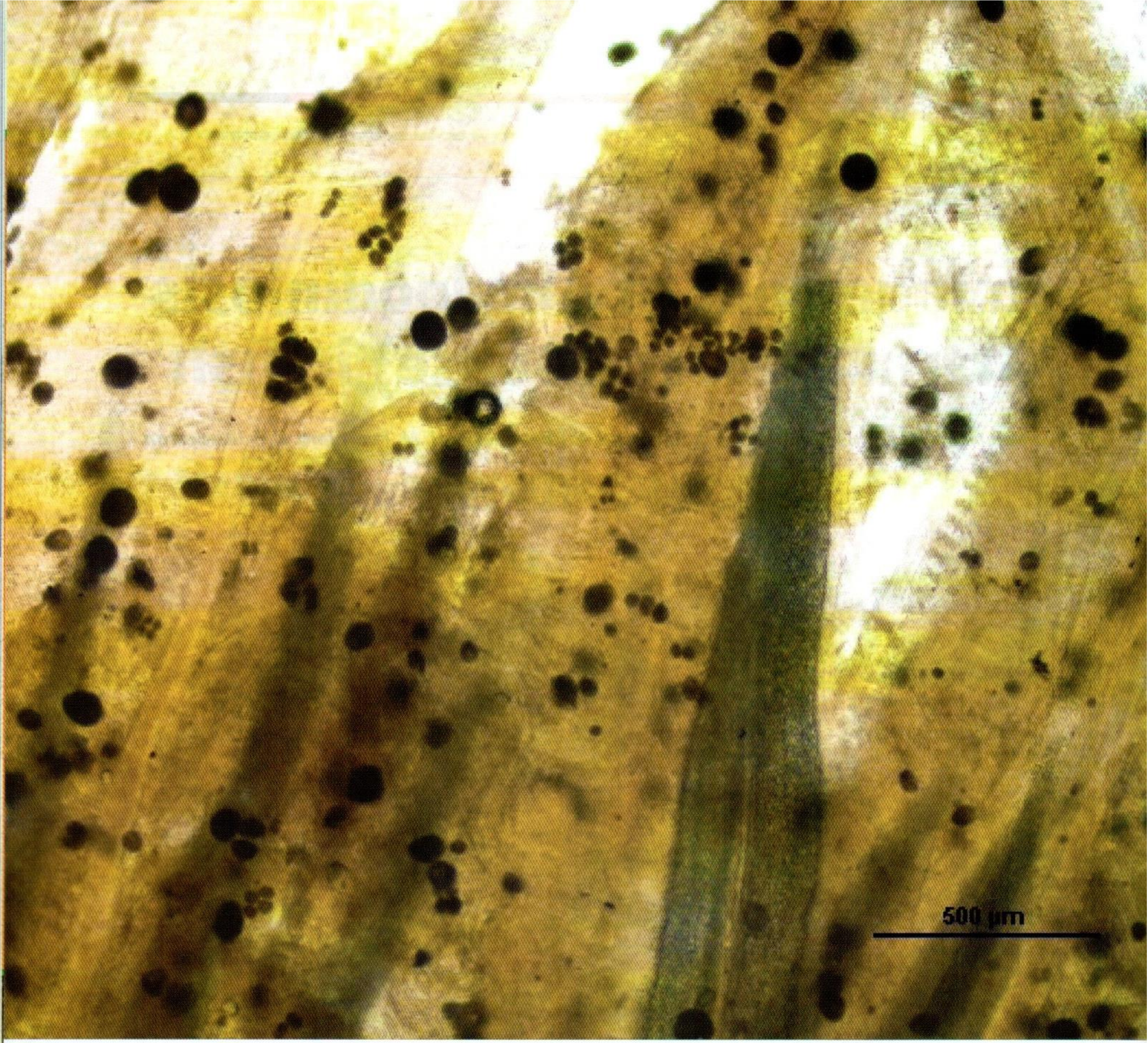

Fig.2. Microscopic observation of Tomonts in infected gills of fish under 4× magnification

particularly those with a short life cycle and various life stages for multiplication and feeding may emerge unexpectedly even in well-maintained aquaculture systems, causing stress to the host and leading to production loss.

Parasitic dinoflagellate *Amyloodinium ocellatum*, a marine dinoflagellate in the Dinophyceae family, infects teleosts and elasmobranchs in tropical and temperate environments. *Amyloodiniosis*, also known as marine velvet disease, is an infection of the skin and gills caused by *Amyloodinium* that affects both larval and adult fishes causing respiratory distress and death. In brackish and marine waters, deaths due to amyloodiniosis have been reported in silver pompano, milkfish, mangrove red snapper, Indian halibut, Asian seabass, cobia, gilthead seabream, silver moony, etc.

Life cycle

The parasite's life cycle begins with the infective dinospore, a free-living stage that contacts the fish and develops into feeding trophonts on the skin and gills of the host. Under optimal temperature and salinity conditions, trophonts develop into tomonts, which divide asexually and can release dinospores to begin the parasitic phase in fishes. The parasitic dinoflagellates, which can live in three stages, frequently evade treatment and resurface the disease. Because they spread quickly in 3 - 6 days under ideal conditions, these infections are the most dangerous to aquaculture systems. The parasite can survive and reproduce in salinities above 10 - 30 ppt, and brackishwater and marine environments are ideal for their productive life cycle. Lowering salinities below 10 ppt triggered the tomont production; whereas below 5 ppt can ultimately arrest tomont division of Indian isolates. Trophonts, on the other hand, can live at 0 ppt for up to 24 hours. Understanding strain-specific salinity regimes can thus aid in outbreak control by lowering salinities in closed aquaculture systems. Indian isolates are sensitive to salinity below 5 ppt and can degrade the tomonts in less than 14 days. Although therapeutic interventions primarily kill dinospores, tomonts and trophonts are less affected and may actively propagate the parasite after drug withdrawal. A single trophont can infect many fishes through multiple divisions at the tomont stage. If the disease is not entirely eradicated, it has the potential to resurface in any part of the cultural system.

Diagnosis

Parasitic dinoflagellates can be identified in gills or skin in wet smear preparations. Except for dinospores, trophonts and tomonts are visible at 100X magnification. Molecular diagnostics based on polymerase chain reactions are tools for detecting *Amyloodinium* sp. in gill tissue and in variety of samples, including seawater.

Management

Sand filtration and disinfections using UV radiation, ozone, and biological controllers such as rotifers, copepods, and adult *Artemia*, the natural predators in the aquatic food chain can kill dinospores. Infected fishes can be immersed in fresh water for two weeks, or dip treatments in fresh water for one to three minutes in 24 hr intervals for two weeks can kill infective dinoflagellates and their trophonts. Repeated dips in freshwater may help to reduce the number of dinospores available to re-infect fish, and they should be kept for at least two weeks to detach and degrade the adhered tomonts. Formalin is a chemical that is commonly used to treat external parasites in fish. It is effective against free-living dinospores and dislodging trophonts from infected fish at a 25 mg/L therapeutic dose. The treated fish should be relocated to an uncontaminated facility. *Amyloodinium* infections are also treated with hydrogen peroxide (35% concentration), primarily in flow-through systems, at a rate of 25 mg/L for 30 minutes. Alternatively, biocontrol methods may be helpful, such as using biological predators that eat dinospores and tomonts, reducing the number of parasites infecting fish. Rotifers, copepods, and *Artemia* can clear tomonts and be used effectively in enclosed systems with little risk to larvae, adult fishes, or the environment. These predators can quickly reduce the number of parasites by feeding and preying on different parasite life stages, which is not always possible in a crowded semi-intensive aquaculture system using other therapeutics.

Biosecurity measures in Aquaculture systems

All new arrivals to an aquaculture facility should be quarantined for a certain period of time to allow the fish to adjust to their new surroundings and recover from the transport. It also ensures that they are free of infectious diseases that could endanger the current population. The risk of pathogen introduction is reduced by screening for and removing sub clinically infected fish. There is no recommended quarantine period for parasitic dinoflagellates; however, quarantine can tell us whether the fish is infected in a short period of time. Routine disinfection with fresh water or formalin must be performed prior to introducing the fish to the facility. Once treatment has begun, ensure that the correct dose is administered in the raceways, cages, and other flow-through systems. Once the infection has been established, the facility may require intermittent treatments with recommended therapeutics to remove various life stages and thorough disinfection in the aquaculture facility is warranted before restocking the fish.

Conclusion

Amyloodinium and other parasitic dinoflagellates can be effectively controlled in a closed system with proper quarantine, disinfection, extended drug, and low saline therapies. It is ineffective to use a single strategy in aquaculture for disease prevention and control as there is a need for an environmentally sustainable approach to fisheries and aquaculture. Natural predators, in addition to other control measures, are a viable option for managing Amyloodiniosis in aquaculture environments.