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Study on infestations and biodiversity of metazoan parasites in *Channa punctatus* (Bloch), Mymensingh region

Naoshin Farzana[1], Jasmin Naher[2], Md Abu Zafar[2] ✉, Kirtunia Juran Chandra[1], Gias Uddin Ahmed[1]

[1]Department of Aquaculture, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh
[2]Department of Fisheries Technology, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh
[3]Department of Aquaculture, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh

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Correspondence:
Md. Abu Zafar
✉: zafarhstu@gmail.com

ABSTRACT

An investigation was conducted on infestation and reviewed biodiversity of metazoan parasites in *Channa punctatus* of Mymensingh region from July 2013 to June 2014. A total of 235 fish were examined and 9 species of four groups of parasites were recorded. They were (i) *Euclinostomum multicaecum* Tubangui and Masilungan, 1935 (ii) *Euclinostomum heterostomum* (Rudolphi, 1809) (iii) *Genarchopsis goppo* Ozaki, 1925 (iv) *Allocreadium handiai* Pandey, 1937 (v) *Senga ophiocephalina* (Tseng, 1933) (vi) *Porrocaecum* sp. (vii) *Ascaridia* sp. (viii) *Contracaecum* sp. (ix) *Pallisentis ophiocephali* (Thapar, 1930).The maximum (86.67%) prevalence was found in (86.67%) October and minimum (35.00%) in December whereas the maximum mean intensity (10) was observed in June and the minimum (1.42) was recorded from December. The prevalence was observed higher (68.85%) in smaller size of fish and in case of larger fish the prevalence was lower and the value was (53.62%). On the other hand, the mean intensity (5.45) was higher in smaller fish and lower (3.39) in medium sized fish. Both prevalence and mean intensity was found maximum in female fish than male fish. Among the four groups of parasites, infestation of Digenetic trematode is much higher than Nematoda, Cestoda and Acanthocephala. During the study, a list of parasites reported from *Channa punctatus* of Indian sub-continent was prepared. It was found that 38 species of Digenea, 4 species of Cestoda, 26 species of Nematoda and 5 species Acanthocephala were recorded. The Biodiversity of parasites seemed to be declined day by day. The responsible factors for this declination may be environmental degradation, entry of exotic fish and modernization of aquaculture etc.

Introduction

Fishes 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 remains a high risk investment (Kumari and Perveen, 2017). Parasitic diseases, either alone or in conjunction with other environmental stresses, may influence weight or reproduction of the host, alter its population characteristics and affect its economic importance (Rohde, 1993). The fish parasites may cause fish mortality in culture fishes where the entire fish population of pond may kill, resulting in loss of potential food and economic loss to the culturist (Srivastava, 1975). 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 host species for this study belongs to the order channiformes and family channidae which is very abundant and vital fish species in the interior water of Bangladesh. Due to its feeding habit, this fish can serve as intermediate or transport, as well as definitive hosts in the life cycles of metazoan parasites. The parasitic fauna associated with *Channa punctatus* may vary due to excessive use of inorganic fertilizers and pesticides in

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cultivated lands, discharge of industrial effluents, inadequate waste disposal etc. which can indirectly cause changes in the aquatic environment (Rakibuzzaman *et al.*, 2011). 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 (Akhter, 2018).

The decline 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). In recent years, parasites have been recognized as an important component of global biodiversity. Parasite biodiversity can be very important because parasitism plays key roles in ecosystems, regulating the abundance or density of host populations, stabilize food webs and structuring animal communities (Poulin and Morand, 2004). But parasites generally represent a neglected compartment of diversity, because they are small, hidden on or within their hosts, and need more detailed observation and preparation than vertebrates and large invertebrates to be identified with precision. 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 (Akhter, 2018). Few 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, Afroz *et al.*, 1999). Research regarding the distribution, prevalence, parasitic infestation, pathogenic effects and biodiversity of metazoan parasites of *Channa punctatus* in Mymensingh region is very scarce. Considering the above facts, the present study was addressed to investigate the infestation and biodiversity of metazoan parasites in *Channa punctatus* in Mymensingh, Bangladesh.

Materials and Methods

Sampling of host specimens

A total of 235 host fishes of *Channa punctatus* were collected from Mymensingh during the period from July 2013 to June 2014. Live and newly dead fishes were mainly collected from different local fish markets of Mymensingh in Bangladesh such as Kamal Ranjit market, Shesmore, Mechhua bazar and Shankipara. After collection of the host specimen, fish were brought to the Fish Disease Laboratory**,** Department of Aquaculture, Bangladesh Agricultural University, Mymensingh.

Length grouping of host fishes

In the laboratory the total length and weight of the specimen were recorded. The weight of each fish samples were measured by using weighing balance. The total length of individual host was measured from the tip of the snout to the end of the caudal fin with a centimeter scale. The fish samples were classified in three groups on the basis of total length. The lengths of fishes were recorded in to three length groups, below 14 cm (<14 cm), 14-16 cm and Above 16 cm (>16 cm). The sexes of the host specimens were also determined by locating the gonad of the host fish. The numerical data of the collected parasite mentioning their organ wise distribution in the host body was also recorded.

Examination on host fishes for detecting parasites

The host fishes were dissected and opened along the mid-ventral line. The surfaces of the visceral organs, mesenteries and body cavity were carefully examined for encysted larvae or any parasites. Each organ of viscera like- liver, stomach and intestine were separated and kept in different petridishes containing clean water. The individual organs were carefully slit opened separately by longitudinal incision. The slit materials were then observed for presence of any metazoan parasite under microscope. If any parasite present were collected and preserved for future studies.

Fixation and preservation of collected fish parasites

The following methods were followed for fixation and preservation of different four groups of collected parasites, monogenean parasites were excluded on the study. After collection of parasite, the specimen was taken over a slide under a cover slip. Then the hot fixative was added at the edge of the cover slip and allowed to run under it. After that the slides were kept for 30-40 minutes to evaporate and then the digenetic trematode was transferred to a vial containing 70% alcohol for preservation. It also preserved in glycerin alcohol. Live nematodes were placed into Berland's fluid for 1 minute for fixation then it was preserved in 70% alcohol. The cestodes were carefully pressed between two slides for properly flattened and dropped few drops of Alcohol-formalin-acetic acid at the corner of the slide which slowly entered the whole body of parasite and then left for 15-20 minutes. Then the parasites were preserved in fixative for future use. Collected acanthocephalans were left in distilled water for several hours to induce evasion of proboscis. The proboscis of acanthocephalan has a great taxonomic importance. Then the specimens were flattened and fixed with F.A.A (Formaldehyde Alcohol Acetic Acid where the ratio of this composition was used 10%: 50%:5% and mixed with 35% distilled water) for 6 hours and then they preserved in glycerin alcohol.

Identification and classification of parasite

Identification and classification of parasites can be made by following Yamaguti (1958, 1959, 1961, 1963) and Chandra (2008). Infestations were analyzed following the equations of Margolis *et al.* (1982):

1) Prevalence = (No. of host infected/No. of host examined) × 100

2) Mean intensity = Total no. parasite/No. of infected host
3) Abundance = Tot. parasite in host/Tot. host examined

Biodiversity study review

During the study of literature seventy-three parasites are recorded with their species during the period from 1952 to 2014. Among them thirty-eight species of Digenetic trematode, twenty-six species of Nematoda, four species of Cestoda and five species of Acanthocephala were reported from *Channa punctatus* of Indian sub-continent. They were separated in three periods as 1952-1972, 1973-1993 and 1994-2014 to see the diversity pattern of this fish.

Data analysis

Data were analyzed by using two mean t-test) both at 1% ($P \leq 0.01$) and 5% ($P \leq 0.05$) level of significance for the determination different parameters.

Results

Collection and observation of parasite from Channa punctatus

A total of 235 fish were examined, of which 150 fish were infected by four groups of parasites. These were digenetic trematode, cestode, nematode and acanthocephalan. They were collected mostly from stomach and intestine. The list of the collected parasites with their group and. the monthly distribution of the prevalence and intensity of metazoan parasites are given in Table 1 and Table 2, respectively.

Group wise monthly infestation

During the period of investigation four groups of metazoan parasites were found to be infected the host fishes. They were digenetic trematode, Cestode, Nematode and Acanthocephala. The prevalence, mean intensity and abundance of four different groups of fish parasite are showing in Figure 1.

Seasonal infestation

Prevalence, intensity and abundance of parasites with different seasons are shown in Table 3.

Infestation in different sex of host

Infestation due to metazoan parasites in male and female host showed some variation. By applying t-test the infestation of metazoan parasites indicated that there were insignificant differences at 5% level of significance among different sexes of host which is shown on Table 4.

Infestation in different length groups of host

The hosts were infested with metazoan parasites in all length groups are showing insignificant after applying t-test at 5% level of significance in Table 5.

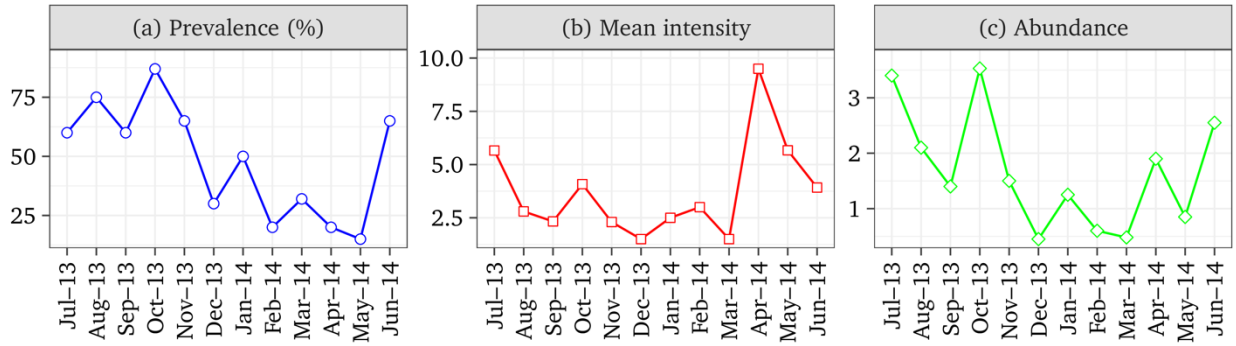
Table 1. List of parasites with their groups collected during the study period

Group	Parasite species
Digenea	*Euclinostomum multicaecum* *Euclinostomum heterostomum* *Genarchopsis goppo* *Allocreadium handiai*
Cestode	*Senga ophiocephalina*
Nematode	*Porrocaecum* sp. *Ascaridia* sp. *Contracaecum* sp.
Acanthocephala	*Pallisentis ophiocephali*

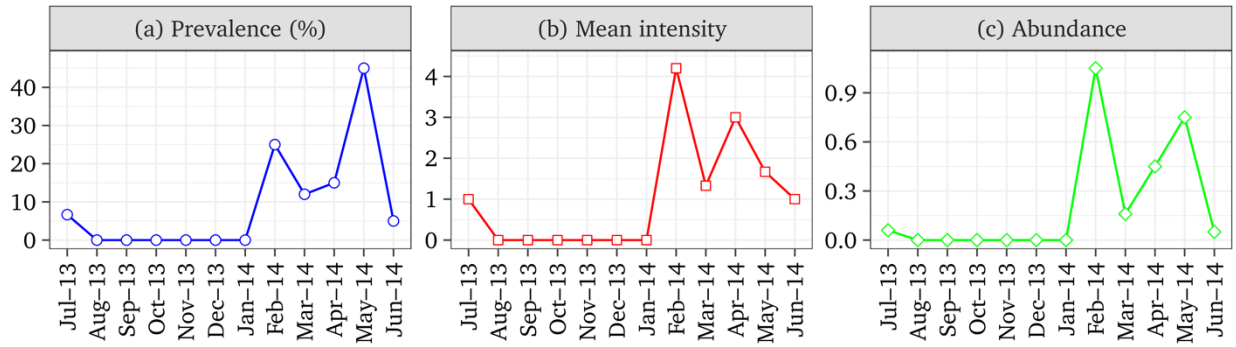
Table 2. Infestation of metazoan parasites in *Channa punctatus* in different months during July 2013 to June 2014

Month	No. of host examined	No. of host infected	No. of worms recovered	Prevalence (%)	Mean Intensity	Abundance
Jul/13	15	10	56	66.67	5.60	3.73
Aug/13	20	17	48	85.00	2.82	2.40
Sep/13	20	12	33	60.00	2.75	1.65
Oct/13	15	13	57	86.67	4.38	3.80
Nov/13	20	13	35	65.00	2.69	1.75
Dec/13	20	07	10	35.00	1.42	0.50
Jan/14	20	10	31	50.00	3.10	1.55
Feb/14	20	11	36	55.00	3.27	1.80
Mar/14	25	17	32	68.00	1.88	1.28
Apr/14	20	09	56	45.00	6.22	2.80
May/14	20	15	44	75.00	2.93	2.20
Jun/14	20	16	160	80.00	10.00	8.00

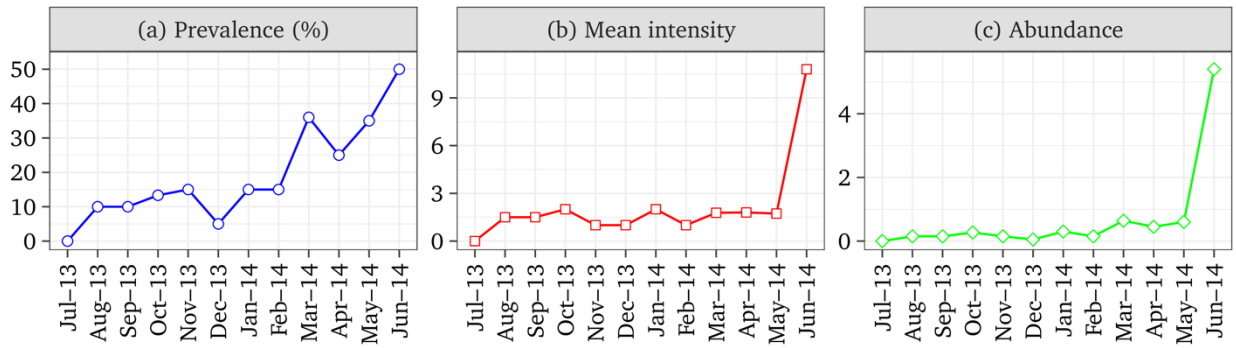
**mean at 1% level of significant ($p<0.01$)



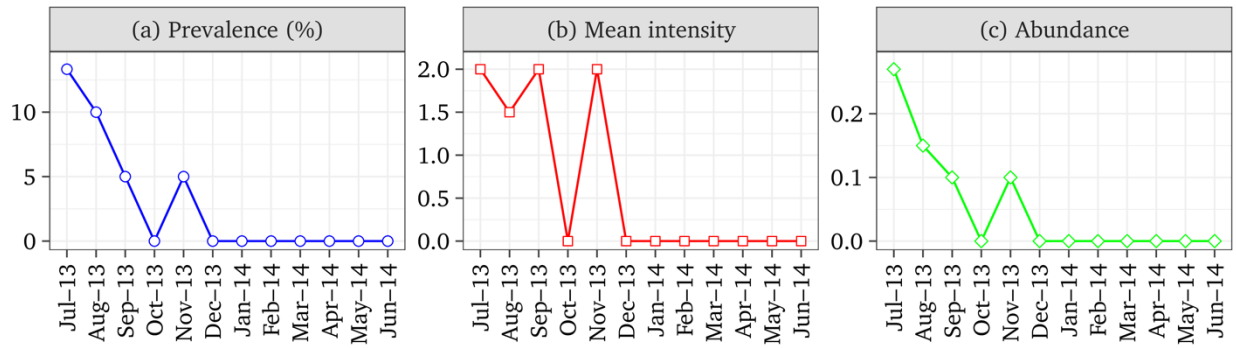
(a) Digenean fish parasites



(b) Cestodes fish parasites



(c) Nematodes fish parasites



(d) Acanthocephalan fish parasites

Fig. 1 Prevalence, abundance and mean intensity of fish parasites in the study sites

Table 3. Seasonal infestation of metazoan parasites in *Channa punctatus*

Season	No of host		No. of parasite recovered	Prevalence (%)	Mean Intensity	Abundance
	Examined	Infected				
Summer	65	41	132	63.08	3.22	2.03
Rainy	55	43	264	78.18	6.14	4.80
Autumn	55	38	125	69.09	3.29	2.27
Winter	60	28	77	46.67	2.75	1.28

Table 4. The prevalence, mean intensity and abundance of metazoan parasites in different sexes of host fish

Sexes	No of host		No. of parasite recovered	Prevalence (%)	Mean Intensity	Abundance	Level of Significance
	Examined	Infected					
Male	129	80	283	62.02	3.54	2.19	NS
Female	106	70	315	66.04	4.50	2.97	NS

* Infestation of metazoan parasites was not significant at 5% level among different sexes of host.

Table 5. The prevalence, mean intensity and abundance in different size groups of host

Size group (cm)	No of host		No. of parasite recovered	Prevalence (%)	Mean Intensity	Abundance	Level of Significance
	Examined	Infected					
<14	61	42	229	68.85	5.45	3.75	NS
14-16	105	71	241	67.62	3.39	2.29	NS
>16	69	37	128	53.62	3.46	1.86	NS

*Infestation in different length groups of host were showing insignificant at 5% level.

Table 6. Parasitic infestation of *Channa punctatus* during the period 1952-1972

Name of parasites	References	Name of parasites	References
Digenea		**Nematode**	
Azygiaa siatica	Simha and Pershad (1964)	*Procamallanus spiculogubernaculus*	Agarwal (1958)
Transversotrema patialense	Soparker (1924)	*Neocamallanus ophiocephali*	Rehana and Bilqees (1972)
Genarchopsis punctati	Agrawal (1966)	*Camallanus anabantis*	Pearse (1933)
Derogenes hyderabadensis	Jaiswal (1967)	*Camallanus atridentus*	Khera (1956)
Diplostomulum cerebralis	Chakrabarti (1968)	*Camallanus fernandoi*	Yeh (1960)
Brahmputrotrema batesia	Dwivedi (1970)	*Camallanus kulasirii*	Yeh (1960)
Clinostomum giganticum	Agarwal (1959)	*Onchocamallanus globoconchus*	Ali (1960)
Metaclinostomum srivastavai	Pandey and Baugh (1970)	*procamallanus planoretus*	Kulkarni (1935)
Tetracotyle szidati	Chakrabarti and Baugh (1970)	*Paragendria vittatusi*	Agrawal (1965)
Neascus channi	Pandey (1971)		
Eucreadium daccai	Bashirullah and Elahi (1972b)	**Acanthocephala**	
Genarchopsis ozakii	Gupta (1955)	*Pallisentis allahabadi*	Agarwal (1958)
Neopecoelina saharanpuriensis	Bashirullah and Elahi (1972a)	*Pallisentis nandai*	Sarkar (1953)
Genarchopsis bangladensis	Bashirullah and Elahi (1972a)	*Pallisentis ophiocephali*	Thapar (1930)

Table 7. Parasitic infestation of *Channa punctatus* during the period 1973-1993

Name of parasites	References
Digenea	
Genarchopsis goppo	Ozaki (1925)
Asymphylodora indica	Srivastava (1936)
Tetracotyle singhi	Pandey (1973b)
Clinistomum giganticum	Agarwal (1959)
Phylodistomum spatulaeforme	Odhner (1902)
Jamuartrema indica	Lal (1978)
Isoparorchis hypselobagri	Billet (1898)
Hemipera ovucuadata	Nicoll (1912)
Orientocreadium batrachoides	Tubangui (1931)
Tetracotyle pandei	Agrawal and khan (1982)
Tetracotyle srivastavi	Agrawal and khan (1982)
Tetracotyle ramalingi	Agrawal and khan (1982)
Eucredium kulpaharensis	Agarwal and Agrawal,1987)
Allocreadium tigarai	Bhadauria and Dandotia (1987)
Euclinostomum heterostomum	Rud (1809)
Clinostomum complanatum	Rudolphi (1819)
Allocreadium bengalensis	Banerjee and Chandra (1992)
Phyllodistomum chauhani	Motwani and Srivastava (1961)
Genarchopsis dasus	Gupta (1951)
Allocreadium handiai	Pandey (1937)
Cestode	
Senga visakhapatramensis	Devi and Rao (1973)
Senga punctati	Gupta and sinha (1980)
Senga chauhani	Hasnain (1992)
Nematode	
Camallanus adamsia	Bashirullah (1973)
Camallanus intestinalus	Bashirullah (1974)
Camallanus gomtii	Gupta and Verma (1978)
Paracamallanus sweeti	Moorthy (1937)
Neocamallanus bareilliensis	SharmaandSharma (1980)
Haplodidentus indicus	Naidu and Thakare (1981)
Spinicauda spinicauda	Olfers and Rud (1819)
Zeylanema pearsei	Yeh (1960)
Zeylanema fernandoi	Yeh (1960)
Zeylanema kulasirii	Yeh (1960)
Zeylanema jullundurense	Yeh (1960)
Hysterothylacium kiranii	Rajyalakshmi (1993)
Hysterothylacium longicaecum	Rajyalakshmi Rao and Koka (1993)
Camallanus sweeti	Moorthy (1937)
Onchocamallanus globoconchus	Ali (1960)
Procamallanus	Kulkarni (1935)
Acanthocephala	
Pallisentis nagpurensis	Bhalerao (1931)
Sphaerechinorhynchus sp.	
Pallisentis ophiocephali	Thapar (1930)

Table 8. Parasitic infestation of *Channa punctatus* during the period 1994-2014

Name of parasites	References
Digenea	
Phyllodistomum chauhani	Motwani and srivastava (1961)
Genarchopsis dasus	Gupta (1951)
Eucreadium dacci	Bashirullah and Elahi (1972)
Eucylometra sp.	
Neodiplostomum sp.	
Genarchopsis goppo	Ozaki (1925)
Eucylinostomum multicaecum	Tubangui and Masilungan (1935)
Euclinostomum heterostomum	Rudolphi (1809)
Allocreadium handiai	Pandey (1937)
Masenia jaunpurensis	Maurya and singh (2004)
Bolbophorus damnificus	Yost, Pote, Wise, Dorr and Rich-Ardson (2009)
Cestode	
Senga ophiocephalina	Tseng (1933)
Nematode	
Neocamallanus sp.	
Porrocaecum sp.	
Ascaridia sp.	
Contracaecum sp.	
Acanthocephala	
Pallisentis nandai	Sarkar (1953)
Pallisentis nagpurensis	Bhalerao (1931)
Pallisentis ophiocephali	Thapar (1930)

Biodiversity of parasites

During the period of investigation, literature study was made during the period from 1952 to 2014 and recording different group of parasite from Indian sub-continent. The period from 1952 to 2014 as divided into three different period of time and the number of parasites collected during the period are presented in Tables 6, 7 and 8.

Discussion

In the present experiment, digenean parasite (*Euclinostomum multicaecum*, *E. heterostomum*, *Genarchopsis goppo*, *Allocreadium handiai*), cestode parasite (*Senga ophiocephalina*), nematode (*Porrocaecum* sp., *Ascaridia* sp., *Contracaecum* sp.) and acanthocephalan (*Pallisentis ophiocephali*) were found from fresh water fish *Channa punctatus* during the study period. Most of them were collected from intestine and stomach. Digenean parasites were abundant in this study and nematode and cestodes parasites were the lowest in this study which is more or less similar to the findings of Khalil (2014).

Monthly variation of infestation was recorded in the present study. The highest prevalence (86.67%) was observed in October and almost similar prevalence was found in August and June whereas the lowest prevalence (35%) was observed in December. Both prevalence and mean intensity were the minimum in December. The highest and lowest mean intensity were found 10 ± 12.806 and 1.42 ± 0.494 in June and December, respectively. Chandra (1985) mentioned that the highest intensity of *Pallisentis ophiocephali* in March and lowest in January. Similarly, Sinha *et al*. (1988) found the highest intensity from April to August and lowest in December and January. It might be due to the environmental factors like temperature which has greater influence on reproduction of parasites. Seasonal variation in infestation was also recorded in the present study. Both prevalence and intensity were higher in rainy season and lower in winter. Similarly Chandra *et al.* (2011) observed the highest prevalence (83.30%) was in rainy season and the lowest (45.50%) in autumn season of *Genarchopsis dasus*. It might be the fact that different groups of parasite may show maximum infestation in different time of the year. Parasitic infestation was also observed regarding the sex of the host fishes. In the present study the infestation was found higher in female fish than the males.

The female fish may be more susceptible to parasitic infestation. Alam *et al*. (2010) stated that the prevalence and intensity were higher in female which was similar to the findings of present study and Aloo *et al.* (2004) stated that the main reason for the differences in parasitic load with sex is physiological. The similar findings were also noticed by Firdaus (1988). During the investigation the intensity of infestation of *Channa punctatus* were higher in small length class group. Chandra (1984) stated that digenetic trematode *Euclinostomum multicaecum* infested the intermediate length group (in between 14-16 cm) of *Channa punctatus* more than that of smaller and larger length group of fishes. Dogiel (1964) reported that the prevalence and intensity of infestations is increased with the age of fish hosts. In the present investigation, parasitic biodiversity has been carried out from 1952 to 2014, in order to know their presence in nature. Available evidence strongly indicates that many parasite species are endangered and that their loss can substantially affect the normal functioning of ecosystems, , also represent disproportionate losses of evolutionary potential, and potentially affect the long-term persistence of their hosts (Gompper and Williams, 1998; Dunne and Williams, 2009). Parasite conservation can be a very challenging endeavor. Many parasite species are believed to be threatened or already extinct. One of the main steps toward conservation of biodiversity requires systematic inventories (Anon, 2000), and parasites have only recently been included in this evaluation of biodiversity (Poulin and Morand, 2004).

Conclusion

The present investigation reveals a distinction of health condition between infected and non-infected fish. The infestation was found in different seasons, size and sex groups of host fishes. The digenetic trematode and nematode were the most abundant among other groups. Total length, body weight, gonad weight were lost due to parasitic action in infested fish. Moreover, seasonal variation and parasitic diversity were also studied but the research work is not sufficient enough for the clear understanding of the biodiversity of metazoan parasites of *Channa punctatus*. Further research work should be continued to clarify the biodiversity of fish parasites.

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