

Fungal Diseases of Fish: A Review

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Abstract

Now a day, fishes are used for biomedical researches along with use as a food also. Chemical contaminants of marine environments are of momentous concern. Similar to other flora and fauna, fish can also be ill with various types of diseases. Freshwater fishes are an important protein source for people of many countries. Fish farming in various parts of the world has increased many folds in the last decade. Bacterial hemorrhagic septicemia, lernaeciasis, saprolegniasis and anoxia are the most frequently occurring fish diseases in pond fishes. Fungal infections are among the most general diseases seen in temperate fish. Water moulds infections cause losses of freshwater fishes and their eggs in both natural and commercial fish farms. Although, infection as a result of microbial contamination does not frequently result in disease but ecological stress may upset the balance between the probable pathogens and their hosts. Prevention is, as always, the best medicine. Most infections can be successfully treated if caught early.

Keywords: Fish Disease; Fungal Infection; Fish Pathogens

Introduction

Fishes not only play a vital role in the demand of food for human being but they have also emerged as main model organisms for various biomedical researches. With increasing numbers of synthetic chemicals introduced into the environment each year, concerns remain concerning our understanding of the linkages between exposure to noxious agents and potential disease. Chemical contaminants of aquatic environments are of significant concern because aquatic systems serve as

major channels for distribution and deposition of many toxic agents. Relatively few methods are available which provide sufficient sensitivity, accuracy and practicality necessary for assessment of chemical toxicity of. As a consequence, new approaches are needed to improve the assessment of health risks associated with exposure to chemical contaminants in the aquatic environments. Fish can also suffer from various types of diseases similar to other animals. Freshwater fishes are an important protein source for people of many countries [1,2]. However fish from freshwater and marine sources are in severe decline,

driven in large part by economic and human population growth around globe [3]. In the last decade, fish farming in several parts of the world has increased many folds. As a result, fish culture has now become commercially an important industry worldwide. The growth of fish culture has also increases issues of fish health. Bacterial hemorrhagic septicemia, lernaeasis, saprolegniasis and anoxia are the most commonly found fish diseases in pond fishes in Punjab [4]. Fish eggs, fry, fingerlings and adult fish are acts as a target of fungi. Fungal infections (fungal infections are called mycoses) are among the most common diseases seen in temperate fish because fungal spores are found in all fish ponds and create problems in stressed fish. Poor water quality can also lead to an increase in fungal infections in an otherwise healthy fish population. Most fungal infections invaded on external tissues and only few fungal infections affect the internal organs of fish [5].

Chance of fungal infections is as follow:

1. Poor quality of water
2. Improper hygiene
3. Fish that are injured have other diseases
4. Dead fish/large amounts of decomposing organic material present in the pond.

Water moulds infections cause losses of freshwater fishes and their eggs in both natural and commercial fish farms [6]. The fungal diseases occur in brood stock as well as all life stages of fish and eggs. Fungal infection cause low yield of fry and low production in fish culture [7]. Sometime mortality rate reach up to 80-100 % due to fungal infection in incubated eggs [8]. According to Akande and Tobor [9] post-harvest management of fishes may also result in infection with microorganisms such as bacteria and fungi. The ubiquitous fungi are part of the normal mycoflora of fresh and estuarine ecosystems and have a worldwide distribution.

There are certain fungi which cause fish diseases. Shahbazian, et al. [10] isolated *Penicillium expansum*, *Penicillium citrinum*; *Aspergillus terruse*, *Aspergillus clivatus*; *Alternaria spp*; *Saprolegnia parasitic*, *Saprolegnia apponica*, *Saprolegnia ferax* and *Saprolegnia hypogyna* and 7 other species of fungi from infected eggs of rainbow trout, *Oncorhynchus mykiss* in Iran. However, Fadaeifard, et al. [11] isolated 8 species of fungi from eggs and brood stock of rainbow trout *O. mykiss*. These isolates were *Penicillium spp*, *Acreomonium spp*, *Alternaria spp*, *Fusarium solani*, *Aspergillus spp*, *Mucor spp*, *Saprolegnia spp.* and *Cladosporium spp*. Primary infections in fishes and fish eggs by oomycetes are also reported [12].

Although, infection as a result of microbial contamination does not usually result in disease but environmental stress may upset the balance between the potential pathogens and their hosts. In such environment the chances of infection increases.

Fungal Diseases Occurring in Fish

Fish can suffer from various fungal diseases. Some of these diseases have been discussed here:

Exophialiasis

Exophiala salmonis and *E. psychrophila* are fungal organisms have hyphae that are septated, irregular in width and branched [13]. Both fungal diseases infected the several species of fish. Symptoms of disease: 1. Fish become darker and lethargic, with erratic and irregular swimming behavior. 2. Round yellow to white granulomas are present in visceral organs like liver, kidney and spleen with prominent enlargement of the posterior kidney. Primarily it affects liver particularly but other severely affected organs are: spleen (in salmonids), heart (in herring), kidney (in salmonids), gonads, brain (in salmonids), gills (in salmonids) and musculature and nerve tissue behind the eyes (in sea fish).

Branchiomycosis (Gill Rot)

Branchiomycosis is to a large extent feared fungal disease of fishes approximately all over the world chiefly on carp farms. It is caused by the fungi *Branchiomyces sanguinis* (in carps) and *Branchiomyces demigrans* (in pike and tench). *Branchiomyces demigrans* differs from *B. sanguinis* by being able to proliferate from the blood vessels to the adjacent tissue of the gills and by having thicker-walled hyphae. The disease occurs most frequently in the warm climatic regions. Branchiomycosis is a pervasive problem in Europe, but has been only infrequently reported by US fish farms.

Branchiomyces, another filamentous fungus obstructing the blood vessels in the gill filaments. Flecking on the gill filaments at a later stage becomes greyish-white and may at last drop off altogether leaving the cartilagenous support exposed. Both species of fungi are found in fish suffering from an ecological stress, such as low dissolved Oxygen, low pH (5.8-6.5) or a high algal bloom. The main sources of infection are the fungal spores carried in the water and detritus on pond bottoms. *Branchiomyces* sp. grows at temperatures between 57°F and 95°F, but grow best between 77°F and 90°F. *B. sanguinis* and *B. demigrans* infect the gill tissue of fish.

Gills appear striated or marbled with the pale areas representing infected and dying tissue. Fish may appear lackluster and may be seen gulping air at the water surface (or piping). Gills should be examined under a microscope by a trained diagnostician for authentication of the disease. Laboratory diagnosis of branchiomycosis is based on the examination of the gill filaments by the compression method.

Fungal hyphae are visible in the blood vessels of the gills at a 150-fold magnification under the microscope. Spoiled gill tissue with fungal hyphae and spores will be present. As the tissue dies and falls off, the spores are released into the water and transmitted to other fish. High mortalities are frequently linked with this infection. Spores can also be recognized when the diseases are in its acute stage. The affected tissues are torn into pieces on the microscope slide and examined by adding a drop of 50% glycerol solution in water or alcohol. The branchiomyces are also well noticeable in preparations from dead fish bodies decayed by rot.

Saprolegniasis

This infection is caused by *Saprolegnia parasitica*. Initially, the fungus attacks the dead eggs and thereafter spread on the surrounding viable eggs resulting in their spoilage as well. This fungus often infects the fertilized eggs in hatching 'hapas'.

Dermocystidiosis

Among the most investigated marine fungal pathogen is *Dermocystidium marinum*. In 1957 Andrews & Hewatt [14] reported that warm-season mortality of oysters in the Chesapeake Bay was attributed to *D. marinum*. This high death rate was ascribed to increased environmental stress and warmer temperatures that aid proliferation of this fungus. It is important to note that *Rhinosporidium seeberi*, a close relative of *Dermocystidium* has recently been isolated from mucosal surfaces of human patients from southern India. Fredricks, et al. [15] reported a disease caused by *R. seeberi*, an aquatic protistan parasite producing rhinosporidiosis in human beings. Rhinosporidiosis manifests as slow-growing tumor like masses of the nasal mucosa or ocular conjunctiva in humans and animals.

Ichthyophonosis Disease (Swinging Disease)

Two species: *Ichthyophonus hoferi* and *I. Gasterophilum* is the responsible agent's for *ichthyophonosis*. Depending on the stage of the disease, different stages of growth of *I. hoferi* can be distinguished

microscopically: "resting" spore, germinating spore and hyphal stage. It grows in fresh and saltwater, in wild and cultured fish, but is limited to cool temperatures (36-68°F). The disease is transferred by fungal cysts, which are released in the faces and also by cannibalism of diseased fish.

The primary route of transmission is through the consumption of infective spores. Fish with a mild to moderate infection will show no external signs of the disease. In severe cases, the skin may have a 'sandpaper texture' caused by infection under the skin as well as in muscle tissue. Curvature of the spine may be found in some fish. Organs may be swollen with white to grey-white sores internally. The disease is called as "swinging disease" because diseased fish shows curious swinging movements. Gustafson and Rucker [16] reported that *Ichthyosporidium* is a fungus, but it manifests itself internally. But it spreads in all organs but primarily attacks the kidneys and liver. Symptoms of disease include that fish may become sluggish, lose balance and eventually show external cysts or sores.

Treatment and Control of Fungal Diseases

Common treatments for fungal disease consist of use of potassium permanganate, formalin and provide iodine solutions. Bath treatment in NaOH (10-25 gm/L for 10-20 min), KMnO_4 (1 gm in 100 L of water for 30-90 min) or in CuSO_4 (5-10 gm in 100 L water for 10-30 min) should be given. Over treatment can promote damage of fish tissue, resulting in recurring infections. Environmental management is important for adequate resolution of chronic cases. If the disease is present, do not ship the infected fish. Averting is the best control for branchiomycosis. Good management practice will craft environmental circumstances unacceptable for development of fungi. Great care must be taken to avert movement of the disease to non-infected areas. Formalin and copper sulphate have been used to help stop mortalities; however, all tanks, raceways and aquaria must be sanitized and dried. Ponds should be dried and treated with quicklime (calcium oxide) and copper sulphate (2-3 kg/ha). An extended term bath in Acriflavine neutral or forma-green for 7 days helps in reduction of this condition. Dead fish should be buried. Saprolegniasis is best prohibited by good management practices. Sanitation should be observed and corrected when *Saprolegnia* is identified in an aquatic system. Good water quality and circulation, dodging of crowd to curtail injury (particularly during spawning) and good nutrition can prevent this condition. There is no cure for fish with *Ichthyophonus hoferi*; they will carry the infection for life.

Cooking helps destroy the infective life stage. To avoid contamination of infective spores, never feed raw fish or raw fish products to cultured fish. If Ichthyophonus disease is recognized by a qualified diagnostician, it is essential to eliminate and devastate any fish with the disease. 1% Phenoxethol solution added to food or Chloromycetin added to the food has also been effective against Ichthyophonus disease [17-23]. Ponds with dirt or gravel bottoms need months of drying to totally eliminate the fungus. Complete disinfection of tanks, raceways, or aquaria is encouraged.

Conclusion

Fungal diseases, in general, are very complicated to control or treat once they have taken hold. Most aquarium owners will have to deal with a fungal infection at one time or another. Most infections can be successfully treated if caught early. Prevention is, as always, the best medicine.

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