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IMPACT OF WATER QUALITY AND INFECTION ON BODY SKIN AND DECOLOURATION OF *CHANNA PUNCTATUS* AND *TRICHOGASTER SOTA* IN A POND OF DIBRUGARH, ASSAM

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ABSTRACT
The present study deals with the impact of water parameter and infection in skin, colouration of two indigenous ornamental fish *Trichogaster sota* and *Channa punctatus* of a private pond in Dibrugarh town. Altogether 76 species of both the species were collected for this experiment and compared with the same fresh specimen collected from other fresh water body. Their body colouration was recorded and examined the presence of any infection in the skin body. The water quality of the pond showed that the highest water temperature was recorded in July (33^0C) and lowest was recorded in December (8^0C), pH was ranged from 5.2 (October) to 6.7 (February), water transparency was found to be highest (8.8 cm) during December and that of minimum (7.1 cm) during June, DO was found between 2.1 (July) and 5.0 mg/l (November), free CO_2 varied from 2.12 (July) to 19.6 mg/l (November) and bicarbonate alkalinity ranged from 8.0 (November) to 35.5 mg/l (July). The findings are below the normal values and it indicating that the experimented pond was being polluted. Most of the collected species was being pink and red lesions in the body skin and body colouration becomes pale in both the species. Deep ulceration was observed at the base of pectoral fins as well as caudal fins and sometime eroded. The body skin removing the slimy coat and body skin ulcer changes the normal body colour of both the species. Perhaps, this is all due to the presence of low pH, low DO content and high transparency and high FCO_2 content in the experimented pond.

KEY WORDS: Ornamental fishes, *Trichogaster sota, Channa punctatus,* Ponds, Dibrugarh

INTRODUCTION

India is endowed with rich and varied aquatic resources amenable for fisheries and aquaculture. Assam is most resourceful among the North Eastern state of India. The state is fortunate to posses vast and varied aquatic resources from the part of global hot-spot of fresh water fish diversity. The major fresh water fishery resources of Assam are the rivers (Brahmaputra and Barak), flood plain wet lands (locally known as beels), reservoirs, ponds and mini barrages. These water bodies harbour more than 200 species of fishes with a high degree of endemism. Like humans and other animals, fish suffer from certain diseases and parasites. Fish defenses against disease are specific and non-specific. Non-specific defenses include skin and scales, as well as the mucus layer secreted by the epidermis that traps microorganisms and inhibits their growth. If pathogens breach these defenses, fish can develop inflammatory responses that increase the flow of blood to infected areas and deliver white blood cells that attempt to destroy the pathogens.

Fishes are parasitized by various organisms like viruses, protozoans, helminthes, annelids, nematodes, mollusks, crusteceans, acantocephala, isopoda, cyclostomes etc. Parasite affects fish population in variety of ways including stunting, emacilation, sterility, mortality etc. High fish mortality occurs in river, ponds, lakes etc. due to heavy parasitic infection thereby decreasing the aquaresource production. The parasite community of fish shows considerable variation with the environmental conditions in which fish live. Various physicochemical factors such as water and atmospheric temperature, pH, hardness of water, dissolved oxygen, biological oxygen demand (BOD) have strong influence on fish health and their resistance to the attack by the causative agents (Plumb *et al*., 1988; Shresta, 1990).

Ornamental fishes usually mean attractive colourful fishes of various characteristics, which are kept as pets in confined space of an aquarium or a garden pool for fun and fancy. Ornamental fishes are usually kept in glass aquarium and hence popularly known as 'Aquarium Fishes'. These living jewels need not always have bright colour, as sometimes their peculiar characteristics such as body colour, morphology, mode of taking food etc. may also add to their attractiveness. However, symptoms of discolouration and infections on the body skin differ from each other depending upon the physico-chemical parameters of water at a particular season. The physico-chemical means are useful in detecting effects of pollution on the water quality but changes in the trophic conditions of water are reflected in the biotic community-structure including species pattern, distribution and diversity (Kaushik and Saksena, 1995). Some ponds of India have been extensively studied by various workers (Michael, 1969; Saha et al., 1971; Vashisht

and Sharma, 1975; Hossain et al., 2008; Mishra, 2008; Parikh and Mankodi, 2012). A little change in the pH of water even completely changes the mimic of these ornamental fishes. Indeed, proper water quality plays an important role for maintaining the natural colour of the ornamental fishes. Therefore, an attempt has been made on the effect of water quality and their infection on body skin, colouration of *Channa punctatus* and *Trichogaster sota* in a private pond of Dibrugarh.

MATERIALS AND METHODS

The present investigation was carried out in a pond situated in urban area of Dibrugarh town. The pond is rounded in shaped and well connected with the number of small domestic drainages. It is having an area of 1.02 ha. and average depth is 6.5 feet. The experiment was conducted in three season viz. monsoon (June-August) post-monsoon (September-November) and winter (December-February) during 2007-2008. In order to observe seasonal changes in occurrence of the parasites, infected fishes were collected on monthly basis. Hand picking, nets, hooks etc. were used for fish collection from the local pond. Fish species were collected from the pond only during morning and evening hours. Water parameters like transparency, pH, DO, and Free CO_2 has been analyzed on the monthly basis as per procedure of Trivedy & Goel (1986) and APHA (1998). The result of physico-chemical parameters of ponds were compared with the prescribed water quality standard given by Boyd (1998).

The same fresh species from other freshwater bodies were used to comparing with the species of experimental pond for their infection, body colour and contrast. After having removed the fish from the water bodies, the colour of the body was noted (decolouration, darkening, blackening etc.), as well as the presence of any cloudiness of the skin (gray or white), reddening, ragged or torn fins, raised scales, white spots visible to the naked eye. The skin was always examined with a magnifying glass. Attention was paid to the skin, in order to detect the presence of areas of trauma, ulcers, abscesses and loss of colour.

RESULT AND DISCUSSION

Altogether 76 species of *Channa punctatus* and *Trichogaster sota* were collected from the experimented pond. Their body colour was recorded and observed for the presence of any infection in skin. The observations were made in both the species, were pink and red lesions over the body skin and colour of the body became pale colour. Out of 43 species of *C. punctatus* examined, 41 species (95.35%) were infested and decolouration during the study periods. In *C. punctatus*, deep ulceration and discolouration were noticed in the cephalic region only, the caudal fins was also affected and sometime eroded. Again in *T. sota*, out of 33 species examined 30 species (90.91%) were infested and decolouration in different part of the body (Table 1). In *T. sota,* deep ulceration was also observed at the base of pectoral fins but not at the pelvic fins. Probably, both the species were infested by parasites. The skin of both the species is light coloured, covered with plenty or excess of mucus. In some cases there are small haemorrhages, mainly at the bases of the pectoral fins and in the front chamber of the eye and in the skin of the gill covers. The gills are also heavily congested and filled with plenty of mucus. Gills are a common site of damage in both the species and may be the only affected area. As the disease progresses, the skin is often involved with numerous gray white ulcers. Ultimately, the damage to the skin or gills may be enough to kill the fish.

TABLE 1: Number of examined fish and % of infested & decolouration in the pond

Name of Species	Number of fish examined	Number of fish Infested & decolouration	% of infested & decolouration
Channa punctatus	43	41	95.35
Trichogaster sota	33	30	90.91

The monthly variation of the water quality of the experimented pond has been given in Table 2. It was observed that the water temperature ranged from 8^{o}C to 33^{o}C during December and July respectively. Due to the highly turbid, light penetration was always less and therefore the temperature of the water will be lower during winter seasons. Temperature will affect all chemical and biological processes and therefore has a direct effect on important factors such as growth, oxygen demand, food requirements and food conversion efficiency (Boyd, 1998). Usually above 20°C, they lose much of their activity and eat much less food. Water temperature also has a great influence on the rise and course of a number of fish diseases. The immunity system of the majority of fishes shows optimum function at water temperatures about 15°C.

pH was found between 5.2 (October) and -6.7 (February). Firstly pH levels of the pond water will change depending on the aquatic life within the pond. Carbon dioxide produced by aquatic organisms when they respire has an acidic reaction in the water. The pH decreases at night because of respiration and production of CO_2 by all organisms. The fluctuation of pH levels will depend on algae levels within the pond. The pH remained acidity throughout the study period and it was below the acceptable range (Boyd, 1998). This nature of pH may be the result of various biological activities (Gupta *et al*., 1996) and due to decrease in photosynthesis during winter while during monsoon it may be due to greater inflow of water (Agrawal & Rajawar, 2010).

The transparency was recorded between 7.1 and 8.8 cm during June and December respectively. The depths of transparency between 20 cm and 60cm are recommended for optimal management of freshwater ponds (Boyd, 1998). But the finding is just below the acceptable range. A combination of less sunlight and lower temperatures will

result in a decreased amount of vegetation present within the ponds which depend on sunlight and warmth to grow.

The concentration of DO content was varied from 2.1 mg/l (July) to 5.0 mg/l (November). Dissolved oxygen is probably the most critical water quality variable in freshwater aquaculture ponds. Declining oxygen levels can be caused by a number of factors. This includes large blooms of phytoplankton and zooplankton, high stocking rates, excessive turbidity that will limit the amount of photosynthesis occurring and high water temperatures. Levels of dissolved oxygen will also decrease after a series of warm, cloudy, windless days. Low dissolved oxygen can be lethal to our aquaculture species. Some effects include stress, increased susceptibility to disease, poor feed conversion efficiency, poor growth and even death. Further depletion of DO to the level of anaerobia is the most critical manifestation of pollution (Lester, 1975). Dissolved oxygen concentrations were above 5 mg/L, which was adequate enough to support aquatic life. In the present investigation it has been found that the DO value is below the acceptable range (Boyd, 1998) in most of the months. Similar observations for DO minima during winter months have been reported (Sehgal, 1980 & Parikh and Mankodi, 2012).

The highest free CO_2 was recorded in November (19.6 mg/l) and that of lowest in July (2.12 mg/l). The increase of CO_2 level in the pond may be due to activities of submerged plants, macrophytes, hydro planktons etc. during the winter season. Moreover, it may be discharge of many waste materials from nearby drainage. The value of FCO2 was found above the acceptable range throughout the study period except the June and July.

The alkalinity was found to be lowest (8.0 mg/l) in November and that of highest (35.5 mg/l) in the July. The pond shows the alkalinity values were almost below the acceptable range (Boyd, 1998). There is an indication that alkalinity concentration is affected directly by rainfall (Venkateswarlu, 1969). Its high concentration may be attributed to sewage pollution in the pond (Negi & Kumar, 2001).

TABLE 2: Monthly variation of physico-chemical parameters of the Ponds

Months	Water temp.(^{0}C)	pH	Transparency (cm)	DO (mg/l)	FCO_2 (mg/l)	Alkalinity (mg/l)
Jun'09	30	6.6	7.1	2.3	3.14	20.1
Jul'09	33	6.3	7.4	2.1	2.12	35.5
Aug'09	32	6.5	7.3	3.3	14.5	18.3
Sep'09	25	5.3	8.5	3.9	14.2	22.2
Oct'09	9.5	5.2	8.0	2.6	18.1	20.2
Nov'09	9	5.5	8.5	5.0	19.6	8.0
Dec'09	8	6.1	8.8	4.5	12.7	11.0
Jan'10	10	6.2	8.2	4.2	18.6	30.5
Feb'10	17	6.7	7.9	4.0	16.3	27.8
Acceptable range of pond (Boyd-1998)		7-9	20-60	5-15	1-10	50-300

Multiple correlations of the parameters of the ponds are shown in Table 3. Correlation between water temperature and DO showed positively correlated (0.436), Alkalinity (0.413) and negatively correlated with other parameters like transparency (-0.778), DO (-0.660), FCO_2 (-0.731). PH showed inverse relationship with transparency (-0.591), DO (0.209), FCO2 (-0.731) and direct relationship with alkalinity (0.353). Transparency showed highly correlated with DO (0.802), FCO_2 (0.616) and negatively correlated with alkalinity (-0.440). Again DO was highly correlated with FCO2 (0.717) and negative correlated with alkalinity (-0.514). FCO2 showed negative correlated with alkalinity (-0.361).

TABLE 3: Pearson Correlation of water quality variables of the ponds

Parameters	Water temp. (^{0}C)	pH	Trans. (cm)	DO (mg/l)	FCO2 (mg/l)	Alkalinity (mg/l)
pH	0.436					
Trans. (cm)	-0.778	-0.591				
DO (mg/l)	-0.660	-0.209	0.802			
FCO2 (mg/l)	-0.731	-0.455	0.616	0.717		
Alkalinity (mg/l)	0.413	0.353	-0.440	-0.514	-0.361	1.0

Like other organisms fish are also susceptible to various diseases. Almost all fishes are potential host to a variety of ecto and endo parasites. Though fishes have very high resistance to diseases, yet they become susceptible under adverse influence due to the variation in water quality. Generally, ornamental fishes immediately changed colour even if there is a slight change in water parameters. The fingerlings are more susceptible to diseases and as a result they die rapidly. Rahman *et al.* (1975), Murty *et al.* (1978) and Hossain *et al*. (2008) also observed similar results in the treated ponds. From the present study, water temperature was highly fluctuated throughout the study period. The

values of pH, transparency, DO and alkalinity was found below the normal range while FCO_2 was above the normal range all the time. In very low or very high temperatures, the fishes are strained, spend more energy and growth of the fish is affected. In case of low water temperature and transparency, fish reduces metabolic activity that in term makes the fish more susceptible during the winter period towards parasitic infection and cause the body skin ulcers which ultimately change the normal body colour of the two fishes. At the same time, at acidity level of pH, gills, lens and cornea of fish eyes might be destroyed and leading to stop feeding and fish die. Fish cannot take DO if carbon dioxide remains high in water. As a result fish might suffer from suffocation and die. The high concentration of Free CO_2 and low DO concentration seems to cause the irritation on the body skin removing the slimy coat. Low Alkalinity reduces the buffer capacity of water and badly affects the pond ecosystem that in turn cause stress to the fish and become more susceptible. So there was a relationship of fish disease, decolouration with the changes of water quality parameters.

The results reveal that *Channa punctatus* were infested more than *T. sota*. Therefore, measure should be taken to control the water level fluctuation, aquatic vegetation, organic debris and water pollution so that the ornamental fishes can grow in their natural habitat. Checking of water quality, prevention of algal bloom and control of DO depletion should be maintained as well. The present study will provide further studies in different aspects of the water quality parameters as well as parasites of freshwater fish, which will be helpful for the development of fish culture and ultimately will contribute to the production of fishes.

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