

# Ornamental Fish

Breeding, Farming and Trade

*Editors*

**B. Madhusoodana Kurup**

**M.R. Boopendranath**

**K. Ravindran**

**Saira Banu**

**A. Gopalakrishnan Nair**

**Department of Fisheries**

**Government of Kerala**

**Thiruvananthapuram, India**



Govt. of Kerala



Govt. of India



FIRMA

**2008**

# Diseases in Ornamental Fishes

**N. K. Sanil and K. K. Vijayan.**

Central marine Fisheries Research Institute  
Cochin – 682 018, India

E-mail: vijayankk@gmail.com

## Abstract

Any impairment that interferes with the performance of normal functions including responses to environmental factors, toxicants, climate, nutrition, infectious agents etc can be termed a disease. Diseases can be caused by a variety of factors, the most important being pathogens. Other factors contributing towards the development of disease conditions include stress, environmental/water quality, physical agents, nutritional imbalance, toxins etc or a combination of these. Disease condition what we see is thus a complex situation resulting from the interaction/modification of the primary disease condition by these biotic and abiotic factors. The effect of disease on animals range from morbidity or reduced production in some cases to heavy mortalities. In this paper, infectious and non-infectious diseases and parasitic diseases commonly encountered in ornamental fish culture and approaches for their prevention, treatment and control are discussed.

**Keywords:** Ornamental fish diseases, control of diseases.

## 1 Introduction

Majority of the aquarists who discontinue keeping fishes do so because of the mortality problems in the aquaria. On the other hand, the increasing export potential demands more production. Since reckless exploitation of selected species of ornamental value from the wild cannot be advised, intensive breeding and rearing practices is the only alternative left. With such intensive practices, as in any other culture systems, disease problems are bound to crop up which can badly affect the profitability of the ventures. So we must be proactive and prepared well in advance to face these disease problems which are going to be the major limiting factors for the growth of the industry in the near future.

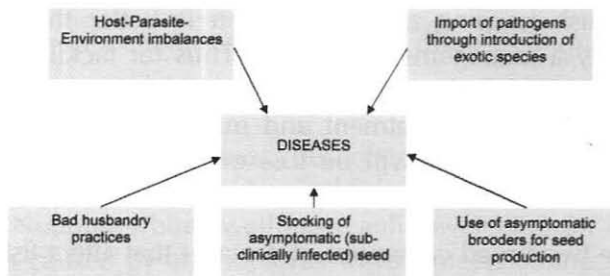


Fig. 1: Pathways of common diseases

Any impairment that interferes with the performance of normal functions including responses to environmental factors, toxicants, climate, nutrition, infectious agents etc can be termed a disease. Diseases can be caused by a variety of factors, the most important being pathogens. Other factors contributing towards the development of disease conditions include stress, environmental/water quality, physical agents, nutritional imbalance, toxins etc or a combination of these. Disease condition what we see is thus a complex situation resulting from the interaction/modification of the primary disease condition by these biotic and abiotic factors. The effect of disease on animals range from morbidity or reduced production, in some cases, to heavy mortalities. In nature we are less aware of fish disease problems because sick animals are quickly removed from the population by predators. In addition, fish are much less crowded in natural systems than in captivity. Pathogens are always present in the environment and there is a delicate balance exists between the host, pathogen and environment (Fig.1). Any changes in any of these factors may disturb the equilibrium and may lead to increasing or decreasing levels of disease.

The most obvious sign of disease in any system is the presence of dead or dying animals. However, the careful observation can usually tell that fish are sick before they start dying because sick fish often stop feeding and may appear lethargic. Fish that are observed hanging listlessly in edges of the aquarium, gasping at the surface, abnormalities in the feeding pattern (poor feeding or overfeeding) or rubbing against objects indicate something may be wrong. These behavioral abnormalities indicate that the fish are not feeling well or that something is irritating them. In addition to behavioral changes, there are physical signs that indicate potential disease problems in fish. These include the presence of sores (ulcers or hemorrhages), ragged fins, or abnormal body confirmation (i.e., a distended abdomen or "dropsy" and exophthalmia or "popped up eyes" or bulged eyes). When these abnormalities are observed, the fish should be evaluated for the presence of diseases. As in the case of any other disease, in ornamental fish keeping also 'prevention is better than cure' since disease is largely a management problem. Thus for tackling any disease condition, the first step is the correct diagnosis of the problem at the right time followed by suitable treatment and management schedules. If the diagnosis is faulty the result will be loss of animals along with wasted treatment efforts.

There are two broad categories of diseases that affect fish, infectious and non-infectious diseases. Infectious diseases are caused by pathogenic organisms present in the environment or carried by other fish. Majority of

diseases affecting fishes are infectious, caused by opportunist viruses, bacteria, and parasites. These pathogens multiply in vast numbers in the fish, causing massive damage to the organism by depriving it of life-essential substances and/or by producing ichthyotoxic substances. In both cases the health of the fish is affected and results in diseases, unless appropriate treatment is given. In contrast, non-infectious diseases are caused by environmental problems, nutritional deficiencies, or genetic anomalies; they are not contagious and usually cannot be cured by medications.

Based on their nature, diseases can be classified into Acute and Chronic. In acute diseases, the process of disease development is as follows: (i) contact with the pathogen, (ii) infiltration/entry into the body, (iii) development / proliferation, (iv) spreading throughout the body, (v) symptoms/syndromes appear, f) the pathogen restricts itself to specific target organ (if the host is able to put up some resistance) or death follows. In the case of chronic infections the development is very slow, usually may or may not show pathology/symptoms and may remain in the body for a prolonged period serving as a reservoir/carrier. Generally, chronic infections are difficult to cure. The time lag between the entry of pathogen into the body and the development of symptoms is known as the incubation period which varies depending upon various factors including temperature and is usually shorter in fishes when compared to other animals. Healthy fish have the natural ability to defend themselves against infections and even if the pathogens gains entry into the body, a strong immunity/host resistance prevents the pathogen from establishing. Stress, however, slows down the immune system making the fish weak and unable to defend itself. The equilibrium between the host and pathogen is of key importance in the process and if the pathogen dominates, disease symptoms start appearing.

## **2 Infectious diseases**

Commonly encountered infectious diseases in ornamental fishes are:

### **2.1 Viral Diseases**

Among the viral diseases described in ornamental tropical fishes, the commonly observed one in tropical fish is lymphocystis disease. Symptoms include: Nodular white swellings (cauliflower like) on fins or body. This disease is caused by an iridovirus which infects connective tissue cells of the fish. The virus induces these cells to undergo extensive hypertrophy, the affected cells increasing thousand folds in size. The disease appears to

be more common in marine and brackish water fishes. Certain species are more prone to this disease especially the members of the genera *Scatophagus*, *Monodactylus*, and *Changa*. Stress is almost certainly a factor in this disease since outbreaks are frequently observed following capture and shipping of fishes. Gross lesions appear white and granular and usually are seen on the skin and fins. Occasionally, lesions will be seen in the mouth and on the gills. There is no proven chemotherapeutic treatment. Most cases are self limiting if the fish is provided with proper water quality and nutrition if not, it is better to remove and destroy the infected fish as soon as possible.

**Koi herpes virus:** The herpes virus was first isolated in Israel in 1998, and has since been detected in ornamental koi carp in Europe, Asia and the United States. This is one of the most lethal, emerging viral infections in carp ornamentals.

## 2.2 Bacterial diseases

Bacterial diseases are the most common infectious problem encountered in ornamental fishes. Collectively, only water quality problems exceed bacterial diseases in the area of pet fish morbidity and mortality. The majority of bacterial infections are caused by Gram-negative organisms including the following pathogenic genera: *Aeromonas*, *Citrobacter*, *Edwardsiella*, *Flavobacterium* (*Flexibacter*), *Mycobacterium*, *Pseudomonas*, and *Vibrio*. Among the Gram-positive bacteria, *Streptococcus* has been shown to cause disease in ornamental fishes. Bacterial organisms may be the primary cause of disease, or very often may be secondary invaders, taking advantage of a breach in the fish's body covering (skin) or compromised immune system. Most bacterial fish pathogens are natural inhabitants of the aquatic environment, be it freshwater or marine. Nearly every bacterial pathogen of fish is capable of living independently away from the fish host. Virtually any extrinsic stress, including shipping, crowding, poor water quality and inadequate nutrition, may predispose an ornamental fish to bacterial disease. Opportunistic pathogenic bacteria can proliferate and spread disease throughout the fish's body fluid or tissues if they are absorbed through the gills or gut, or gain entry via the skin. This is known as a systemic infection. Typical signs of bacterial diseases in fish include: red and inflamed areas on the body and fins, raised scales, skin ulcers, exophtalmos, dropsy or swollen abdomen, fin rot etc. Additionally, affected fish may be lethargic and anorexic. There may be lesions or haemorrhages in organs and/or a build-up of bloody fluid in the abdominal cavity (ascites). Commonly encountered bacterial diseases include:

**Fin and/or tail rot:** usually manifested by disintegrating/eroded fins that are often reduced to stumps, exposed fin rays, blood on edges of fins, reddened areas at base of fins, skin ulcers with grey or red margins and cloudy eyes. It usually results from environmental stress, poor water quality/ aquarium conditions and injury to the fin and tail during handling and secondary infections by pathogenic bacteria, especially *Vibriosis*.

**Bacterial body ulcers:** Appears as open, shallow to deep, lesions on the fish's body often along with bloody streaks on fins or body and are caused by various bacterial infections.

**Scale Protrusion:** Infected fish exhibit raised areas of scales which are simply red or appear "bruised". Scale protrusion is essentially a bacterial infection of the scales and/or body. If left untreated, these areas "blow out" and expose the tissues underneath leading to mortality. Mouth rot is another common springtime bacterial infection.

**Dropsy:** Manifested by bloating of the body and protruding scales. 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.

**Bacterial gill disease:** The gills are the primary target and the gill tissues are destroyed leading to mortality.

**Systemic bacterial disease:** Bacteria invade the fish's body and damage internal organs/systems.

### 2.3 Fungal Diseases

It is common for ornamental fish keepers and pet store owners alike to implicate "fungus" for any grossly visible skin disease of tropical fish. Even diseases such as lymphocystis and protozoan ectoparasitic diseases are lumped into the fungus category but fungal diseases are easy to identify under the microscope as a tight mat of fungal hyphae following a simple skin scraping. Fungi belonging to the genus *Saprolegnia* are the most commonly observed species affecting the tropical fishes. They are opportunistic pathogens/secondary invaders which typically colonize exposed damaged tissue. Normally if the fish is well supported with clean water and good food, the fungal tufts will slough off in time without the necessity of treatment but some severe conditions may demand chemotherapy.

### 3. Parasitic diseases

Parasites are generally opportunistic pathogenic organisms, causing diseases under congenial conditions. Usually parasites are present in

almost all animals in low numbers, but generally do not cause any disease condition but if present in large numbers they can turn fatal for the host. They are generally divided into two groups: ectoparasites, which live on the outside of the host (including the gills, mouth, skin and fin surfaces), and endoparasites, which live in the tissues, blood and/or organs (including the gastrointestinal tract). Based on their organization they are also classified into protozoans (single celled) and metazoans (multicellular). Some parasites have a direct life-cycle while others have complicated life-cycle patterns involving 2 or more intermediate hosts. Some are highly host specific while many others are non-specific thus making their control of outbreaks very difficult.

Table 1: Treatment for common parasites in ornamental fishes

Parasites	Treatment
<b>Ectoparasites</b>	
<i>Ichthyophthirius multifiliis</i> , <i>Trichodina</i> sp., <i>Ichthyobodo</i> sp and <i>Tetrahymana</i> sp	Salt, formalin, malachite green, other commercial products, increasing temperature.
Gill flukes, skin flukes	Copper, malachite green, formalin etc.
External protozoa, flukes	Malachite green and formalin, others
Piscinoodinium	Antiparasite medication, salt, copper, increasing temperature.
Fish lice, gill maggots	Formalin, potassium permanganate, other commercial products.
Anchor worms	Organophosphate, manual removal and then dab with antiseptic
Larval stage of digenetic fluke parasites	organophosphate, other commercial products
<b>Endoparasites</b>	
<i>Hexamita</i> sp and <i>Spironucleus</i> sp	Metronidazole and other commercial products
Blood parasites	If flukes: praziquantel; others difficult to treat
Nematodes (roundworms)	Use of appropriate anthelmintic drug, eliminate IM host, remove dead fish, piperazine
Spiny-headed worm	Appropriate anthelmintic
Tapeworms	Praziquantel
Digenetic flukes	Difficult to treat, praziquantel

### Protozoan parasitic diseases

Protozoan parasitic diseases are caused by small microscopic organisms which live in the aquatic environment. There are a variety of protozoans which infest the gills and skin of fish causing irritation, weight loss, and eventually death.

**Ich Disease or 'white spot disease':** Ich disease is the most common disease in aquaria and is caused by the ciliate parasite, *Ichthyophthirius multifiliis*. Symptoms include white glistening spots or salt-like specks on the body/fins, excessive slime on body, difficulty in breathing, clamped fins and loss of appetite. The parasite lacks host specificity and can infect any fish species, making it the most destructive fish parasite in ornamental fishes.

**Ichthyobodosis:** Formerly known as Coastiasis is caused by *Ichthyobodo necator* (formerly *Coastia necatrix*) is a dangerous infection, attacking the entire body surface and gills, destroying the epithelial cells resulting in mortality through respiratory and osmoregulatory failure. Microscopically the protozoa are very small (5-10 microns), move rapidly, and are shaped like small sickles. They may be attached to host tissue or may be found swimming free. Milky cloudiness on skin is the main symptom and weak and young fishes are usually infected. Poor water quality and other stresses (especially crowding) may allow this normally mutualistic parasite to reproduce rapidly and overwhelm the host. Non-specific nature and direct life cycle makes it a very dangerous parasite of ornamental fishes.

**Chilodonellosis:** Caused by a ciliated protozoan of the genera *Chilodonella* which can cause high morbidity and mortality among freshwater tropical fishes. infects the skin and gill tissues of fishes. Dull colouration due to excessive slime, fraying of the fins, weakness and damage to gills are the main symptoms. Easily identified microscopically by its heart-shaped structure and slow circular motion when not crawling on the surface of the fish. Heavy infections under stressful conditions leads to mortality. Non specific nature makes the transmission easier.

***Piscinoodinium* infection:** Is a protozoan parasite attacking the gills, where the parasites cause both localized and diffuse swelling of the gills and fusion of the gill lamellae. At later stages it can be found on the body surface and even eyes. The body lose its glossy shine and seems to have yellowish to golden-brown or rusty-colored patches.



**Hexamitosis:** Hexamita also known as Spironucleus is a flagellate protozoa inhabiting the intestinal tract of fishes (systemic infections can also occur) and may cause severe gastrointestinal disease in heavy infections. As an ectoparasite it is believed to be involved with "Hole in the Head Disease" (Head and Lateral Line Erosion) common to oscar and other cichlids. It may cause small holes to appear in the body, especially the head region, and often strings of mucus trails from the lesions. Lesions may also develop at the base of the fins and near the lateral line.

**Epistylis (Heteropolaria) infection:** A stalked ciliate which is commonly found in freshwater containing a high organic loads. Lesions appear pale and white in color and resemble a fungal disease. Microscopically, it appears as a ciliated crown atop a long stalk which is prone to frequent contractions. This disease is usually not fatal in itself but may open the fish up to secondary bacterial disease.

**Trichodina infection:** A disc-shaped ciliate protozoan found on the skin and gills of many freshwater fishes. Circular rows of denticles and a ciliary girdle give this parasite a unique radial symmetry. Probably not harmful when present in small numbers but on stressed, debilitated and young fishes, especially when organic load in the water is high, they proliferate rapidly and behave like true ectoparasites, start feeding on gill and skin tissues leading to necrosis, desquamation and erosion of tissues. Lack of host specificity coupled with their mobility on body surface adds to their pathogenicity.

**Microsporidiosis:** Caused by a group of intracellular parasites usually attacking the musculature of fishes. Pleistophora, a microsporidian is known to cause "Neon Tetra Disease". Growth and proliferation of the parasite destroys the entire cell and the infected muscle appears white or pale. Can cause high mortality, is usually unresponsive to treatment and diseased fish should be removed from the tank. The zebra danio and some barbs are also commonly affected by a similar disease. Some microsporidians are also known to induce hypertrophy in infected cells leading to cyst/tumour like structures known as 'xenomas' in tissues. There is no effective treatment for microsporidiosis.

**Myxosporidiosis:** Caused by myxosporidians, a group of sporozoan parasites found exclusively in fishes. Some species appear in the form of small white cysts on the fins and gills are less pathogenic while many others found infecting the internal organs can cause high mortalities. Since Tubifex worms act as intermediate hosts for many species, the practice of

feeding the aquarium fishes with live tubifex worms increases the risk of myxosporidian infections. Treatment is practically difficult.

**Tetrahymena infections:** Commonly called "Guppy Killer Disease." Caused by a pear-shaped, ciliated, free-living/ parasitic protozoan, common in crowded conditions and in water containing excessive organic debris. Severe infections can lead to mortalities. Unaffected by parasiticides because of its ability to burrow deeply into skin of host which ultimately protects parasites from chemotherapeutics.

### Metazoan parasitic diseases

**Monogenean trematode infestations:** Monogenean parasites including *Dactylogyrus* and *Gyrodactylus* are ectoparasitic and can cause considerable damage to the host when present in large numbers. These parasites possess a multiple hooked attachment organ called an opisthaptor which disrupts the integrity of the host's skin and mucus membranes. Ability of these parasites to complete their life-cycles in a single host within a short period makes them more dangerous. Crowding and other stress factors predispose tropical fish to monogenean trematode infections.

**Digenean trematode infections:** The majority of digenean fluke problems in tropical fishes appear to be primarily aesthetic in nature. Fish commonly serve as an intermediate host for these parasites which frequently have a complex life cycle. Invertebrates may be the first host and a bird or mammal the primary host. Encysted digeneans are commonly observed as metacercaria in the skin and underlying tissues and occasionally in the coelomic cavity of tropical fishes, the numbers varying from few to hundreds. This disease will not harm the fish and will not progress unless the fish is consumed by an appropriate primary host animal. Affected fish are sometimes said to have "Salt and Pepper" disease since the cysts become pigmented and the uplifted scales appear especially white or shiny. Another common digenean parasite is *Clinostomum* with a worm-like metacercaria and is called the "Grub disease". There is no treatment for this disease.

### Cestode Diseases

Though tapeworms are found inhabiting the digestive tract of wild tropical fishes they do not pose a serious threat in aquarium conditions. Tropical fish can also act as intermediate hosts of other tapeworms.

## Nematode Diseases

Nematodes are common intestinal parasites of fish and can be found abundant in wild species. In some cases the fishes can act as intermediate hosts and may harbour larval nematodes, encysted beneath the skin, musculature or coelomic cavity.

## Crustacean infestations

There are several important crustacean parasites infesting tropical fishes.

**Laernea infestation:** Known commonly as “Anchor worm,” is a common copepod parasite which infects many species of ornamentals. They get their name from the attachment organ which is a highly modified structure resembling the anchor on a ship which is buried in the host’s musculature. A raised ulcer usually develops at the point of attachment, creating an opportunity for secondary infection with pathogenic bacteria. Physical removal by plucking the parasites from the fish is possible and usually results in inflamed areas which heal quickly.

**Ergasilus infestation:** Also known as ‘gill maggot’ is small in size and attacks the gills and some times skin of fish, appears as whitish-green threads hanging out of the fish’s gills. Heavy infestations result in severe gill damage, emaciation, anemia and death usually due to secondary bacterial infection.

**Argulus infestation:** commonly known as “Fish Louse”, have a flat, distinctive shape and appearance, are found attached to the skin and fins by means of its suckers. Feed on the body fluids and are especially harmful to small fish. Reddish lesions occur at the site of attachment, and this opens the up the skin to secondary bacterial and fungal infections. Physical removal by plucking with a forceps is possible.

## 4. Non-infectious diseases:

Non-infectious diseases can be broadly categorized as environmental, nutritional, or genetic. Environmental diseases are the most important and may be caused by low dissolved oxygen, high ammonia, high nitrite or natural or man-made toxins in the aquatic environment etc. Managing proper water quality will enable us to prevent most of these. Nutritional diseases can be very difficult to diagnose. Deficiency of various essential micro nutrients including vitamins can cause a variety of nutritional diseases. The condition seems to disappear when the deficient feed is

discarded and a new feed provided. Genetic abnormalities include conformational oddities such as lack of a tail or presence of an extra tail. Most of these are of minimal significance; however, it is important to bring in unrelated fish for use as brood stock every few years to minimize inbreeding.

## **5. Prevention, treatment and control**

The cornerstone of disease prevention is the creation and maintenance of excellent water conditions. The proper physical parameters of the water for an aquarium differs on the basis of the type of fish being kept, and on the basis of the area of interest of the aquarist. Good sanitation practices will always help reduce the load of potential pathogens. This include proper system maintenance by removing excess suspended particulates, uneaten food, and dead or dying fish; reducing organics and removing wastes.

Quarantine is an extremely important concept since it helps to avoid several serious problems, mainly related to infectious diseases. The term quarantine originally indicated an isolation period of 40 days, and generally it can be defined as a six weeks period of segregation away from the final destination tank. Though quarantine procedures greatly reduce the problems associated with the acquisition of new fish, there is no guarantee that the problems will be eliminated completely because in some cases, the diseases may have an incubation period so slow, that it takes months before symptoms appear or the newly introduced fish may simply be a healthy or sub-clinical carrier of an infectious disease. The risk of parasite infestation is higher in wild-caught fish than in animals obtained directly from a reputable breeder. Though fish purchased from aquarium stores may be in good shape, but because of the promiscuity with wild-caught or otherwise sick specimens, they should be considered at high risk of carrying potential pathogens. Quarantine helps in the (i) evaluation of the health condition of the new fish (ii) reduction of disease transmission risk to pre-existing fish (iii) gradual acclimatization of the new fish and (iv) convenient administration of drugs.

Avoidance or at least minimizing the introduction of known infectious pathogens is also important. Preventative treatments ("prophylactic" treatments), such as freshwater dips for marine fish or salt water dips for freshwater fish, can be helpful in removing initial loads of external parasites. Use of external parasite treatments, such as formalin, copper etc. can also be used for susceptible parasites. A good clinical

history of the fish and information on their origin and possible diseases should be obtained in order to help the aquaculturist and the fish health specialist target their search for possible causes of infectious and non-infectious diseases.

### 5.1 Common symptoms and their causes

**Weight loss:** non-infective causes include poor appetite, poorly accepted food, lack of optimum water quality and presence of other disease problems. While the infective causes include a variety of pathogens including skin/gill/intestinal flagellates, flukes, worms, other intestinal infections etc.

**Lesions on skin/gills/eye:** include presence of dark coloration/ discoloured patches/ white dots/ thick mucus coat on the skin, sores/open wounds, raised scales etc. Can be caused by stressed conditions, superficial wounds or scratches of physical origin, followed by subsequent bacterial or fungal superinfection or may be due to various parasitic organisms.

**Abnormal breathing/respiration:** Fishes gasp for air near the water surface or abnormal gill movements. Poor water quality is the prime suspect followed by protozoans, flukes and other pathogens infecting the gills.

**Abnormal swimming behavior:** The fish swims abnormally, some times standing on its head or are found laying flat. The reasons may include stress, water quality problems, anoxia, intestinal bloating due to improper feeds, swim bladder infection and terminal stages of many other infectious diseases.

### 5.2 Some principles on use of medications

In most cases, symptoms are discovered during routine tank clean-up or fish feeding. A symptom-based approach to the treatment of diseases means the medications are chosen on the basis of the type of behavior and physical appearance of the fish, as opposite to decisions made on the basis of diagnostic tests. An effective empirical treatment of some fish diseases is often possible, but it still requires a good knowledge and understanding of the basics of fish physiology and diseases.

The medications most commonly used to treat diseases in ornamental fishes are antibacterial, antifungal and antiparasitic drugs. It is important that the aquarist understands that each category of pathogens has different

types of targets on which these medications work, and that therefore a “magic bullet” does not exist. Even within the same category of pathogens, say for example bacteria, there are major differences in the susceptibility to each antibiotic, which therefore should be chosen on the basis of a careful selection of the most active compound. The effectiveness of any compound on a given target is an intrinsic characteristic, but it may be influenced by the dose used, the frequency of administration and the duration of use. In addition, sometimes adverse effects occur as a result of toxicity occurring not only on the target organism, but also on the host. The use of single preparations that are (erroneously) believed to cover every problem is commonly called the “shotgun” approach. The downside of this idea is that in most situations the majority of the array of chemicals given to the sick fish is useless in terms of efficacy, since they are not targeted on the desired pathogens. This may “mask” the characteristics of the disease and it can cause unnecessary toxicity problems which could have been easily avoided by selecting only the proper compound. In addition, other problems such as avoidable selection of resistant pathogens may occur as well. More over, bacterial infections are very often secondary to injuries or parasite infestations, and once the primary cause is taken care of, they may resolve with just clean and healthy water conditions. So it is always better to diagnose the disease first and then go for medications with caution and following specific criteria.

Once a problem is noticed and before proceeding with any medication, as first step always see that non-infective causes. A careful evaluation of the water parameters, followed by water changes and other chemical and physical manipulations is in most cases followed by complete recovery of the fish, unless major infectious problems are involved.

### **5.3 Chemotherapy options**

It is always better to obtain help from qualified professionals regarding the diagnosis of the disease problem, choice of drugs and treatment schedule. However, for the information of the reader a brief description of the commonly employed drugs against the various diseases is given below.

#### **Antibiotics**

Antibiotics are very useful tools against bacteria and their ability depends on a number of factors including sensitivity, dosage, treatment schedule etc. Antibiotics themselves, do not cure a fish, instead they

merely control the population growth of bacteria in a fish long enough for its immune system to eliminate them. Before antibiotics are even considered, sources of stress and other non-infectious components must be removed or reduced. Similarly, possibility of parasitic infections should also be ruled out because, any of these factors may be the primary cause of disease, as bacterial infections are often secondary responses to such management problems. Usually antibiotics are administered in the form of injection, mixed with food and as bath treatments. Presently, usage of antibiotics is not advised in food fishes due to antibiotic resistance issues while their usage is generally accepted in the case of aquarium fishes. The most commonly used antibiotics against bacterial infections in fish are given below.

Broad spectrum antibiotics, effective against a wide variety of bacteria: Oxytetracycline and related antibiotics; quinolones, including nalidixic acid and oxolinic acid and sulfa drugs, including Romet. Antibiotics effective against gram-positive bacteria like *Streptococcus* species include erythromycin and penicillins, including penicillin, amoxicillin, and ampicillin. Those effective against gram-negative bacteria include aminoglycosides, including gentamicin, neomycin, kanamycin, and amikacin and nitrofurans, including nitrofurantoin, nitrofurazone, furanace, and furazolidone. Nitrofurans are considered to be the most effective against superficial bacterial infections. Misuse of any antibiotics can lead to the creation of resistant bacteria in a facility. The most extreme cases of misuse and 'shot-gunning' can result in 'superinfections' in fish, caused by bacteria that are resistant to most of the commonly used antibiotics.

### **Antiparasitic chemicals**

A variety of compounds have been employed for the treatment of Parasitic diseases. Some of them may be highly effective when used properly, while others may not be too efficacious. Several skin and gill protozoans (e.g. *Ich*, *Piscinoodinium*, *Costia*) do not tolerate high temperatures. The critical temperature to eliminate them varies according to the pathogen, but a temperature of 33-34°C maintained for a week, should eliminate all of them. But it should be remembered that many fishes may not tolerate such high temperatures. Kitchen or aquarium salt is one of the most commonly used remedies (approximately 0.2g/l water in the aquaria for about 7 days) to treat external problems (parasitic as well as other origins) in fresh water aquaria but may cause some damage to live plants. A mild water disinfectant such as methylene blue may be used for

the control of skin lesions of non-parasitic origin. Other drugs used for the treatment of protozoan infections include metronidazole, formalin, malachite green, copper compounds, quinine hydrochloride or quinine sulphate, acridine orange, acriflavine, benzalkonium chloride etc. Compounds suggested for the treatment of monogenean flukes include common salt (30-35 ppm), Glacial acetic acid, hydrogen peroxide, formalin, praziquantel, flubendazole etc. Infections caused by parasitic crustaceans on skin and gills can be controlled by using formalin, potassium permanganate, copper compounds, benzalkonium chloride, organophosphates, glacial acetic acid (diluted) dips etc. in appropriate dosages.

## **6 Conclusions**

As in any other rearing system, diseases continue to be a major problem in ornamental fish keeping. Due to the immense export potential, more and more entrepreneurs are venturing into this field of aquaculture and with the intensive nature of culture practices and frequent trans-boundary introductions of many exotic species, new diseases and pathogens are bound to affect this industry. Since chemotherapy/treatment options will definitely reduce the economic viability of the ventures, it is always better and safe to adopt a proactive approach through better health management approaches for the prevention/control of diseases.

## **References**

- Roberts R. J. 2001. *Fish Pathology*. Bailliere Tindall, London
- Woo, P. T. K. 1995. *Fish Diseases and Disorders*. CAB International, Oxford
- Spotte, S. and McKittrick, F.W. 1973. *Marine Aquarium Keeping: The Science, Animals, and Art*. John Wiley & Sons, New York