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Effects of Monogenean Fish Parasites on Indian Major Carp, *Labeo rohita* (Ham.) with reference to Abundance and Pathophysiology

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ABSTRACT

The study was conducted to evaluate the abundance and pathology of monogenean fish parasites in Indian Major Carp, Labeo rohita fingerlings (Average length 10.75±0.8 cm and weight 17.25±0.5 g) with special reference to the prevailing low water temperature in Ri-Bhoi district of Meghalaya. The stream water was converted to the aquaculture ponds with three different stocking densities i.e. Pond A, Pond B and Pond C maintaining the other water quality parameters constant. Among the three ponds, Pond C showed the highest abundance (1.84±0.75) of monogenean parasite where as there was no significant differences (P>0.05) in the Pond A and Pond B. The Mean Intensity (MI) was also estimated (3.96±0.70) during the study period which showed the significant difference (P<0.05) compared to Pond A and Pond B. The pathological indices i.e. plasma glucose and plasma protein were also estimated in the present study. The PCV, plasma glucose and plasma protein showed significant reduction (P<0.05) in Pond C where as there was no differences between the Pond A and Pond B. The water quality parameters were also evaluated periodically in the present study. There was no significant influence of physicochemical parameters of water on the abundance of monogenean parasite.

KEYWORDS : Monogeneans, Abundance, Mean Intesity (MI), Pathophysiology, Labeo rohita.

Introduction

Aquaculture is the fastest growing food production sector in the world as well as in India. The three Indian major carps, namely catla (*Catla catla*), rohu (*Labeo rohita*) and mrigal (*Cirrhinus mrigala*) contribute the bulk of production with over 1.8 million tonnes (FAO, 2009). *Labeo rohita* are predominantly consumed and cultured in Eastern and North Eastern states of India. The northeast region of India, comprised of the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura is blessed with bounty of fisheries resources. Meghalaya is one of the smallest hilly and landlocked states of the North-Eastern India, covering an area of 22489 sq. km. The State lies within 25″1′ and 26″5′ North latitudes and 85″49′ and 92″52′ East Longitudes. The temperature range is approximately 2^0 C-36^0 C degree centigrade depending upon the altitude ranging between 300 m above mean sea level (MSL) to 2000 m above MSL. Meghalaya is amongst the highest rainfall areas in the world with an annual average rainfall of 11,000 mm during the period of 1980-91, predominantly mountainous, lying between the Brahmaputra valley in the North and the Surma valley (Bangladesh) in the South (GOM, 2011). The economy of Meghalaya is basically agrarian as it is rural based with Agriculture laying a predominant role in the state's economy. Since, 81% of the state's population depends on Agriculture, employment and income generation also depends on agricultural developmental activities to a great extent. As fish is one of the vital food items of the population of Meghalaya there exists a big gap between supply and demand of fish. The inadequate production and lower benefit is found to be due to the lower water temperature and poor management that leads to different diseases problems. However, from Meghalaya, there are very few reports on the fish disease related issues. Vinod et al. (2000) recorded the *Aeromonas* disease in *Cyprinus carpio* of Umiam reservoir of Meghalaya. In this region fishes, both from culture ponds as well as from wild have been observed to carry parasites in different parts of their body. These parasites do not show severe clinical signs until heavy infestation occurs. In the context of parasites, helminths and protozoans are the main fish parasites present in all types of inland waters (Gupta, 2008). However, among the helminthes, monogeneans have greater deleterious impact on the freshwater aquaculture systems of this region. Monogeneans are flatworms (Platyhelminthes), ectoparasitic, hermaphrodite and attached by special posteriorly positioned attachment organs to their host's skin or gills. Most monogeneans found in freshwater fishes belong to Dactylogyroidea and Gyrodactylidae. Monogenean species exhibit a high degree of host specificity, and follow their respective specific fish hosts throughout their distribution range (Paperna, 1979). Since parasitic diseases are a common occurrence in this region and it affects the growth and physiology of fish, a better understanding of the parasitic diseases of cultured fishes from this region will certainly help to mitigate the disease related problems and will enable a fish farmer with advanced management strategies to be adopted for sustainable aquaculture. Among the IMCs, *Labeo rohita* (Hamilton) commonly known as rohu is most preferred fish for their test, look, and their fast growth performance in various freshwater aquaculture systems in India. But, in this part of the country growth performance of *L. rohita* is not at all satisfactory. Keeping all this in view, the present study was conducted to estimate the abundance, prevalence, mean intensity and pathology of monogenean parasite in Ri-Bhoi district of Meghalaya.

Methodology

The stocking ponds were stocked with *Labeo rohita* fingerlings at the stocking density of 8000 ha^{-1} (Pond A), 10000 ha^{-1} (Pond B) and 12000 ha^{-1}(Pond C). A total of 180 fish samples were examined during entire study period (60 fishes from each pond). Weight, total length, standard length & body width of each fish were recorded before examining the fishes for parasites. The corresponding parasitic studies were also done for each individual fish. In the laboratory, the operculum was removed to expose the gill. Each gill arch was separated in an order and was placed separately in petridish containing filtered pond water/ tap water. The number of monogenean parasites on each section was counted (Hla Bu and Leong, 1995). The monogeneans were fixed with 2-5% neutral buffered formalin (NBF) and preserved in 70% alcohol. Staining of the specimens was done using borax carmine (Lucky, 1977). Prevalence, mean intensity or mean density and abundance of monogenean were calculated following the formulae proposed by Margolis et al. (1982). The prevalence of the ectoparasites was estimated as the percentage of infected fishes out of total number of fishes examined.

$$\text{Prevelence (\%)} = \frac{\text{Total number of infected fishes}}{\text{Total number of fish hosts examined}} \times 100$$

The abundance was estimated as the ratio between the total number of parasites in a sample and the total of fish examined.

$$\text{Abundance} = \frac{\text{Total number of parasites recovered}}{\text{Total number of fish hosts examined}}$$

The mean density or mean intensity (MI) was determined as the ratio between the total number of parasites in a sample and the number of infected fish in a sample.

$$\text{Mean intensity (MI)} = \frac{\text{Total number of parasites recovered}}{\text{Total number of infected fish}}$$

The pathological studies of blood were carried out after three months of stocking. The blood taken by caudal vein punctures using heparinised syringes following anesthetized by CIFECLARM. Blood plasma was obtained by centrifuging 5 ml of whole blood for 3 min and then the supernatant plasma was collected and stored in plastic tubes at -20^{0}C for analysis. For the determination of glucose in serum, glucose diagnostic kit was used which is based on Trinder (1969) GOD/POD method.

$$\text{Glucose Concentration (mg/dl)} = \frac{\text{Absorbance of Test X 100}}{\text{Absorbance of Standard}}$$

Total plasma protein was measured using a diagnostic kit (Crest Biosystems, India) based on Biuret method (Raghuramulu et al., 2003).

$$\text{Total Protein (g/dl)} = \frac{\text{Absorbance of Test x 8}}{\text{Absorbance of Standard}}$$

Water quality parameters

The range of water quality parameters viz. temperature (19.80 - 23.70°C), pH (6.80 -7.2), alkalinity (102.66 - 105.66 ppm), dissolved oxygen (6.97 –7.35 mg/L), free carbon dioxide (negligible), total hardness (218–235 mg/L), ammonia (0.01–0.05 ppm), nitrite (0.001 0.004 mg/L) and nitrate (0.02–0.05 mg/L) were found throughout the experimental periods. The water temperature was recorded twice daily at 0600 and 1430 h, the other parameters were analysed in every 15-day interval. All the water quality parameters during the entire experiment period were found to be in the optimum range of fish rearing (Saha, 2010).

Statistical Analysis

All the data collected were subjected to analysis of variance (ANOVA) using SPSS-15.0 for windows software (SPSS Inc., Chicago, IL, USA). Results are presented as mean±SE. Comparisons of mean values were determined by one way ANOVA. Probability levels of 0.05 were used to find out the significance in all cases.

Results

The prevalence percentage of the monogenean was significantly higher ($P<0.05$) in Pond C (96.67±3.33) compared to Pond A and Pond B. There was no significant difference between the Pond A and Pond B (Table 1, Fig. 1). The abundance also showed the same pattern with the prevalence in case of pond C. Monogenean abundance was significantly higher in Pond C (3.38±0.75) (Table 1, Fig. 2). Mean Intensity (MI) showed significantly higher ($P<0.05$) value in Pond C compared to Pond A and Pond B. MI of the Pond C was 3.96±0.71 (Table 1, Fig. 3). The blood parameters showed the significant reduction in case of Pond C compared to Pond A and Pond B. Lowest serum protein was found to be in the Pond C as 5.63±0.14 whereas serum glucose was significantly higher in Pond C as 97.00±1.34 (Table 2, Fig. 4).

Discussion

The monogeans were found in all the ponds where as Pond C showed the higher number compared to Pond A and Pond B. The recorded monogeneans could have originated from infected brooders, or the hatchery itself. Poor hatchery conditions provide excellent breeding environments for ectoparasites as intra population transmission rates becomes high in such facilities (Kearn, 2004). In addition, spawn and fry have underdeveloped immune systems, which renders the natural repellent ability of the skin and gill surface non-functional and results in increased susceptibility to ectoparasites which in many cases serve as mechanical vectors to other systemic and ulcer diseases by virus and bacteria (Barker and Cone, 2000). When such fry are used in stocking either a newly established or already existing pond, the parasites may be transmitted into ponds to cause an outbreak. Infected brood stocks might also transfer ectoparasites from farm to farm when their fry or fingerlings are used to stock un-infected ponds (Murray and Peeler, 2005). Fish samples from the infected ponds showed no visible signs of skin lesions or tissue damage in the study. Heavy burden of monogeneans in pond 'C' throughout the study period verify the findings of Obiekezie (1991) that under cultured condition these pathogens build up heavy burdens. In the present study the prevalence percentage of monogenean in Pond C was 96.67%.

Stocking density of fish in ponds is important in relation to parasite abundance (Snieszko, 1974). High stocking density in ponds affects the water quality which results from deficient oxygen levels, increased ammonia levels and lack of water flows among others. These conditions in densely populated ponds increase stress on fish from competition for limited space, food and oxygen. In general, parasites intensities become high on fishes under stress as transmission rates are enhanced when natural immunity is suppressed or low (Davydov et al., 1990). In the present study, most of the physico-chemical properties did not seem to influence parasite infection when the results from different ponds were compared. Moreover, Akter et al. (2007) have reported that November to March was the most susceptible period of the year when fish parasites were abundant in Bangladesh, where almost similar agroclimatic condition prevails. In the present study the more stocking density as well as the prevailing low temperature enhances the higher number of parasite in case of all the ponds. Present study revealed that the blood pathological characteristics as PCV, blood glucose and serum protein had significant negative correlation with the monogeneans intensity. It indicates that when the fishes were heavily infested with monogeneans their blood parameters were low and vice-versa. This can be explained by the fact that the parasite infection increases when the host natural immunity get suppressed due to various bio-ecological stress as described by Snieszko (1974). Stress in the form of high stocking density in Pond C affected the water quality which ultimately enhanced the transmission rate of parasite when natural immunity was suppressed or low.

Conclusion

From the study it was found that the stocking density has a relation with the monogenean prevalence, mean intensity and abundance. More stocking density is the favourable condition of monogenean abundance in the pond. The blood pathological parameter showed the negative influence with higher monogenean load of the pond. The low water temperature in the present study not critically hampered the fished by the parasitic distribution rather than the higher stocking density of the ponds. The further research is to be done for the growth as well as the relationship between the fish size with the parasite distribution.

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Experimental group	Abundance	Prevalence (%)	MI
Pond A	1.55±0.21	83.33±4.22	1.88±0.26
Pond B	1.65±0.17	85.00±3.42	1.87±0.18
Pond C	3.48±0.75	96.67±3.33	3.96±0.71

Table 1. Abundance, Prevalence and MI of parasite in different experimental group (Mean±SE)

Experimental group	Glucose (mg/dl)	Protein (g/dl)
Pond A	80.17±0.65	6.20±0.08
Pond B	82.17±1.42	6.08±0.08
Pond C	97.00±1.34	5.63±0.14

Table 2. Glucose and Protein level of different experimental group (Mean±SE)

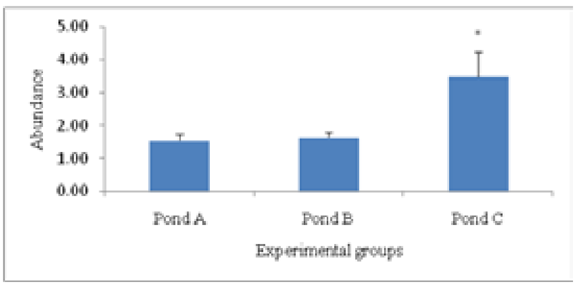

Fig. 1 Abundance of parasite in different experimental group

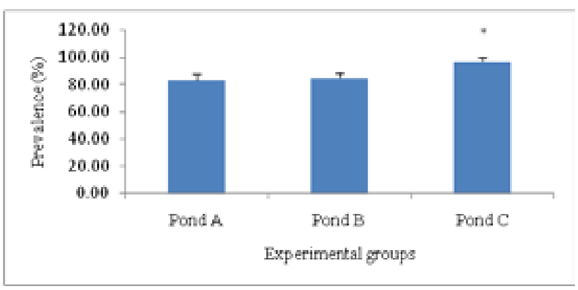

Fig. 2 Prevalence of parasite in different experimental group

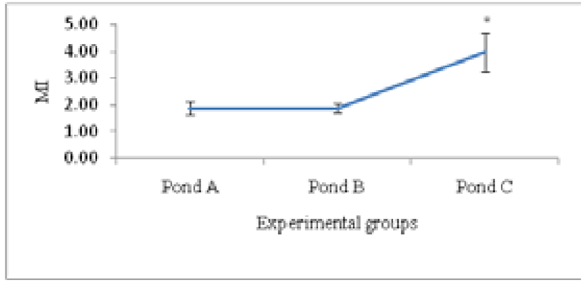

Fig. 3 MI of parasite in different experimental group

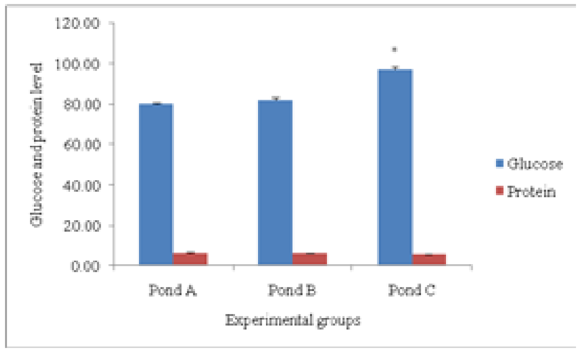

Fig. 4 Glucose and protein level of different experimental group

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