

Original Research Article

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Prevalence of Parasitic Infestations in the Freshwater Fish, *Channa punctatus* (Bloch) from Rajshahi Metropolitan, Bangladesh

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ABSTRACT

Channa punctatus is one of the most delicious and demandable freshwater fishes of the country because of its high nutritional value, cheap cost and availability in the local markets. These fishes are often infected by parasites, which decrease the rate of growth as well as the reproduction rate of the host fishes, resulting in deteriorating the food value of fishes and economic loss to the culturists. Study of parasites is therefore an urgent necessity today. The prevalence of parasites in *Channa punctatus* was studied from different regions of Rajshahi Metropolis during July 2013 to April 2014. A total of 368 parasites were collected from the skin, gill, fin, intestine and stomach of 74 host species from 102 experimental fishes. Ten different parasitic genera were identified, among them six were ectoparasites and four endoparasites. Of ectoparasites, three were protozoan viz., *Trichodina pediculatus*, *Ichthyophthirius multifiliis*, and *Myxobolus* sp., two monogenetic viz., *Dactylogyrus vastator* and *Gyrodactylus elegans* and one crustacean viz., *Argulus* species. Among endoparasites, one nematode viz., *Camallanus* sp., two trematodes viz., *Eucreadium* sp., *Genarchopsis* sp. and one acanthocephalan viz., *Pallisentis* sp. were recorded. Organ-wise distribution, monthly, seasonally, sex and length-wise fluctuations of prevalence, abundance and mean intensity of the parasites were studied. The highest level of infestation was observed in host skin, while lowest levels were observed in host stomach. The results also revealed that the intensity of parasitic infestation in different organs of *C. punctatus* varied with the season. In particular, the highest levels of infestation were recorded during the autumn (October-November), when the fishes are most susceptible to parasites and the lowest number was recorded in the rainy season. Prevalence of infection of parasites is very considerably depending on seasonality, environmental conditions and management practices.

Keywords

Prevalence,
Infestation, Parasite,
Freshwater, Fish,
Channa punctatus

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Introduction

Fishes are cheap and important source of protein for human. Fishes are play an important role for the Bangladeshi economy as it provides employment opportunity, is a source of earning. But due to diseases caused

by parasites, fish culturing remain a high risk investment (Kumari and Perveen, 2017). The fish parasites have also been signified as zoonotic and biological hazard in prospective to human health. Parasites are small organisms which feed on other animals, living in or on their skin or body slime, gill, intestine,

stomach or inside the body. Parasites are potentially capable of killing their hosts (Crofton, 1971). Parasites interfere with the nutrition of hosts; disturb metabolism and lesions of the alimentary canal, damage nervous system (Markov 1946). Mohan (1999) reported that the major group of parasites in freshwater fish is ectoparasitic protozoans, monogenetic trematodes, fish lice and anchor worm which have significant impact on the yield in fish hatcheries and seed production centre in the different parts of the world. Besides these, there are a number of parasites which are transmitted to human beings only through fish that may affect the general public health (Hoffman, 1967). The snake headed fish *Channa punctatus* is the representative of the Channiformes with family of Channidae, which is the most important species of inland fisheries of Bangladesh. It is mud-loving fish and due to its food habit, it can act as an intermediate host for many helminthic parasites. However, this fish has a very good commercial value in Bangladesh as well as in Indian subcontinent. Parasitic infestation has harmful influence for fish health that inhibits the normal growth of the fishes and outbreaks high mortalities. The declination of *Channa punctatus* is regarded as its susceptibility to Epizootic Ulcerative Syndrome disease (Harris *et al.*, 1992) and over exploitation and habitat degradation (Hussain, 2010). The parasitic infections of this fish results in economic losses due to not only mortality, but also treatment costs, decreasing growth that reduces the expansion of aquaculture. In Bangladesh, parasitic study has been conducted in both freshwater and marine environment where several protozoan, helminthes and crustacean parasites were recorded in different fish species. Some studies of *Channa punctatus* have been done in biology, mainly in the breeding program of this fish (Srivastava and Singh, 1994), and histopathology of diseased fish (Chandra, 1998 and Afroz *et al.*, 1999). A little

knowledge about the distribution, prevalence, parasitic intensity, pathogenic effects and control of most of the parasitic diseases in natural population of freshwater fish has been obtained particularly in different areas of Bangladesh. As *Channa punctatus* is most popular fish throughout the country, their abundance is reducing due to the massive parasitic invasion and the occurrence of diseases. The objectives of the present work has been undertaken to investigate the occurrence, prevalence and infestation of parasites in *Channa punctatus* of different parts of Rajshahi Metropolitan, Bangladesh.

Materials and Methods

Location of the study area

The study was conducted in Rajshahi, Bangladesh. The geographical position of Rajshahi is 24° north and 89° east. It is situated in the south-western part of Rajshahi division and lies between 24°6' N and 25°13' N latitude and between 44°02' E and 49°21' E longitude. It lies on the northern bank of the river Padma.

Collection of sample fish

Live or freshly dead fishes were collected every month at regular interval from different fish markets of Rajshahi city from July 2013 to April 2014. The fishes were mainly caught from the adjacent beels, rivers and ponds. The collected fishes were transported to the Fisheries Research Laboratory, Department of Zoology, University of Rajshahi for detailed investigation. All host fishes were examined as early as possible after collection, generally within 12 hours. Immediately before examination, each fish specimen was measured and weighted. The fish samples were grouped into different length and weight groups. The numerical data of the collected fishes were recorded.

Observation of the organs

The targeted organs of the fish like fin, intestine, stomach, gills were taken out by cutting off and kept on petridish. Each fish was dissected with a fine scissors and used to make an incision along the mid-ventral line of the body to find out the parasites from the internal organs.

The selected internal organs were investigated through a microscope and separated by needle and forceps. The intestines were carefully opened out by an incision from the body and put into a petridish. Sometimes larger nematodes (roundworms) were visible in naked-eyes lying in the body cavity with their heads buried in the intestines and were quickly isolated using forceps, fixed on glass slide with glycerine.

Fixation and preservation of collected parasites

Different methods and preservatives were used for the fixation and preservation of different groups of parasites. Hot formalin acetic alcohol (FAA) was used to fix the trematodes. In case of smaller trematodes (2 mm or less), the specimens were dropped into the warm fixative. On the other hand, large trematodes were flattened slightly under a cover slip and the fixative was added at the edge of the cover slip and allowed to run under it. After 5-10 minutes, the compressed trematodes were transferred to a petri dish and suffused with the fixing fluid (Humanson, 1979).

Nematodes were then washed in saline solution (0.8%) to remove mucus and debris. The worms were then fixed in hot glacial acetic acid and preserved in 70% ethyl alcohol. The collected crustacean parasites were directly preserved in FAA or 70% alcohol.

Preparation of temporary slide

For microscopic study, the temporary slides of fixed parasites were prepared. For this purposes, the parasites were cleaned with the help of lacto phenol. The parasites were then temporarily mounted in Canada balsam.

Before staining it was carried out with borax carmine. Nematodes were not usually stained because of its thick cuticle. Thus the temporary slides were prepared.

Microscopic observation

All the isolated parasites were fixed in glass slides and subjected to microscope observation.

Statistical analysis

The statistical analyses were carried out to find out the prevalence, abundance and mean intensity according to Margolis *et al.*, (1982).

Prevalence (%)

$$\text{Prevalence} = \frac{\text{Number of infected host}}{\text{Total number of host examined}} \times 100$$

Abundance (%)

$$\text{Abundance} = \frac{\text{Number of Parasites}}{\text{Total number of host examined}} \times 100$$

Mean intensity (%)

$$\text{Mean intensity} = \frac{\text{Number of Parasites}}{\text{Total number of infected host}} \times 100$$

Co-efficient of correlation

$$r = \frac{\sum(x-x')(y-y')}{\sqrt{\sum(x-x')^2 \sum(y-y')^2}}$$

Where,

r = Co-efficient of correlation

x = Values of first variables

y = Values of second variables

x' = Mean of the first variables

y' = Mean of the second variables

Results and Discussion

A total of 102 samples of *Channa punctatus* were examined during the study period from July 2013 to April 2014.

Out of observed fishes, a total of 74 fishes were found to be infected from which a total of 368 parasites were collected. Among the collected parasites a total of 10 species were identified of which 6 were ectoparasites and the rest of 4 were endoparasites.

Among observed group of parasites, protozoan and monogenean were very common on the gill skin and fin of the host fish. They were found alive and active in gill filaments. They strongly attached with the gill skin or fin base. Crustacean was mostly abundant to be attached on the fin and skin. On the other hand digenean fluke and nematodes were recorded from intestine.

Parasitic infestation

Infestation was studied from the recorded parasites of host species, which indicated the general parasitological condition of host fish. In the present study, infestations were studied in snake-head, *Channa punctatus*. The prevalence, mean intensity and abundance in relation to different months and size of the three host species during July 2013 to April 2014 were investigated and presented. Moreover, comparative prevalence, mean intensity and abundance of different parasites are also recorded with the help of the collected data.

Prevalence and occurrence of parasites in different organs of host fish

The parasites were mainly found on different organs like gill, skin, fin, intestine and stomach of the host. A total of 368 parasites of 10 genera were collected from these organs of *Channa punctatus* (Table 1 and 2; Fig. 1). During the study period a total of 120 parasites of 6 species were collected from the skin. Among which *Myxobolus* was the highest (36) in number. The number of *Argulus*, *Trichodina sp*, *Dactylogyrus sp*, *G. elegans* and *Ichthyophthirius* were recorded as 26, 21, 14, 12 and 11 respectively. The skin parasite was highest in autumn seasons. During the study period a total of 69 parasites of 4 species were found on the fin of the host fish of which *Myxobolus sp*. was the highest recorded as 22 in number. The number of *Ichthyophthirius* and *Gyrodactylus* were investigated as 18. *Argulus* was the lowest showing the number as 11. A total of 82 parasites of 4 species were collected from the gills of the host fish. *T. pediculatus* and *D. vastator* were recorded 28 as the highest in number. Among the other three species, *Gyrodactylus sp* was 14 and *Ichthyophthirius* was the lowest in number. *Pallisentis sp* showed the highest as 35 in number where *Genarchopsis sp* was the lowest one showing the number as 7 in the intestine of the host fish. The other parasite, *Camallanus* and *Eucreadium* were observed as 27 and 21 respectively. Only one species, *Genarchopsis sp*. was recorded in stomach of host fish that was 7 in number. The stomach parasites were found to be the lowest number of total parasites.

Organ wise fluctuation of prevalence, abundance and mean intensity of parasites

During the study, organ wise fluctuation of prevalence, mean intensity and abundance were observed (Table 3 and Fig. 2). The

highest prevalence value was recorded as 48.04% in skin and the lowest one was found as 4.90% in stomach. The abundance value ranged from 1.18 to 0.07 during the study period. The highest abundance value was recorded 1.18 in skin and the lowest was 0.07 recorded in summer stomach. The highest mean intensity of parasites was observed as 2.48 in gill and the lowest as 1.4 in stomach. The correlation co-efficient analysis showed that all the relationships between prevalence and abundance, $r = 0.98$; abundance and mean intensity, $r = 0.87$ and prevalence and mean intensity, $r = 0.81$ were positively correlated.

Monthly fluctuation of prevalence, abundance and mean intensity of parasites

During the study period the highest parasites were recorded as 75 in November and the lowest one was recorded as 49 in July. The second highest value was found 43 in the month of October (Table 4 and Fig. 3). The highest prevalence of parasites was recorded as 92.30% and the lowest value was recorded as 50% in the months of November and July. The highest abundance value was recorded as 5.77 in November whereas the lowest one was recorded as 2.13 in July. The mean intensity value ranged from 3.89 to 7.17 during the study period. The highest mean intensity of parasites was observed as 7.17 in November, 2013 and the lowest as 3.89 in the month of

April, 2014. The correlation co-efficient analysis showed that all the relationships between prevalence and abundance ($r= 0.75$); abundance and mean intensity ($r = 0.87$), and prevalence and mean intensity ($r = 0.34$) were positively correlated.

Prevalence, abundance and mean intensity of parasites in different seasons

During the study period the highest parasites (118) was recorded in autumn and the lowest value (73) was recorded in summer season. The prevalence value ranged from 67.86% to 81.82% during the study period. The highest prevalence value (81.82%) was recorded in autumn and the lowest one (67.86%) was found in rainy season. The highest abundance value (5.36) was recorded in autumn and the lowest (2.92) was recorded in summer season.

The highest mean intensity of parasites was observed as 6.56 in autumn and the lowest one was recorded as 4.05 in summer season. The correlation co-efficient analysis depicted that all the relationships between prevalence and abundance ($r= 0.91$); abundance and mean intensity ($r= 0.98$) and prevalence and mean intensity ($r= 0.83$) were positively correlated in different seasons. Seasonal variation of parasitic infestation was also investigated in both sexes of male and female hosts (Table 5 and 6; Fig. 4 and 5).

Table.1 List of parasites and their site of infection

Host fish	Parasites	Infestation site	
<i>Channa punctatus</i>	Protozoa	<i>Trichodina</i>	Skin, Gill
		<i>Ichthyophthirius</i>	Skin
		<i>Myxobolus</i>	Gill, Skin
	Monogenea	<i>Dactylogyrus</i>	Gill, Skin, Fin
		<i>Gyrodactylus</i>	Gill, Skin, Fin
	Digenea	<i>Eucercidium</i>	Intestine
		<i>Genarchopsis</i>	Intestine and stomach
	Acanthocephala	<i>Pallisentis</i>	Intestine
	Nematoda	<i>Camallanus</i>	Intestine
	Crustacea	<i>Argulus</i>	Fin, skin

Table.2 Organ wise distribution of parasites

Name of Parasites	Skin	Fin	Gill	Intestine	Stomach	Total
<i>Trichodina</i> sp.	21		28			49
<i>Dactylogyrus</i> sp.	14		28			42
<i>Gyrodactylus</i> sp.	12	18	14			44
<i>Ichthyophthirius</i> sp.	11	18	12			41
<i>Myxobolus</i> sp.	36	22				58
<i>Pallisentis</i> sp.				35		35
<i>Camallanus</i> sp.				27		27
<i>Eucercidium</i> sp.				21		21
<i>Genarchopsis</i> sp.				7	7	14
<i>Argulus</i> sp.	26	11				37
Total	120	69	82	90	7	368

Table.3 Organ wise fluctuation of prevalence, abundance and mean intensity of parasites

Seasons	No. of host		No. of parasites recovered	Prevalence	Abundance	Mean Intensity
	Examined	Infected				
Skin	102	49	120	48.04	1.18	2.45
Fin	102	31	69	30.4	0.67	2.22
Gill	102	33	82	32.35	0.80	2.48
Intestine	102	44	90	43.14	0.88	2.05
Stomach	102	5	7	4.9	0.07	1.4

Table.4 Monthly (during July 2013 to April 2014) fluctuation in prevalence, abundance and mean intensity of parasites

Months	No. of host		No. of parasites recovered	Prevalence	Abundance	Mean Intensity
	Examined	Infected				
Jul	8	4	17	50	2.13	4.25
Aug	11	8	36	72.73	3.27	4.5
Sep	9	7	40	77.78	4.44	5.71
Oct	9	6	43	66.67	4.78	7.17
Nov	13	12	75	92.30	5.77	6.25
Dec	9	7	30	77.78	3.33	4.28
Jan	8	5	20	62.5	2.5	4
Feb	10	7	34	70	3.4	4.86
Mar	13	9	38	69.23	2.92	4.22
April	12	9	35	75	2.92	3.89

Table.5 Prevalence, abundance and mean intensity of parasites in different seasons

Seasons	No. of host		No. of parasites recovered	Prevalence	Abundance	Mean Intensity
	Examined	Infected				
Rainy	28	19	93	67.86	3.32	4.89
Autumn	22	18	118	81.82	5.36	6.56
Winter	27	19	84	70.37	3.11	4.42
Summer	25	18	73	72	2.92	4.06

Table.6 Prevalence, abundance and mean intensity of parasite sexes in different seasons

Seasons	Sexes of host	No. of host		Parasite recovered	Prevalence	Abundance	Mean Intensity
		Examined	Infected				
Rainy	Male	13	8	37	61.54	2.85	4.625
	Female	15	11	56	73.33	3.73	5.09
Autumn	Male	10	7	43	70	4.3	6.14
	Female	12	11	75	91.67	6.25	6.82
Winter	Male	14	9	39	64.28	2.78	4.33
	Female	13	10	45	76.92	3.46	4.5
Summer	Male	9	6	21	66.67	2.33	3.5
	Female	16	12	52	75	3.25	4.33

Fig.1 Organ wise distribution of parasites in *Channa punctatus*

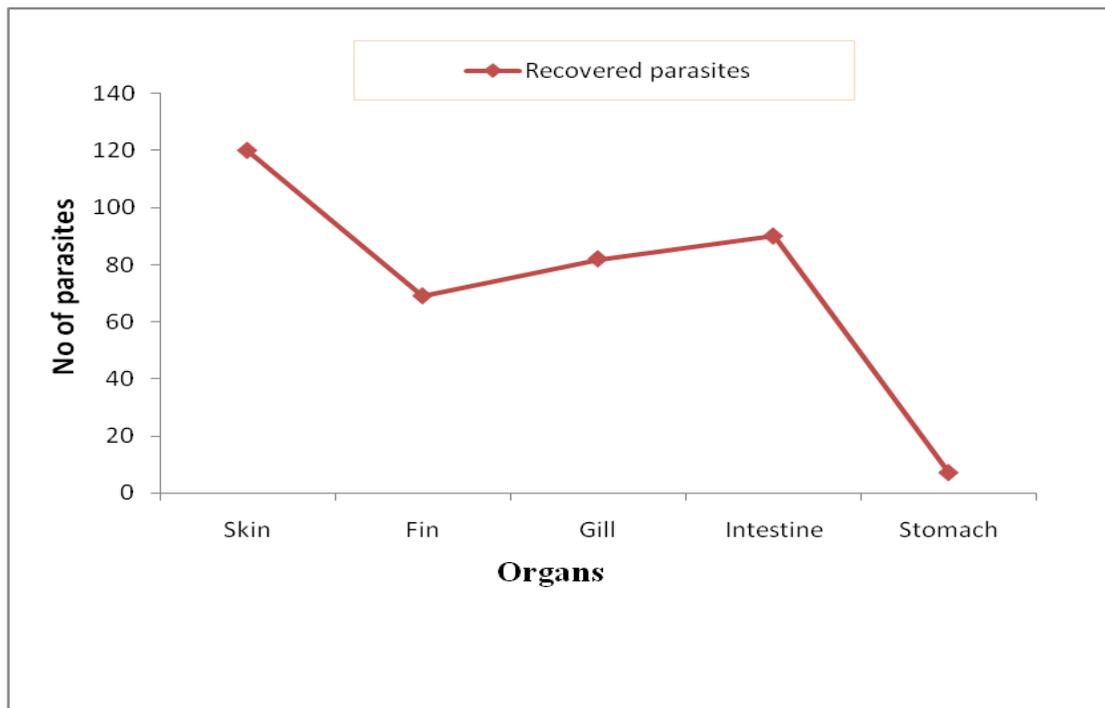


Fig.2 Organ wise fluctuation of prevalence, abundance and mean intensity of parasites

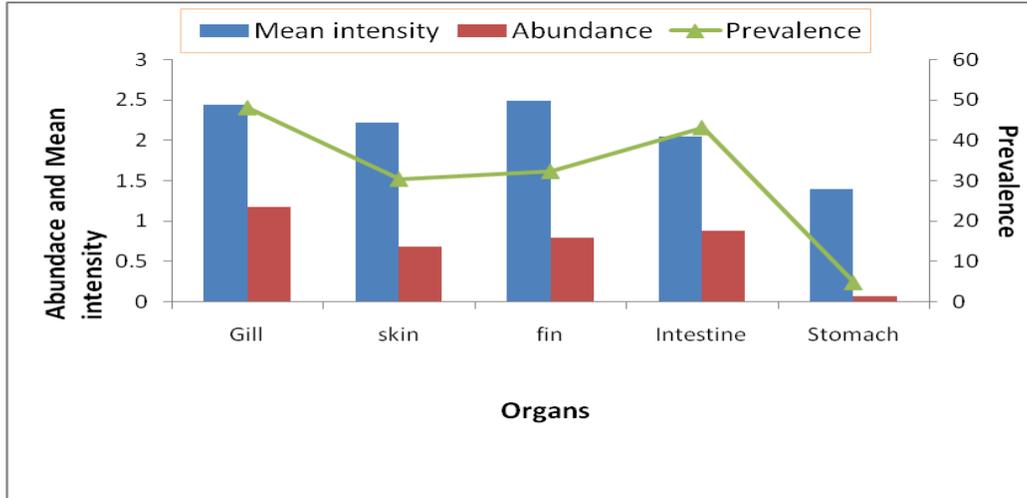


Fig.3 Monthly fluctuation in prevalence, abundance and mean intensity of parasites

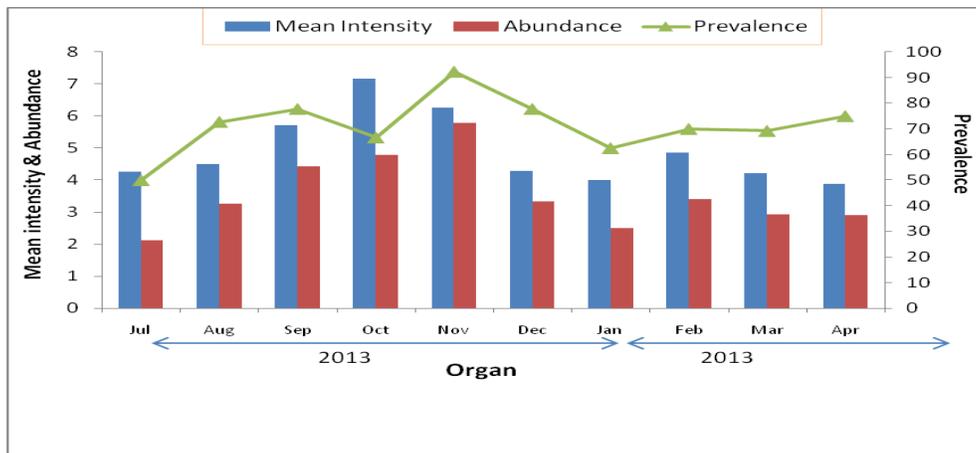


Fig.4 Prevalence, abundance and mean intensity of parasites in different seasons

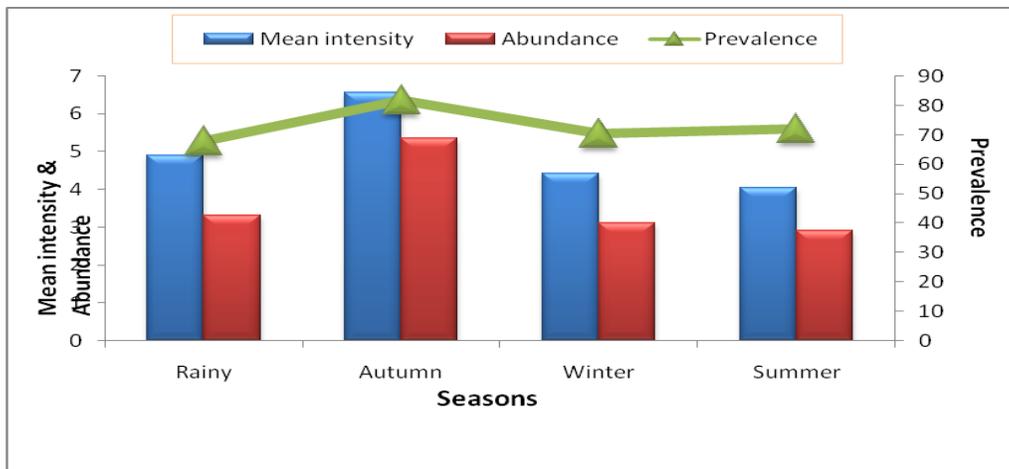
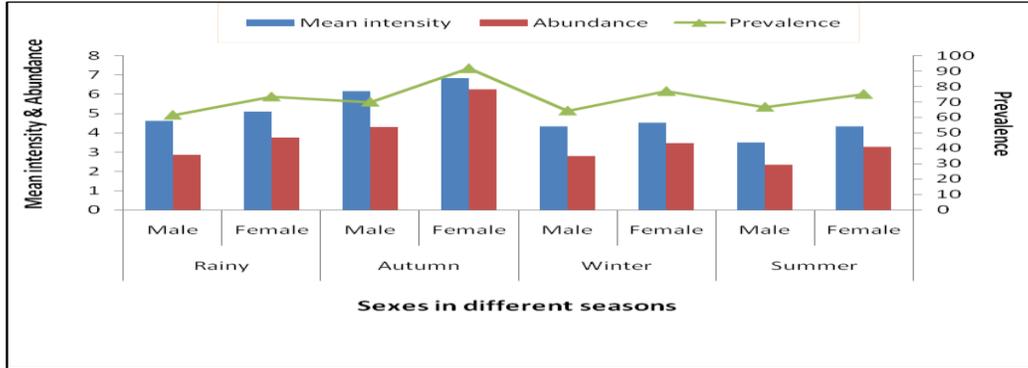


Fig.5 Prevalence, abundance and mean intensity of parasite sexes in different seasons



In this experiment the protozoan parasites (*Trichodina pediculatus*, *Ichthyophthirius multifiliis*, and *Myxobolus* sp.), monogenetic parasites (*Dactylogyrus vastator* and *Gyrodactylus elegans*), crustacean parasite (*Argulus* sp.), nematode parasite (*Camallanus* sp.), trematode parasites (*Eucreadium* sp. and *Genarchopsis* sp.) and acanthocephalan parasite (*Pallisentis* sp.) were identified from fresh water fish *Channa punctatus*. Most of the parasites were found in host skin and lowest levels were observed in host stomach. Protozoan parasites were abundant in this study and crustacean, nematode, acanthocephalan parasites were the lowest in this study. This result is supported by the findings of Miah *et al.*, (2013). The prevalence and parasitic infestation in freshwater fishes have also been by several researchers (Bhure *et al.*, 2016; Bommakanti, 2016; Gupta and Sharma, 2015; Kumari and Perveen, 2017; Bhure and Nanware, 2014; Gupta *et al.*, 2012).

A number of parasitic fish diseases from different water bodies of Bangladesh have been investigated and common protozoan parasites such as *Trichodina*, *Chilodonella*, *Ichthyophthirius*, *Myxobolus* etc. and metazoan parasites such as *Dactylogyrus*, *Gyrodactylus*, *Camallanus*, *Argulus* etc. are infected in most freshwater fishes of Bangladesh (Hoffman, 1967). In this study, the freshwater fish *Channa punctatus* was also infected by protozoan parasites *viz.* *Trichodina*, *Ichthyophthirius* and *Myxobolus* species.

Rahman *et al.*, (2017) reported that two species of ectoparasites and six species of endoparasites were identified from *Channa punctatus* of Belai Beel, Gazipur, Bangladesh. It was also noticed that most of the parasites were found in intestine and those parasites were belonged to five groups *viz.* cestode, trematode, nematode, acanthocephalan and crustaceae of eight species (*Senga* sp., *Clinostomum* sp., *Euclinostomum* sp., *Camallanus* sp., *Pallisentis* sp., *Echinorhynchus* sp., *Argulus* sp., *Larnaea* sp.). It was observed that *Eucreadium dacci*, *Camallanus adamsia*, *Camallanus ophicephali*, *Pallisentis* sp., were located in the intestine and *Genarchopsis* sp. in the stomach of *Channa punctatus*, *Channa marulius*, *Channa striatus*, *Channa gachua* (Bashirullah and Elahi, 1972a, 1972b). The prevalence of *L. bata* and *Dactylogyrus vastator* were found in the skin and gill of host which were also observed as a common parasite of *C. striatus* (Banu *et al.*, 1993). Chandra *et al.*, (2011) noticed that *Genarchopsis dasus* was located in the intestine and stomach of *Channa punctatus*. Alam *et al.*, (2010) observed that *Genarchopsis bangladesensis* was located in intestine of *Channa punctatus*. In this investigation, it was found that nematode (*Camallanus* sp.), acanthocephalan (*Pallisentis* sp.) and digenea (*Eucreadium* sp., *Genarchopsis* sp.) from the intestine of *Channa punctatus* resembling to the findings of Miah *et al.*, (2013) and Bashirullah and Elahi (1972a, 1972b). In this study the prevalence of parasitic infestation was highest in autumn and the lowest in rainy season.

Parasitic abundance in fishes showed that the highest rate in autumn season and lowest in summer season where the fishes were more infested by parasites in winter season (Das, 2003). It was observed that there was monthly variation in the rate of infection and infestation of parasites in fish. November was the most susceptible period of the year when fish parasites are abundant. The minimum value was recorded in the month of July. This could be due to stocking density of fish, water depth, water temperature along with other physicochemical parameters and management practices maintained (Banu and Khan, 2004). Jhingran and Pulling (1985) noted that fishes were susceptible to a wide range of parasites and diseases when under stress from poor environmental condition and inadequate feeding. Chandra and Golder (1987) reported that the unfavourable environmental and ecological conditions caused a variety of fish parasites. This result is in close conformity with those reported above. However, more in-depth research is needed to explore the parasitic infestation of *Channa punctatus*.

In the present study, 102 specimens of *Channa punctatus* were observed for parasitic infections during the period of July 2013 to April 2014. Total 74 fishes (72.55%) were found to be infected. Organ wise distribution, monthly, seasonally, and sex wise fluctuation of prevalence, abundance and mean intensity of parasites were studied. Fish parasites are the great threat in our fish culture system. Many fish species are affected by various parasites every year and as a result, production of fishes decreases significantly in Bangladesh. Some steps should be taken to prevent fish diseases and to protect these important fish species from parasitic infection.

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