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Prevalence and Intensity of Helminth Parasites in Macrognathus Aculeatus (Lecepede, 1803)

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ABSTRACT

The current study was carried out to investigate the prevalence and intensity of helminth parasites in Macrognathus aculeatus procured from Swarighat and Keraniganj fish ghat of Dhaka. A total specimen of 35 Macrognathus aculeatus were autopsied during July 2019 to March 2020. Total 35 fishes were examined, of which 20 were infected with 68 parasites. The overall prevalence and intensity were found as 57.14% and 3.4±0.11 respectively. The prevalence of infestation in male and female were 57.9% and 56.25% respectively. Intensity was higher (4±0.24) in male than (2.67±0.184) in female. Macrognathus aculeatus were infected by 2 trematode (Acanthocolpus indicus and Octangioides sp.) and Octangioides sp. identified as new record of helminth sp., which is commonly a parasite found in reptiles. Regarding infestation in relation to three different length groups of host fish, indicating higher prevalence and intensity in lower length group (6-10.5 cm). Infection was negative and moderately correlated (r= -0.241) with length and not statistically significant. Young, aged male displayed high infection rate than female. Higher prevalence and intensity of infestation observed in intermediate weight group (100-200gm), here infection was moderate and negatively correlated (r= -0.489) with weight and statistically significant. Among various visceral organs, intestine possessed highest parasite burden. Metabronema magnum showed 100% prevalence in intestine. Male fish had the highest prevalence in rainy season and lowest in summer while, female had the highest in winter and low in rainy season.

Introduction

Bangladesh has a vast potential for the development of marine, estuarine and freshwater fishes. Bangladesh has large number of rivers, beels, haors, lakes, ponds etc. At present there are 260 freshwater fish species, 12 species of exotic fish, 475 species of marine fish and 60 species of prawn and shrimp available in these waters. Fisheries sector contributes to GDP 5.24%, animal protein supply 63% and foreign exchange earning 4.76% for the nation (Rahman, [1]). Fishes are the main source of protein in the riverine country like Bangladesh. They supply an appreciable part of human nutrition and also play a significant role in the economy of Bangladesh. Besides, all dietary essentials, amino acids are present in fish flesh and about 85-95% of fish protein is digestible (Nilson, [2]). Apart from being the source of essential nutrients, fisheries sector plays a significant role in the economic development of Bangladesh and contributed about 3.57% to National GDP during 2017-2018 fiscal years. In addition, exporting of fish and fishery products contributed about 1.50% of the total export earnings in Bangladesh during 2017-2018 fiscal years. Prime source of protein in our country is fish. But fish source of protein is generally invaded by parasites, causing various diseases to fish, which enhances considerable economic impairment in the form of mortality, stunted

growth, and poor nutrient quality of fish flesh. A substantial part of the fish food is consumed by parasite (Zaman and Khanum [3]). The weight of fish may increase but the actual weight of the fish itself decreases (Srivastava, [4]). For proper progress of our body, it requires 50-60 gm of animal protein per day. But in Bangladesh we get only 6 gm per day. The per capita consumption of protein products is beef 0.4 gm, mutton 1.4gm, poultry 3.0 gm and eggs 1.2 gm. But the per capita consumption of fish has been estimated at 21 gm per day (Nuruzzaman, et al. [5-7]).

Parasites possess certain status in the animal kingdom because of their inconceivable acclimatization and impairing activities towards host. Fish parasitology has become a swiftly manifesting ground of aquatic science due to the progressive magnitude of aquaculture, concerns on filth effects on fish wellness and a generally growing interest in environmental biology Parasitic life autonomously evolved nearly each phylum from Protestant phyla to Chordates along with plant group so therefore their mode of life is highly fruitful (Schmidt, et al. [8]). In Bangladesh, scientists worked mainly on the taxonomic aspects of the fish helminthes of Bangladesh. Akhtar, et al. [4,6,9] have worked on the distribution of some aspects of biology of some metazoan parasites of fresh water and marine fishes of Bangladesh. In Bangladesh 290 parasite species till now been filed from marine and freshwater fishes. The fish parasites have also been signified as zoonotic and biological presumption in prospective of human health (Chaia, [10]). Dibothriocephalus latus and Gnathostoma spinigerum have zoonotic importance which was recovered from fishes. The ubiquitous fish fauna constitutes 31,400 species where half (14,970 species) dwelling in marine waters. Marine ecosystems possess long stability so that variety of fish parasite within host is supreme in freshwater.

Macrognathus aculeatus, commonly known as Tara baim and occupies in rivers, canals, ditches and inundated grounds. The fish is highly nutritious and are consumed by commoners. But heavy infestation of parasites may lead to the decreased production with decreased food value. Very few studies (Anonymous; Khanum et al. [11-13]) have explored the parasitic infestation of Macrognathus aculeatus and recent studies are scarce. The aim of the study was to investigate the prevalence and intensity of helminth parasites in Macrognathus aculeatus to understand the factors for high parasite burden causing decreased food value. Research and parasitological investigations in fishes accomplished in Bangladesh and are reviewed via literature study. But majority of fishes is heavily infected by parasites which decreases the food value, nutritional amounts and causes mortality.

Materials and Methods

Sampling Area

In the present study, the fishes were collected from different local fish ghat of Dhaka city, such as Swarighat and Keraniganj fish ghat of Dhaka city. The collection was held on weekly basis at a regular interval from July 2019-March 2020. Sampling Technique: A total of 35 Macrognathus aculeatus were examined. After the collection of the host specimen, these were brought to the Parasitology Laboratory, Department of Zoology, University of Dhaka. Each fish was measured, and sex of fishes were recorded properly. The fishes were divided into 3 groups according to their length (6-10.5 cm, 11-15.5 cm ,16-20.5 cm). The fishes were divided into 4 groups according to their weight (50-100 gm,101-151 gm, 152-202 gm, 203-253 gm). The numerical data of the collected parasites mentioning their organal distribution in the host body and food items shared in the host stomach were recorded. The specimens were kept temporarily in a freezer for further investigation.

Collection of Parasites

To collect the endoparasites, the surface of the visceral organs, mesentaries and body cavity were examined carefully i.e., stomach, intestine, rectum, liver etc. was separated and kept in Sodium-bicarbonate Solution (0.75% NaHCO3 Solution). The stomach, intestine and rectum were opened by an incision. To dislodge the parasite, the organs were scrapped by the scalpel. Livers and Kidneys were shredded with forceps to isolate the parasite. Fixation and preservation of parasites: Collected parasites i.e., the Cestode, Trematode, Nematode and Pentastomida were fixed in their respective methods accordingly. Fixation of parasites were done by the following methods:

Trematodes

Trematodes were chiefly by Acetic Formalin Alcohol (A.F.A.). Before fixation all groups of parasites must be sinked in Lactofenol for clearance image. The fixation of the compressed worms was carried out for several minutes for fixation. Then the trematodes were transferred in 70% ethyl alcohol in a vial for prolonged preservation and the vials were numbered and dated finally.

Nematodes

Nematodes were fixed mainly by hot glacial acetic acid. Boiled water poured in nematode parasites containing petridish. Therefore, parasites become relaxed and straightened. After 10 minutes the parasites were transferred to 70% ethyl alcohol solution in a vial.

Parasites Identification

Parasites were identified by using a compound microscope following the description and figures of Yamaguti (1958, 1959, 1961, 1963), Dogiel (1964) and Srivastave (1936) [14-18].

Results and Discussion

In the present investigation and research work provides useful information on the variety of endoparasites in Macrognathus aculeatus. A total of 4 species of parasites were recovered, two

trematode and two nematodes. The prevalence and intensities of infection were reported in the study to measure their infestation rate. Different species variation of helminths was observed in the examined fish samples. The prevalence was highest for Acanthocolpus indicus (34.29%) and lowest in Metaquimperia callichroi (2.85%). Highest intensity was recorded in Acanthocolpus indicus (3.91±1.019) and lowest in Metabronema magnum (2±1.414) (Table 1). The present parasitic fauna was different than previous studies (Khanum, et al. [13]) where five and six species of helminth parasites were detected. The difference in the environmental factors due to continuous climate change over time may have been responsible for the discrepancies between the findings. Overall Prevalence and Intensity according to sex of fish: Total 35 Macrognathus aculeatus fishes were examined, of which 20 were infected with 68 parasites. The overall prevalence of infestation was 57.14%. The prevalence of infestation in male and female hosts were 57.9% and 56.25% respectively. Intensity was higher (4±0.24) in male than (2.67±0.184) in female (Figure 1).

Table 1: Prevalence and intensity of each species of helminths in Macrognathus aculeatus.

	Parasite	Total host	Infected Host	Prevalence (%)	Number of Individual	Intensity±SD
Trematode	Acanthocolpus indicus	35	12	34.29	47	3.91±1.019
	Octangioides sp	35	5	14.29	14	2.8±0.96
Nematode	Metabronema magnum	35	2	5.71	4	2±1.414
	Metaquimperia callichroi	35	1	2.85	3	3

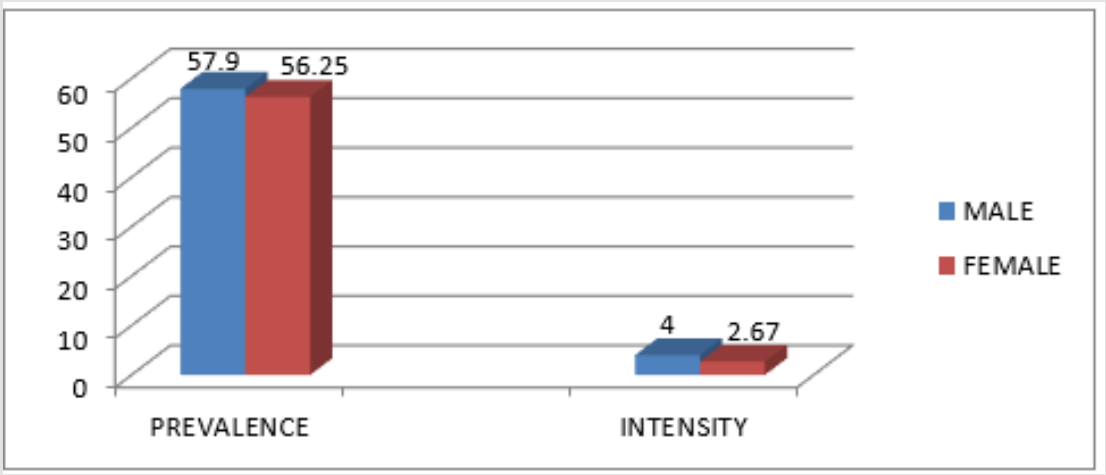

Figure 1: Graphical representation of Prevalence and Intensity according to sex of M. aculeatus.

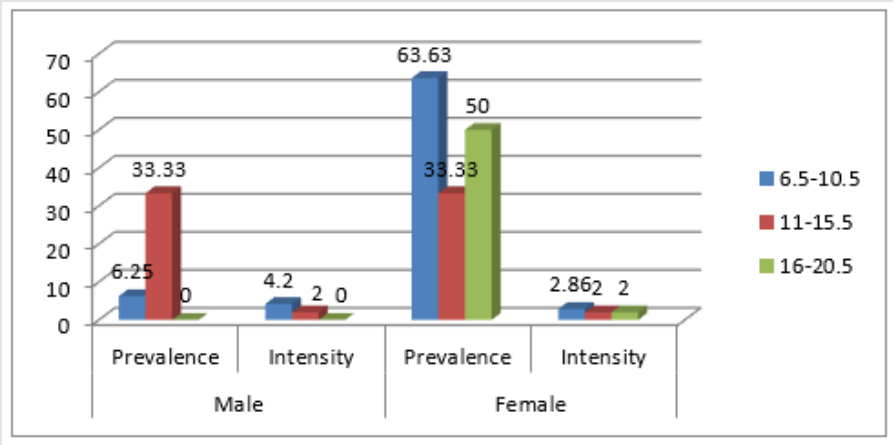

Figure 2: Overall and sex-wise prevalence and intensity of parasite in different length groups of M. aculeatus.

Prevalence and Intensity of different Helminth Parasites in relation to Length Groups of Macrognathus Aculeatus

Prevalence of infestation was highest (62.96%) in 6-10.5 cm length group and lowest (33.33%) in 11-15.5 cm length group. The prevalence was 50% in 16-20.5 cm length group (Figure 2). Intensity of infestation was highest (3.65±.0143) in 6-10.5 cm length group, (2±0.5) in 11-15.5 cm and (2±0.7) in 16-20.5 cm length group. The value of r revealed that there were no significant association between length of the fish and parasite infestation Male fish had the highest prevalence in rainy season and lowest in summer while, female had the highest in summer and low in rainy season. (Table 2) Khanum et al. (1997) [12] reported heavy infestations in the largest size. length groups which is contradictory to the current findings. This variability may be due to the difference in feeding habit in the changing climatic context in recent years which may have affected the parasite burden in smaller length groups. Besides, Dogiel (1964) [18] reported that infective larvae could penetrate the tissue of the younger host more easily than those of others. Dobson (1962) [19] also indicated that younger animals were highly susceptible to non-specific infections. Thus, younger and smaller length fishes may have been harbouring more parasites than the other reported groups.

Table 2: P and r value of M. aculeatus.

Correlation among	Value of (r)	Value of (P)	Significance	Extent of correlation
Infestation in Length	-0.241	0.305	Not Significant	Negatively and moderately correlated

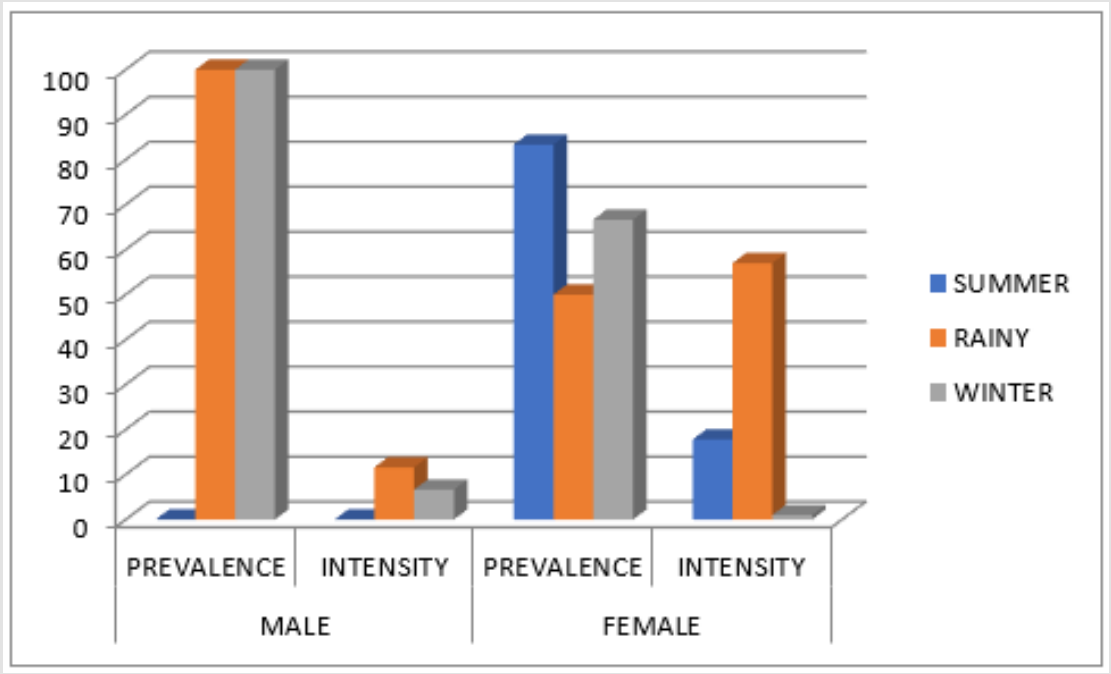

Figure 3: Graphical representation of sex wise seasonal variation of prevalence and intensity in Macrognathus aculeatus.

Prevalence and Intensity of Parasite in Relation to Length Groups in Male and Female

In male, highest prevalence is (33.33%) in the 11-15.5 cm length group and lowest (0%) in 16-20.5 cm length group. The intensity was highest (4.2±0.274) in 6.5-10.5 cm length group and lowest (0%) in 16-20.5 cm length groups. In female, highest prevalence was (63.63%) in the 6.5-10.5 cm length group and lowest (33.33%) in 11-15.5 cm length group. The intensity was highest (2.86±0.26%) in 6.5-10.5 cm length group and lowest (2) in 11-15.5 cm and 16-20.5 cm length groups (Figure 2). Similar finding was observed by Pathak, et al. [20,21].

Prevalence and Intensity of Different Helminth Parasites in Relation to Different Weight Groups of Macrognathus Aculeatus

Prevalence of infestation was the highest (66.66%) in 101-151 gm weight group and lowest (50%) in 203-253 gm weight group. The prevalence was 60% and 55% in 152-202 gm and 50-100 gm weight group. Intensity of infestation was highest (4.54±0.22) in 50-100 gm weight groups. Here, Coefficient of correlation (r) is -0.489. The value of P is 0.028 which is less than degree of freedom, α (0.05). Where P≤ 0.05, the correlation is significant statistically (Table 3). Infestation is negatively and moderately correlated with weight of host. Negative correlation implies that if weight of fish increase, the infestation rate will decrease. This is an important observation

since previous studies on Macrognathus aculeatus didn't report any association between weight of the fishes and parasite burden. The result could imply that nutrient deprived fishes are more prone to infection than well-fed heavy weight fishes.

Table 3: Prevalence and Intensity of helminth parasites in 4 weight groups of the host M. aculeatus.

Weight groups(gm)	No. of fish examined	No. of fish infected	Prevalence (%)	Total no. of worm collected	Intensity ± SD
50-100	20	11	55	50	4.54±0.22
101-151	3	2	66.66	5	2.5±1.06
152-202	10	6	60	11	1.8±0.125
203-253	2	1	50	2	2±0

Prevalence and Intensity of Parasite in Relation to Weight Groups in Male and Female

In male, highest prevalence was 60% in the 50-100 gm weight group and lowest was 0% in 101-151 gm and 203-253 gm weight group. The intensity was highest (4.44±0.27) in 50-100 gm weight group and lowest (0) in 101-151 and 203-253 gm weight groups. In female, highest prevalence is 66.66% in the 101-151 gm and 152-202 gm weight group and lowest (40%) in 50-100 gm weight group. The intensity was highest (5) in 50-100 gm weight group and lowest (1.75±0.24) in 152-202 gm weight groups (Table 4). Therefore, Coefficient of correlation (r) is -0.489. The value of P is 0.028 which is less than degree of freedom, α (0.05). Where P≤ 0.05, the correlation is significant statistically. Infestation is negatively and moderately correlated with weight of host. Negative correlation implies that if weight of fish increase, the infestation rate will decrease (Table 5).

Table 4: Prevalence and Intensity of parasite separately in male and female in different weight groups of the host Macrognathus aculeatus.

	Male					Female				
Weight group (gm)	No. of fish examined	No. of fish infected	Prevalence (%)	No. of worms collected	Intensity ±SD	No. of fish examined	No. of fish infected	Prevalence (%)	No. of worms collected	Intensity ±SD
50-100	15	9	60	40	4.44±0.27	5	2	40	10	5
101-151	0	0	0	0	0	3	2	66.66	5	2.5±1.06
152-202	4	2	50	4	2	6	4	66.66	7	1.75±0.24
203-253	0	0	0	0	0	2	1	50	2	2

Table 5: P and r value of M. aculeatus.

Correlation among	Value of (r)	Value of (P)	Significance	Extent of correlation
Infestation in Weight	-0.489	0.028	Significant	Negatively and moderately correlated

Organal Distribution and Percentage of Helminth Parasites in Macrognathus Aculeatus

Investigation of organal distribution of helminth parasites including gills, alimentary tract (Oesophagus, stomach, intestine), liver, kidney, swim bladder was examined. Prevalence and Intensity were highest (42.86%) and (3.6±0.172) in intestine. Lowest Prevalence was in liver (2.85%) and lowest Intensity (1.5±0.35) was in rectum. Intestine is a preferred site by parasites as it provides the simplest form of nutrients which can be absorbed directly. Hence the finding is similar to a previous study (Khanum et al. 2011; Khanum and Parveen 1997) [12,13] in which intestine was the most affected organ followed by stomach and body cavity (Table 6). In the present observation, nematode parasite Metabronema magnum had the highest prevalence 100% in the intestine and found no other places in the alimentary canal. Among Trematode, Acanthocolpus indicus had highest prevalence (85.11%) in intestine and lowest (4.25%) in rectum. The other trematode Octangioides sp. had highest prevalence (64.29%) in intestine and lowest (7.14%) in rectum. The other nematode Metaquimperia callichroi had highest prevalence (66.66%) in liver and lowest (33.33%) in intestine (Table 7).

Monthly Prevalence and Intensity of Helminth Parasites in M. Aculeatus

In M. aculeatus, high prevalence rate was seen in February, high intensity rate seen in the month of October (Table 8). The seasons of Bangladesh are divided into 3 main seasons such as Summer (July, August, September), Rainy season (October, November, December) and Winter (January, February, March). In the male host, prevalence

was highest (80%) in rainy season and intensity (3.625±0.305), prevalence 60% in winter and intensity (5±1.2) and 0% in summer. In female host, prevalence was highest (71.42%) and intensity (2.4±0.389) in winter, prevalence 57.14% and intensity (3±0.35) in summer and 0% in rainy season (Figure 3). Previous studies Khanum et al. (1997) [12] reported on the Organal distribution and seasonal prevalence of endoparasites in Macrognathus aculeatus and Mastacembelus armatus. The prevalence of infection was highest during the rainy season in Macrognathus aculeatus, while in Mastacembelus armatus the prevalence was highest in the winter. In both the species, heavy infestations were recorded in the largest length groups (Table 8).

Table 6: Prevalence and intensity of helminth parasites in different organs of Macrognathus aculeatus.

Organ	Total no. of fish	Examined no. of fish	Prevalence (%)	Total collected worms	Intensity±SD
Liver	35	1	2.85	2	2
Stomach	35	3	8.57	9	3±0.57
Intestine	35	15	42.86	54	3.6±0.172
Rectum	35	2	5.71	3	1.5±0.35

Table 7: Organal distribution and percentage of helminth parasite species in Macrognathus aculeatus.

Group	Name of the parasite	Total no. of worms collected	Liver		Stomach		Intestine		Rectum	
			No.	%	No.	%	No.	%	No.	%
Trematode	Acanthocolpus indicus	47	0	0	5	10.63	40	85.11	2	4.25
	Octangioides sp	14	0	0	4	28.53	9	4.29	1	7.14
Cestode	Metabronema magnum	4	0	0	0	0	4	100	0	0
Nematode	Metaquimperia callichroi	3	2	66.66	0	0	1	33.33	0	0

Table 8: Monthly Prevalence and Intensity of helminth parasites in M. aculeatus.

Month	Total no. of host	Examined no. of host	Prevalence (%)	No. of worms	Intensity± SD
July	3	2	66.66	7	3.5±0.02
August	2	1	50	2	2
September	6	1	16.66	3	3
October	5	3	60	16	5.33±0.5
November	4	2	50	6	3±0.9
December	3	2	66.66	7	3.5±0.01
January	4	3	75	11	3.66±0.13
February	4	4	100	15	3.75±0.24
March	4	1	25	1	1

The current investigation shows in Macrognathus aculeatus that infection rate was higher by trematods and lower by nematode. Male and female hosts were almost equally infected by parasites of different types. Among 3 different length groups of host high level of infection rate showed in lower length level. Infection rate was not statistically significantly correlated with length data. Among 4 various weight groups of host infection rate was statistically significantly correlated with weight data. Lowest infestation rate was seen in much heavier fishes. Parasites occupied in highest rate in intestine than any other organs in host body. In male host, prevalence rate was higher in rainy season and on the other hand prevalence rate is lower in winter for female fish host. Khanum et al. (2011) [13] reported that the prevalence of infection was highest during the rainy season in Macrognathus aculeatus which is observed here in male fishes. In the current study, females were less prone to infection during breeding seasons. Past studies reported the overall prevalence of parasites rather than sex-wise seasonal variation hence the difference may have not been observed previously (Eduardo, et al. [22]).

Intension of helminth parasite is to shatter the internal various parts of host like digestive tract having that meal and possess

trouble by migrating to internal systems and fluid channels and due to scarcity of nutrition, lesion, ulcer and results mortality due to excessive transit. Nematodes larvae move to fish tissue and hampers destruction of cells and haemorrhage happens (Khanum, et al. [23,24]). Multiple factors such as nutrition, location, temperature, salinity, anatomical movement dominating the fish growth (Weatherley and Gill, 1987. Ahmed, et al. [25])and physique arrangement may alter owing to these factors. Around 56 critically endangered freshwater species are available and literatures available on biochemical and nutritional knowledge of fish, shrimp and prawn species (Rubbi, et al. [1,9,26]; Chakrabarty et al., 2003). Several alteration of surroundings may have true consequences production of fish (Brander, and Mohn, 2004). According to work done by Khanum, et al. [27], this research work supports that there is high prevalence rate in rainy season but in the present work larger fishes were more susceptible to infection by helminthes in winter and summer as well. The cestode Marsipometra confusa found from my research work which also supports with this work.

Conclusion

The various fishery development programs depend to certain extent on the successful fish parasitological research, as the improvement of fish yield can mainly be achieved from healthy fish stock. As hosts fishes play an important role for parasites. Among the animals' fishes are the most important host for maintenance of mainly helminthes. Most of the fishes have parasites. They not only serve as the host of different parasites but also serve as carrier of many larval parasitic forms that mature and cause serious diseases in many vertebrates including man. The parasites of fish's cause decrease in growth rate, weight loss and emaciation, affect yield of fish products, spread human and animal diseases, postpone sexual maturity of fish and mortalities of fish (Chandra 2006) [28-33]. The present study was conducted to identify different helminth parasitic infestation in relation to sex, length, weight, organs, months, and seasons for Macrognathus aculeatus. 4 parasites species (2 trematode Acanthocolpus indicus and Octangioides sp and 2 nematode Metabronema magnum and Metaquimperia callichroi) was observed in the examined fishes. A new record of helminth named Octangioides sp; commonly a parasite found in reptiles was identified showing zoonotic transmission in fish from reptiles. Further studies are necessary to detect the histopathological impact of parasite burden which may in turn affect the nutrient value and productivity of Macrognathus aculeatus.

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