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ORIGINAL ARTICLE

Seasonal incidence of protozoan parasitic infestation in ornamental fishes of West Bengal, India

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Abstract The communication, dealing with the prevalence of protozoan parasites of the ornamental fish of West Bengal. During the study more than five hundred fish have been examined from five districts namely, Nadia, Hooghly, Howrah, North 24-pargana and South 24-pargana of West Bengal during pre-monsoon, monsoon and post-monsoon season. The study reveals that the intensity of infection is more in case of ciliate parasites. The highest ectoparasitic infection has been recorded during post-monsoon season, i.e. from November to February, followed by the pre-monsoon period while the lowest infection was recorded during monsoon i.e. from July to October which may lead to the conclusion that environmental factors are responsible for spreading infection.

Keywords Ornamental fish · Parasitic infestation · India

Introduction

The ornamental fish trade plays an important role for socioeconomic upliftment of the farmers in our country. The culture of ornamental fish for the aquaria is a good economic activity which has not so far been popularized in India. It is a very profitable economic activity and deserves scientific study and development. Though it is a very lucrative business, but ornamental fish culture in West Bengal is suffering from losses due to the invasion of different ectoparasites. It has been found that protozoan, helminth and crustacean parasites cause severe diseases to the fishes (Smyth 1994). In heavily infected fishes, white cyst has been noticed in the skin and gill causing loss of mucus and hemorrhage at the base of the dorsal, pectoral and caudal fin. Hatchery diseases of freshwater fish in Sri Lanka have been reported to cause heavy mortality in major carp fry and fingerling due to ciliate ectoparasites like *Trichodina* sp., *Ichthyopthirius* sp., *Chilodonella* sp. and fluke like *Dactylogyrus* sp. during nursery operation. (Subasinghe 1992). In India ectoparasitic protozoans, fish lice, anchor worm, are some of the very important pathogens which cause significant impact on the yield in carp hatcheries and seed production (Mohan 1999). Due to parasitic infestation with *Trichodina* sp., *Myxobolus* sp, and *Dactylogyrus* sp. highest mortality of fish has been recorded from the nursery pond (Hossain et al. 1944). Protozoan, parasites cause fatal diseases to the fishes directly or indirectly (Kabata 1985). According to Lom (1960) amongst the protozoan parasites, myxozoans and ciliophora cause serious diseases in fish. Several protozoan parasites which devastatingly affect this fish fall under the ciliophoran and myxozoan group. During the study ciliates like *Trichodina* sp. Ehrenberg 1838, *Tripartiella* sp. Lom 1959 and *Ichthyopthirius multifilis* were found from the host fish which were prevalent during the post-monsoon season, whereas, the myxozoan infections have not been observed in that particular two seasons. Among the ciliates parasites, *Trichodina* sp. were the most prevalent parasite which infects the fish during the post-monsoon season mentioned earlier, which was followed by *Ichthiopthirius multifilis* and *Trichodinella* sp. showed a moderate infection on gold fish.

During the study, the variation in mean intensity and abundance of those parasites depending on environmental

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condition has been found. The parasitic community of fish shows considerable variation with the aquatic environment in which fish live (Hossain et al. 2008). Certain environmental conditions, particularly temperature play a significant role in disease outbreaks. Ahmed et al. 1991 stated that the prevalence of the disease was higher in the post-monsoon period as compare to other seasons. It was further observed that there was a seasonal variation in the rate of infection and infestation of parasites in fish. The most susceptible period of the year was November to February when fish parasites are abundant. This could be due to high stocking density, low water depth, and low temperature along with other physico-chemical parameters and management practices maintained as pointed out by Banu and Khan (2004). The present study has been undertaken to assess the prevalence of parasitic infestation in ornamental fish.

Materials and methods

Collection of fishes

During the period of March 2014 to April 2015, around thirty fish farms, belong to different districts of West Bengal, India, like Nadia(23.4710°N, 88.5565°E), Hooghly (22.8963°N, 88.2461°E), Howrah (22.5958°N, 88.2636°E), South 24-pargana (22.1352°N, 88.4016°E) and North 24-parganas (22.6168°N, 88.4029°E) have been surveyed for collection of different host fishes (Goldfish *Carassius auratus* L; Molly *Poecilia sphenops*; Guppy *Poecilia reticulata*). The fishes were brought alive to the laboratory for examination. All fish were kept in several aerated covered glass aquaria of 20 lit capacities.

Parasitological examination

A total of 730 fishes was observed for detection of ectoparasitic infestation. Parasitological examination was carried out to detect the external parasites of the skin, gills and on the accessory respiratory organs of the host fishes.

Isolation of pathogens

The infected fishes were collected throughout the year on a monthly basis and examined in the laboratory following standard protocol. Gill, body and tail fin smear were prepared on grease free clean slides with a drop of 0.5 % NaCl solution and air-dried.

The Indian ink method of Lom and Vavrá (1963) was employed to identify the myxozoan spore the air-dried smears were stained with Giemsa for permanent preparation. The ciliophoran parasites were stained with silver impregnation technique of Klien (1958).

The months were divided into three periods, for example March to June (Pre-monsoon) and July to October (Monsoon) and November to February (Post-monsoon). The prevalence rate was calculated as, number of infested fish divided by the number of observed fish multiplied by hundred. The water quality parameters like water temperature; pH and dissolved oxygen have also been measured in every month. For the analysis of dissolved oxygen, water was collected from column region in DO bottles and fixed with $MnSO_4$ and alkaline KI. For measurement of water temperature and pH the mercury thermometer and Pen pH meter were used respectively.

Results

During the survey, out of 730 fishes 450 were found to be infected with different protozoan parasites. The infected fishes showed irritating and sluggish movement. Heavily infected fish showed the reddish appearance and white spots in the whole body.

The survey showed that the fishes were mainly infected with myxozoan as well as ciliophoran parasites. It was found that myxozoan parasites were most prevalent during monsoon while, the ciliophorans are prevalent throughout the year but mostly during the post-monsoon. Considering the average intensity of parasitic infection throughout the year, it may be commented that the maximum parasitic infections occurred during the post-monsoon season (November to February) and the minimum during the monsoon season (July to October) (Table 1).

In this study, we have identified two types of myxozoan parasites up to genus level, e.g. *Myxobolus* sp. containing two polar capsules and *Thelohanellus* sp. containing only one polar capsule. Among the myxozoan parasites, the prevalence of *Thelohanellus* infection was found to be highest in the post-monsoon season, while, *Myxobolus* was more common during monsoon (Table 1). Among the ciliophoran parasites, we have identified four types of parasites up to genus level, e.g. *Ichthyophthirius* sp., *Trichodina* sp., *Tripartiella* sp. and *Trichodinella* sp. Trichodinid infection has been noticed throughout the year, but *Ichthyophthirius* infection was less in rest other two seasons of the year (Table 1). *Trichodinella* infection was slightly higher than other ciliates during the monsoon season (Table 1). Among the ciliates, the intensity and abundance of *Trichodina* sp. infection was most frequent, which was more prevalent in comparison to other parasites during pre-monsoon and post monsoon season (Table 1).

In this communication, Table 2 represents the seasonal incidence of parasites of fish. The abundance and mean-

Table 1 Prevalence, mean intensity and abundance of ectoparasite in ornamental fish in different seasons of the year

Season	No. of fish sample examined	Ciliophoran						Myxozoan					
		Parasites	No. of infected fish	No. of collected parasites	Prevalence	Mean intensity	Abundance	Parasites	No. of infected fish	No. of collected parasites	Prevalence	Mean intensity	Abundance
Pre-monsoon	170	*Trichodina* sp.	85	603	50.50	7.09	3.55	*Thelohenellus* sp.	17	32	10	1.88	0.19
		Trichodinella sp.	69	424	40.59	6.14	2.49						
		Tripertiella sp.	54	318	31.77	5.89	1.87	*Myxobolus* sp.	0	0	0	0	0
		Ichthyophirius sp.	14	45	8.24	3.21	0.26						
Monsoon	250	*Trichodina* sp.	37	67	14.80	1.81	0.27	*Thelohenellus* sp.	49	205	19.60	4.18	0.82
		Trichodinella sp.	65	201	26.00	3.09	0.80						
		Tripertiella sp.	47	99	18.80	2.11	0.39	*Myxobolus* sp.	76	449	30.40	5.91	1.79
		Ichthyophirius sp.	0	0	0	0	0						
Post-monsoon	310	*Trichodina* sp.	271	3009	87.42	11.10	9.71	*Thelohenellus* sp.	76	331	24.52	4.36	1.07
		Trichodinella sp.	212	1699	68.39	8.01	5.48						
		Tripertiella sp.	191	1338	61.61	7.01	4.32	*Myxobolus* sp.	33	101	10.65	3.06	0.33
		Ichthyophirius sp.	261	2619	84.19	10.03	8.45						

intensity were more in post-monsoon followed by pre-monsoon and monsoon in succession (Table 2).

This information established that the outbreak of disease occured in post-monsoon season with maximum intensity of parasite leading to a conclusion that a biological factor as well as environmental factors of the host may play a pivotal role. The water temperature, DO and pH with their mean and ±SD have been presented in Table 3.

Discussion

This investigation of the parasitofauna of ornamental fish can be stated that the prevalence and mean intensity of a total average of parasites are more during the post-monsoon period in comparison to other seasons. Usually the parasites cause diseases in ornamental fishes are more delicate, since they are susceptible to infection and may die very quickly. Due to rapid fluctuation of water quality parameters during post to pre-monsoon season, the fish becomes more affected by diseases in these two seasons. These findings corroborated with those of Ahmed et al. (1991).

During the study, only three types of parasites namely, myxozoan, ciliophoran and crustacean were isolated and identified from the ornamental fish. Two types of myxozoan parasites (*Myxobolus* sp. and *Thelohanellus* sp.) were identified on the basis of the number of their polar capsules (Kudo 1933). Among the myxozoan parasites, *Thelohanellus* infection were mostly found during the post-monsoon season while, *Myxobolus* infection were found more frequently in monsoon season i.e. July to October. This work corroborated with the findings of Majumdar et al. (2013). On the contrary, while studying the ciliophoran parasites, much intensity and more abundance throughout the year in comparison to other parasites. Chanda et al. (2011) reported that the prevalence of *Ichthyophthirius* sp. was more prominent than others. The mortality rate of infected fish caused by Ichthyophthiriasis was almost 100 % at low temperatures but the fish mortality was reduced at the time of high temperature. Therefore, it can be concluded that low temperature is susceptible to parasitic infestation. This work justified the work done by Majumdar et al. (2013).

Furthermore fluctuation of temperature and poor water quality are also responsible for spreading of disease to delicate ornamental fish. Srivastava (1975) reported that the characteristics of the water body can determine its parasitic fauna. When the water quality detoriats, the ectoparasitic infection is increased during post-monsoon season due to decrease of the temperature and dissolved oxygen level in the water body. In winter, fish require more O_2 and due to lack of O_2 they become more prone to infection. In Post-monsoon season the pH level also decreases and low pH influences the disease outbreak.

Table 2 Season wise prevalence (%), mean intensity and abundance of parasites in ornamental fish: (IF-infected fish)

Season	No. fish examined	Total number of parasitic infection (%)		Prevalence (%)	Mean Intensity (Unit)	Abundance (Unit)
		Ciliophoran	Myxozoan			
Pre-monsoon	170	58.82 (IF-100)	10.00 (IF-17)	34.41	4.03	1.39
Monsoon	250	27.20 (IF-68)	50.00 (IF-125)	38.5	2.85	0.67
Post-monsoon	310	90.97 (IF-282)	35.16 (IF-109)	63.065	7.24	4.89

Table 3 Season wise fluctuation of water quality parameters

Season	Temperature (0 °C)	pH	DO (ppm)
Premonsoon	29	7.7	6.25
Monsoon	27.5	7.3	6.15
Postmonsoon	20	6.8	6
Mean ± SD	25 ± 4.821	7.2 ± 0.450	6.1 ± 0.125

Therefore, it can be concluded that the water quality plays an important role for the abundance of parasites and their ability to survive on the host. The finding of Akhter et al. (1997) and Hossain et al. (1944) corroborated with the present findings. Environmental fluctuations and management practices such as handling, transport, drug treatment, crowding, undernourishment, fluctuating temperature and poor water quality limit parasitic infection in ornamental fish (Subasinghe 1997; Wildgoose 1998; Scholz 1999). Thus, it may be inferred that high temperature reduces the life cycle of these parasites or apparently they remain in the dormant stage, thereby the prevalence of the parasites is very much dependent on temperature as also reported by Majumdar et al. (2013) and Hossain et al. (2008).

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The fishes were collected in fresh form the different ornamental fish farm of West Bengal. At the point of time when work began on the parasites of ornamental fishes, we approached Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCEA), Ministry of Environment, Forest and Climate Change, and Government of India for ethical clearance. The committee informed that CPCEA instruction's protocol for experimentation on fishes does not require CPCEA approval.

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