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Prevalence of Monogenean Parasites on Indian Major Carps in Bheries of West Bengal

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Abstract

The research work was conducted to find out the prevalence or PFI and severity of monogenean parasites on Indian Major Carps in West Bengal fish farms. An investigation was made on Catla (*Catla catla*), Rohu (*Labeo rohita*) and Mrigal (*Cirrhinus mrigala*), from different parts of West Bengal. Approximately 505 fishes were observed in between June to December 2012 from different fish farms. *Dactylogyrus* sp. infest gill whereas *Gyrodactylus* sp. affect both skin and gill. Prevalence of *Dactylogyrus* sp. were high during August (PFI,83.45%) compared to June where PFI was only 4.5%. Similarly *Gyrodactylus* sp. showed high prevalence in August (PFI,28.88%) compared to it's zero prevalence in June. Prevalence and severity of the infestation were also found to be related to different length group of the hosts. *Labeo rohita* was more susceptible to monogenean parasites. Infestation rate were more in small (1 to 10 cm) and medium (10.5 to 30cm) sized fishes, may be due to poor immune power compare to large size fishes (30.5 to 45 cm). Large size fishes were more susceptible to *Gyrodactylus* sp.as these provides more surface area for attachment.

Key words: Monogenean parasites, Infestation, Prevalence, Severity, IMC

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1. Introduction

Aquaculture is one of the most economically important applied strategies all over the world and India. In West Bengal the bheries are the unique ecosystem that sustains the world's largest wetland, and it happens to be one of the oldest practices of integrated resource recovery, since beginning of the last century. They form a large spectrum in the aquaculture field of West Bengal, both freshwater and brackish water. Everyday about 250 million litre of waste water along with solid waste is discharged here though different canals. Maximum Bheries of fish farmers using this canal water (Kolkata sewage water) for culture. Huge amounts of hazardous substances, heavy metal, sulphide, grease, oil originated from different industries of the surroundings, domestic waste water and industrial effluent from Kolkata city and pollute the aquatic environment. That can leads to stress on the fishes, under the stress condition fish can prone to so many parasitic diseases. Although fish suffered bacterial, fungal diseases, the prevalence of different parasites in the fish farm might be due to improper stocking density. These findings are in agreement with a previous study [1]. Not only that the infected brood stocks might transfer ectoparasites from farm to farm their fry and fingerlings are used to stock uninfected ponds [2,3]. The death of fish seeds were mainly due to extreme low and high temperature of winter and summer respectively. Parasitic infections often give an indication of the quality of water since parasites generally increase in abundance and diversity in more polluted waters [4,5]. However, five factors namely age, diet, abundance of fishes, independent number of a parasite within the fish and season, directly influence the parasite fauna of fishes [6-8]. Stated that the characteristic of any water body can influence and determine its parasitic fauna and when environmental conditions, such as water, food and temperature become favourable for mass reproduction of parasites, the disease may spread very quickly. The parasitic community of fish show considerable variation with the environmental conditions in which fish live [9].

For a considerable proportion of existing biodiversity, these questions are increasingly being asked in relation to parasitic organisms [10,11]. Monogeneans are the most ubiquitous and abundant group of helminth parasites in the aquatic environment [12]. They are predominantly ectoparasitic on gills and skin of fishes [13]. Among the monogenea, *Dactylogyrus* sp. was mostly observed in gills

as compared to *Gyrodactylus* sp. which corroborate the earlier view [14]. A few may invade the rectal cavity, ureter, body cavity and even the blood vascular system. There are more than 100 families of monogeneans found on fishes of the world, in fresh and salt water, and at a variety of temperatures. Most monogeneans are browsers, moving about the body surface and feeding on dermal (skin) mucus and gill debris. Monogeneans have a series of hooks that enable them to attach while feeding. Most species are host- and site-specific, requiring only one host to complete an entire life cycle. In fact, some adult monogeneans will remain permanently attached to a single site on the host. Morbidity and mortality epidemics in cultured fish caused by excessive parasite loads are associated with crowding, inadequate sanitation and deterioration of water quality.

The main objective is to find out the monthly prevalence and severity of monogenean parasites on and length wise prevalence (%) of monogenean parasites on Indian major carps in West Bengal fish farms.

2. Materials and methods

The present study was conducted to find out the prevalence and severity of monogenean parasites in major cultivable fish species in West Bengal fish farms. An investigation was made on Catla (*Catla catla*), Rohu (*Labeo rohita*) and Mrigal (*Cirrhinus mrigala*), from different parts of West Bengal. Approximately 505 fishes were observed in between June to December 2012 from different fish farms . The samples were collected from five different fish markets and some farm namely Garia station, Bantala, Gobindapur, Potormore and Bamanghata respectively in the district of South 24 parganas , West Bengal, India. The markets and farm were selected in such a way that the five fish markets at different locations represent the district. Live host or freshly dead specimen were randomly sampled and collected. The fishes were examined immediately after collection. The length and body weight of the fishes and date and site of collection of host specimens were recorded. External symptoms and health conditions of each specimen were recorded. The gills, fins, scales and operculum were removed with least damage and placed on separate petri-dishes containing filtered water and examined. Each of the four gills of both sides was examined separately. The gills and body surface were checked thoroughly for any attached parasites. The dorsal, pectoral, pelvic, anal, and caudal fins were placed in separate petri-dishes. Each fin was thoroughly examined. Scales of each side were scrapped out along with the mucus and taken separately for examination. The first microscopic examinations were done for observing ectoparasites and identifying any cysts, ulceration and scars. Skin, gills and fins were examined Then the gill filaments were dissected out of the branchial cavity and placed in a petridish containing saline solution (0.75% NaCl). Parasites were collected and preserved, and identification was performed according to the characteristics described by, [15, 16]. All of the collected parasites were kept in tap water, fixed in 10% formaldehyde and transferred to 5% glycerol in 70% ethanol after 1 week. In addition, at least 10 specimens of *Gyrodactylus* and *Dactylogyrus* were placed on glass micro-scope slides with a drop of 1/4000 formalin while the cover slip was placed over the parasite. They were fixed in glycerin alcohol (90 parts of 70% ethyl alcohol and 10 parts of glycerol), stained in Borax carmine and finally mounted in glycerin jelly.

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The Parasitic Frequency Index (PFI) was calculated (Table 3) by taking the percentage of the number of hosts infected by an individual parasite species against the total number of hosts examined in a particular area under investigation. The frequency index were further classified into rare (0.1 – 9.9%), occasional (10-29.9%), common (30 – 69.9%) and abundant (70-100%) as per [17].

Prevalence was estimated following the formulae proposed by [18, 19] as:

$$\text{F1. Prevalence (\%)} = \frac{\text{Total number of infected fishes}}{\text{Total no of fish hosts examined}} X\ 100$$

Determination of Severity of infection (Table 1) was estimated as proposed by [18, 19] and Phenotypic Characterization of Monogenean Parasites noted down in the Table 2.

3. Results and Discussion

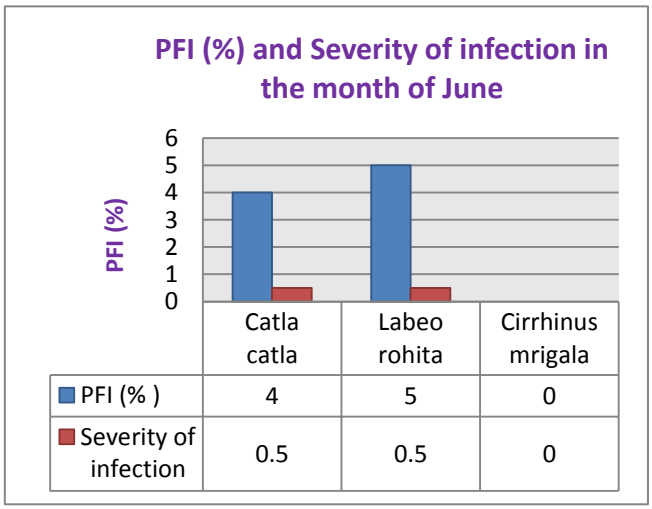
It was observed that among all these species *Labeo rohita* highly susceptible species to the monogenean parasites (Fig.9 & 10). The Parasitic Frequency Index (PFI) was calculated (Table.3) for these two parasites in Indian Major Carps. Prevalence and severity of monogenean parasites in all fish species were recorded (Table 4). During the study highest infestation with *Dactylogyrus* sp. in the month of August (83.45%), lowest (4.5 %) in the month of June was recorded, which was similar with the results obtained by [20], in Roach. In case of *Gyrodactylus* sp. highest prevalence in the month of August (28.88%), lowest in the month of June (0%) was recorded. This corroborated with the work of [16], who assumed that this decline was due to the disappearance or death of adult fish in that period. In all the fishes mixed infection with *Myxobolus* sp., *Thelohanellus* sp., *Trichodina* sp., *Chilodenella* sp. and *Vorticella* sp. in June to December was observed but the high severity of monogenean parasite infestation was also recorded (Table 3). All the fishes were highly infested with Mongeneans i.e both *Dactylogyrus* sp. and *Gyrodactylus* sp. in the month of August. This might be due to wild fish entry into the Bheries which is a natural habitat. High infestation rates of *Gyrodactylus* sp. observed from natural populations have also been reported by several authors [21-25]. The *Dactylogyrus* sp. and *Gyrodactylus* sp. infestation were increased by 41.14%, 7.24% respectively in the month of December due to cold weather temperature. *Gyrodactylus* sp. showed strict influence of temperature on the prevalence and intensity of infestations which generates a definite seasonal cycle of the parasite, while some species showed a maximum prevalence in spring [26, 27] summer [24, 25]and winter season [16]. Both *Dactylogyrus* sp. and *Gyrodactylus* sp. showed decreased prevalence from August to September and followed by October and November, but again increased in the month of December (41.14% & 7.24%) respectively. Mean±SD also found based on the prevalence for *Dactylogyrus* sp. and *Gyrodactylus* sp. from June to December, i.e 27.99 ± 6.72 and 19.28 ± 6.61 respectively (Table 4). Prevalence and severity of the infestation were also found to be related in different length groups of *Catla catla* (Table.5 & Fig.6), *Labeo rohita* (Table.6 & Fig.7) and *Cirrhinus mrigala* (Table.7 & Fig. 8).

Table 1: Determination of Severity of infection: Generalized scheme for assigning numerical qualitative value to severity grade of infections, surface infestations and disease syndrome severity followed by [36].

0.5	Non infective
1	Mild
2	Moderate
3	Infective
4	Excessive

Table 2: Phenotypic Characterization of Monogenean Parasites:

***Dactylogyrus* sp. (Fig. 9)**	***Gyrodactylus* sp. (Fig.10)**
Haptor with 14 marginal hooks, squamodisc absent.	Haptor with 16 marginal hooks, squamodisc present.
The anterior end is provided with two pairs of eye spots.	No eye spots.
Oviparous, laying eggs and live as parasites, particularly in gills.	Viviparous and liberates live young worms.
Head is scalloped. Parasitize particularly the gills.	V shaped head (bilobed). Parasitize the skin and more rarely the gills.



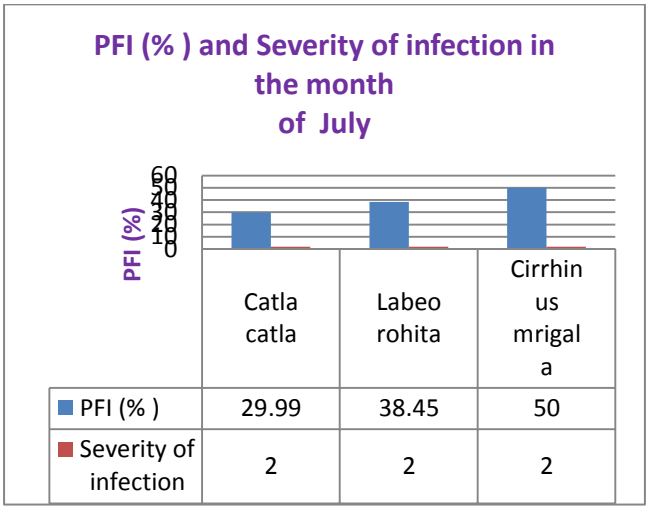
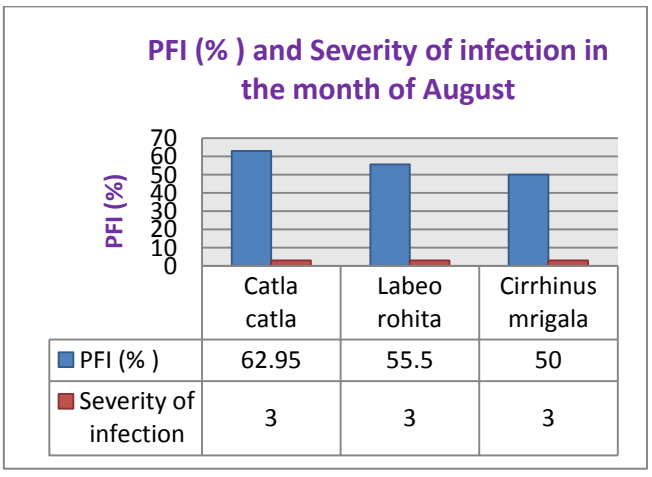


Fig.1. PFI (%) and severity of infection in the month of June and July-2012



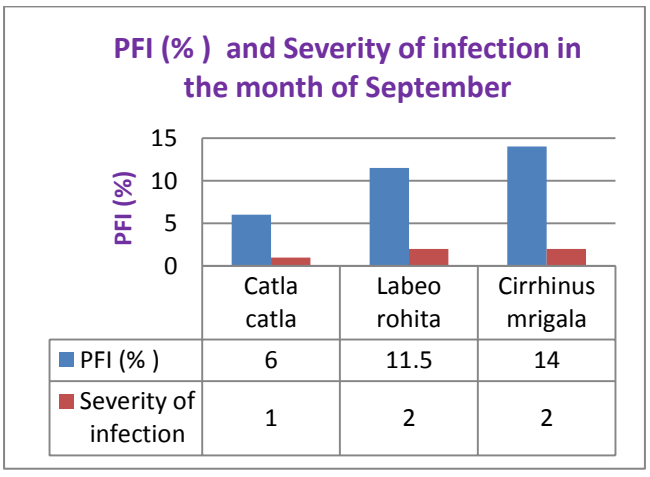


Fig.2. PFI (%) and severity of infection in the month of August and September-2012

Table 3: Monthly parasitic frequently index (PFI) and severity from June to December-2012

Month	Fish	No. of Fishes investigated	Parasitic data				
			Monogenic Parasites present	**No. of Infected fishes**	**PFI(%)**	**Site of infection**	**Severity of infection**
JUNE	*Catla catla*	25	*Dactylogyrus* sp.	1	4	Gill	0.5
	Labeo rohita	20	*Dactylogyrus* sp.	1	5	Gill	0.5
	Cirrhinus mrigala	25	-	-	-	-	-
JULY	*Catla catla*	30	*Dactylogyrus* sp. *Gyrodactylus* sp.	14 4	46.66 13.33	Gill & Skin Gill	3 0.5
	Labeo rohita	26	*Dactylogyrus* sp. *Gyrodactylus* sp.	16 4	61.53 15.38	Gill & Skin Gill	2 0.5
	Cirrhinus mrigala	30	*Dactylogyrus* sp	15	50	Gill	2
AUGUST	*Catla catla*	27	*Dactylogyrus* sp. *Gyrodactylus* sp.	24 10	88.88 37.03	Gill Gill	3 0.5
	Labeo rohita	27	*Dactylogyrus* sp. *Gyrodactylus* sp.	22 8	81.48 29.62	Gill & Skin Gill	3 0.5
	Cirrhinus mrigala	25	*Dactylogyrus* sp. *Gyrodactylus* sp.	20 5	80 20	Gill Gill	3 0.5
SEPTEMBER	*Catla catla*	21	*Dactylogyrus* sp. *Gyrodactylus* sp.	10 2	47.61 9.52	Gill Gill	1 0.5
	Labeo rohita	27	*Dactylogyrus* sp. *Gyrodactylus* sp.	20 3	74.07 11.11	Gill Gill	2 0.5
	Cirrhinus mrigala	20	*Dactylogyrus* sp	14	70.00	Skin	2
OCTOBER	*Catla catla*	21	*Dactylogyrus* sp. *Gyrodactylus* sp.	10 5	47.61 23.80	Gill Gill & Skin	3
	Labeo rohita	20	*Dactylogyrus* sp. *Gyrodactylus* sp.	11 4	55.00 20	Gill Gill	3
	Cirrhinus mrigala	21	*Dactylogyrus* sp.	6	28.57	Gill	1
NOVEMBER	*Catla catla*	26	*Dactylogyrus* sp	3	11.5	Gill	0.5
	Labeo rohita	20	*Dactylogyrus* sp. *Gyrodactylus* sp.	8 2	40 10	Gill Gill & Skin	0.5
	Cirrhinus mrigala	25	*Dactylogyrus* sp.	5	20	Gill	1
DECEMBER	*Catla catla*	23	*Dactylogyrus* sp. *Gyrodactylus sp.*	12 5	52.17 21.73		1
	Labeo rohita	21	*Dactylogyrus* sp.	15	71.42	Gill	3
	Cirrhinus mrigala	25	-	-	-	-	-

Table 4: Mean±SD based on the prevalence (%) of monogenean parasites from June to December-2012:

Parasites	**Mean ± SD**
Dactylogyrus sp.	44.75 ± 25.81
Gyrodactylus sp.	10.7 ± 9.48

Table 5: Length wise prevalence (%) of *Dactylogyrus* sp. and *Gyrodactylus sp.* in *Catla catla* from June to December 2012.

Length (cm)	Total number of fish host examined	Total number *Dactylogyrus* sp. Ifected fish	Prevalence (%)	Total number *Gyrodactylus sp.* Ifected fish	Prevalence (%)
1 to 10	7	2	28.57	1	14.28
10.5 to 20	112	46	41.07	21	18.75
20.5 to 30	14	10	71.42	4	28.57
30.5 to 45	9	0	0	0	0
Total	142	58	40.84	26	18.30

Table 6: Length wise prevalence (%) of *Dactylogyrus* sp. and *Gyrodactylus sp.* in *Labeo rohita* from June to December- 2012.

Length (cm)	Total number of fish host examined	Total number *Dactylogyrus* sp. Ifected fish	Prevalence (%)	Total number *Gyrodactylus sp.* Ifected fish	Prevalence (%)
1 to 10	18	16	88.88	1	5.55
10.5 to 20	71	32	45.07	6	8.45
20.5 to 30	69	23	35.93	17	24.63
30.5 to 45	7	3	42.85	1	14.28
Total	165	74	44.84	25	15.15

Table 7: Length wise prevalence (%) of *Dactylogyrus* sp. and *Gyrodactylus sp.* in *Cirrhinus mrigala* from June to December- 2012.

Length (cm)	Total number of fish host examined	Total number *Dactylogyrus* sp. infested fish	Prevalence (%)	Total number *Gyrodactylus sp.* infested fish	Prevalence (%)
1 to 10	29	3	10.34	1	3.44
10.5 to 20	87	27	31.1	5	5.74
20.5 to 30	35	15	42.85	2	5.71
30.5 to 45	0	0	0	0	0
Total	151	45	29.80	8	5.29

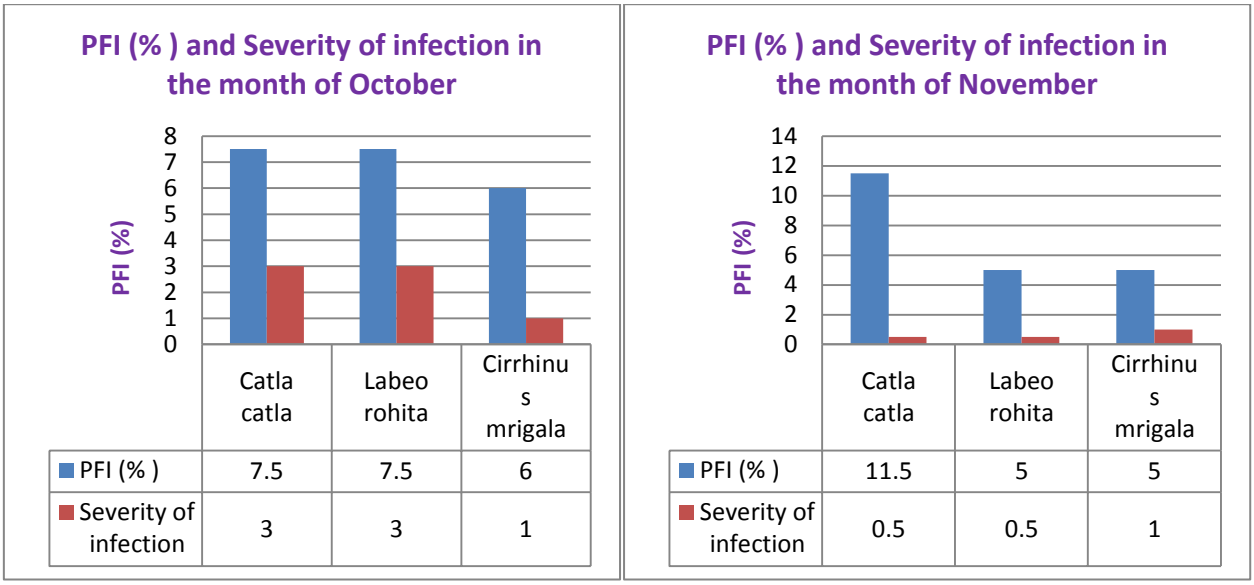


Fig.3. PFI (%) and severity of infection in the month of October and November-2012

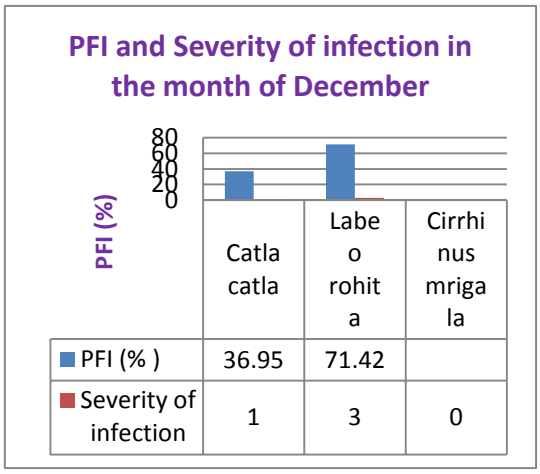


Fig.4. PFI (%) and severity of infestation in the month of December

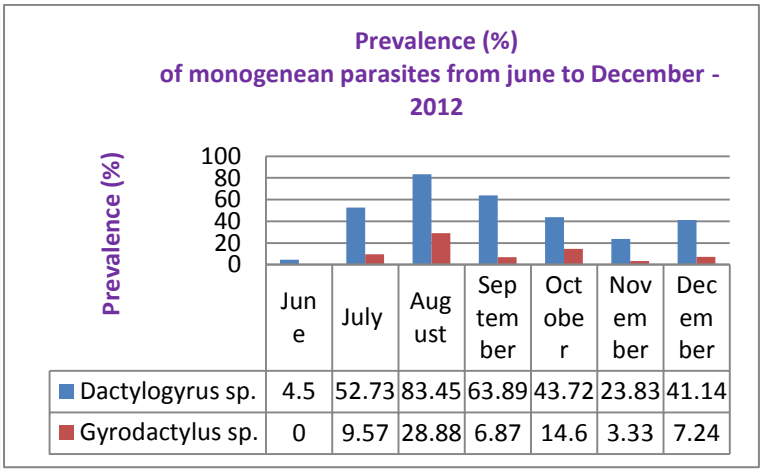


Fig.5. Prevalence (%) of monogeneanparasites from June to December -2012

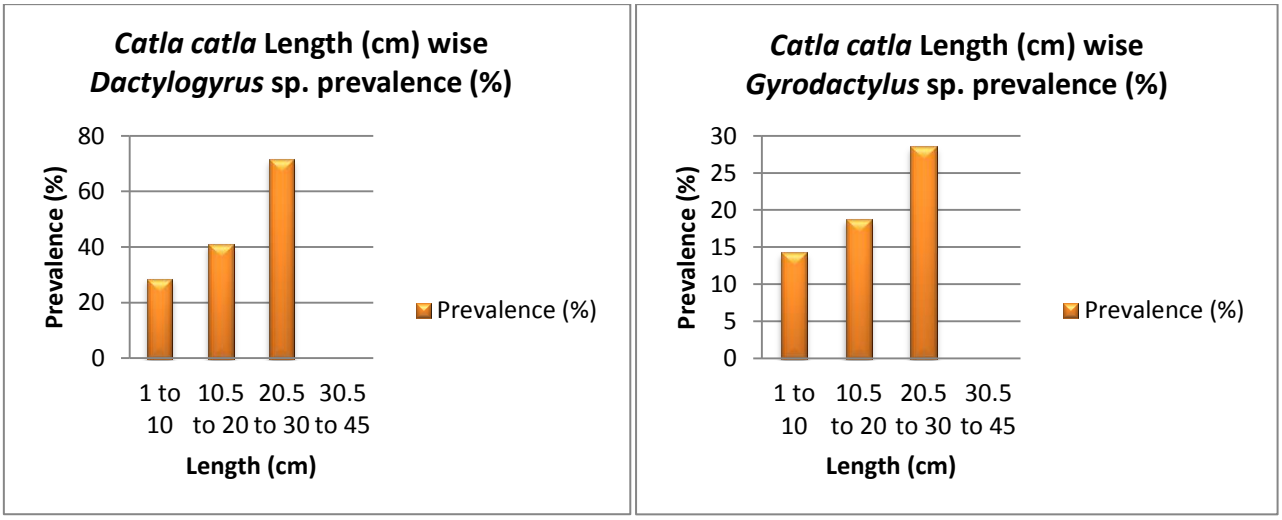


Fig.6. Length wise prevalence (%) of *Dactylogyrus* sp. and *Gyrodactylus* sp. in *Catla catla* from June to December 2012

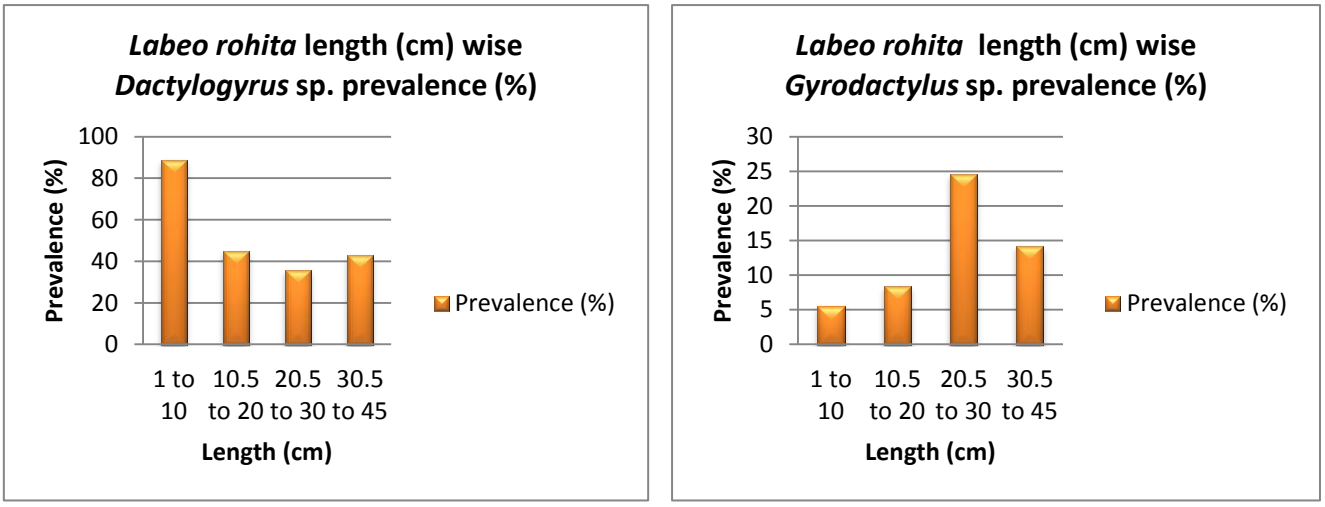


Fig.7. Length wise prevalence (%) of *Dactylogyrus* sp. and *Gyrodactylus* sp. in *Labeo rohita* from June to December- 2012

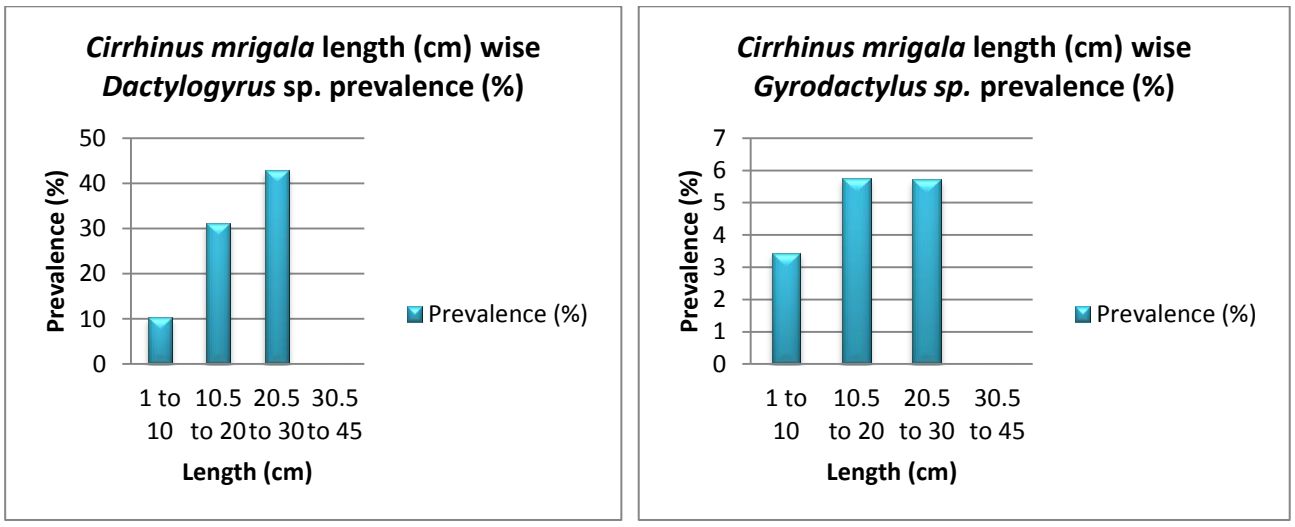


Fig.8. Length wise prevalence (%) of *Dactylogyrus* sp. and *Gyrodactylus* sp. in *Cirrhinus mrigala* from June to December 2012

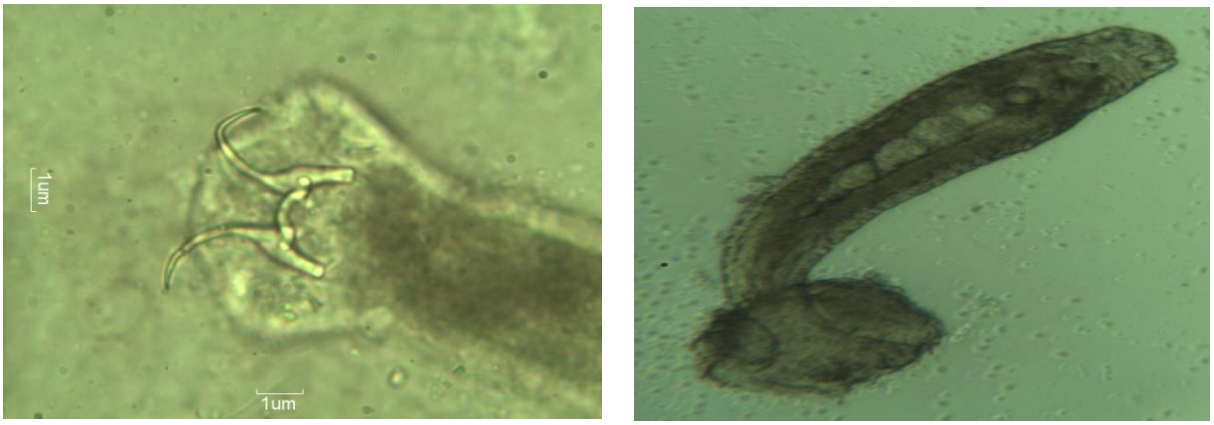


Fig. 9. *Dactylogyrus* sp. With distinct marginal hooks (Wet mpunt,40x)

Fig. 10. *Gyrodactylus sp.* found on the skin (Wet mpunt,40x)

A total number of 142 *Catla catla* were observed, in which the prevalence of *Dactylogyrus* sp. was 40.84%,while highest prevalence found (71.42 %) in 20.5 to 30 cm length group fishes, lowest prevalence (0 %) in 30.5 to 45 cm length groups. *Gyrodactylus sp.* prevalence was 18.30%, while highest prevalence (28.57%) in 20.5 to 30 cm length group fishes, lowest prevalence (0%) in 30.5 to 45 cm length groups was observed from the same lots(i.e 142 nos of fishes). The probable reason for less number of species observed in large length groups of 30.5 to 45 cm may due to scanty fishes available in fish farms. A total number of 165 *Labeo rohita* were observed, in which the prevalence of *Dactylogyrus* sp. was 44.84%, while highest prevalence (88.88%) found in 1 to 10 cm length groups, lowest prevalence (35.93%) in 20.5 to 30 cm length group fishes. Out of 165 fishes *Gyrodactylus sp.* prevalence was recorded 15.15% while highest prevalence (24.63%) found in 20.5 to 30 cm length group fishes, lowest prevalence (5.55%) in 1 to 10 cm length groups. While observing a total of 151 numbers of *Cirrhinus mrigala*, *Dactylogyrus* sp. prevalence was recorded 29.80%, while highest prevalence (42.85%) found in 20.5 to 30 cm length groups, lowest prevalence (10.34%) in 1 to 10 cm length group fishes. Out of 151 fishes *Gyrodactylus sp.* prevalence observed to be 5.29%, while highest prevalence (5.74%) in 10.5 to 20 cm length group fishes, lowest prevalence (3.44%) in 1 to 10 cm length group fishes was recorded.

Small (1cm-10 cm) and medium (10.5-30cm) sized fishes were more susceptible to *Dactylogyrus* sp., which corroborated with the result of [28]. He had observed that among the different size groups of fishes, the prevalence was highest in medium length groups, abundance and mean density was highest in smaller length groups. The reason for it is that small and medium size fishes have less immune power compared to large size fishes (30.5cm - 45 cm). Large size fishes were more susceptible to *Gyrodactylus* sp. because of the availability of surface area for attachment to skin. Larger hosts provide more nutrient resources and space, which in turn promote parasitic growth. My present work supported by [29] who opined about higher monogenean species richeness in Larger fish , but only richness in specialise parasite species increases with host body size. However the authors like [30] suspect that an increasing host size is linked with an increase in available niches for colonization and thus a grater parasite richness. Not only that the schooling behaviour of hosts before the breeding season in winter and spring is an important factor for increase in parasite population. Direct contact is one of the main routes for *Gyrodactylus* sp. infestations and it might be another reason for higher prevalence and intensity levels, which corroborated with the result of [31]. During the study period, parasite species composition, PFI (%), prevalence, and severity of infestations varied in different fish species and it might be due to host specificity, temperature, metabolic activity and suppression of natural immune system of fish. The association of parasitic fauna in the host fishes in the present study was supported by the findings of [31-35].

4. Conclusion

Prevalence and severity of monogenean parasites were more during August, September and October months. The maximum prevalence of monogenean parasites were recorded in the month of August and the minimum in June. In December month again prevalence of monogenean parasites was increased due to sudden changes of temperature. Poor water quality ,health management, irregular feeding practices and host specificity and preference are some of the key factors that lead to stressful conditions and subsequent parasitic infection of the host organism. This study describes the parasitic infestations from different fish farms of West Bengal and indicates that infestation rate of parasites varied with fish size and Month. This could be due to stocking density, water depth, temperature along with other physico-chemical parameters and management practices maintained. Nevertheless, more in depth research is needed to be carried out for studying parasites as well as diseases of these fishes.

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