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SEASONAL VARIATION AND EFFECTS OF HELMINTH INFESTATION ON *Clariasbatrachus* (LINNEAUS, 1957) FROM *HAOR* BASIN OF SYLHET REGION IN BANGLADESH

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Abstract

The present experiment was aimed to investigate the infestation of helminth parasites and their effects on different size groups of walking catfish, *Clarias batrachus* from *haor* basin of Sylhet region, Bangladesh. A total of 100 *C. batrachus* fish were collected from different natural water bodies like beels, *haor* and adjacent fish markets of Sylhet namely *Lal Bazar*, *Major Tilla* and *Kazir Bazar*. The collected *C. batrachus* were divided into three length groups namely small (<13cm), medium (13-18 cm) and larger (>18cm). Among thecollected 100 individuals of *C. batrachus*, 76 were found to be infested with 1855parasites individuals of seven different endohelminth parasitic species i.e. *Orientocreadium batrachoides*, *Bovienia serialis*, *Lytocestusindicus*, *Lytocestus birmanicus*, *Djombangia penetrans*, *Pseudocaryophyllaeus indica* and *Paracamallanusspiculo gobernaculus* all of which are belonging to three different groups (i.e. trematode, cestode and nematode). It reveals thatthe % gain in mean head length (GHL) and % weight loss (WL)of *C. batrachus* were found to be variedincreasingly in every length groups with high (snowballing) level of endohelminth infestation. Among the endo-helminth infested *C. batrachus*, comparatively higher % GHL6.0 were recorded in medium length group over smaller (5.0 cm) and larger group (5.0 cm), whereas higher mean % WL8.0 were recorded in smaller length group followed by larger (7.0) and medium (6.0) group. Seasonal variation in hleminths parasitic infestation and its effect explicated in-terms of % GHL and % WLin different length groups of *C. batrachus* revealed that high %GHL of *C. batrachus* along with % WL were observed in highly infested cluster over the low infested and non-infested set in every length group duringdifferent seasons of the yearnamely pre-monsoon, monsoon and post- monsoon.The observed highest % WL were recorded in smaller (13.0) length group in pre-monsoon and medium (14.0) group in monsoon, whereas lowest (1.0) in low infestation sub cluster of the larger length group wasrecorded during monsoon. The observed %GHL of *C. batrachus* were highest in highly infested cluster of smaller length group (12.0) and lowest in larger (2.0) group du ring pre-monsoon, followed by highest (11.0) in small and lowest (4.0) in medium length group during monsoon season.Thus the present finding reveals that over the different season of the year, % gain of mean head length (cm) and % WL (g) has increasing along with increased level of helminthes infestation.

Keywords: Seasonal variation, helminthes infestation, *Clarias batrachus*, gain head length, weight loss, *haor b*asin

Introduction

Walking catfish, *C. batrachus* (Linneaus, 1957) locally known as magur is traditionally popular and important as food fish and widely distributed throughout the South and South-east Asia (Ng and Kottelat, 2008) including Bangladesh. In many provincesof India, particularly in West Bengal and Tripura, *C. batrachus* is considered as a medicinal fish,and traditionally remained a strike among the pregnant women, lactating mothers, elderly peoples and children (Debnath, 2011).It is much esteemed as food for convalescence and invalids (Bhuiyan, 1964). Once the fish was available in any kind of water bodies like low lying swamps, lakes, canals, small pits, ponds and rivers etc.However, now a day, because of habitat destruction and indiscriminate exploitation its abundance and harvests in natural waters has drastically declined a lot.Due to it's the delicious taste, palatability, food value and high consumer preference this native catfish fetches higher price and shows an increasing trend in demand, both in domestic and

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export markets.Due to the presence of accessory respiratory organs and hardy nature, the catfish can survive in water with low oxygen level and high temperature. High demand,fry availability, lucrative size and exclusive market value lead the farmers in aquaculture of *C. batrachus* thus contributed a lot to the fisheries sector.Therefore, an increase in aquaculture of *C. batrachus* has been observed in many parts of the country. But farmers are facing problem with health management and diseases problems (Ahmed *et al.* 2009_c; and Kashem *et al.* 2014)along with others that hinder the fish (Hossain *et al.* 2014) and shrimp (Iqbal *et al.* 2011) farm production.Diseases (Ahmed *et al.* 2009_a; Ahmed *et al.* 2009_bHossain*et al.* 2009 and Hosain *et al.* 2014) and parasitic infestations are severe limiting factors in aquaculture (Kabata, 1985) as parasites are causing diseases and in many cases responsible for fish mortality (Caira and Littlewood, 2001) along with the changes in homeostasis ecology of host in terms of health, behavior, sexual selection and regulation of the host population (Borde and Jawale, 2012).

Helminth parasites are undoubtedly the most well-known group among vertebrate parasites in freshwater fisheries of Bangladesh. Three major assemblages of helminthes *i.e.* Nemathelminthes (nematodes), Platyhelminthes (flatworms) subdivided into Cestoda (tapeworms) and Trematoda (flukes) are so far recognized. Caryophyllaeid cestodes are widely distributed mainly in freshwater Siluriform and Cypriniform (Mackiewicz, 1972). *C. batrachus* (Linn.) is designated as one of the main host of caryophyllaeids and nine species of cestodes were so far recorded from the intestine of *C. batrachus* at Amravati (Nimbalkar *et al.* 2010) in the Indian subcontinent. Though there are several studies have been conducted on parasitological infestation and systematics of caryophyllaeid cestodes of *C. batrachus* (Mackiewicz 1982; Hafeezullah 1986; and Sawaskar, 2012) from Indian subcontinent, *C. gariepinus* (Clariidae) from Lakki lagoon, Nigeria (Akinsanya and Otubanjo, 2006) and Africa (Aliyu and Solomon, 2012) however, very few on the occurrence of helminth infestation in *C. batrachus* in Bangladesh and none from natural water bodies of Sylhet region. Considering the above facts, the present experiment was carried out to investigate the infestation of helminth parasites and their effects on different size groups of *C. batrachus* from *haor* basin of Sylhet, Bangladesh.

Materials and Methods

Study Area

The present experiment was conducted in *Sadar* (sub-district) located in between 24°52´ and 25°02´ north latitudes and in between 91°01´and 91°40´ east longitudes at Sylhet, Bangladesh (Figure 1).

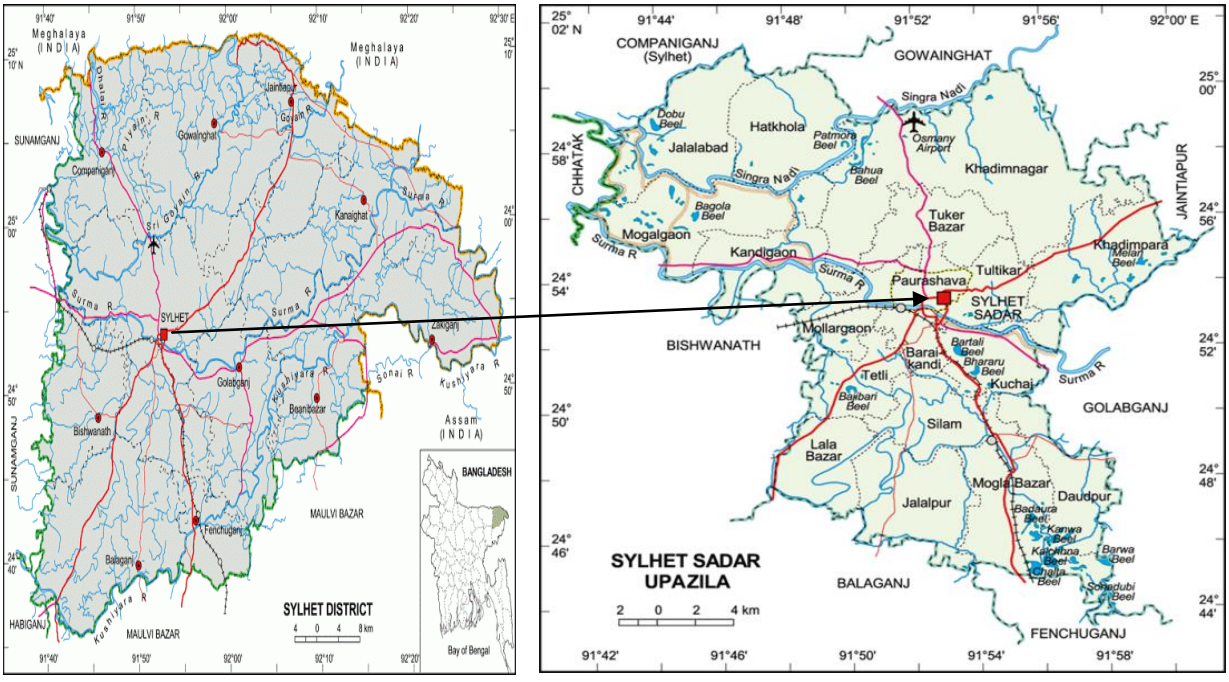

Fig. 1.Showing geographical location of the study area located at Sylhet Sadar, Sylhet, Bangladesh (Banglapedia, 2012)

Sampling and Setting of the Experiment

A total of 100 *C. batrachus* were collected from the natural water bodies like *haor*, *beels* and adjacent fish markets of Sylhet (Lal Bazar, Major Tilla and Kazir Bazar) to investigate infestation of helminth parasites and their effects on the host for a period of ten months from March 2013 to December 2013.Collection of experimental fishes were carried out monthly basis and during each sampling, ten (10) live *C. batrachus* were collected and transported to the Laboratory in plastic bags in alive condition. As soon as the live sample arrived in the Fish Disease Laboratory of Sylhet Agricultural University, these *C. batrachus* were subjected to measurement of morphometric parameters such as measurement of total length (TL), standard length (SL), head length (HL) and total body weight (BW). BW wasmeasured by using a digital electronic balance (OHAUS, Model CT 1200-S, USA) and TL, SL and HL by a centimeter scale (Stainless Steel SwordFish Brand, China) and the experimental fishes were divided into three length groups *viz.* small (<13cm), medium (14-18 cm) and larger (>18cm) after (Laboni *et al.* 2012) and (Khalil *et al.* 2013). *C. batrachus* were then sub categorized on the basis of average length and weight of infected and uninfected specimen with in the same group.*C. batrachus* were also categorized or sub-clustered according to the intensity of attack or level of infestation *viz.*, low infection (if infested with 1-19 individuals of helminth parasites) and high infection(if infested with more than 19 helminth individuals in a single individual of host) with in each length groups (Table 3 & 5). Abundance and quantification of helminths parasites were measured manuallyby counting the number of collected infested parasites.Seasonal variation i.e. Pre-monsoon (March - May), Monsoon (June - August) Post-monsoon (September- December) in prevalence of hleminths parasitic infestation, percent (GHL)and weight loss (WL) of *C. batrachus* in different length groups were also measured and recorded (Table 3 and 5). The relationship between the fish length and helminth parasitic infestation were determined according to the following formula {(100x lt)/X} after (Desbrosses, 1948), where 1t = head lengthand X = total length of fish. Loss of fish weight (g)was calculated by deducting the average weight of infested fish from that of non-infested fishi.e., weight loss = (average weight of non-infested fish – average weight of infested fish)/ average weight of non-infested fish. The percentage (WL) = (average weight of non-infested fish – average weight of infested fish)/ average weight of non-infested fish*100.

The collected *C. batrachus* were then anaesthetized by using chloroform and or by pitting (small fishes) or by cutting the neck (in some cases). For parasitological investigation, *C. batrachus* were then subjected to dissection (opened the ventral side starting from genital pore towards head up to the opercula) by using sharp scalpels, scissors, forceps etc.After careful dissection, stomach and intestine were collected and put in a petridish containing water. Then external part of the stomach and intestine were washed and further dissect with sharp scissor,observed and collected the parasites carefully. The collected parasites were then washed and clean with water prior to making temporary mounts or permanent slides. Fixation of nematodes were made by placing the parasites in hot glacial acetic acid and alcohol formalin acetic (AFA) for five minutes. The collected parasites were identified and their morphological characters were determined according to (Yamaguti, 1959;Mackiewicz, 1982;Hafeezullah, 1993; Chandra, 2008; and Ash *et al.* 2011) and then preserved in vials containing 70% ethyl alcohol and kipped for prolonged storage.

Statistical analysis: Descriptive analysis of me and collected data were conducted bySPSS 17 (Chicago, USA) to detect the differences in intensity of helminths and the values were represents as means of data obtained ± Std. Deviation (mean ± SD) of monthly determinations.

Results and Discussion

Abundance and Quantification of Helminths Parasite

Among the 100 individuals of *C. batrachus*, 76 were found to be infested with 1404 individuals of seven different endohelminth parasites species and rest 24 *C. batrachus* were found to be unaffected (Table 1). The endohelminth were belonged to three different groups (i.e. trematode, cestode and nematode), comprised of one digenean trematode (*Orientocreadium batrachoides)*, five cestodes (*Lytocestus indicus*, *Lytocestus birmanicus*, *Bovienia serialis*, *Djombangia penetrans*, and *Pseudocaryophyllaeus indica*) and one neamtode (*Paracamallanusspiculo gobernaculus*) (Table 1).Nine species of cestode parasites were so far recorded from the intestine of *C. batrachus* from Maharashtra, India (Sawarkar, 2012). Douellou (1992) reported the occurrence of trematode, *Glossidium pedalum*, and cestodes *Bothriocephalus acheilognathi*, *Polyonchobothrium clarias* and *Proteocephalus glanduliger* in *C. batrachus* from South Africa. Unlike other fish species, high diversity of helminth parasites along with the highest worm burdens in *C. batrachus* in the current findings could be attributed to favorable habitat of *C. batrachus* with turbid environment, shore areas covered with aquatic vegetation and basin structure of *beels*. This habitat also favors intermediate hosts of cestodes and digenean trematodes. Hoffman (1967) reported that in the mud habitat

second intermediate hosts of many fish digeneans such as larvae of aquatic insects like Ephemeroptera, Odonata, Chironomidae and various Crustacea are found and form part of the diet of *C. batrachus*. Another reason for the recovery of a large number of helminths in *C. batrachus* could be related to larger size of *C. batrachus* as compared to other fish species.

Table 1. Group, identified species and number of Helmnith parasites along with their site of infestation

Group of Helminths	Helminth Species	Site of infestation*	Number of Helminths*
Trematode	*Orioentocreadium batrachoides* (Tubangui, 1931)	Intestine	92
Cestode	*Lytocestus indicus* (Moghe,1925)	Stomach, Intestine	611
	Lytocestus birmanicus (Lynsdale, 1956)	Intestine	206
	Bovienia serialis (Bovien, 1926)	Intestine	309
	Djombangia penetrans (Bovien, 1926)	Stomach, Intestine	72
	Pseudocryophyllaeus indica (Gupta, 1961)	Intestine	75
Nematode	*Procamallanusspiculo gobernaculus* (Agarwal, 1958)	Stomach, Intestine	490
Total:	Fourteen hundred four individual of helminthes comprising sevendifferent speciesfrom three groups		1855

**Site of infestation and number of helminthes (Manual detection and counting)*

Helminths infestation and %gain inhead length (GHL) of *C. batrachus*

It was recorded that the percent (GHL) of *C. batrachus* were found to be varied in all length groups at different level of helminths infestation. Among the endo-helminth infested *C. batrachus*, comparatively higher % GHL6.0 cm were recorded in medium length group followed by smaller (5.0 cm) and larger group (5.0 cm)(Table 2).Higher gain of mean head length (4.07 cm) in *H. fossilis* with total length of(17-21cm) were reported by Khalil *et al.* (2013) which were also in agreed with the findings of the present experiment.

Table 2. Relationship non-infested and infested *C. batrachus* in head length of different length groups

Length groups (cm)	Mean Head length (cm)		% Gain of mean head length
	Non-infested (Length cm)	Infested(Length cm)	
Small (<13)	2.46±0.29	2.59 ± 0.25	5.00
Medium (14-18)	3.09±0.33	3.29 ± 0.43	6.00
Large (>18)	4.43± 0.59	4.65± 0.30	5.00

Values are means of data obtained ± Std. Deviation (mean ± SD) of monthly determinations

Seasonal variation in Helminths Infestation and % gain of head length (GHL) of *C. batrachus*

Seasonal variation in hleminths parasitic infestation and percentage gain of mean head length (cm) were exhibits in different length groups of *C. batrachus* (Table 3). Along with different level of infestation, high percentage gain of mean head length (cm) in *C. batrachus* highly infested cluster were observed over the low infested and non-infested set in every length groups in different season of the year (i.e. pre-monsoon, monsoon and post monsoon) (Table 3). The observed percent gain of mean head length (cm) in *C. batrachus* were the highest in smaller length grouped (12.0& 9.0) followed by medium (6.0& 6.0) and larger (2.0& 5.0) length group during pre and post- monsoon season respectively (Table 3). Whereas, during monsoon, highest values of % gain of mean head length (cm) in *C. batrachus* were recorded in small (11.0) length group followed by larger (6.0) and medium (4.0) length group (Table 3).The observed lowest % (GHL) were recorded in highly infested cluster of large length group (2.0) during pre-monsoon and followed by middle group (4.0) in monsoon (Table 3). The present findings reveal that over the different season of the year, % GHLhas increasing along with increased level of helminthes infestation.The availability of more parasites in pre and monsoon season may be due to suitable environment with sufficient foods in gut of the host which also more or less similar with the findings of (Chhanda and Chandra,2011). Seasonal variation in diseases and pathologies were also reported by (Hossain *et al.*2014). Infestation with large number of parasites hamperedthe growth of host, hence reducing the muscle contents, total body length and loss of body weight, while skull of host remain unchanged thus resulting more gaining of head length.These results also agreed with the observation on caryophyllaeid infestation in Mymensingh (Laboni *et al.* 2012) and (Chhanda and Chandra, 2011).Higher percent gain of mean head length (4.44 cm) in medium sized group (17-21cm) of *H. fossilis* was observed during high level of infestation by (Khalil *et al.* 2013) which is also agreed with the present findings.

Helminths Infestation and % loss of body weight of *C. batrachus*

It was evident that % WL of *C. batrachus* were found to be varied in all length groups at different level of helminths infestation. Among the endo-helminth infested *C. batrachus*, comparatively higher percent (WL) (8.0 g) were

recorded in smaller group than the medium (6.0 g) and larger group (7.0 g) (Table 4). Laboni *et al.* (2012) reported that 1.63g of WL in examined host *C. batrachus* were due to helminths parasitic infestation.The current findings suggested that the smaller *C. batrachus* fishes were greatly influenced and losses their body weight due to endo-helminths parasitic infestation which was agreed with the findings of (Khalil *et al.* 2013) who reported loss weight in *H. fossilis* due to parasitic infestation. More or less similar observation of (Laboni *et al.*2012) where the highest % WL 26.38 g were noticed in the small length group while lowest 7.44 g in large length group which coincides the findings of the present study.

Table 3. Relationship between head length and total length at different level of infestations of parasites in *C. batrachus* during different season

Length groups (cm)	Mean Head Length (cm) of host *C. batrachus* *								
	Pre-monsoon(March- May)			Monsoon(June - August)			Post-monsoon(September- December)		
	Non-infested	Low infestation	Highly infested	Non-infested	Low infestation	Highly infested	Non-infested	Low infestation	Highly infested
Small (<13)	2.33±0.28	2.55±0.07	2.65±0.18	2.55±0.39	2.75±0.10	2.85±0.07	2.45±0.08	2.55±0.13	2.70±0.00
% Gain of Head length	-	9.00	12.00	-	7.00	11.00	-	4.00	9.00
Medium (14-18)	3.10±0.26	3.20±0.14	3.33±0.21	2.92±0.36	3.0±0.14	3.05±0.78	3.40±0.14	3.55±0.15	3.60±0.41
% Gain of Head length	-	3.00	6.00	-	3.00	4.00	-	4.00	6.00
Large (>18)	4.30±1.27	4.60±0.53	4.40±0.42	4.45±0.21	4.58±0.21	4.71±0.33	4.55±0.23	4.82±0.39	4.80±0.32
% Gain of Head length	-	7.00	2.00	-	3.00	6.00	-	6.00	5.00

*Values are means of data obtained ± Std. Deviation (mean ± SD) of monthly determinations. *Sub-cluster: Low infestation (infested with 1-19 individuals of helminthes parasites), High infestations (infested with more than 19 individuals of helminthes parasites) in a single individual of host C. batrachus.*

Table 4. The percentage of weightloss in different length groups in *C. batrachus*

Length groups (cm)	Mean weight(g)		
	Non-infested (weight g)	Infested(weight g)	% Weight Loss
Small (<13)	21.0±2.29	19.28 ± 2.28	8.00
Medium (14-18)	34.78±4.68	32.81 ± 4.39	6.00
Large (>18)	69.67 ± 3.33	65.02 ± 9.78	7.00

Values are means of data obtained ± Std. Deviation (mean ± SD) of monthly determinations

Table 5. The percentage of weight loss at different level of infestation in different length groups of *C. batrachus* during different seasons

Length groups (cm)	Mean body Weight (g) of host *C. batrachus* *								
	Pre-monsoon(March - May)			Monsoon(June - August)			Post-monsoon(September- December)		
	Non-infested	Low infestation	Highly infested	Non-infested	Low infestation	Highly infested	Non-infested	Low infestation	Highly infested
Small (<13)	19.67±2.52	18.50±2.12	17.00±4.24	21.50±2.19	19.55±0.78	19.25±0.35	22.0±2.83	20.50±3.11	20.0±1.41
% Weight Loss	-	6.00	14.00	-	9.00	10.00	-	7.00	9.00
Medium (14-18)	36.67±2.19	35.50±0.70	32.67±2.08	32.0±6.05	30.50±4.95	27.50±1.20	37.50±0.71	35.50±0.71	33.5±1.48
% Weight Loss	-	3.00	11.00		5.00	14.00	-	5.00	11.00
Large (>18)	70.50±2.12	67.66±3.21	66.57±8.56	67.05±2.12	66.33±9.09	62.63±11.92	71.00±5.66	68.40±10.75	63.0±9.35
% Weight Loss	-	4.00	6.00	-	1.00	7.00	-	4.00	11.00

Values are means of data obtained ± Std. Deviation (mean ± SD) of monthly determinations. *Sub-cluster: Low infestation (infested with 1-19 individuals of helminthes parasites), High infestations (infested with more than 19 individuals of helminthes parasites) in a single individual of host *C. batrachus*.

Seasonal variation in Helminths Infestation and % loss of body weight of *C. batrachus*

Seasonal variation in hleminths parasitic infestation and percent WL were exhibited in different length groups of *C. batrachus* (Table 5). Along with different level of infestation, high% WL of *C. batrachus* in highly infested cluster were observed over the low infested and non-infested set in every length groups in different season of the year (Table 5). In Pre-monsoon season, the observed percent WL were the highest in smaller length group (14.0)

followed by medium (11.0) and larger (6.0) length group, whereas in monsoon, the highest % WL were observed in medium (14.0) length group (Table 5). In post-monsoon, highest% (WL) were recorded in medium (11.0) and larger (11.0) group followed by smaller (9.0) length group (Table 5). The observed lowest % WL were recorded in low infested cluster of large length group (1.0) in monsoon and (4.0) in post monsoon followed by small group (3.0) in pre monsoon (Table 5). The present findings reveal that over the different season of the year, % WLwas increasing along with increased level of helminthes infestation. Laboni *et al*. (2012) reported maximum % weight loss (27.68) in small length group during summer whereas, minimum (1.29) in medium length group during rainy season. Most of the authors including Khalil *et al.* (2013) observed considerable loss of weight in fishes mainly when infested with large number of enohelminths parasites that coincides with the findings of the present study.

Seasonal variation in hleminths parasitic infestation and its effect explicated in-terms of % GHL and % WL in different length groups of *C. batrachus* reveals that high %GHL of *C. batrachus* along with % WL were observed in highly infested cluster over the low infested and non-infested set in every length groups during different season of the year (*viz.* pre-monsoon, monsoon and post- monsoon). Thus the present findingsdiscovered that over the different season of the year, % gain of mean head length (cm) and % (WL) (g) has increased along with increased level of helminths infestation.

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