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OVERVIEWS OF THE TREATMENT AND CONTROL OF COMMON FISH DISEASES

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ABSTRACT

Similar to other animals, fish can also suffer from different diseases. All fish carry pathogens and parasites. Disease is a prime agent affecting fish mortality, especially when fish are young. Pathogens which can cause fish diseases comprise: viral infections, bacterial infections, fungal infections, protozoan infections, water mould infection, etc. Fish are also exposed from different environmental pollutants, including drugs and chemicals. The most common fish diseases, particularly in freshwater aquaria, include columnaris, gill disease, ick (ich), dropsy, tail and fin-rot, fungal infections, white spot disease, pop-eye, cloudy eye, swim bladder disease, lice and nematode worms infestation, water quality induced diseases, constipation, anorexia, chilodonella, ergasilus, tuberculosis, glugea, henneguya, hexamita, hole-in-the-head disease, injuries, leeches in aquaria, lymphocystis, marine velvet, and neon-tetra disease, etc. Antibiotics are frequently used to control fish diseases caused by bacteria, but there is an increasing risk of developing antibiotic resistant strains of bacteria. The non-specific immune functions such as bacteriolytic activity and leukocyte function of fish have been improved by some herbs. Plants have been used as traditional medicine since time immemorial to control bacterial, viral, fungal and other diseases.

KEYWORDS: Fish, diseases, pathogens, microorganisms and parasites, treatment and control.

INTRODUCTION

Fishes not only play an important role in the demand of food for humans but they have also emerged as major model organisms for different biomedical researches. With increasing numbers of synthetic chemicals introduced into the environment each year, concerns remain regarding our understanding of the linkages between exposure to toxic agents and potential disease. Chemical contaminants of aquatic environments is of significant concern because although it is understood that aquatic systems serve as major conduits 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. As a consequence, new approaches are needed to improve the assessment of health risks associated with exposure to chemical contaminants in the aquatic environments¹.

Similar to other animals, fish can also suffer from various types of diseases. All fish carry pathogens and parasites. Usually this is at some cost to the fish. If the cost is sufficiently high, then the impacts can be characterized as a disease. However, disease in fish is not understood well. What is known about fish disease often relates to aquaria fish, and more recently, to farmed fish. Disease is a prime agent affecting fish mortality, especially when fish are young. Fish can limit the impacts of pathogens and parasites with behavioural or biochemical means, and such fish have reproductive advantages. Interacting factors result in low grade infection becoming fatal diseases. In particular, things that cause stress, such as natural droughts or pollution or predators, can precipitate outbreak of disease. Disease can also be particularly problematic when pathogens and parasites carried by introduced species affect native species. An introduced species may find invading easier if potential

predators and competitors have been decimated by disease. Pathogens which can cause fish diseases comprise: viral infections, bacterial infections, fungal infections water mould infection, etc.².

Fish are exposed from different environmental pollutants, including drugs and chemicals. The fish can also be infected or damaged by different pathogens, microorganisms or parasites. The most common fish diseases, particularly in freshwater aquariums, include columnaris, gill disease, ick (ich), dropsy, tail and fin-rot, fungal infections, white spot disease, pop-eye, cloudy eye, swim bladder disease, lice and nematode worms infestation, water quality induced diseases, constipation, anorexia, chilodonella, ergasilus, tuberculosis, glugea, henneguya, hexamita, hole-in-the-head disease (head and lateral line erosion disease, lateral line erosion or lateral line disease), injuries, leeches in aquariums, lymphocystis, marine velvet, and neon-tetra disease, etc.³. The bacterial infections are considered the major cause of mortality in aquaculture. Among the common fish pathogenic bacteria, *Streptococcus agalactiae*, *Lactococcus garvieae*, *Enterococcus faecalis* (all Gram-positive), *Aeromonas hydrophila* and *Yersinia ruckeri* (both Gram-negative) cause infectious diseases⁴.

A number of experiments and the use of drugs have been performed in fish. Therefore, fish may be used as model organism in the experimental pharmacology and toxicology¹. Diseases in fish caused by bacteria are most widespread. Antibiotics are frequently used to control fish diseases caused by bacteria, but there is an increasing risk of developing antibiotic resistant strains of bacteria. The non-specific immune functions such as bacteriolytic activity and leukocyte function of fish have been improved by some herbs⁴. Treatment of bacterial diseases with different herbs has been safely used in organic agriculture, veterinary and human

medicine. These herbs mitigate many of the side effects which are associated with synthetic antimicrobials. Additionally, the plant-derived phytochemicals provide a cheaper source for treatment and greater accuracy than chemotherapeutic agents. Plants have been used as traditional medicine since time immemorial to control bacterial, viral, fungal and other diseases. Recently, research has been initiated to evaluate the feasibility of herbal drugs in fish diseases⁵.

COMMON DISEASES OCCURRING IN FISH

Fish can suffer from various types of protozoan, fungal, bacterial, viral, crustacean and helminth diseases, etc. Some of these diseases have been discussed here.

Protozoan diseases:

There have been noticed five most common protozoan diseases:

1. Ichthyophthiriasis (ICH)- This disease is caused in major carps by protozoan ciliate, *Ichthyophthirius multifiliis*, which infects different regions of the body externally. This parasite causes simple hyperplasia of the epidermal cells around the site of infection causing forming of postules. Symptoms of this disease are whitish cysts on the skin, gill and fins⁶. Ichthyophthiriasis has been experimentally produced in the fingerlings of *Labeo bata* and *Cirrhinus mrigala*⁷.

2. Costiasis- It is produced by *Costia necatrix*. It is the most common mastigophoran infection observed in Indian major carps. Indications of costiasis are the presence of a bluish coating on skin of the fish and presence of large amount of mucus. The parasite causes irritation and disturbs respiration. Other mastigophoran parasites recorded are: *Bodomonas rebae* in mrigal, rohu and catla⁸ and *Trypanosoma punctati* in *Channa punctatus*⁹.

3. Trichodiniasis- This disease is caused by a group of peritrichal ciliated protozoans. The organisms are saucer shaped, 50 microns diameter, with rows of cilia at both ends and a macro and micronucleus. When viewed dorsoventrally, the parasite appears as an ornate disk with a characteristic ring of interlocking denticles forming a circle in the middle of the organism. *Trichodina truttae* is considered to be a specific pathogen for salmonids. These are observed on most fresh and saltwater fish. This protozoan is relatively common on many fish and is not always associated with disease. Clinically, fish usually exhibit flashing and become lethargic. There is an increase in mucus production causing a white to bluish haze on the skin. The skin may develop ulcers and the fins may fray. If the gills are involved, the fish may have severe respiratory distress. Histologically, masses of organisms are attached by adhesive discs and denticles of exoskeleton to the epidermis. The underlying epithelial cells undergo necrosis. There is secondary hyperplasia and hypertrophy of the gill epithelium^{6,10}.

4. Epistylis (Red sore disease)- It is caused by branched stalked ciliated protozoan, *Heteropolaria colisarum*. It is found primarily in wild populations of scaled fish. Clinically, one observes ulcers or cotton-like growth on the skin, scales and spine resulting in a red coloured lesion. In catfish, the lesion involves the spines and bones that underlie the skin of the head and pectoral girdle. This protozoan parasite has also been observed on eggs¹¹.

5. Myxosporidians infestation- Myxosporidians constitute typical fish parasites known to produce cysts on different regions of the body and internal tissues and organs. The common myxosporidians genera are: *Leptotheca*,

Chloromyxum, *Myxobolus*, *Henneguya*, *Thelohanellus*, *Myxidium*, *Lentosperma*, etc.⁶. Symptoms of this infestation include weakness, emaciation, raising of the scales along their posterior margins, falling of scales, etc.⁷.

Fungal diseases:

The three most common fungal diseases are saprolegniasis, branchiomycosis and ichthyophonosis.

1. Saprolegniasis- This infection is caused by *Saprolegnia parasitica*. This fungus often infects the fertilized eggs in hatching 'hapas'. Initially, the fungus attacks the dead eggs and thereafter spreads on to the surrounding viable eggs resulting in their spoilage as well⁶.

2. Branchiomycosis (Gill Rot)- It is caused by the fungi, *Branchiomyces sanguinis* (in carps) and *Branchiomyces demigrans* (in pike and tench). Branchiomycosis is a pervasive problem in Europe, but has been only occasionally reported by US fish farms. Both species of fungi are found in fish suffering from an environmental stress, such as low pH (5.8-6.5), low dissolved oxygen, or a high algal bloom. *Branchiomyces* sp. grow at temperatures between 57° F and 95°F, but grow best between 77° F and 90°F. The main sources of infection are the fungal spores carried in the water and detritus on pond bottoms. *B. sanguinis* and *B. demigrans* infect the gill tissue of fish. Fish may appear lethargic and may be seen gulping air at the water surface (or piping). Gills appear striated or marbled with the pale areas representing infected and dying tissue. Gills should be examined under a microscope by a trained diagnostician for verification of the disease. Damaged 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 often associated with this infection¹².

3. Ichthyophonosis disease (Swinging disease)- This disease is caused by the fungus, *Ichthyophonus hoferi*. It grows in fresh and saltwater, in wild and cultured fish, but is restricted to cool temperatures (36-68°F). The disease is spread by fungal cysts, which are released in the faeces and by cannibalism of infected fish. Because the primary route of transmission is through the ingestion 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 and in muscle tissue. Some fish may show curvature of the spine. Internally, the organs may be swollen with white to grey-white sores. Diseased fish shows curious swinging movements hence the disease is called as "swinging disease". Along with liver, particularly 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)¹².

Bacterial diseases:

Fish are susceptible to several bacterial infections, mainly when reared in high density conditions. Disease outbreaks elevated the mortality rate and decrease the productivity efficiency, causing high economic loss of the fish farmers⁵. *S. agalactiae*, *L. garvieae* and *E. faecalis* are closely related groups of bacteria that can cause diseases like streptococcosis, lactococcosis, haemorrhagic septicemia (HS) and ulcers in fins¹³. *Flavobacterium columnare* is pathogenic only to freshwater fish species and shows low environmental fitness, when compared with other aquatic bacteria. Even though, this agent is highly virulent to young fish (fry and

fingerling), causing skin lesions and high mortality, generally associated with poor environmental conditions¹⁴. Enteric red mouth disease mostly restricted to salmonids is caused by *Y. Ruckeri*, and reddening of mouth and throat is the most common symptom¹⁵. *A. hydrophila* is responsible for cases of skin infections, septicemia and gastroenteritis in fish and human¹⁶. *A. hydrophila*, the most common bacterial pathogen in freshwater fish, has been recognized to be the aetiological agent of several distinct pathological conditions including tail/fin rot, motile *Aeromonas* septicemia (MAS) or HS and epizootic ulcerative syndrome (EUS) as a primary pathogen. EUS is a globally distributed disease and is an epidemic, affecting a variety of wild and cultured fish species, especially in Southeast Asia, including Pakistan and India^{4,17}. Common bacterial diseases prevalent among fresh water cultivated fishes in India are as under:

1. Fin and tail rot fin diseases- These afflict both adults and young fishes. The infection during its early stage appears as a white line on the margin of the fin, spreading and imparting frayed appearance to the appendage which eventually putrefies and disintegrates. The disease is contagious and may cause considerable damage⁶.

2. Ulcer disease (Columnaris disease)- This disease is caused by *Flexibactor columnaris* shows raised white plaques, often with reddish peripheral zone leading to haemorrhagic ulcers⁶.

3. Dropsy- In this condition, accumulation of fluid inside the body cavity, scale protrusion, exophthalmic condition and inflammation of intestine¹⁸ and haemorrhagic ulcers occur on skin and fins⁶.

4. Eye Disease- This is an epidemic eye disease which affects medium-sized and large sized catla fish. This disease is caused by a variant of the bacterium, *Aeromonas liquefaciens*. The infected sites are: eyes, optic nerves and brain of the fish¹⁹⁻²⁰.

Viral diseases:

The two important viral diseases are²¹:

1. Spring viremia- *Rhabdovirus carpio* is the causal agent (pathogen) of this disease. Common carp is the host species for this disease and this disease is mainly restricted to European countries. The infected fish becomes black and develops lesions on the skin and gills. Bleeding from scales, accumulation of fluid in the body and inflammation of alimentary canal are some other symptoms of this disease.

2. Fish pox- This disease is also reported in European countries. The epidermis of the infected carp becomes proliferous, that is why the lesions or blisters are formed on the skin.

Crustacean diseases:

1. Argulus (fish lice) infestation- Argulus or fish lice are a very major threat to your fish's health. They can cause significant morbidity and mortality when heavily infesting the fish and they have been known to be the vehicle for other fish diseases. *Labeo rohita* is mainly affected by this disease. The affected fish have patches of haemorrhagic and oedematous skin, gills or fins. The parasite causes these injuries by attaching to the fish with its curved hooks and sucker.

Its feeding apparatus further injures the host fish when it inserts the stylet into the epidermis and underlying host tissue causing haemorrhage. Argulus feed on the host's blood and body fluids. The feeding apparatus also releases digestive enzymes which can cause systemic illness⁶.

2. Lernaea diseases- This disease is caused by *Lernaea cyprinacea*. The body of this crustacean is elongated, worm like and its head is embedded in the body of fish. Many branches arise from this embedded head. Due to infestation, initially fish starts swimming rapidly and later on, lesions/wounds develop on the body. Catla fish is mainly affected by this disease.

An isopod parasite, *Ichthyoxenus jellinghausii*, has been recorded²² from *Labeo bata* and *L. gonius* of Pariat lake, Jabalpur, MP. These parasites do not cause apparent harm to the hosts.

Helminth diseases:

Many parasitic worms infect fishes and cause great harm to them. *Dactylogyrus* and *Gyrodactylus* are the two common parasitic worms. *Dactylogyrus* attacks the gills, while gills and skin both are attacked by the infection of *Gyrodactylus*. Fish becomes less motile by the attack of these parasites, their fins start falling, body becomes yellow in colour and blood spots develop on their body. Delay in treatment may be lethal. Cyst of the metacercaria of the worm, *Posthodiplostomum cuticola* also causes "black spot disease" in fishes. Such black spots appear on whole body, including eyes and mouth. These parasites enter in the body of the fish through their skin, during cercaria stage²³.

TREATMENT AND CONTROL OF FISH DISEASES

Defences by fish against diseases and parasites: Fish have a variety of defences to prevent the diseases and parasites. The 'non-specific defences' include the skin and scales, as well as the mucus layer secreted by the epidermis which traps and inhibits the growth of microorganisms. If pathogens breach these defences, fish can develop an inflammatory response which increases blood flow to the infected region and delivers white blood cells (WBCs) which attempt to destroy pathogens. The 'specific defences' response to particular pathogen recognized by the fish's body, i.e., to an immune response. During recent years, the vaccines have become widely used in aquaculture and also with ornamental fish, e.g., the furunculosis vaccines in farmed salmon and koi herpes virus in koi. Some species of fish use the 'cleaner fish' to remove external parasites. The best known of these are the 'blue streak' of the genus *Labroides* found on coral reefs in the Indian and Pacific oceans. These small fishes maintain so-called the "cleaning stations", where other fishes congregate and perform specific movements to attract the attention of the cleaners. The cleaning behaviours have been observed in a number of fish groups, including an interesting case between two cichlids of the same genus, *Etroplus maculatus* (cleaner) and the much larger fish, *Etroplus suratensis*²⁴.

Treatment and control of protozoan diseases: For ICH disease, dip for hourly duration, in 1:5,000 formalin solution for 7 to 10 days, or in 2% common salt solution for more than 7 days, or in 1:50,000 quinine solution for 3 to 10 days should be used^{23,25}. The control measure for costiasis disease is the bath of 10 minutes in 3% common salt solution²⁵. *Bodomonas rebae* has been found to be killed in 5 to 10 minutes by 2 to 3% common salt solution⁸. In trichodiniasis, chelated copper compounds, which are extremely effective against protozoan parasite, have been used. The copper compounds, e.g., Argant and Aquavet are available in the market.

Treatment and control of fungal diseases: Saprolegniasis is best prevented by good management practices, such as good

water quality and circulation, avoidance of crowding to minimize injury (especially during spawning), and good nutrition. Once *Saprolegnia* is identified in an aquatic system, sanitation should be evaluated and corrected. Common treatments include potassium permanganate, formalin and povidone iodine solutions. Over treatment can further damage fish tissue, resulting in recurring infections. Environmental management is essential for satisfactory resolution of chronic problems. Bath treatment in NaOH (10-25 g/L for 10-20 min), KMnO_4 (1 g in 100 L of water for 30-90 min) or in CuSO_4 (5-10 g in 100 L of water for 10-30 min) should be given^{6,12}. Avoidance is the best control for branchiomycosis. Good management practices will create environmental conditions unacceptable for growth of fungi. If the disease is present, do not transport the infected fish. Great care must be taken to prevent 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 disinfected and dried. Ponds should be dried and treated with quicklime (calcium oxide). A long term bath in Acriflavine Neutral or Forma-Green for 7 days helps this condition. Ponds should be dried and treated with quicklime (calcium oxide) and copper sulphate (2-3 kg/ha). Dead fish should be buried. There is no cure for fish with *Ichthyophonus hoferi*; they will carry the infection for life. Prevention is the only control. To avoid introduction of infective spores, never feed raw fish or raw fish products to cultured fish. Cooking helps destroy the infective life stage. If *Ichthyophonus* disease is identified by a trained diagnostician, it is important to remove and destroy any fish with the disease. Complete disinfection of tanks, raceways, or aquaria is encouraged. Ponds with dirt or gravel bottoms need months of drying to totally eliminate the fungus¹².

Treatment and control of bacterial diseases: For fin and tail rot fin diseases, one minute dip in 1:3,000 solution of copper sulphate should be given²³. Painting the site of infection with concentrated copper sulphate solution also helps to cure the disease²⁶. In ulcer disease, the badly infected fish should be destroyed and the pond water should be disinfected with a 0.5 ppm solution of KMnO_4 . Dip treatment for one minute in 1:2,000 copper sulphate solution for 3 to 4 days in case of fish showing early stage of infection is required. Addition of chloromycetin at 5 to 10 ppm to pond water and/or addition of the antibiotic oxytetracycline to feed @ 75 mg/kg of fish/day is done⁶. In dropsy, thorough disinfection is done with 1 ppm potassium permanganate solution or dip treatment in 5 ppm of the same chemical for 2 minutes can be given²³. In eye disease, during the initial stage of infection, chloromycetin (8-10 mg/L) bath for one hour should be given for 2 to 3 days. Disinfection of pond with 1 ppm potassium permanganate, improvement of sanitary conditions and resorting to artificial feeding to fishes (in case plankton population is not sufficient) should be done¹⁹.

Treatment and control of crustacean diseases: For Argulus infestation, pond treatment with gammexane at a concentration of 0.2 ppm should be repeated at weekly intervals twice or thrice²⁵. In Lernaea diseases, when a few fishes are affected, mechanical removal of parasites by pulling them out from anchorage by means of fine forceps would be sufficient, preferably followed by a bath in weak permanganate solution for 2 to 3 minutes⁶. In case of large numbers of fish being infected, dip treatment over short

durations in a 5 ppm solution of KMnO_4 has been suggested²³.

Treatment and control of helminth diseases: For gyrodactylosis, alternate bath in 1:2,000 acetic acid and sodium chloride solutions have been effective for major carps. Dip treatment of 5 minutes duration in 5% common salt or of 5 to 10 minutes duration in 1:5,000 formalin solution should be given²⁵.

CONCLUSION

Fish suffer from different diseases as they can carry different pathogens and parasites. Pathogens which can cause fish diseases include viral infections, bacteria, fungi, protozoa, water moulds, etc. Fish are also exposed from different environmental pollutants, including drugs and chemicals. Common fish diseases include columnaris, gill disease, ick, dropsy, tail and fin-rot, fungal infections, white spot disease, pop-eye, cloudy eye, swim bladder disease, lice and nematode worms infestation, water quality induced diseases, constipation, anorexia, chilodonella, ergasilus, tuberculosis, glugea, henneguya, hexamita, hole-in-the-head disease, injuries, leeches in aquaria, lymphocystis, marine velvet, and neon-tetra disease, etc. Antibiotics are generally used to control fish diseases caused by bacteria. However, the non-specific immune functions like bacteriolytic activity and leukocyte function have been improved by some herbs.

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