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DISEASES AND THEIR CONTROL IN AQUACULTURE SYSTEM

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The importance of aquaculture to the population of India is well known. There is considerable scope for improving the fish protein resources by resorting to intensive and scientific methods of aquaculture. Aquaculture helps to augment production and provides gainful employment to people. In this system, fish is stocked in culture farms at a high density and given artificial feeds. Unnaturally high population favours the spread of diseases. Disease is one of the most serious problems in aquaculture. The frequency and severity of disease outbreaks have increased with the intensification of aquaculture.

Aquatic environment

There are several parameters in aquatic environment which determine the maintenance of homeostasis of the organism. Alteration of these parameters beyond certain limits adversely affects the health of the organism predisposing them to the attack of micro-organisms. These parameters are temperature, light, chemical composition, biological content of the water, availability of space and food and frequency of fright stimuli such as moving shadows.

Temperature

Fish has upper and lower thermal tolerance limits and optimum temperature in which it can carry out its physiological activity without stress. Dissolved gases such as oxygen decreases as the temperature rises. Solubility of toxic compounds like crude oil and pesticides increase with temperature. As temperature increases the metabolic demand for oxygen increases. Fish can adjust to the temperature changes within the tolerance range if they occur gradually. In aquaculture farms, rapid fluctuation in water temperature is prevented by maintaining the depth of ponds above one metre.

Light

Light is essential for algal production and supply of food for fish. Excess lighting may cause algal blooming and oxygen

depletion during night. Light intensity can be controlled by increasing the water depth and controlling the unicellular algae and macrophytes and by providing shade. Poor light penetration through water caused by absorbent or reflecting pollutants such as clay, coal washings and industrial wastes diminishes algal productivity. Ultra-violet radiation from excessive sunlight may cause sun burn disease affecting dorsal surface, head and fin of fish. In certain nutritional conditions, even low levels of UV radiation cause photosensitization.

Dissolved gases

Among the gases, oxygen and nitrogen are the important ones. The gases dissolve in water according to their solubility which depends on the total and partial air pressure. Increase in dissolved salt content and temperature decreases the solubility of gases.

When water is pumped, water and air are drawn into the pump and compressed by it. This results in supersaturation of water with gases. The fish living in the supersaturated water suddenly release the gases from the body fluid resulting in gas embolism . This disease called gas bubble disease occurs at the water intake point in the hydroelectric projects.

Physicochemical parameters

Water plays as a weak base. In water containing ammonium salts, increasing alkalinity causes greater amounts of undissociated ammonia which is more toxic than dissociated ammonia.

Carbonate alkalinity and hardness

The buffering capacity of fresh water is defined by the carbonate alkalinity and is expressed as mg/litre of equivalent calcium carbonate. Hardness is a measure of the content of carbonate and bicarbonate of calcium, magnesium and other metals in fresh water and is expressed as mg/litre of calcium carbonate.

0-60 mg/litre	Soft water
60-120 mg/litre	Moderately hard water
120 mg/litre and above	Hard water

Fresh water containing calcium carbonate is generally alkaline. Seawater has a high carbonate alkalinity. Acidity

in fresh water is caused by carbonic acid and organic acids derived from soils, forests, swamps and logs. The quality of aquatic environment depends on natural acidity, carbonate alkalinity and pH. Though fish can live in a pH range of 5.0-9.5, their optimum performance is within a narrow range of pH probably between 6.8 to 7.8.

Carbondioxide

Carbondioxide, carbonate or bicarbonate in water forms the reservoir carbon for photosynthesis by aquatic plants. This provides the basis for fish food production. During day time carbondioxide is removed by aquatic plants and hence the pH rises but during night, plans and respiration releases carbondioxide and there will be fall in pH. Carbondioxide level in natural water is below 6 mg/litre. Increasing amounts of carbondioxide depress fish respiration. Fish generally avoid carbondioxide levels as low as 1.6 mg/litre. Intensive culture generates high amount of carbondioxide due to fish metabolism and microbial decomposition.

Ammonia

The undissociated ammonia occurs in alkaline pH and is highly toxic. High protein diets fed to fish in intensive culture system result in high level of ammonia.

Hydrogen sulphide

Hydrogen sulphide is an extremely toxic gas and the maximum accepted level in water is 0.002 mg/litre.

Contamination and pollution

Water becomes contaminated through domestic agricultural and industrial effluents. These include insecticides, fertilizers and harmful chemicals. Serious pollution often results from human activity. The only way to protect fish is to prevent them from entering aquaculture system.

Biotic environment

Several organisms coexist with fish and prawn as components of the same environmental complex. They may become harmful to the cultured species. These harmful effects are either direct or indirect. Activities of some organisms alter

the environmental parameters in such a way as to render it less capable of sustaining the cultured species. The presence of intermediate hosts living in aquatic systems helps to complete the life-cycle of certain pests which are harmful to fish and their larvae. When stocking density is high and fish of various age groups are mixed they develop cannibalism.

Algae

Algal colonies can form surface scum or hair-like matted filaments suspended in water. Some algae get embedded in the surface tissues of fish. They may clog the gills and cause asphyxia.

Several genera of blue green algae produce dangerous blooms which will result either in algal toxicosis or disturbance in oxygen balance. These blooms result in excess fertilization of pond. Photosynthetic process produces excess oxygen during day time and water is supersaturated with oxygen leading to gas bubble disease. During night, algal respiration leads to oxygen deficiency and predawn death of fish.

Overcrowding of algae leads to lack of nutrients and mass death of algae. Dead and decomposing algal cells release toxic products. The fish die due to toxicosis. An example of algae which causes toxicosis is *Microcystis aeruginosa*. Other algae which cause matting are *Spirogyra, Hydrodictyon* etc. Copper sulphate is the best algicide and a solution of 0.7 ppm is sprayed over the pond to control the bloom. Filamentous algae can be controlled by lime treatment.

Insects

Larvae of many flying insects are aquatic during their pre-adult stage. They may affect the fish.

Crustaceans

Planktonic crustaceans may act as pest on fish.

Viral diseases

A large number of viral infections are being recognised in cultured fish and prawns. It is not possible to describe each one of them. A few of them are mentioned below.

Fish viruses		***Affected group***
DNA viruses:		
Herpes viruses		
Channel catfish virus	-	Catfish
Herpes virus cyprini	-	Carp group
Herpes virus salmoni		Rainbow trout
Pike Herpes virus	-	Pike
Iridio viruses		
Lymphocystis virus	-	142 species
Gold fish iridiovirus	-	Gold fish
Carp gill necrosis iridiovirus	-	Carps
Cichlid virus	-	Cichlid
Erythrocytic necrosis virus	-	Marine fish
RNA viruses		
Rhabdoviruses		
Rhabdovirus anguilla	-	Eels
Perch Rhabdo virus	-	Perch
Striped snake head Rhabdo virus	-	Snakehead & Catfish
Pike fry Rhabdovirus	-	Northern pike
Spring viraemia of carp virus	-	Carps
Infectious Haematopoietic Necrosis virus	-	Salmon
Viral Haemorrhagic septicaemia	-	Trouts
Birna viruses		
Infectious pancreatic Necrosis virus		Trouts
Yellow tail Ascites virus		
Reo virus		
Several reo viruses have been isolated recently.		

Important shrimp viruses

(1) Systematic Ectodermal Baculo virus - White spot disease

(2) Mondon Baculo virus - Affecting hepato pancreas

(3) Yellow head virus

(4) Infectious Hypodermal and Haematopoetic Necrosis virus (IHNV)

(5) Hepato pancreatic parvo like virus (HPV)

Prophylaxis and control of viral infections

Preventive and control measures against virus are difficult. In the case of fish viruses, vaccination and genetic selection offers some hope. However, no successful vaccine has so far been developed. When epizootics occur, destruction of the entire stock and disinfection of the premises and utensils are the only methods possible.

Disinfection methods

Physical methods :

(1) Temperature : Heat at 56°C for 1-2 hours.

(2) Radiation : UV radiation and direct sunlight.

Chemical methods

Halogen preparations such as hypochlorite, tincture iodine and 1% providone iodine are powerful disinfectants. Formaldehyde and detergents are also used. Ozone, hydrogen peroxide and idophore are also useful.

Disease due to bacteria

Several bacteria cause disease in aquatic organisms. Among them, gram negative bacteria are more common in causing septicaemic disease.

Septicaemic bacterial diseases

Vibrios, Aeromonas salmonicida, A.hydrophyla, Pseudomonas and *Edwardsiella* are the bacteria causing septicaemic infections. A number of other bacteria such as Flexibacteria, Myxobacteria and Renibacteria are also important fish pathogens. Several species of vibrio are pathogenic to shrimps. Chitinoclastic bacteria cause shell diseases in prawns.

Control of bacterial infection

Disinfectants are effective against local infections. Antibiotics and nitrofurans are given when infection cannot be controlled by usual procedures.

Mycotic infection

Fungal infections are easily recognised by the mould-like growth. *Saprolegina, Ichthyophonous, Aspergillus* and *Achlya* are the major fungal pathogens of fish. *Legenidium* and *Fusarium* are the major shrimp fungi.

Prevention and treatment

Malachite green (0.15 ppm), common salt and potassium permanganate (100 ppm) are the best antifungal agents.

Protozoan infection

Several species of ciliates, flagellates and sporozoans cause disease in fish eg: *Ichthyophthirius multifiliis, Trichodina, Costia nacatrix, Myxobolus* etc.

The best preventive measure is disinfection of pond before stocking. For disinfection, formalin, sodium chloride, potassium permanganate, calcium chloride, copper sulphate etc. are used.