J. Asiat. Soc. Bangladesh, Sci. 38(2): 135-144, December 2012

EFFECTS OF CARYOPHYLLAEID CESTODE INFESTATIONS ON CLARIAS BATRACHUS (LINN.)

N.N. LABONI, K. J. CHANDRA AND M.S. CHHANDA
Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract

Effects of caryophyllaeid cestode infestations on *Clarias batrachus* was conducted during the period from August 2010 to July 2011. Fish samples collected from K.R. market, BAU campus came from various waterbodies. Sex, total length (cm), standard length (cm), head length (cm) and weight (g) were recorded. Five different species of caryophyllaeid namely *Djombangia penetrans, Lytocestus indicus, L. birmanicus, L. parvulus* and *Bovienia serialis* were identified from the host. Severe infestations of caryophyllaeid cestodes were found in *C. batrachus*. Changes in the nature of growth and loss of weight as a result of parasitic infestation were noticed. Accordingly length, weight and condition factors were found to be greatly affected. Loss of total length (8.73%) and the highest loss of mean head length (4.49%) were found in smaller infested length group fish. Loss of weight (1.63%) and the highest percentage loss of weight (26.38) were noticed in the small length group while it was 7.44 in large length group. The highest condition factor (1.13) was found in uninfested fish and lowest (0.85) in infested fish. Suggestions were made for further investigation on blood composition and gonadal development of infested host.

Key words: *Clarias batrachus*, Parasitic effect, Length, Weight, Condition factor

Introduction

Catfish is an important group of fish in our country and it is getting increasing importance showing a promising future for commercial culture (Barua 1989). Indigenous catfish popularly known as Magur *Clarias batrachus* and Singhi *Heteropneustes fossilis* have been contributed greatly as a delicious food fish of our country. The most severe limiting factors in culture and management are diseases and parasitic infestations (Kabata 1985). Caryophyllaeid cestode parasites are widely distributed mainly in freshwater Siluriform and Cypriniform fishes (Mackiewicz 1982). However, *C. batrachus* (Linn.) and *H. fossilis* (Bloch) are the main hosts of caryophyllaeids in the Indian subcontinent.

Much works on systematics of caryophyllaeid cestode of *C. batrachus* have been carried out from this subcontinent particularly from India by Mackiewicz (1981), Agarwal (1985) and Hafeezullah (1986). Only few works have been conducted on these cestodes of fishes from Bangladesh by Ahmed and Sanaullah (1976), Sanaullah and Ahmed

Corresponding author: Email : kirtuniajchandra@yahoo.com

(1978), Mamnur Rashid *et al*.(1983, 1985), Ahmed *et al.* (1985), Chandra and Khatun (1993) and Chandra *et al*. (1997).

Very few works have been initiated on the effect of parasitism on the host animals particularly in freshwater fishes. Probably a single work so far recorded on the effect of helminths in *Nandus nandus* from Bangladesh by Chandra and Golder (1987). Some initiations have been taken in other countries by Mann (1953), Kabata (1958) and Natarajan and Nair (1977) particularly infestations of crustacean fish parasites. Complexity of single or multiple infestations on host species is really a problem for determining the single parasitic effect of both endo or ectoparastes (Chandra and Golder 1987). As *C. batrachus* is a highly infested fish by different caryophyllaeid cestode species, their influence on this host is an essential task for determining its successful culture practice. In addition to study the infestations of these parasites (Chhanda *et al*. 2011) the present part of research work was therefore, carried out to evaluate certain effects on length, weight and condition factor of *C. batrachus* due to caryophyllaeid infestations.

Materials and Methods

Field work: A total of 222 host fish namely Magur (*Clarias batrachus)* was collected and used as the experimental fish. Sampled fish were examined to investigate the effects of parasitic infestation on host during the period from August 2010 to July 2011. The entire study period was divided into four seasons: Summer (March - May), Rainy season (June -August), Autumn (September - November) and Winter (December - February). Live and fresh fishes were collected from K.R. market, Gouripur, Sutiakhali and Churkhai. Almost all these fishes were brought to these markets after collection from Kailla Beel (a very big beel) of Ishwarganj *Upazila* of Mymensingh. Besides these fishes, few collections were also made from local fish markets around BAU, Natun bazar and Mechhua bazar of Mymensingh town.

Laboratory work: The fishes were brought to the fish disease laboratory of Aquaculture Department in polythene bags or bucket with water in live condition for parasitic investigation. Before investigation the source of the fish was recorded in a data book, the total length (TL), standard length (SL), head length (HL), weight and sex of the fishes were recorded.

The total length of each fish was taken from the tip of the lower jaw to the tip of the lower lobe of the caudal fin. The head length has taken from the tip of the lower jaw to the operculum while the body length, from the operculum to the tip of the lower lobe of the caudal fin. The method adopted by Desbrosses (1948) was followed to find out the relationship between the head length and the total body length. The formula $\frac{100\times lt}{X}$, where 1t = the length of the head and X = the total body length, was applied for all the fishes. The fishes were classified into different length groups. The average length and

weight of uninfected and infected specimen, belonging to each group were categorized. The loss of weight was then calculated by deducting the average weight of infested fish by caryophyllaeid cestode from that of uninfested fish. Then percentage loss of weight was calculated. Based on the intensity of attack, hosts coming under different length groups were categorized and the percentage loss of weight was calculated. Condition factor was employed to evaluate the effect of parasite on the host. Condition factor was calculated by employing the formula $k = \frac{100 \times w}{l^3}$, where w = the weight of the fish in grams; l = the length in centimeters. The magnitude of parasitism is indicated by the difference in k values of an infested and an uninfested fish.

Fishes were also categorized with the level of infestation as mild (1-5), moderate infection (6-10) and heavily infect (11- above) parasites.

Then the host fish was anaesthetized by chloroform and some time by cutting at the neck region and the smaller fish was killed by pithing. A slit was made on ventral side near the genital pore on anal region and was opened towards the head up to the opercular region. After careful opening the stomach and the intestine were removed and put in a Petridish containing water for parasitic investigation. The external part of stomach and intestine was washed and the stomach was first opened with scissor and then investigated for effects of parasitic infestation on *C. batrachus.* After collection, the parasites were kept in normal saline for relaxation, flattened and fixed in F.A.A. Some of the parasites were prepared for permanent slides.

Results and Discussion

Among 222 examined, 186 *C. batrachus* were infested with 1428 caryophyllaeid cestode. They belonged to five different species, *Djombangia penetrans, Lytocestus indicus, Lytocestus birmanicus, Lytocestus parvulus* and *Bovienia serialis*as identified by Chhanda *et al.* (2011). The overall prevalence was recorded 83.78%, mean intensity 7.78 and abundance 6.43. Maximum number of caryophylaeid cestode parasites in a single infested host was 151. The infested host fishes were found to be infested by multiple species dominated by *D. penetrans.* Though there are reports of digenean and nematode parasitic infestations in *C. batrachus* (Arthur and Ahmed 2002) only caryophyllaeid cestodes were found in the present investigation. It could be interested if the study could be concentrated on the effect of parasitism of a single parasitic infestation. Not only the case of *C. batrachus*, it is true for other host fishes as they have multiple infestations by a number of parasite species even by different groups parasites (Natarajan and Nair 1977 and Agarwal 1985, Chandra and Golder 1987). However, Kabata (1958) and Mann (1964) observed the biology and its effects of single parasite on the host fish which was not possible in the case of *C. batrachus.*

For the present study the experimental fishes were first differentiated as infested and uninfested and their average total length is presented in Table 1 and their differences noted as 1.98 and the percentage loss of length was 8.73. The mean head length varied with host size. Significantly highest percentage loss of mean head length (4.49) was observed in small length group and the lowest percentage loss of mean head length (1.11) was observed in large length groups (Table 2). The highest loss of mean head length (6.73%) was found at the moderate level of infested in small length group. Whereas, the lowest value (1.09%) was found in medium level of infested fish of larger length groups (Table 2).

Overall the highest and lowest (%) loss of mean head length 11.15 and 1.14 were found in winter season in moderate and small length group (Table 3). Desbrosses (1948) found that the whiting infested with *Lernaeocera* showed a retardation in growth. Kabata (1958) noticed no such effects in the haddock parasitized by *Lernaeocera*. Sproston and Hartely (1941) were on the opinion that parasites showed a selective infestation of larger fishes.

During the period of investigation, the average weight of the uninfested hosts was 100.08 g and the average weight of the infested hosts was 98.45 g. Due to parasitic infestation the weight loss was different as 1.63 g and the percentage loss of weight is also presented in Table 1. The highest percentage loss of weight 26.38 was noticed in the small length group while it was 7.44 in large length group (Table 4).Significantly the highest percentage loss of weight (28.34) was found in mild infected smaller length group fish (Table 4). The maximum loss of weight (27.68%) was found in summer season in small length group. Whereas, the lowest value (1.29%) was found in rainy season in medium length group (Table 5). Loss of weight as a result of crustacean infections has been observed by Lechler (1935), Mann (1964), Goregyad (1955) and Kabata (1958). Most of the authors expressed the view that there was a considerable loss of weight in fishes when parasites were present in large number.

From the condition factor of uninfested and infested fishes presented in Table 1 it is apparent that the uninfested fish had higher condition factor (1.13) than infested ones (0.85). The highest condition factors (1.21, 1.01 and 0.83) were found in uninfested fish in small,moderate and large length groups than infested ones (0.95, 0.83 and 0.78)(Table 6). The highest % loss of condition factor 22.31, 18.18 and 23.14 was found in small length group than other groups. The lowest (%) loss of condition factor 1.20, 4.82 and 7.23 was found in large length group. In case of overall differences in infestation level of the host organism it was higher in mild infected group than other infection groups (Table 6).The highest (%) loss of condition factor (23.97) was found in winter season in small length group and the lowest (%) loss of condition factor (1.20) was found in rainy and autumn seasons in large length group (Table 5).

Table 1. The average length, weight and condition factor of uninfested and infested *C. batrachus* with their percentage loss.

Infested or uninfested	Number examined	Mean length (cm)	Loss /gain length (cm)	% of gain	Mean weight (g)	Loss of weight (g)	% of loss	Mean condition factor	Loss of condition factor	% of loss
Uninfested	36	20.69*	-	-	100.08*	-	-	1.13	-	-
Infested	186	22.67*	1.98	8.73	98.45*	1.63	1.63	0.85	0.28	24.78

*Means significant at 5% level.

Table 2. Relationship between head length and total length of uninfested and infested host and also at different level of infestations of caryophyllaeid cestodes in *C. batrachus*.

Length groups (cm)	21>					21-23					23<				
Infestation	Un-infested	Infested	Mild Infested (1-5) parasite	Moderate Level of Infestation (6-10) parasite	Heavily Infested more than (10) parasite	Un-infested	Infested	Mild Infested (1-5) parasite	Moderate Level Of infestation (6-10) parasite	Heavily Infested more than (10) parasites	Un-infested	Infested	Mild Infested (1-5) parasite	Moderate Level of infestation (6-10) parasite	Heavily Infested More than (10) parasite
Number Examined	32	90	57	15	18	3	78	50	19	9	1	14	4	5	5
Mean Head length (cm)	4.46*	4.25*	4.19*	4.16*	4.29*	4.67*	4.61*	4.59*	4.78*	4.80*	5.40*	5.34*	5.48*	5.46*	5.08*
% loss of Mean Head length	-	4.49	6.05	6.73	3.81	-	1.25	1.71	2.30	2.71	-	1.11	1.38	1.09	5.93

Means significant at 5% level.

Table 3. Relationship between head length and standard length of *C. batrachus* in different seasons (August 2010 to July 2011).

Length groups (cm)	Mean Head Length (cm)											
	Summer			Rainy season			Autumn			Winter		
Infestation	Uninfested	Infested	% loss of mean head length	Uninfested	Infested	% loss of mean head length	Uninfested	Infested	% loss of mean head length	Uninfested	Infested	% loss of mean head length
21>	4.46*	4.18*	6.28	4.64*	4.49*	3.23	4.00*	4.00*	-	4.38*	4.33*	1.14
21-23	-	4.72*		-	4.97*		4.67*	4.50*	3.64	5.20*	4.62*	11.15
23<	-	4.35*		-	5.84*		5.40*	5.07*	6.11	-	5.53*	-

*Means significant at 5% level.

Table 4. Level of infestation, average weight, percentage loss of weight of uninfested and infested *C. batrachus* by caryophyllaeid cestodes.

Length groups (cm)	21>					21-23					23<				
Infestation	Un-infested	Infested	Mild infested (1-5) parasite	Moderate level of infestation (6-10) parasite	Heavily infested more than (10) parasite	Un-infested	Infested	Mild infested (1-5) parasite	Moderate level of infestation (6-10) parasite	Heavily infested more than (10) parasite	Un-infested	Infested	Mild infested (1-5) parasite	Moderate level of infestation (6-10) parasite	Heavily infested more than (10) parasite
Number examined	11	32	21	5	6	22	82	53	13	16	3	72	41	21	10
Average weight (g)	96.36*	70.94*	9.05*	79.00*	70.83*	100.14*	88.72*	88.21*	90.97*	88.75*	113.33*	121.76	120.53*	118.86*	121.00*
% loss of weight	-	26.38	28.34	18.02	26.49	-	11.40	11.91	9.16	11.37	-	7.44	16.88	18.03	16.55

Means significant at 5% level.

Table 5. Percentage loss of weight and condition factor of *C. batrachus* in different seasons (August 2010 to July 2011).

Length groups (cm)	21>					21-23					23<				
Infestation	Un-infected	Infested				Un-infected	Infested				Un-infected	Infested			
Seasons	Un-infected	Summer	Rainy season	Autumn	Winter	Un-infected	Summer	Rainy season	Autumn	Winter	Un-infected	Summer	Rainy season	Autumn	Winter
Mean weight (g)	96.36*	69.69*	97.73*	73.33*	70.77*	100.14*	89.40*	98.85*	87.52*	88.59*	145*	116*	118*	125.22*	129*
Mean length (cm)	19.97*	19.52*	19.97*	18.93*	19.73*	21.45*	22.23*	21.67*	21.84*	22.00*	25.13*	24.07*	24.97*	24.84*	25.07*
Wight Loss (g)	-	26.67	1.37	23.03	25.59	-	10.74	1.29	12.62	11.55	-	29.00	27.00	19.78	16.00
% weight loss	-	27.68	1.40	23.90	26.56	-	10.72	1.29	14.42	11.53	-	20.00	18.62	13.64	11.03
Condition factor	1.21	0.94	1.20	1.08	0.92	1.01	0.81	0.97	0.84	0.83	0.83	0.80	0.76	0.82	0.82
% loss of condition factor	-	22.31	1.63	10.74	23.97	-	19.80	3.96	16.83	17.82	-	3.61	8.43	1.20	1.20

*Means significant at 5% level.

Table 6. Relationship between infestation and the condition factor of *C. batrachus* by caryophyllaeid Cestodes.

Length groups (cm)	21>					21-23					23<				
Infestation	Un-infested	Infested	Mild infested (1-5)	Moderate level of infes-tation (6-10)	Heavily infested more than (10)	Un-infested	Infested	Mild infested (1-5)	Moderate level of infestation (6-10)	Heavily infested more than (10)	Un-infested	Infested	Mild infested (1-5)	Moderate level of infest-ation (6-10)	Heavily infested more than (10)
Number examined	11	32	21	5	6	22	82	53	13	16	3	72	41	21	10
Mean length (cm)	19.97*	19.55*	19.41*	20.00*	1967*	21.45*	22.07*	21.14*	21.94*	21.97*	25.13*	25.04*	24.53*	24.64*	25.05*
Mean Weight (g)	96.36*	70.94*	69.05*	79.00*	70.83*	100.14*	88.72*	88.21*	90.97*	88.75*	113.33*	121.76	120.53*	118.86*	121.00*
Condition factor	1.21	0.95	0.94	0.99	0.93	1.01	0.83	0.92	0.86	0.84	0.83	0.78	0.82	0.79	0.77
% loss of condition factor	-	21.49	22.31	18.18	23.14	-	17.82	8.91	14.85	16.83	-	6.02	1.20	4.82	7.23

*Means of significant at 5% level.

The coracideium larva release from the egg of gravid cestodes and the larvae are eaten by the crustaceans and develop into infective procercoid form in the body cavity. The fish become infected by eating the crustacean with procercoid larva. In *C. batrachus* the condition factor decreases when the number of caryophyllaeid cestodes increases. Similar finding was observed by Mann (1953) and Kabata (1958) in case of attack of *Lernaeocera*. Almost similar observations were made by Sproston and Hartely (1941). Further investigations are suggested on the changes in blood composition and gonadal development of the host fish for detailed understanding of the effect of caryophyllaeid infestation for taking necessary measures and sustainable clariid aquaculture.

Acknowledgement

The authors would like to acknowledge the Ministry of Science, Information and Communication Technology, Govt. of the People's Republic of Bangladesh for funding the research project under which the present work was conducted.

References

Agarwal, S.M. 1985. Caryophyllaeids and Caryophyllaeidiasis in India. *Indian Rev. Life Sci*. **5**: 139-161.

Ahmed, A. T. A. and M. Sanaullah. 1976. Organal and percentage distribution of some metazoan parasites in *Heteropneustes fossilis* (Bloch) and *Clarias batrachus* (L.). *J. Asiatic. Soc. Bangladesh (Sci.)*. **2(1)**: 7-15.

Ahmed, A.T.A., G. Mustafa and P. Roy. 1985. Organal distribution of some Caryophyllaeid cestode parasites and their seasonal fluctuation of infestation in the two freshwater catfishes. *Bang. J. Agric*. **10**:59-63.

Arthur, J. R. and A. T. A.Ahmed. 2002. *Checklist of the parasites of fishes of Bangladesh.* FAO Fisheries Technical Paper 369/1. Food and Agriculture organization of the United Nations, Rome, Italy. 24pp.

Barua, G. 1989. *The status of epizootic ulcerative syndrome of fish of Bangladesh*. In: R.J. Roberts, B. Campbell and I.H. Macrae (eds) ODA Regional Seminar on epizootic ulcerative syndrome. Aquatic Animal Health Research Institute, Bangkok. pp 13-20.

Chandra, K.J. and M.I. Golder. 1987. Effect of helminth parasites on a freshwater fish *Nandus nandus. Env. Ecol*. **5(2)**: 337-341.

Chandra, K.J. and M.R. Khatun. 1993. A new species of caryophyllaeid cestode from *Heterpneustes fossilis* of Mymensingh. *Riv. Di Parassitol.* 10 N. **2**: 235-239.

Chandra, K.J., K.Z. Islam and R. Wootten. 1997. Some aspects of association and development of *Lytocestus indicus* Moghe in carfish *Clarias batrachus* (Lin.). *Bangladesh J. Fish. Res*. **1**: 31-38.

Chhanda, M.S., K.J. Chandra and N.N. Laboni. 2011. Caryophyllaeid cestode infestations in *Clarias barachus* (Linn., 1758) in Mymensingh region. *J. Bangladesh Agril. Univ*.**9 (2)**: 351-357.

Desbrosses, P. 1948. Le Merlan (*Gadus merlangus* L.) de la cote francaise de 1 Atlantique Rev. *Trav. off Peches marit*. **13**: 177-95.

Goregyad, K.I. S. 1955. *Diseases and pests of fishes* (In Russian) Gosizdat Selkhoz. Lit., Moscow, 237 PP.

Hafeezullah, M. 1986. Status of the species of *Djombangia* Bovien, 1926 (Cestoidea: Caryophyllidea; Lytocestidae). *Rec. Zool. Surv. India.* **83**: 121-125.

Kabata, Z. 1958. *Lernaeocera obtusa* n. sp. its biology and its effects on the haddock. *Marine Research*.**3**: 1-26.

Kabata, Z. 1985. *Parasites and diseases of fish cultured in the tropics*. Taylor and Francis Ltd. 318 pp.

Lechler, H. 1935. Die Wirkung von kiemenparasiten auf das Wachstum von Reinanken. *Fis. ch. Ztg*. **38**: 39-40.

Mackiewicz, J. S. 1981. Synoptic review of the Caryophyllidean (Cestoidea) of India, Pakistan and Nepal. *Himalayan J. Sci.* **1**: 1-14.

Mackiewicz, J. S. 1982. Caryophyllidean (Cestoidea): Perspectives. *Parasitology*. **84**: 397-417.

Mamnur Rashid, M., A.K.M. Aminul Haque and K.J. Chandra. 1983. Records of some metazoan parasites of *Clarias batrachus* (Linnaeus) from Mymensingh. *Bangladesh J. Fish*. **6**: 37-42.

Mamnur Rashid, M., A.K.M. Aminul Haque and M.B.R. Chowdhury 1985. Population dynamics of Caryophyllid cestodes parasitizing *Clarias batrachus. Bangladesh J. Agril. Sci.* **12**: 179-174.

Mann, H. 1953. *Lernaeocera branchialis* (*Copepoda Parasitica*) and seine schadwirkung bei einigen Gadiden. *Arch. Fischereiwiss.*1952/53, 133-143.

Mann, H. 1964. Vorkommen, Verbreitung and Schadwirkung Von *Lernaeocera minuta* (T. Scott) (Copepoda Parasitica). *Ver. Inst. Meeresf. Bremerhaven*. **9**: 79-83.

Natarajan, P. and N.B. Nair. 1977. On certain effects of parasitic infestation by *Lernaeenicus hemirhamphi* Kirtissinghe on *Hemirhamphus xanthopterus* Val. and *H. far* Fork. *J. Anim. Morphol. Physiol.* **24(2)**: 229-243.

Sanaullah, M. and A.T.A. Ahmed 1978. Observation of some aspects of association in the parasitic infections in the catfishes *Heteropneustes fossilis* (Bloch) and *Clarias batrachus* (L.) of Bangladesh. *Bangladesh J. Fish.* **1**: 78-84.

Sproston, N. G. and P.H.T. Hartely. 1941. The ecology of some parasitic copepods of gadoids and other fishes. *J. Mar. Biol. Ass*. U.K. **25**: 361-417.

(Received revised manuscript on 26.6.2012)