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Research Article

# Parasitic infestation in *Channa punctatus* at Sylhet in Bangladesh

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**ABSTRACT**

The parasitic infection was studied on *Channa punctatus*, an indigenous snakehead fish collected from Lalabazar and Ratargul swamp forest of Sylhet in April and December, 2016. A total of 100 individuals of *C. punctatus* were examined. In total 72 individuals were observed to be infested with 87 parasites of 5 groups namely Digenea, Nematode, Acanthocephala, Crustacea and Cestode. Seven different species of parasites were identified from the studied hosts such as *i)Allocreadium handiai*, ii) *Argulus bengalensis*, iii) *Camallanus intestinalus*, iv) *Euclinostomum multicaecum*, v) *Procamallanus mysti*, vi) *Pallisentis ophiocephali* and vii) *Sanga ophiocephalina* of which six were endoparasites and one was ectoparasite. Prevalence was different in different months. The highest prevalence (76.00%) was observed in April from the hosts of Ratargul swamp forest and the lowest (56.00%) was observed in December from the hosts of Lalabazar fish market in Sylhet. 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 greatly affected. Loss of total length was 1.75% and the highest loss of weight (18.34%) was found in longer fish. The highest condition factor (0.59) was found in uninfested fish and the lowest (0.45) in the infested fish. The information will be useful for the management and determination of harvesting time of *C. punctatus.*



## INTRODUCTION

Bangladesh is a riverine country located in the sub-tropical region. Bangladesh is ranked as third in aquatic biodiversity in Asia and the richest freshwater resources, comprising of 260 indigenous and 12 exotic species of fishes (DoF, 2013). The country is fortunate to have a vast area of inland water resources such as rivers, beels, canals, ponds and estuaries (DoF, 2016). Total fish production in 2014-2015 was about 3.7 million MT contributing 3.69% to the GDP and over 23% to the agricultural GDP (DoF, 2016). With the increase of population in Bangladesh the demand of animal protein is increasing geometrically. Fishes are the source of good quality protein easily and completely digestible, and are excellent sources of polyunsaturated fatty acids. The inland fishery of Bangladesh is one of the most productive resources in the world. There are many ponds, ditches, cannels, rivers, ox-bow lakes and floodplain in this country. Inland capture fisheries have been under heavy pressure as a result of rapid environmental changes and human interferences, irresponsible and destructive fishing practices and loss of natural breeding grounds through habitat degradation and fish diseases. The status of fish health depends on the quality of the present environment for both the fish and pathogen. Environmental factors that are stressful to fish may actually provide a more optimal environment for pathogenic organisms and consequent increase of their virulence. Infectious diseases are decreasing production in aquaculture as well as open water capture in the Haor region. Parasites are important groups of pathogens since it evolved independently in nearly every phylum of animals, from Protozoa to Arthropods and Chordates, as well as in many plant groups. It is now universally accepted that parasites presented a continual and unaccepted threat to the well-being of millions of people of the globe, especially the people of the tropics and subtropics and to domestic animals in all parts of the world. In any natural environment the parasites remained normally in a complex dynamic equilibrium with the free living communities of plants and animals (Hoffman, 1967). Fish parasitology is a rapidly developing field of aquatic health science. This is due to the

growing importance of aquaculture, concerns on pollution effects on fish health and a generally increasing interest in environmental biology (Moller and Anders, 1986). The study of parasitology is important from point of view of fishery management, fish yield and to check the spread of human and animal disease for which fish act as a carrier (Srivasta, 1975). Parasites occupy a definite position in the animal kingdom for their remarkable adaptations and damaging activities to host. The parasitic fauna associated with *C. punctatus* may vary due to excessive use of inorganic fertilizers and pesticides in cultivated lands, discharge of industrial effluents, inadequate waste disposal etc., which can indirectly cause changes in the aquatic environment. Every parasite living in or on a fish have some degree of harmful influence on its host. The normal growth of fish is interrupted or inhibited if they are heavily infected with parasites. The composition of the parasites of fish depends on various environmental factors such as geographical location of the habitat, season of the year, physico-chemical factors of the water, the fauna present in and around the habitat etc. Parasitic study has been conducted in both freshwater and marine environment where several protozoan, helminthes and crustacean parasites were recorded in different fish species. Some studies of *Channa punctatus* fish have been done on biology, mainly in the breeding program of this fish and histopathology of diseased fish (Chandra, 1998). Bangladesh is a major producer of inland fish. Inland water resource of Bangladesh is measured to be one of the richest in the world and potential for fisheries development. Among the freshwater fishes, snakeheads are important group of fish in our country and it is getting increasingly popular showing a promising future for culture (Barua,1989). Snakeheads popularly known as taki (*Channa punctatus*), shol *(Channa marulius*) and gazar *(Channa striatus*) have been contributed greatly as delicious foods of country's people. These are commercially important fishes in Bangladesh and comparatively cheaper than other indigenous fishes. The host species for this study was *Channa punctatus* which belonged to the order Channiformes and Family Channidae. The fish is known as "Zeol fish" (Shafi and Quddus, 1982). Study of parasites is scarce in Bangladesh and a little knowledge about the distribution, prevalence, parasitic intensity, pathogenic effects and control of most of the diseases in natural population of freshwater fish has been studied particularly in Sylhet region of the Bangladesh. *Channa punctatus* is the most popular fish in Bangladesh. Their abundance is reducing due to overexploitation, environmental stress and the occurrence of diseases. Though a lot of indigenous fish species are available in the water body of Sylhet, but very few parasitic investigations has been done so far. As a consequence, parasitic has been provoked in fisheries stock over the time. Moreover, research on parasitic infestation in *C. punctatus* in Sylhet region is scanty. It is a great demand to study fish parasites in the water body of Sylhet. Large number of water bodies around the Sylhet division promotes the region as one of the major sources of fish producing area in Bangladesh. Considering the above, the present study was aimed to survey the parasitic infestation on indigenous fish *C. punctatus*. The objectives of the study were i) to collect and identify different groups of parasites of *C. punctatus* from Lalabazar and Ratargul Swamp Forest of Sylhet, ii) to determine prevalence (%), mean intensity and abundance in relation to head length and weight of host, and iii) to study the effect of parasitism on length, weight and condition factor of the host.

## MATERIALS AND METHODS

*Experimental fish*

The snakehead *Channa punctatus* (locally known as Taki) was selected as the experimental fish for the collection of parasites. The host fishes were collected from Lalabazar fish market and Ratargul swamp forest of Sylhet.

*Sampling technique*

After collection, fishes were brought in live condition to the Laboratory of Department of Fish Health Management, Sylhet Agricultural University, Sylhet, using polythene bags or bucket with water for investigation. The sources of the fishes were recorded in a data book. Standard length (SL), Total length (TL), Head length (HL), sex and weight of the fish were also recorded.

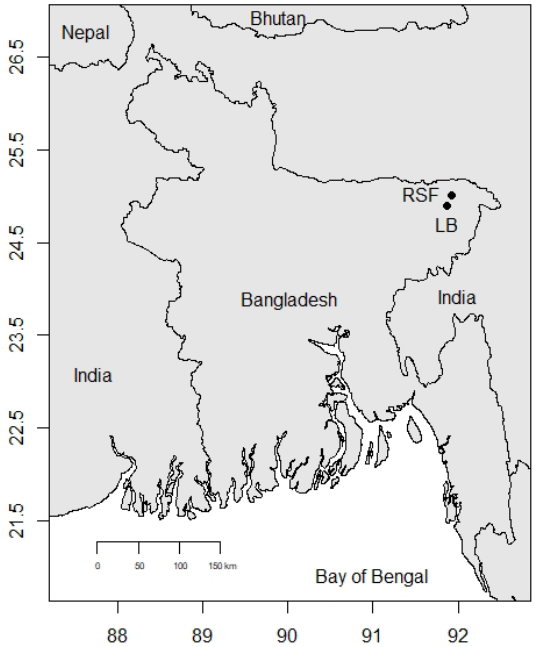


Fig. 1. Sampling locations of *Channa punctatus*: Letters: RSF, Ratargul Swamp Forest; LM, Lalabazar

*Length grouping of host fishes*

The collected fishes were divided into three groups according to their length i.e. smaller (<14cm), medium (15 - 17cm) and larger (>18cm). This grouping was done to depict a clear picture of relationship between the length of fishes and parasitic infestation.

*Parameters of host fish*

A total of 100 individuals of *C. punctatus* were examined. Sex of the fish was determined by locating the gonad of the host fish. Then the total number and percentage of male and female fish was calculated by category.

*Duration of sampling*

The examination was carried out in April, 2016 and December, 2016.

*Methods of collection of parasite*

For the collection of parasites, the fish was first placed on a dissecting tray. Then it was cut and opened along the mid ventral line of the body by an incision. The dissection was from the anal region to the mouth. For the collection of parasites, all the organs of fish were examined. The surface of the visceral organs, mesenteries and body cavity were examined carefully using a hand lens for encysted larva. The external surface of the host body including scales, fins, skin, fin base etc. were examined by magnifying glass for ectoparasites or any kind of lesions. Each organ of viscera i.e. stomach, intestine and liver were separated and kept in different petridishes containing water. The stomach, intestine and liver were opened by an incision. To dislodge the parasite, the organs were separated by scalpel because the parasite might attach to the epithelium. Liver and kidneys were shredded with forces to isolate the parasite.

*Preparation of parasite for microscopic studies*

The collected parasites were grouped into different parasitic groups, for example, cestodes, digenea, nematodes, crustacea and acanthocephalans, based on the morphometric characteristics observed under the microscope.

*Fixation of parasites*

These parasites were fixed following the methods for fixation, clearing and staining. Different groups of parasites were fixed by following ways.

*Fixation of Digenetic trematodes*

1. Alcohol-formalin-acetic acid was used for the fixation of trematodes.
2. First the specimen was taken over a slide under a cover slip.
3. Then the hot fixative was added at the edge of the cover slip and allowed to run under it.
4. After that the slides were kept for 30-40 minutes to evaporate, which would be helpful to observe the internal organ of parasite during permanent slide preparation.
5. Finally digenetic trematodes were transferred to vial containing 70% ethanol for prolonged period.
6. Then these were preserved in glycerin alcohol in vials that were numbered and dated.

*Fixation of Nematodes*

1. After collection of parasite, nematodes were fixed in Barlend's fluid.
2. Then the specimen was flat and preserved in 70% alcohol.

*Fixation of Cestodes*

1. In case of large cestodes, the parasites were carefully pressed between two slides for properly flattened.
2. Dropped few drops of alcohol-formalin-acetic acid at the corner of the slide which slowly entered into the whole body of parasites and left for 15-20 minutes.
3. The parasites were then preserved in fixative for future use.
4. In case of small cestodes specimens were first dropped into the fixative fluid. After a few minutes the worms were preserved.

*Fixation of Acanthocephala*

1. The proboscis of acanthocephalan has a great taxonomic importance.
2. The worms were transferred from the saline water for the protrusion of proboscis.
3. They were fixed into hot formalin acetic alcohol and left for several hours throughout fixation.
4. Finally they were preserved in 70% ethyl alcohol.

*Preparation of temporary slides*

For temporary preparation parasites were processed and cleared through glycerin gel. Some permanent whole mount were prepared, stained with borax caramine, dehydrated with alcohol grades, cleared with lacto phenol and mounted with Canada balsam.

*Identification and analysis of parasites*

The identification of the collected parasites was determined by using following formulae (*i-iii*) according to Yamaguti (1959), Mackiewicz (1981), Hafeezullah (1993), Chandra (2008) and Ash and Scholz (2011).Infestations were analyzed following Margolis *et al.* (1982).

$$i)\ Prevalence = \frac{No.\ of\ hosts\ infested}{No.\ of\ hosts\ examined} \times 100$$

$$ii)\ Mean\ Intensity = \frac{No.\ of\ the\ parasites\ colleted}{No.\ of\ infested\ hosts}$$

$$iii)\ Abundance = \frac{No.\ of\ the\ parasites\ collected}{No.\ of\ hosts\ examined}$$

*Analysis of growth parameters*

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.

$$Relationship = \frac{100\ \times lt}{X}$$

Where, lt = the length of the head and
X = the total body length was applied for all the fish.

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 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 using the following 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.

## RESULTS AND DISCUSSION

A total of 100 individuals of *C. punctatus* were examined, of which 72 fishes were infected by seven species of parasites of six different groups i.e., Crustacea, Digenea, Nematode, Cestode and Acanthocephala.

Table 1. Information of collected parasites with site of infection

| Group of parasites | Species | Site of infection |
|---|---|---|
| Acanthocephala | *Pallisentis ophiocephali* (Thapar, 1931) | Stomach, Intestine |
| Crustacea | *Argulus bengalensis* (*Ramkrishna, 1952*) | Skin |
| Cestode | *Sanga ophiocephalina* | Intestine |
| Digenea | *Euclinostomum multiceacum* (*Tubangui and Masilungun, 1935*) | Liver, Stomach |
| | *Allocreadium handiai* (*Pande, 1937*) | Intestine |
| Nematode | *Camallanus intestinalus* (*Bashirullah and Hafizuddin, 1973*) | Intestine |
| | *Procamallanus mysti* (*Karve, 1952*) | Intestine |

A total number of 87 parasites were collected from host, which belongs to seven species. They were mostly collected from stomach, intestine, skin, liver. The list of the collected parasites with their site of infection is shown in (Table 1).

*Morphology of Allocreadium handiai (Pande, 1937)*

Body was elongated with rounded anterior and posterior ends (3.07-3.82 × 0.47-0.68) mm. Cuticle was smooth. Oral sucker was sub terminal and 0.23-0.31 mm in diameter. Pharynx was well developed. Oesophagus was short with 0.05-0.06 mm. Two intestinal caeca were extending up to posterior extremity of body. Ventral sucker was rounded, pre-equatorial, larger than oral sucker and 0.19-0.25 mm in diameter. Two testes were situated in the hind region of body. Anterior testis was almost equal to posterior testis and lied just behind anterior testis. Cirrus sac was flask-shaped and preacetabular. Ovary was pretesticular and lied behind acetabulum and measure a 0.16-0.22×0.09-0.12 mm. Vitelline glands were follicular and extend from hinder end of acetabulum to posterior end of body. Excretory pore was terminal, leaded into a long tubular excretory bladder which extended up to middle of posterior testis.

*Morphology of Argulus bengalensis (Ramkrishna, 1952)*

The louse was dorsoventrally flattened body divided into three regions: thorax cephalothorax and abdomen. The cephalothorax and its shield were together from an inverted saucer enclosing a cavity housing many appendages. Between the two professional lobes of the shield there was a deep medium sinus extending to the posterior margin of cephalothorax. The thorax consisted of three segments, usually fairly clearly delimited from each other on dorsal surface. *Argulus bengalensis* was also found by Pojmanska (1995) from various carps.

*Morphology of Euclinostomum multicaecum (Tabangui and Masilungun, 1935)*

Body was medium and elliptical elongated 3.22-4.78×1.17- 1.87mm. Oral sucker was small, surrounded by collar like fold when retracted measures 0.45- 0.49×0.56-0.59mm. Pharynx was absent, caeca more or less sinuous wall, opening into excretory vesicles by a very narrow passage. Acetabulam was well developed, larger than oral sucker, 0.59- 1.22×0.88- 0.99mm. Testes were two and irregular, with larger anterior testis, 0.19- 0.22× 0.22-0.56mm. Ovary was small circular, situated between two testes and measured 0.09- 0.12mm diameter with small and v-shaped excretory vesicle.

*Morphology of Camallanus intestinalus (Bashirullah and Hafizuddin, 1973)*

Male: Body was 2.13- 4.98 mm long and0.08- 0.25mm wide. Buccal capsule was 0.066- 0.099×0.09 – 0.1mm with two lateral valves, each with 15- 25 ridges, tridents with equal arms and occasionally middle one long. Oesophagus were divided into two parts with anterior muscular of 0.28-0.45 mm long and conical, pedunculate caudal papillae, and 14-16 pairs of which 6- 8 preanal, 2 adanal and 6 post anal.

Female: Body was 1.99- 11.95mm long and 0.12-0.52mm wide with buccal capsule of 0.08- 0.050×0.05-0.016 mm and as in male. Tridents were also as in male. Oesophagus was anterior 0.16- 0.66mm long and posterior 0.28- 0.87 mm. Tail was 0.28- 1.45mm long with rounded tip. Valve was post equatorial with conspicuous and 2.17-6.82 mm from anterior end.

*Morphology of Procamallanus mysti (Karve, 1952)*

Male: Body was 4.51- 6.10 mm long with posterior glandular of 0.3- 0.35mm ; never ring 0.11- 0.14 and excretory pore 0.13mm both from anterior end; tail 0.04-0.06 mm long, broadly rounded at tip; caudal alae well developed; spicules similar, sharp pointed at posterior end.

Female: Body was 5.23- 7.30 mm long, 0.12- 0.16 mm wide ; buccal capsule 0.06- 0.07×0.025- 0.05; oesophagus, anterior 0.28- 0.33 mm long, with rounded tip; valve post-equatorial, conspicuous, 2.17- 6.82 mm from anterior end.

*Morphology of Pallisentis ophiocephali (Thapar, 1931)*

Male: Body was 5.5 - 6.0 × 0.29 - 0.39 mm. Proboscis was 0.15 × 0.22 mm. Length of the proboscis sac was 0.77 × 0.23 mm. Length of neck gland was 1.62 mm. There were two testes with the anterior testis of 0.60 - 0.66 mm and the posterior testis of 0.35 - 0.66 mm long.

Female: Body was 8.0- 14.0 × 0.195 mm. Proboscis was 0.17 × 0.24 mm in size. Length of the proboscis sac was 2.32 mm. Length of neck gland was 1.62 mm. Size of egg was 0.068 × 0.025 mm.

*Morphology of Sanga ophiocephalina*

Alimentary canal or body cavity was absent. Most were equipped with one attachment or hold fast organ known as scolex. In a generalized cestode the scolex is flattened by small, narrow, unsegmented neck, without sharply limited boundaries, passing into a long body, whose ribbon like appearance prompted the common name of tapeworm. The body is usually depressed. The dorsal and ventral surfaces are called surficia. The strobila are segmented, consisting of many compartments, the proglottids. Each proglottid is a separate unit, consisting one set each male and female reproductive organ. The reproductive organ does not mature at the same time, so that each segment is first male and later female. The strobila is produced by the development of new proglottids in the neck region, so that the proglottids most distant from it are the oldest. Consequently, proglottid nearest the neck was usually in male and those furthest away were female. The life involves either one or more two intermediate hosts, mainly various invertebrates, but sometimes small vertebrates also.

*Monthly infestation*

During the period of investigation 100 *Channa punctatus* were examined. Among them 72 fishes were infested with 87 parasites of different species and groups (Table 2). Average prevalence was found 68 % and average mean intensity was recorded as 1.28. From the monthly infestation it was observed that maximum number of parasite was collected from the host in April and minimum in December. The maximum prevalence (76%) was observed in the month of April in fishes collected from Ratargul swamp forest and minimum prevalence was observed in December (56 %) in fishes collected from Lalabazar fish market. On the other hand the highest mean intensity was recorded in April followed by December. However, lower level of intensity was recorded in December in fishes collected from Ratargul.

Table 2: Parasitic infestation in *Channa punctatus* during different months in 2016

| Months and location | No. of host examined | Prevalence | Mean intensity | Abundance |
|---|---|---|---|---|
| April (Ratargul) | 25 | 76 | 1.44 | 1.04 |
| April (Lalabazar) | 25 | 72 | 1.29 | 0.92 |
| December (Ratargul) | 25 | 68 | 1.21 | 0.80 |
| December (Lalabazar) | 25 | 56 | 1.18 | 0.72 |
| Average | 100 | 68 | 1.28 | 0.87 |

*Changes in the nature of growth (Length)*

The experimental fishes were first differentiated as infested and uninfestedand their average total lengths were estimated (Table 3).Their differences were noted as 0.23 and the percentage loss of length was 1.49.

Table 3: The average length of uninfested and infested *C. punctatus* and the percentage loss of length

| Infested or Uninfested | Number Fish of Examined | Mean Length ± SD | Loss of Length (cm) | % Loss of Length |
|---|---|---|---|---|
| Uninfested | 28 | 15.34 ± 1.57 | - | - |
| Infested | 72 | 15.11 ± 1.79 | 0.23 | 1.49 |

*The categorical variation of head length of infested and uninfested C. punctatus*

The mean length varied with host size. The highest percentage gain of mean head length (4.05) was observed in large (>18) length group and the percentage gain of mean head length (2.99) was observed in small (<14) length groups. The percentage gain of mean length (3.83) was observed in medium (15-17) length groups (Table 4).

*Changes in the nature of growth (Weight)*

During the period of investigation both the uninfested and infested host fish *C. punctatus* were weighted. The average weights of the uninfested hosts were 48.21 ±9.93 g and the average weight of the infested hosts were 43.06± 12.32 g. Due to parasitic infestation the difference of weight was 5.15 g and the percentage loss of weight was 10.68 also shown in (Table 5). It appeared that there was a noticeable loss of weight of the host fish as a result of infestation of parasites after applying t-test at 5% level of significance.

Table 4. Categorical variation of head length (HL) of uninfested and infested *C. punctatus* by different length groups

| Length Groups (cm) | Mean Head Length(cm) ± SD | | % Gain of Mean Head Length |
|---|---|---|---|
| | Uninfested (Head Length cm) Mean ± SD | Infested (Head Length cm) Mean ± SD | |
| <14 | 2.67 ± 1.086 | 2.59 ± 0.74 | 2.99 |
| 15 – 17 | 3.92 ± 0.75 | 3.77 ± 0.70 | 3.83 |
| >18 | 4.93 ± 0.28 | 5.13 ± 0.64 | 4.05 |
| All | 3.43 | 3.67 | - |

Table 5: The average weight of uninfested and infested fish with the percentage loss of weight

| Infested or Uninfested | Number of | Mean Weight(gm)± | Loss of weight( | % Loss of |
|---|---|---|---|---|

| | Examined | SD | gm) | Weight |
|---|---|---|---|---|
| Uninfested | 28 | 48.21 ± 9.93 | - | - |
| Infested | 72 | 43.06 ± 12.32 | 5.15 | 10.68 |

*The nature of weight loss in different length groups*

It was evident that the loss of weight was regular phenomenon for all length of fish due to parasitic infestation. In this investigation the highest loss of weight 11.28 % was noticed in the larger length group and lowest loss of weight 1.61 % was found in medium length groups (Table 6). From this it was evident that the percentage loss of weight was much higher in larger sized fish than in other ones after applying t-test at 5% level of significance.

Table 6. The percentage loss of weight in different length groups infestation of parasites in *C. punctatus*

| Length Groups (cm) | Mean Weight (gm) ± SD | | % Gain of Mean Weight |
|---|---|---|---|
| | Uninfested Mean ± SD | Infested Mean ± SD | |
| <14 | 40.71 ± 7.31 | 39.58 ± 8.45 | 2.77 |
| 15 – 17 | 50.17 ± 7.32 | 49.36 ± 10.55 | 1.61 |
| >18 | 68.00 ± 17.32 | 60.33 ± 7.52 | 11.28 |
| All | 48.21 | 43.06 | - |

*Changes in the nature of growth (Condition factor)*

During the study a total of 100 *C. punctatus* were examined of which 28 fishes were unfinished and 72 fishes were infested by parasites. It was cleared that the uninfested fish have higher condition factor (1.39) than infested ones (1.33) (Table 7).

Table 7: Condition factor of uninfested and infested parasites in *C. punctatus*

| Parameter | Uninfested | Infested | Loss of Condition Factor |
|---|---|---|---|
| Mean Length(cm) ± SD | 15.11 ± 1.57 | 15.34 ± 1.79 | - |
| Mean Weight (gm) ± SD | 43.06 ± 9.93 | 48.21± 12.32 | - |
| Condition Factor | 1.39 | 1.33 | - |

*Prevalence, mean intensity and abundance of parasitic infestation in different length groups*

During the period of investigation the experimental fishes were differentiated as infested and uninfested. Total 100 fishes were examined, of which 72 fishes were infested, rest 28 fishes are uninfested. The experimental fishes were also categorized by different length group. The prevalence was observed higher in the length group of <14 fishes and prevalence is (77.42 %) (Table 7). Mean intensity was observed higher in the medium length group of (1.83) fishes. The maximum parasites were collected from stomach and intestine of infested fishes those were belongs to the medium length group of 15- 17 cm throughout the experimental period.

Table 8: Prevalence, mean intensity and abundance of parasitic infestation in *C. punctatus* of different length groups

| Length group (cm) | No. of hosts examined | No. of hosts infested | Total no. of parasite | Prevalence (%) | Mean intensity | Abundance |
|---|---|---|---|---|---|---|
| <14 | 31 | 24 | 27 | 77.42 | 1.13 | 0.87 |
| 15-17 | 60 | 42 | 49 | 70.00 | 1.67 | 0.81 |
| >18 | 9 | 6 | 11 | 66.67 | 1.83 | 1.22 |

*The condition factor of uninfested and infested C. punctatus in different length groups*

The highest condition factors (0.64, 0.56 and 0.47) were found in uninfested fish in small, medium and large length groups than infested ones (0.58, 0.55 and 0.45)(Table 9). From these results it was indicated that there was a marked difference among different length groups after applying t-test at 5% level of significance.

*Comparison of total length of fishes between Lalabazar and Ratargul Swamp Forest*

The highest gain of mean length was 4.33% found in the month of April and hosts are collected from Ratargul swamp forest. The highest gain of mean length was1.97% found in December and hosts are collected from Lalabazar fish market. The value of percent gain of head length was same 0.38% observed in both months and fishes are collected from Lalabazar fish market in April and Ratargul swamp forest in December. Overall the highest and lowest gain of mean head length was 4.33% and 0.38% found in April.

Table 9. Relationship between infestation and condition factor of fish parasite indifferent length groups in *C. punctatus*

| Length Groups (cm) | <14 | | 15-17 | | >18 | |
|---|---|---|---|---|---|---|
| Infestation | Uninfested | Infested | Uninfested | Infested | Uninfested | Infested |
| Meanlength(cm) | 18.97 ±1.08 | 18.65 ±0.74 | 20.77 ±0.75 | 20.65 ± 0.79 | 23.39 ±0.28 | 24.75 ±0.64 |
| Meanweight(g) | 40.71 ±7.31 | 39.58 ±8.45 | 50.17 ± 7.32 | 49.36 ± 10.55 | 60.00 ±17.32 | 68.33 ±7.52 |
| Condition Factor | 0.64 | 0.58 | 0.56 | 0.55 | 0. 47 | 0.45 |

Fish was susceptible to a wide range of parasites and diseases when under stress from poor environmental condition and inadequate feeding. The result of the study are discussed below. Seven species of parasites named *Allocreadium handiai, Argulus bengalensis, Camallanus intestinalus, Euclinostomum multicaecum, Procamallanus mysti, Pallisentis ophiocephali and Sanga ophiocephalina* were recorded from *C. punctatus* during the present investigation. The parasites were also reported by Ahmed *et al*. (2009).

The findings of Rashid *et al*. (1991) and Chandra (2011) from this host is in agreement of occurrence of these parasites *C. punctatus* in Bangladesh waters. All of the parasites were found to infest in the stomach and intestine of the host fish. However, some parasites were also collected from the external part of the stomach or liver as cystic condition. The distributions of other parasite were found in the intestine of *C. punctatus.*

Monthly variation of infestation was recorded in the present study. The prevalence of parasite was the maximum (76.00 %) in April, and fishes are collected from Ratargul and minimum (56.00 %) in April, and fishes are collected from Lalabazar fish market. The maximum mean intensity of collected parasites was found in December, and fishes are collected from Lalabazar fish market and lowest was recorded from December, fishes are collected from Ratargul.

Chandra (2011) observed highest prevalence and mean intensity in December and lower in August in *Clarias batrachus*. Similar results also observed by Laboni (2011). Factors such as distribution and environment of the host, the diet and mode of feeding, often play important role to limit a parasite to a particular host species as well as higher prevalence occur in a particular season. Similar results found by Khalil *et al*. (2014) form snakehead fish *C. punctatus.*

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*. Parasites showed a selective infestation of larger fishes. Laboni (2011) found that due to parasitic infestation the head length of infected fishes were larger then uninfected fish. Khalil *et al*. (2013) reported that higher gain of mean head length (4.44) was in medium sized grouped (17-21 cm) of *H. fossilis* during high level of infestation. More similar results found by Khalil *et al*. (2014) who showed 4.20 % loss of infested hosts. Loss of weight as a result of crustacean infections has been observed by Lechler (1935), Mann (1964), Goregyad (1955), Grabda (1957) 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 larger numbers. Laboni (2011) investigated that due to parasitic infestation the weight loss was different as 1.63g. The highest percentage loss of weight 26.38 was noticed in the small length group while it was 7.44 in large length group. Significantly the highest percentage loss of weight (28.34) was found in the mild infected smaller length group fish. Infested fishes loss 8.99% weight in larger length grouped *H. fossilis* (Khalil *et al*. 2013).

A few works have been done by Rakibuzzaman *et al*. (2011), Faruque *et al*. (2013) on some parasitic fauna of *C. punctatus* and *C. striatus* from different parts of Bangladesh. Similar findings were observed by Kabata (1958) in case of attack of *Lernaeocera.* Almost identical observations were made by Sproston and Hartely (1941). When values are less than the mean values, the fishes fall in alarming situation due to parasitic infestation. Laboni (2011) found that 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. Khalil *et al*. (2013) investigate that the highest (%) loss of condition factor were 16.83 found in medium length group then others group and the lowest (%) loss of condition factor were 2.08found in large length group.

To conclude, seven species of parasites were recorded from 100 host fishes. Parasites were found to be related to season, length groups and size of host. The highest prevalence (77.42 %) was observed in the length group of <14 cm fishes. The highest mean intensity (1.83) was observed in the length group of >18 cm fishes from Lalabazar fish market in December and the highest prevalence (76.00%) was observed in fishes from Ratargul. The minimum mean intensity (1.18) was observed in fishes from Ratargul in December and the minimum prevalence (56.00 %) was observed in fishes from Lalabazar fish market in April. The highest abundance (1.04) was found in fishes from Lalabazar fish market in December. The study provided preliminary information on infestation and their effects on host, *Channa punctatus.* Further research is necessary for detail understanding of host parasites relationship, life cycles and their nature of infestation.

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