Diseases of Ornamental Fishes and their Control

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Introduction

In the global scene, tropical aquarium fish keeping is considered as the second largest hobby next only to photography. The practice of maintaining fish for ornamental purpose is known from Tang dynasty (680 to 908, A.D). Ornamental fish keeping was initiated as a small time hobby using gold fish during the 18th century. In 20th century, aquarium keeping and rearing of ornamental fish got worldwide recognition. At present this technique has developed in to an extensive and global component of international trade worth millions of dollars. According to FAO, the export value in 1996 was US$ 206,603,000. Since 1985, the international trade in ornamental export has increased on an average of 14.0% per year. The 'developing countries' account for about 63.0% of the export value. According to Dr. Kevan Main of Harbor Branch Oceanographic Institution, nearly 90.0% of fresh water ornamental fish are captive bred. The same author has indicated that about 25 of 8,000 marine ornamental species only are easily raised. Hence, much scope exists for breeding and domesticating many high-value marine ornamental fish.

In India, a variety of fresh water and marine ornamental fishes are available. About 600 of species have been identified as potential fishes with ornamental value. The trade in India fetches about Rs. 50 crores /year. However, the success of ornamental fish culture or breeding depends on the health status of the candidate species. Several diseases of economic importance are recorded and the common diseases, symptoms and methods of inspection together with treatment protocols are summarized in this article.

Causative factors for fish diseases:

The causative factors of fish diseases can be grouped under six broad categories:

1. Internal to the individual – genetic diseases
2. Environment associated diseases (such as critical intensities of light/temperature/pH/ dissolved gases)
3. Physical injuries (ex: handling/transporting)
4. Nutritional diseases (ex: deficiency syndromes)
5. Co-existing organisms (biological entities)
6. A combination of a few or all factors indicated above.

General methods to detect the health of fish in field conditions:

1. Visual examination is one of the quickest and least costly and requires a well-trained eye. But it need not be highly reliable. Some of the quick indicators are given below:

External:

Reflexes: In healthy fishes, reflexes will be quick such as: Escape reflex, Eye reflex and Tail reflex. The other types of symptoms may be:

Sluggish behaviour

Twirling, spiral or erratic movements

Faded or darkened pigmentation

Exophthalmus or 'pop eye' condition

Hemorrhages

Erosion of jaw or mouth

Gill parasites, gill erosions, white nodules

Tail or fin rot

Distended abdomen (Dropsy)

Protruded anus (vent)

Blood oozing

Ulcers/boils (furuncles)

External parasites

Cotton wool like growth

Internal:

Gas filled hollows

Ascitic fluid in the abdominal cavity

Hemorrhages in the muscle wall/air bladder/ internal organs

Liquid in the air bladder

White nodules in internal organs

Swelling of organs (Kidneys, liver etc.,)

2. Microscopic and Histologic examination:

Impression smear or wet mount preparation can be examined using a light microscope. This is a rapid and inexpensive diagnostic tool. This method is good for observing motile bacteria and protozoa. More specific information can also be obtained from histological method when special stains are applied to the tissue sections. But it is slow and expensive. It also requires a trained technician, and some times fails to yield a definitive diagnosis.

3. Bacterial isolation:

A sample is taken and either streaked on agar – based medium or introduced into a liquid broth containing a mixture of specially designed ingredients. Some media are also designed to allow the selective growth of certain bacteria from a potential mixture of pathogenic and non-pathogenic bacteria. General morphologic classification of the bacteria can be made based on the colony size, shape, color and smell. For more exact identification, biochemical characterization is often used. In this, a single purified colony is assayed for its ability to metabolize a variety of different minerals, chemicals and food sources. This is a very specific diagnostic method. However, it requires days or even weeks obtaining the results, and not all bacteria will grow on defined medium.

4. Tissue culture:

As viruses cannot grow or multiply unless they are within living cells, cell cultures allow the diagnostician to grow many types of viruses in the laboratory. A sample is homogenized and added to the cells in the tissue culture flask. If virus is present in the sample, it causes the Cytopathic Effect (CPE). However, cell cultures have been developed only for some finfish, but not for shellfish.

Rapid diagnostic tests for detecting fish pathogens:

In order to prevent outbreaks, minimize the presence of pathogens and to reduce the use of antimicrobial compounds, rapid detection of pathogen is essential. They are further advantageous since the tests are: a. speedy, sensitive and accurate, b. presumptive and/or confirmatory, c. be micro-modified for inexpensive handling of large number of individuals and small volume samples, d. require non-destructive samples, e. yield qualitative and quantitative results. The results obtained from such tests can be correlated with the other clinical symptoms of the fish. Some of the important rapid diagnostic tests are given below:

1. Immuno-diagnostic assays such as Monoclonal & Polyclonal antibody assays.
2. Direct fluorescent antibody test (d-fat)
3. Enzyme immuno assays (EIAs) or ELISA
4. Dot immunobinding assay
5. Western Blotting technique
6. The Latex agglutination assay
7. DNA – based diagnostic tests
8. Polymerase Chain Reaction (PCR) tests.

Common diseases and their management

Viral diseases:

Common disease: Lymphocystis

Symptoms: Nodular white swellings (cauliflower) on fins or body.

Lymphocystis is caused by virus and hence affects the cells of the fish. It usually manifests itself as abnormally large white lumps (cauliflower) on the fins or other parts of the body. This is a rare disease.

Treatment: it is better to remove and destroy the infected fish as soon as possible.

The other treatment is to simply separate the infected fish for several months.

Bacterial diseases and treatment:

1. Fin and Tail Rot:

Symptoms: Disintegrating fins that may be reduced to stumps, exposed fin rays, blood on edges of fins, reddened areas at base of fins, skin ulcers with grey or red margins, cloudy eyes.

Possible predisposing factors: Poor water quality/ aquarium conditions and injury to the fin and tail. The affected area slowly breaks down.

Treatment: It is advisable to treat the water or fish with antibiotics @ 20 - 30 mg per litre. For mixing with feed, 1.0% of antibiotic can be used and fed to the fish. Antibiotics such as chloromycetin (chloramphenicol) or tetracycline will be effective in controlling fin and tail rot conditons.

2. Scale Protrusion:

Symptoms: Protruding scales without body bloat.

Scale protrusion is essentially a bacterial infection of the scales and/or body.

Treatment: An effective treatment is to add an antibiotic to the food. With flake food, use about 1% of antibiotic such as chloremphenicol or tetracycline. In the water, add about 10 mg per litre of the required antibiotic.

3. Dropsy

Symptoms: Bloating of the body, protruding scales.

Causes: Dropsy is caused by bacterial infection of the peritoneal area including kidneys, causing fluid accumulation. The fluids in the body build up and cause the fish to bloat up and the scales to protrude.

Treatment: Recommended dose of antibiotic.

4. Ulcerations, Red sores or redpest:

Symptoms: Bloody streaks on fins or body.

Causes: Bacteria penetrates inside the body tissue.

Treatment: Disinfect the rearing water with suitable antiseptics such as acriflavine or monacrin (monoaminoacridine) with 0.2% solution @ 1 ml per litre followed by antibiotic treatment.

Fungal Diseases:

1. Saprolegniosis:

Symptoms: Tufts of white cotton-like growth on the skin or fins. Eggs turn white.

Predisposing factors: Usually fungus is a secondary infection. Fungal attacks follow an injury, parasitic attack or after a bacterial infection.

Treatment: For attacks on fish eggs, use 3 to 5 mg/ l methylene blue as a preventative measure after the eggs are laid. In addition, 10 ml of 1.0% phenoxethol per liter of aquarium water can be added. It is advisable to repeat for a few days as per the requirement. If the symptoms are severe the fish can be removed from the aquarium and swabbed with a cloth immersed in weak solution of povidone iodine or mercurochrome.

Protozoan diseases

1. Ich Disease or Ichthyphthiris Disease

Ich disease or 'white spot disease' is the most common disease in aquaria.

Organism causing the disease: The ciliate, *Ichthyophthirius multifiliis*

Symptoms: White glistening spots or Salt-like specks on the body/fins. Excessive slime on body, difficulty in breathing, clamped fins and loss of appetite are other symptoms.

Treatment: The free-swimming phase of the parasite is susceptible to chemicals. Quinine hydrochloride or Quinine sulphate at 30 mg per litre (1 in 30,000) can be used. Others such as acridine orange, acriflavine, mild formalin solution, benzalkonium chloride, malachite green or malachite green with copper are effective.

2. Costia

Symptom: Milky cloudiness on skin.

Treatment: Copper at 0.2 mg per liter (0.2 ppm) to be repeated once in a few days if necessary. Acriflavine may be used at 0.2% solution (1 ml per litre).

3. Chilodonella

Symptom: Dulling of the colors due to excessive slime, fraying of the fins, weakness and gill damage.

Treatment: Acriflavine at 1.0% solution (5 ml per litre).

Parasitic Diseases

1. Argulus (Fish louse) and anchor worms (Lerneae)

Symptoms: The fish scrapes itself against objects, clamped fins, visible parasites about 1/4 inch in diameter are visible on the body of the fish.

Treatment/Management: With larger fish and light infestation, the lice can be removed with forceps. Weak formaldehyde is also useful to remove the parasites.

2. Ergasilus

This parasite is like the anchor worm, but is smaller and attacks the gills instead of the skin.

Symptoms: Whitish-green threads hang out of the fish's gills.

Treatment: Bath for 10 to 30 minute in 10.0mg/ litre of potassium permanganate or continuous exposure of the whole tank with 2 mg/ litre of potassium permanganate. In addition, 30-minute dip with 1.0 ppm of Copper control followed by 30-minute dip with 1.0 ppm of BKC will be helpful to control gill parasites.

Miscellaneous Diseases/infections

Eye problems are more common in aquarium fishes.

Symptoms: pop eye, cloudy cornea, opaque lens, swelling, blindness.

Treatment: Pop eye (exophtalmia) can result from rough handling, gas embolism, tumors, bacterial infection, or vitamin A deficiency. It can be treated successfully with penicillin or amoxicillin. Cloudy cornea can result from a bacterial invasion. Antibiotics may help. Opaqueness can result from poor nutrition or a metacercaria invasion (grubs).

Disease control using vaccines, immunostimulants and other additives

Vaccine could be defined as a substance that causes a specific immune response. Vaccination as a part of standard fish culture programme is relatively new although the impact of vaccination is dramatic. Considering the importance of vaccination, biotechnologists are trying to develop subunit vaccines, i.e., vaccines consisting of the major protective antigens of the pathogen. The sub-unit vaccines have evident advantages: The important advantage is that the vaccine contains only a component of the pathogen and is therefore, more chemically defined and likely to be more stable. The other advantage is that the vaccine can be produced by direct synthesis or recombinant DNA technology. Thus these vaccines may be genetically engineered to express further protective antigens from other fish pathogens and thereby yield multivalent vaccines.

Immunostimulants elicit non-specific defense mechanisms and enhance the barrier of infections against pathogens. They are isolated from natural sources and then synthesised chemically. (Ex: cell wall preparations from bacteria, fungi, mushroom). The active principles of immunostimulatory cell wall preparations are various muramylpeptide fragments, lipopolysaccharides, lipopeptides, and acyloligopeptides.

Techniques in administering vaccines, bacterins and immunostimulants

The route of exposure of the immunizing antigen has a direct impact on the levels and types of protective immunity that develops. Currently four methods are commonly used:

1. Injection (intraperitoneal, intramuscular or subcutaneous) induces highest levels of protection; but is very labour-intensive and stressful. Semi-automated devices, which can immunize 4000 fish per hour, have been developed which reduce the stress on fish and risk of exposure to the worker.
2. Vaccination by immersion is one of the most widely used methods. In this method, fish are dipped for 20 seconds in a well-aerated vaccine

suspension. Thus a litre of vaccine can be used to vaccinate 10,000X10g fish. Dip vaccination would be stressful, but the problem is overcome by bath vaccination where fish are vaccinated by being exposed to higher dilutions of vaccines (e.g. 1:100) for times ranging from 20 minutes to several hours. Vaccine can be added directly to hatchery troughs or transport bags. Hyperosmotic infiltration is also used to administer the immunizing agent through osmotic principle.

3. Spray vaccination is another modification of direct immersion but in this method fish must be handled thus making it stressful. The level of protection was reported to be comparable to immersion.
4. Immunization by oral route by incorporating the bacterin or immunostimulants in the feed is a potentially useful method.

One of the important prophylactic measures against the disease problems is proper water management. In culture conditions, the disease problems are linked to the stress factors arising out of inadequate physico-chemical and microbiological quality of water. Ammonia and hydrogen sulfide are two important factors of great significance. As the culture progresses and biomass increases, the water quality deteriorates due to accumulation of metabolic waste of cultured organisms, decomposition of unutilized feed and decay of other biotic materials. For the eco-friendly environment and disease management, the concept of 'probiotics' is gaining importance.

Presently a variety of commercial products of water additive probiotics are available. The 'probiotic organisms' work on the principle of competitive exclusion. This ecological process modifies the microbial species composition of the host and its environment. The probiotic application also acts as a "bio control", through which pathogens can be killed or reduced in number in the aquatic environment. The possible disease preventive steps are depicted in Fig. 1.

Appendix:

Some useful fish/ shellfish pathological terms:

Aetiological agent: An organism which initiates or causes disease in an animal

Aetiology: Study of the cause of the disease, including the factors which enhance the transmission and infectivity of the aetiologic agent.

Anaemia: A condition characterized by deficiency of hemoglobin, packed cell volume and/or erythrocytes.

Anorexia: The loss or deficiency of appetite for food.

Ascites: Abnormal accumulation of serous fluid in the abdominal cavity.

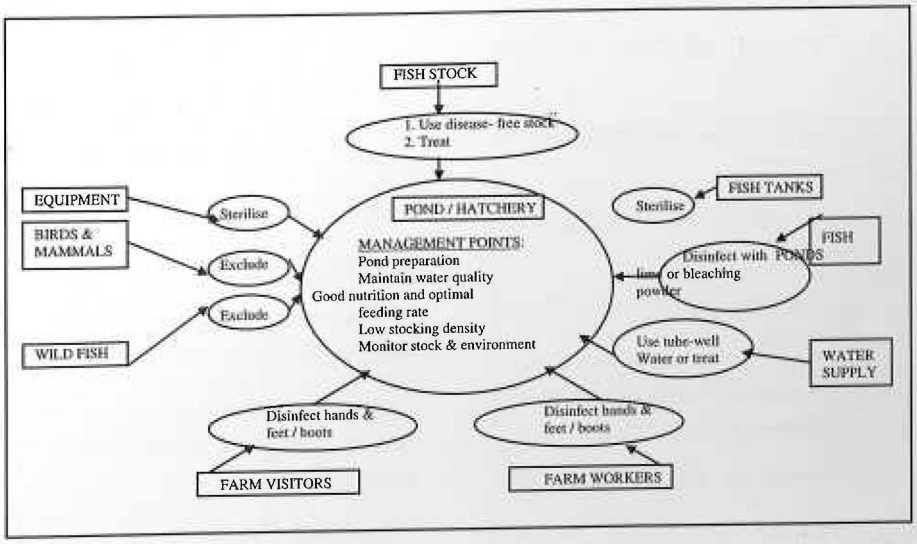

Fig. 1. Diagram summarizing methods of preventing entry of infectious agents to the ornamental fish farm conditions

Carrier: An animal with no clinical disease but persistently infected with a pathogen; pathogens from carrier fish may be shed in faeces, urine or reproductive products.

Chitinoclastic (chitinolytic): Chitin degrading organisms which have chitinase enzyme capable of breaking down the chitin component of the exoskeleton.

Ecchymose: The escape of blood from a blood vessel into surrounding tissue; visible as a red to purple spot.

Emaciation: Excessive leanness or wasting of body tissue.

Enteritis: Inflammation of the intestine.

Epibionts: Organisms which live on the surface of other organisms.

Epidemiology: The study of factors influencing infection by a pathogenic agent.

Erythemic: Inflammation, redness of the skin.

Exophthalmia: Abnormal protrusion of the eyeball from the orbit. (=Popeye).

Fibrosis: Proliferation of connective tissue containing a high proportion of fibroblasts.

Focal lesion: A small lesion in any tissue, limited to a focus.

Haemagglutination: The agglutination of red blood cells.

Haemolysis: The disruption of red blood cells and release of haemoglobin.

Haemorrhage: Internal or external bleeding caused by rupture of blood vessels.

Histolysis: Breakdown of tissue by disintegration of the plasma membrane.

Hyperplasia: Abnormal increase in size of a tissue or organ (due to new cells)

Hypertrophy: Increase in size of tissue or organ due to an increase in individual cells.

Hypoxia: Oxygen deficiency in tissues or organs.

Lesions: Abnormal changes in tissues or body functions.

Leucopenia: An abnormal decrease in the number of leucocytes.

Lordosis: An exaggerated forwarded, convex curve of the lumbar spine.

Moribund: Dying or close to death.

Mycosis: A disease resulting from infection by a fungus.

Necrosis: Localized death and degeneration of cells and tissues in a living organism. It is irreversible and involves nuclear breakdown and cell death.

Oedema: Swelling of a tissue or of an organ caused by excessive accumulation of serous fluid in extracellular spaces due to increased permeability of capillaries.

Papilloma: A branching benign tumour derived from epithelium.

Pathogenicity: The capability of an organism to produce disease.

Petechial haemorrhage: Small or minute reddish spots on the skin or in the serous or mucous membranes caused by bleeding.

Prevalence: The percentage of animals in a population which are infected at anyone time by a specific organism.

Pustule: A sub-epidermal swelling containing necrotic cell debris as a result of inflammation in response to a focal infection. The pustule may also contain living or dead infectious organisms.

Pyknosis: A condition in which the nucleus of a cell stains more densely than normal and is suspected to be a precursor of necrosis.

Refractory: Able to resist to disease.

Scoliosis: A lateral curvature of the spine.

Septiacemia: Presence of bacteria in the circulation system following an infection.

Ulcer: Excavation of the surface of an organ or tissue, involving sloughing of necrotic inflammatory tissue.

Virulence: The ability of a microorganism to cause disease.