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MYCOTIC DISEASES

Fungi were reported to be responsible for many fish diseases. These fungi belong to a wide range of taxa and the most frequent are the water molds belonging to Oomycetes. They are widespread in fresh water and represent the most important fungal group affecting wild and cultured fish. The saprolegniaceae, in particular members of the genus Saprolegnia, are responsible for significant infections, involving both living or dead fish and eggs of the fish.

The major mycotic diseases , which face the fish production are :

Saprolegniasis
Branchiomycosis (gill rot)
Ichthyophonosis

Saprolegniasis

Definition:

It is fungal disease of fishes and fish eggs caused by member of family saprolegiaceal. Characterized by presence of cotton like, white to gray growth on the skin, gills or eyes of fishes or in fish eggs.

Saprolegnia spp. are aquatic fungi that occasionally are found infecting skin wounds and gills

Several investigators considered the saprolegniasis as the most significant mycotic disease affecting wild and culture fish causing economical losses, because the disease is difficult to prevent and treat, particularly in the intensive fresh water system, and is reported to be second only to bacterial disease.

They are commonly found in fresh water but members of saproleginaea also

found in moist soil some species may found in brackish water but salinities higher than 2.5% limit the distribution of saprolegniaceia.

Several factors are involved in the development of fungal infection in fish, These factors affect both the fish and the fungus. Saprolegniasis are secondary pathogens and lesions are commonly seen after handling and after any traumatic damage to the skin.

- In overcrowded conditions
- conjunction with pollution or bacterial or viral conditions
- Temperature has a significant on the development of saprolegenia infection

Causative agent:

Saprolegnia is the main genus of water molds responsible for significant fungal infections of freshwater fish and fish eggs.

Saprolegnia diclina
S. parasitica
S. mixta
S. ferax

A broad range of media has been used for the culture of fungi from fish. The media are glucose yeast extract agar, glucose peptone agar, Sabourauds dextrose agar and corn-meal agar.

The fungus forms long, branched and non septated hyphae. Incubation temperature ranges between 5 and 37^{o}C, however, temperature of 10, 15 and 20^{o}C are the most common.

Saprolegnia has complex life cycle, which includes both sexual and asexual reproduction.

1. Sexual reproduction involves the production of the antheridium and oogonium.

2. Asexual spores of Saprolegnia release motile, primary zoospores . These are active only for a few minutes before encysted, germinated and release a secondary zoospore. They are motile for long period of time, they are considered the infectious spore of Saprolegnia.

Fish have three types of defenses against Saprolegnia:

1. Physical renewal of attaches spores by the renewal of mucous.
2. Morphogen in the mucous inhibited the growth of mycelium but not killing it.

3. Celluler response in the mucous have direct effect at growing mycelium.

Predisposing factors:

1. Malnutrition among cultured fish.
2. Presence of toxic substances in food or water or damage to skin, fin or gills from rough handling or external parasites may lead to secondary invasion by *Saprolegnia spp*.
3. Physical stresses such as reduced water temperature, high or low pH or high salinity may be responsible for invasion of fish by *Saprolegnia*.
4. Over crowding in fish culture increase the incidence of saprolegina infection.
5. High organic load is also identified as a cause of increase infection by *Saprolegnia spp*.
6. Saprolegeniasis may be secondary to other infection e.g. fin rot, ulcer disease and other bacterial disease.

Susceptible species:

Most species of fresh water fish are susceptible to take the infection with Saprolegnia, especially those fish in intensive aquaculture. Saprolegnia also infects the fish eggs by adhesion and penetration of egg membrane and can spread from dead eggs to healthy one.

Mode of transmission:

The disease is transmitted by:

1. Direct contact between diseased fish or fish eggs and healthy one.
2. Indirect contact through several sources, including, the water supply, transport vehicles, movement of staff between aquaculture facilities and farm equipment, such as nets.

Clinical signs and Gross pathology:

Saprolegniasis is characterized by:

1. The appearance of cotton -like, white to grey growth on the skin, gills, fins and eyes or eggs of fish. These growth is white or grey white in color.
2. In severe cases, 80% of body may be covered with fungal growth.

3. In early infections, skin lesions are gray or white in color with a characteristic circular or crescent shape, which can develop rapidly causing destruction of the epidermis.
4. Lethargy of fish and loss of equilibrium.
5. Scales are lifted away from body surface of fish.
6. Neccrosis of fins and membranous part of gills may occur.
7. Respiratory manifestations appear on fish when infection is associated with gills.
8. Secondary infections of ulcerative dermal necrosis
9. Infected eggs are opaque in color with growth of fungus on eggs surface lead suffacation and become good medium for growth of the fungi. Saprolegnia lead to death by heamodilution or osmoregulatory failure.

Time to death by saprolegniasis depends on:

1. the initial site of infection.
2. type of tissue destroyed.
3. growth rate of fungus.
4. the ability of the fish to withstand the stress of a fungus invasion.

Diagnosis:

1. Case history.
2. Observation of a cottony, proliferative growth on the skin or gills alerts the clinician to a possible diagnosis of saprolegniasis.
3. Direct smear from fungal growth, presence of long, branched non-septate hyphae help in diagnosis of saprolegniasis.
4. Isolation and identification of saprolegnia using cultural method.
5. Recently: Polyclonal and monoclonal antibodies raised against various species of saprolegnia indicate that developing a rapid antibody assay for the detection of saprolegnia infection of fish.

Treatment and control:

- NaCl 5% for 5 minutes, 2.5% for 10 minute, 1% for 15-30 minute
- Malachite green 1:2000 for 1 hour.
- Cupper sulphate 1:2000 for 1 hour.
- Potassium permanganate 1:100.000 for 15 minute or 1:2000 for 30 minute.

- treatment of egg 1:1000 or 1:500 formalin or by ultraviolet.

Water molds can not be eliminated from any culture system. For this reason, prophylaxis is the best strategy for prevention and control of the saprolegnia infection, which is summarized in:

1. Removal the predisposing factors.
2. Avoiding damage of skin during transportation of fish.
3. Right kind of food with sufficient amount must be provided to fish.
4. Over crowding of fish must be prevented.
5. Preventing the introduction of new fish to the fish farm until known that fish are free from disease.
6. Disinfection of the equipments and utensils to prevent spread of the infection.

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Branchiomycosis (gill rot)

Definition:

It is a fungal disease involving gill tissues, affecting the most species of freshwater fish. The disease is caused by *Branchiomyces sanguinis* and *Branchiomyces demigrans*.

It is characterized by areas of infarctive necrosis of the gills, anorexia, and marbling appearance of the gills.

Causative agent:

There are two species from genus Branchiomyes, which are responsible for occurrence of the disease.

1. B. sanguinis: It grows mainly in the blood vessels of gill arches, filaments and in the gill lamellae.
2. B. demigrans: This fungal species is found in the parenchymal tissues of the gills.

Both species produce branched and non-septate hyphae. The fungi grow at temperature between 14 and 35úC. The optimun growth temperature appears to be between 25 and 32úC. The fungi grow on Sabouraud's dextrose agar medium.

Stress factors:

1. Elevation of the water temperature above 20úC.
2. Low dissolved oxygen.
3. Reduced water flow.
4. Over crowded conditions.
5. High levels of nutrients in the water and phytoplankton blooms.

Susceptible species:

The most species of freshwater fishes are susceptible to branchiomycosis.

Mode of transmission:

Fungal spores are transmitted by water to gills. These spores adhere to the gills, germinate and produce hyphae. The hyphae penetrate gills epithelium or within the blood vessels of gills depending on species of fungi.

Incubation period:

Incubation period for disease is related to water temperature. The disease has been rapidly developed within 2-4 days under suitable conditions.

Clinical signs:

1. Fish become weak in movement.
2. Fish are gathered in groups at water inlet and die.
3. Fish do not react to the approach of man and can be caught by hand.
4. There are respiratory distress in infected fish and do not swallow the air.
5. Fungus develops on or in gill tissue, or penetrates the blood vessels causing obstruction, congestion and necrosis of gill tissues.
6. Gills may be appearing red from impaired circulation.
7. Subacute form of branchiomycosis characterized by marbling appearance of the gills due to pale anemic patches in contact with red congested one due to disturbance of circulation in gills.

Diagnosis:

1. Case history.
2. Clinical signs.
3. Microscopical examination of wet preparation from infected gill.
4. Isolation and identification of the causative agent.

Prognosis:

Morbidity rate among fish populations with epizootics of brachiomycosis usually reach 100% depending on fish species and susceptibility. Mortality rate may each 30 to 50% of the fish population during late summer epizootics.

Treatment and control:

1. Strict sanitation and disinfection are essential for disease control.
2. Dead fishes should be collected and daily and burned or deeply buried.
3. Ponds with enzootic branchiomycosis should be dried and treated with calcium oxide (quicklime) or 2 to 3 kg copper sulphate per hectare.
4. Diseased fish can be treated with malachite green at 0.1mg/l for extended periods of time or 0.3mg/l for 12 hours.
5. Transportation of infected fish areas to non-infected areas must be prevents.
6. Increase of water supply help in control of that disease.
7. Stress factors must be avoided.
8. Regulating the feeding rate during warm weather.

Ichthyophonosis

Definition:

It is the fungal disease of both freshwater and marine fish. Affecting any species of both types. Caused by *Ichthyophonus hoferi*. Disease characterized by rough or granulomatus of the skin and white to gray-white lesions in the internal organs and different parts of the body.

Causative agent:

The disease caused by *Ichthyophonus hoferi*. This fungus is an obligate parasite with complicated life cycle. *Ichthyophonus hoferi* is spherical or oval in shape, yellowish-brown and has granulated cytoplasm. The fungus lives as an intercellular parasite in the tissues of various organs. Parasites become encysted by host tissues. If the cyst walls become very thick, the fungus cannot reproduce and dies. If the fungus grows faster than cyst wall, it produces numerous daughter cells.

I. hoferi can be cultivated on broth gelatin-agar or Sabouraud's dextrose agar with 1% bovine serum. Growth can occur between 3 and 20C. The optimum temperature is 10úC. Growth appeared within 7-10 days after inoculation.

Susceptible species:

Infection with *I. hoferi* has been reported in many species from freshwater and marine water fishes. The fungus has been found in crustaceans, amphibians, reptiles & fish eating birds.

Mode of transmission:

1. Oral route: Ingestion of infected raw fishes or fish products or other food transmits disease.

2. Skin abrasions or damaged gills help in transmission of the infection.

3. Carriers help in spreading of the infection through faecal discharges.

4. The disease can transmitted by contact between diseased fish & healthy one.

Clinical signs:

1. Fish with slight or moderate infection. There is no external signs can be observed.

2. Fish with advanced infection have rough or granulomatus skin, the term sandpaper effect is used to describe the granulomatus appearance. Its caused by development numerous infective unites under the skin & underlying muscle. These infective unites are swelling & necrotic lesions. Some may rupture through the skin leaving small openings. These are located on the latero-ventral tail region. Those are black in colour & a raise above the skin.

3. Those lesions found in the internal organs as white nodules similar to the granulomatus lesion of mycobacterium infection.

4. These nodules found in heart, liver, kidney, spleen, and brain and filled with cellular debris and fungus.

5. Infection of liver or kidney lead to abdominal distension & exophthalmia.

6. Infection of swim bladder, which led to damage of it, fish lies on the bottom of the pond & died.

7. The infection of the brain causes marked changes in the behavior of fish.

8. Curvature of the vertebral column may also occur due to muscle spasms.

Diagnosis:

1. Case history.

2. Clinical signs and P.M.

3. Microscopical examination of infected tissues to detect the fungi (spores).

4. Histopatholgical examination: Host response to the parasites is variable but severe granulomatous response is the usual finding, with large numbers of epithelioid cells and macrophages and occasional giant cell. In the early stages, calls of the inflammatory series are seen in large numbers. The granulomata usually have well-developed capusle of connective tissue.

5. Isolation and identification the causative agent.

Treatment and control:

1. There are no therapeutic procedures for treatment of ichthyophonus disease.

2. Prevention of infection is the best method for controls the disease.

3. Feeding of raw fish or infected food must be prevented.

4. Any infected fish or dead fish must be destroyed.

5. Complete disinfection of raceways or aquaria with chlorine or other throng disinfection.

6. All nets, brushes and utensils used around infected fish must also be disinfected at the same time.

7. Removal of fishes and water for several months or years of drying may be necessary to eliminate the pathogen form soil