E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2017; 5(5): 86-92

www.fisheriesjournal.com
Received: 03-07-2017
Accepted: 04-08-2017

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A comparative study of parasitic infestation in *Oreochromis niloticus* (Linnaeus, 1758) from Different Sources under Patuakhali District

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Abstract
An investigation was made on the parasitic infestation of Nile Tilapia *Oreochromis niloticus* collected from four different sources, i) Taranga Tonu pond of Patuakhali Science and Technology University (PSTU), ii) Nilkomol pond of PSTU, iii) Pirtala fish market of Dumki upazilla and iv) Chanchal hatchery in Bauphal upazilla during August 2016 to February 2017. A total of 80 host fishes were examined of which 52 fishes were found infected by protozoan and metazoan parasites. A total of 3093 parasites belonging to nine genera (three ectoparasites and six endoparasites) were recorded from the investigated samples. Among the parasites, two were protozoan parasites, one was monogenic parasites and six were digenetic parasites. Endoparasites were higher than the ectoparasites. In terms of endoparasite and ectoparasites, *Capillaria and chilodonella* respectively were found in highest numbers. The maximum prevalence were recorded in Taranga tonu pond (100%) and Nilkomol pond (75%) and lowest was recorded in hatchery source (20%). The highest number of parasites, mean intensity and abundance was observed in the Taranga tonu pond probably due to the poor water quality and associated with the sewage lines and the lowest in numbers of parasites, mean intensity and abundance was observed in the Hatchery.

Keywords: Ectoparasites, Endoparasites, *Oreochromis niloticus*, prevalence, intensity, abundance

1. Introduction
Bangladesh is a riverine country. Fisheries sector in Bangladesh represents as one of the most productive and dynamic sectors in the country. This sector plays a significant role in food security, employment, and foreign exchange earnings in the economy. In Bangladesh, freshwater aquaculture systems mainly revolve around the poly culture of various species of carps (both Indian and Chinese carps) and in varying combinations and densities depending on the availability of seed. The monoculture of the Pangasius catfish is a recent practice using improved management methods. However, costly feed and low market price has slowed progress in farming of this fish. Under such conditions, progressive farmers and entrepreneurs have been looking for alternative species which can maximize production and profit. Among them, the tilapia is the best contender, due to several desirable characteristics. Tilapia fish farming is very profitable and it is a common fish species of Bangladesh and suitable for commercial production. Farming of the tilapia has a great potential in Bangladesh and it will be a prime culture species in the near future for freshwater and brackish water ecosystems. The way tilapia aquaculture is expanding at small, medium to commercial scale; it will not be long before the tilapia contributes to the bulk of aquaculture production. Before starting a Tilapia (*Oreochromis niloticus*) fish culture scheme everyone should be careful of problems or diseases, which threatens fish population and habitats and which pose a definite barrier to the development of the fisheries. Tilapia fish cultured in high stocking densities and in a confined areas. That's why many problem or disease can be arise like viral diseases, parasitic diseases, and fungal diseases. Among them effects of parasitic infestations resulting in diseases is the integral part of the existence of all animals including both cultured and wild fish population. Common protozoan parasitic diseases of freshwater fishes in Bangladesh are caused due to *Trichodina, Chilodonela, Ichthyophthirius, Myxobolus* etc. (Bhuiyan *et al*.,). The parasitic detrimental effects upon fish are diversified. Parasite is an important factor in fisheries and aquaculture as it causes diseases and in many cases is responsible for mortality.

Parasite has a wide range of distribution in all groups of animals. It has been estimated that more than 50 percent of all known species are parasitic at some stages of their life cycle, although parasites are generally considered to be harmful, therefore the eradication of all parasites would not necessarily be beneficial (Chandra, 2013) [3]. Studies on parasites of fishes in Bangladesh particularly in the northern region of Bangladesh are very recent and fragmentary. The study of different parasites along with their frequency and distribution in fishes in different location (fresh and polluted water bodies) is very scant in Bangladesh with a comparison of the considerable progress achieved by India, Japan and other oriental region. Therefore, the study and information about the species composition, community, assemblage, population dynamics etc. of the parasites are very much essential. The present study will also focus on the scopes for studying fish parasitology, aquatic animal health specialists and policy makers to approximate the economic costs of infestation to the *Oreochromis niloticus*. Considering the above, the present study was aimed to survey the parasites in *Oreochromis niloticus* from different sources under Patuakhali district.

2. Materials and Methods

The following materials used and methods during the study period are described below.

2.1 Experimental fish

Tilapia (*Oreochromis niloticus)*, were selected as the experimental fish for the study, as this fish are widely cultured in the Patuakhali district.

2.2 Study area

The study was conducted in Dumki upazilla and Bauphal upazilla of Patuakhali district.

Fig 1: Map of the study area and showing the sampling location

2.3 Sample collection

A total 80 live or freshly dead host sample fishes were collected from the study area. The samples were collected from four distinct sources; i) Taranga Tonu pond of (PSTU), ii) Nilkomol pond of PSTU, iii) Pirtala fish market of Dumki upazilla, and iv) Chanchal hatchery in Bauphal upazilla of Patuakhali district. Samples were collected by cast net from ponds in PSTU and hatchery; and purchased from bazar. Samples were collected from different sources were transported using oxygenated polythene bags with water in live condition or freshly dead for investigation. Among the 80 samples, twenty (20) samples were collected from Taranga Tonu pond, twenty (20) samples from Nilkomol pond, twenty (20) samples from the Hatchery, and twenty (20) samples from the pirtala fish market. The sampling were done from August 2016 to February 2017 and transported to the Laboratory of Faculty of Fisheries, Patuakhali Science and Technology University for detailed investigation

2.4 Size of host fishes

The entire eighty host fishes were almost of the same sizes, 8-10 inches for every individual.

2.5 Examination of host fishes

Foremost, the external surface of the host body including scales, fins, skin, fin base etc. was examined under a Microscope (optical microscopes Italy) for ectoparasites or any kind of lesions. Then scrapping of the skin was done by an unshaped scalpel to collect the mucus in a glass slides for microscopic examination. Next, gills were removed from the branchial cavity by a sharp scissors and placed on a glass slide for microscopic examination for each fishes and also gills slime was collected and incorporated into the slides. After examination of the external surface, the organs were dissected to search the internal parasites. Considerable attention was given to the internal organs, viz., and heart, Liver, Intestine, spleen, gonads and kidneys. Peritoneum and mesenteries were also observed for parasites. After that Parasites were collected from the infected area for gross observation and identified by Microscope (optical microscopes Italy). Cestode parasites were observed under microscopes in a slide and small nematodes and helminthes were collected by a hairbrush. Protozoan parasites were collected from the mucus or body fluid by needle in a slide for microscopic observation.

Fig 2: Dissecting different parts of *Oreochromis niloticus* for identification of parasites.

2.6 Identification of parasites
Parasites were then placed under a compound microscope (Optical microscopes, Italy) and then observed. The printed parasites figures were being used to identify them from the respective published papers. After that a digital camera were used to capture the parasitic image.

2.7 Statistical analysis
All calculations will be calculated by using Microsoft Excel 2010 and other appropriate statistical analytical program was used. The following statistical analyses will carried out after Margolis *et al*. (1982) [8]:

2.7.1 Prevalence
Prevalence (%) = (Number of infected host) ÷ (Total number of host examined) ×100

2.7.2 Abundance
Abundance (%) = (Number of parasites) ÷ (Total number of host examined) ×100

2.7.3 Mean intensity
Mean intensity (%) = (Number of parasites) ÷ (Total number of infected host) ×100

3. Results
3.1 Study of infected fish
80 samples were studied which were collected from four different sources. Among the 80 samples 52 fish samples were found infected by parasites both external and internal parasite. The complete lists of parasitic infestation are presented in Table 1.

Table 1: Number of infected samples

Name of the sources	Sample collected	Infected sample no.
Pirtala Fish Market	20	13
Taranga tonu pond	20	20
Nilkomol pond.	20	15
Chanchal Hatchery	20	4
Total	80	52

3.2 Parasitic infestation
3.2.1 Source 1: Pirtala fish market
20 samples were collected from Pirtala fish market and brought into Fisheries research laboratory, for the identification of parasites. After the microscopic observation, 13 samples were found infected by parasites. The list of parasites that found in the infected fishes is presented in Table 2. Total 890 parasites were found among them 480 are ectoparasites and 410 are endoparasites. Most parasites were found in the gills of the infected fishes.

Table 2: List of parasites recovered and their site of infection in Pirtala Fish market

Site of infection	Types of parasites	Genus of parasite	No. of parasites	Figure No.	
Body surface	Ectoparasites	*Chilodonella*	40	4	Total (Endoparasites) (480)
Gill	Ectoparasites	*Gyrodactylus*	90	5	
		Chilodonella	350	4	
Intestine	Endoparasities	*Oreochromis*	60	9	Total (Endoparasites) (410)
		Orientocreadium	200	12	
		Eustrongylidae	150	7	
Total no. of parasite found 890					

3.2.2 Source 2: Taranga Tonu pond
20 samples were collected from Taranga tonu pond by cast net and brought to the laboratory for the identification of parasites. All of collected samples were infected. Total 1730 parasites were found in 20 infected fish samples among them 700 are ectoparasites and 1030 were endoparasites. Most of the parasites were found in the intestine of the infected fishes.

Table 3: List of parasites recovered and their site of infection in Taranga Tonu pond

Site of infection	Types of parasites	Genus of parasites	No. of parasites	Figure no.	
Body surface	Ectoparasites	*Chilodonella*	133	4	Total (Ectoparasites) 700
		Trichodinia	137	6	
Gill	Ectoparasites	*Gyrodactylus*	130	5	
		Trichodinia	70	6	
		Chilodonella	230	4	
Intestine	Endoparasites	*Capillaria*	416	11	Total (Endoparasites) 1030
		Eustrongylidae	174	7	
		Allocreadium	173	10	
		Leithochirium	267	8	
Total no. of parasites found 1730					

3.2.3 Source 3: Nilkomol Pond

20 samples were collected from Nilkomol Pond and were brought to laboratory for the identification of parasites. 13 fishes were infected out of 20 samples. List of parasites that found in the infected fishes are presented in Table 4. Total 430 parasites were found among them 210 were ectoparasites and 220 were endoparasites. In the Intestine most parasites were found.

Table 4. List of parasites recovered and their site of infection in Nilkomol Pond

Site of infection	Type of parasites	Genus of parasites	No. of parasites	Figure No.	
Body surface	Ectoparasites	*Chilodonella*	57	4	Total (Ectoparasites) 210
		Trichodinia	73	6	
Gill	Ectoparasites	*Trichodinia*	18	6	
		Chilodonella	62	4	
Intestine	Endoparasites	*Leithochirium*	85	8	Total (Endooparasites) 220
		Eustrongylidae	115	7	
		Allocreadium	20	10	
Total no. of parasites found (30 sample) 430					

3.2.4. Source 4: Hatchery (Chanchal Hatchery)

20 samples were collected from the Chanchal Hatchery, Bauphal upazilla of patuakhali district and were brought into research laboratory. Here only four samples were found infected. The list of parasites that recovered from the infected fish sample are presented in Table 5. Total 43 parasites were found in the infected sample that was collected from Hatchery sources among them 16 were ectoparasites and 27 were endoparasites. In the Intestine, most parasites were found.

Table 5: List of parasites recovered and their site of infection in Chanchal hatchery

Site of infection	Type of parasites	Genus of parasites	Parasites No.	Figure No.	
Body surface	Ectoparasites	*Chilodonella*	10	4	Total (Ectoparasites) 16
Gill	Ectoparasites	*Chilodonella*	6	4	
Intestine	Endoparasites	*Capillaria*	8	11	Total (Endoparasites) 27
		Allocreadium	19	10	
Total no. of parasite found (10 sample) 43					

A total of 3093 parasites belonging to nine genera (three ectoparasites and six endoparasites) were collected from 52 infected fish samples out of 80 examined samples of 4 different sources. All of the parasites were found in the skin, gills, body surface and intestine. Among the collected parasites, two were protozoan parasites (*Trichodina, Chilodonella*), one was monogenic parasites (*Gyrodactylus*), and six were digenetic parasites (*Allocreadium, Leithochirium, Eustrongylidae, Oreochromis, Orientocreadium and capillaria*).

3.2.5 Ectoparasites

Three genera of ectoparasites were found among them two were protozoan (*Trichodina and Chilodonella*), one was monogenic parasites (*Gyrodactylus*).The figure of ectoparasites that were identified from the infected fish sample are given in (Fig. 4, Fig. 5, Fig. 6).

Fig 4: *Chilodonella* (Gills)

Fig 5: *Gyrodactylus* (Gills and Skin)

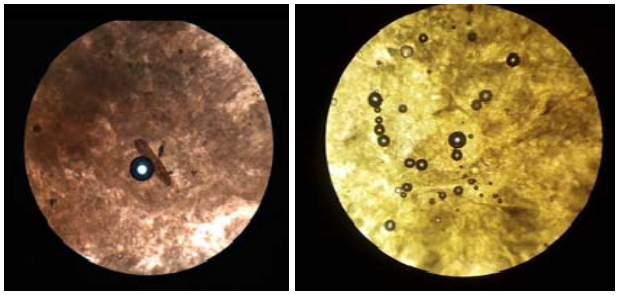

Fig 6: *Trichodinia* (Gills or skin)

3.2.6 Endoparasites

Six genera of endoparasites were found. These were *Allocreadium, Leithochirium, Eustrongylidae, Oreochromis, Orientocreadium and capillaria*. The figures of endoparasites that were identified from the infected fish samples are given in (Fig.7, Fig. 8,Fig. 9, Fig. 10, Fig. 11, Fig. 12)

Fig 7: *Eustrongylidae* (intestine)

Fig 8: *Leithochirium* (intestine)

Fig 9: *Oreochromis* (intestine)

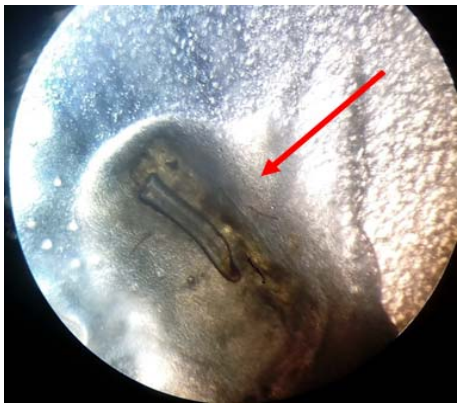

Fig 10: *Allocreadium* (intestine)

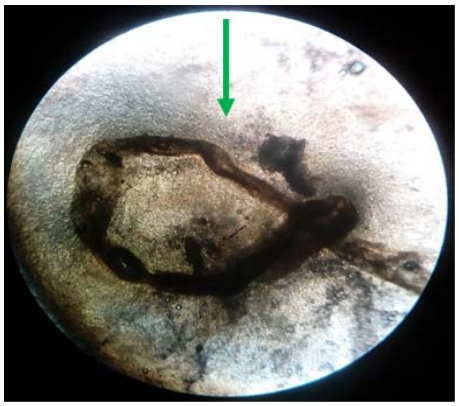

Fig 11: *Capillaria* (intestine)

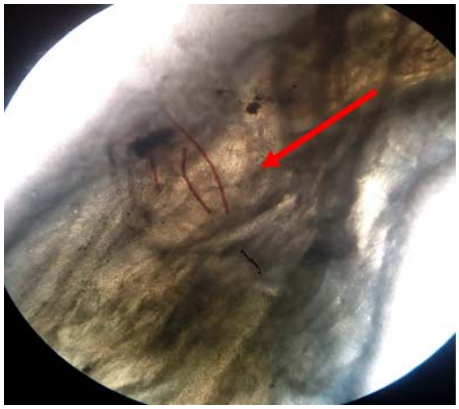

Fig 12: *Orientocreadium* (intestine)

Table 6: Prevalence, mean intensity and abundance of parasitic infestation of *O. niloticus* in different sample areas.

Sample areas	No. of Host		Total no. of parasites recorded	Prevalence (%)	Mean intensity (Unit)	Abundance (Unit)
	Infected	Examined				
Pirtala Bazar	13	20	890	65%	68.46	44.5
Taranga Tonu pond	20	20	1730	100%	86.50	86.5
Nilkomol pond	15	20	430	75%	28.66	21.5
Hatchery	4	20	43	20%	10.75	2.15
Total	52	80	3093	65%	59.48	38.66

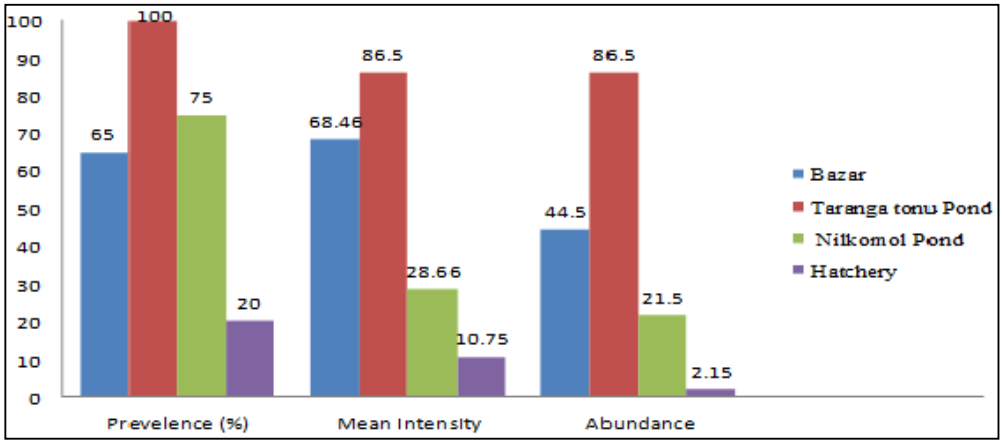

Fig 13: Comparative prevalence, abundance and mean intensity of parasites in different sample areas of (*Oreochromis niloticus*).

Table 7: Different types of parasites recorded and their numbers.

Genus of the Parasites	No. of Parasite Found	Types of parasite
Chilodonella	888	Ectoparasites
Trichodinia	298	,,
Gyrodactylus	220	,,
Oreochromis	60	Endoparasites
Leithochirium	352	,,
Eustrongylidae	439	,,
Orientocreadium	200	,,
Capillaria	424	,,
Allocreadium	212	,,
Total ectoparasites	1406	
Total endoparasites	1630	
Total (Ecto +EndoParasites) 3093		

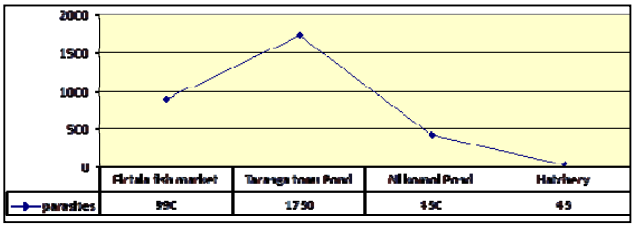

Fig 14: No of parasites found in Different sources

4. Discussion

The highest prevalence of parasite (100%) was recorded from 20 fish samples belonging to the Taranga tonu pond and also (75%) was recorded from 20 samples of Nilkomol pond. But the parasites were found higher in the Taranga tonu pond Than Nilkomol pond. Lowest were (20%) from 20 fish samples belonging to the Hatchery. Pirtala fish market prevalence of parasites (65%) was recorded from 20 fish samples. (Table 6 and Fig 13). The highest mean intensity of parasites (86.50%) was observed in the Taranga tonu pond and the lowest (10.75) was in the Hatchery samples. While the mean intensity of parasites in Nilkomol pond and the Pirtala fish market were recorded 28.66 and 21.5, respectively (Table 6 and Fig 13). The abundance value ranged from 2.15% to 86.50 %. The highest value was recorded (86.50) from the Taranga tonu pond. While the lowest from the Hatchery which was 2.15. Pirtala fish market and Nilkomol pond was recorded respectively 44.45 and 21.50%. (Table 6 and Fig 13). The present study deals with different external and internal parasites they infested *O. niloticus* in relation to the different sources. The present study showed that the maximum infestations were recorded from the medium length group 8-10 centimeter the present finding agree with those of Golder *et al.* (1987) [6]. *Oreochromis niloticus* is an exotic species in Bangladesh. Exotic species have fewer parasite species in their introduced range relative to their native range Dominique, *et al.*, (2010) [4]. Similar findings have been observed in this study. In the present study, the highest parasitic infestation were found in Taranga tonu pond (1730 parasites) and then in Pirtala fish market (890 parasites). These were probably due to the poor water quality of Taranga tonu pond and were associated with the drainage system of PSTU. The stocking density of fishes was high during the study period. The present findings agree with that of Eissa *et al.*, (2010) [5]. Total ectoparasites were 1420 parasites and endoparasites were estimated 1530 parasites. (Table 7 and Fig. 14) Endoparasites are predominant in tilapia than ectoparasites. Eissa *et al.* (2010) [5] also studied on Tilapia and found similar results. Among the identified parasites, *Chilodonella* of gills parasites counted highest numbers (888 parasites) (Table 7). The *Oreochromis niloticus* gills were highly susceptible to parasite, mainly by protozoans and monogeneans Peter Akoll *et al*. (2012). In the present study, it was also found that the tilapia fish samples were highly infested by protozoans and monogenean parasites. These parasites can affect the fish in exhibited depigmentation, skin ulceration, scale loss, excessive mucus production and gill

lesions. Pádua *et al*. (2013) [10]. In terms of endoparasite, the *Capillaria* and *Eustrongylidae spp* were found in highest numbers (439 and 424 parasites). *Eustrongylidae* was found the highest numbers (439 parasites.) *Eustrongylides* species represents the potential public health risks, as these parasites are recognized to infect humans from consumption of raw or inadequately cooked fish. (Bekele and Hussien, 2015) [1].

5. Conclusion

The present study revealed that the Taranga tonu ponds is highly infested with parasites both ectoparasites and endoparasites. A total of 3093 parasites belonging to nine genera were identified from 52 fish (infected) samples out of 80 samples from four different areas. Endoparasites were higher than the ectoparasites. Parasites were mainly found in the gills, body surface and the intestine. The Taranga tonu ponds (unmanaged pond) Abundance, mean intensity and prevalence was highest, this was probably due to the fact that the water quality of Taranga tonu was poor and associated with the drainage line, high stocking density and the ponds were not well managed, on the other hand hatchery abundance, mean intensity and prevalence was lowest. This was probably due to the fact that the good water quality of Hatchery, good pond management and not associated with drainage/sewage lines. Therefore, appropriate control measures could be put in place in the Ponds so as to avoid infection of the fish. Further studies may be attempted on the parameters of the water bodies and good pond management system which are directly related to parasitic infestation.

6. Acknowledgement

The author expresses his heart squeezed gratitude, indebtedness and sincere appreciation to Research and Training Center of Patuakhali Science and Technology University and all beloved teachers, for valuable suggestion and co-operations during the study. The author also expressed his thanks to Chanchal Biswas owner of the Chanchal Hatchery.

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