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A comparative study of endoparasite infestation of *Oreochromis niloticus* (Linnaeus, 1758) in polluted and non-polluted water bodies of Bangladesh

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ABSTRACT

The present study was conducted on the host fish named *Oreochromis niloticus* (Linnaeus, 1758) of the family Cichlidae. A total of 42 host fishes of the same species was collected from the two different locations, Pagla Lagoon at Narayanganj and Tongi Hatchery at Gazipur. The host was identified and separated into two groups of males and females. Host fishes were divided into five length groups and eight weight groups according to their length and weight respectively. The female hosts were observed to be more infested than the males. The parasitic infestation, prevalence and intensity of host fishes in Tongi hatchery were observed higher than the host fishes of Pagla lagoon. A total of sixty one and one hundred and twenty three parasites were recovered from a host of Pagla lagoon and Tongi respectively. Each parasite was examined for taxonomic identification. A total of seven parasites were identified from three taxonomic groups. Trematodes: *Allocreadium mahaseri* (Pande, 1938), *Clinostomum piscidium* (Southwell et. Prasad, 1918), *Lecithochirium sp.* (Liihe, 1900), *Opegasterditrematis* (Yamaguti, 1942). Nematodes: *Gnatho stoma spinigerum* (Owen, 1836), *Porrocaecum sp.* (Ralliet. et. Henry, 1912). Acanthocephala: *Pallisentis nandai* (Sarker, 1953). *Allocreadium mahaseri*, *Gnathostoma spinigerum* and *Porrocaecum sp.* parasitic species affected commonly the host fishes of both water bodies. Only one acanthocephalan, *Pallisentis Nanda* was collected from Tongi hatchery and one trematode *Lecithochirium sp.* from Pagla Lagoon.

Keywords: Endoparasite, Tilapia, Bangladesh, Infestation, Length, Weight, Water Quality

1. Introduction

Bangladesh is a small country of South Asia. It is rich in fisheries resources along with large rivers, huge number of beels, lakes, haors and ponds. Fisheries resources play an important role in the economy of Bangladesh. The aquatic bodies of Bangladesh usually harbour about 260 species of freshwater fishes [9]. It is estimated that these fishes contribute 32.8 g of protein out of 57 g of protein required per person per day [1]. So, fish plays an important role to fulfil the demand of animal proteins of the population of Bangladesh. But over the past two decades the consumption of fish has actually declined from about 33 g to 22 g per capita per day (Socioeconomic Indicators, Bangladesh Bureau of Statistics). Parasitic infestation of fish is one of the most important reasons for declining the fish consumption. All living beings as well as fishes are infested by parasites and subject to disease and some fishes only carry parasites without any harmful effect. As a consequence of this infestation the food value of fish deteriorates and mortality of fishes occurs due to heavy infestation.

The parasites of fish live in or on the fish body for food or shelter. They have been linked with mechanical interferences, distribution of host tissue, abnormal growth, biological effect and various kinds of tissue reaction such as effects of toxins, poisons or secretion of parasites to the host. Some parasites damage the tissue of the gills and destroy the respiratory system. The parasitic infestation decreases the growth rate and heavy worm burden, reduce the host's reproductive potentials and delay sexual maturity of fishes [5]. The wall of intestine, stomach, bile duct, liver of fishes become damaged by the irritating activities of parasites which cause the site for secondary infection by bacteria [3]. But, if a few numbers of parasites are present, the fish usually not show visible impairment. If large numbers are present, the fish may be killed. The study of different parasites along their frequency & distribution of fishes in different location (fresh & polluted water bodies) is very scant in Bangladesh with a comparison of the considerable progress achieved by India, Japan & other oriental region. Therefore, the study & information about the species composition, community, assemblage, population dynamics etc. of the parasites are very much essential.

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Our target host fish, Tilapia (*Oreochromis niloticus*) of two different locations, one of the polluted (lagoon in Pagla, Narayanganj) water body and another from the fresh water of Gazipur has been investigated. No work has been found in the comparative study of parasites of *Oreochromis niloticus* (Linnaeus, 1758) in Bangladesh. So, by this study it can be achieved more information about the parasitic infestation of fish in different location which has not been investigated yet. The present study carried out to establish the relationship between host and parasitic infestation in different location of tilapia fish.

The main purpose of the study was to investigate the different endoparasitic infestation and their distribution in various organs of the *Oreochromis niloticus* (Linnaeus, 1758) especially in intestine, liver, stomach and body cavity and to determine the differences between pollutant and non-polluting water body's parasites.

2. Materials and Methods

The present study was conducted on the host fish named *Oreochromis niloticus* (Linnaeus, 1758) of the family Cichlidae collected from two different water bodies. The fishes were collected from Pagla lagoon (polluted) of Narayanganj and the Tongi hatchery of Tongi and investigated from May to August of 2007. The parameters of sample water were tested from the laboratory of BCSIR. Collected fishes were brought to the Parasitology Laboratory, Dept. of Zoology, University of Dhaka for detail observation regarding the biological aspects of the host fish and the infestation of fish by different endoparasites in their ecological niche.

Identification of *Oreochromis niloticus* was followed by Day [4], Munro [7], Shafi and Quddus [11] and Rahman [9]. After collection, the specimens were kept temporarily in a freezer for further investigation. Each host was examined for studying the incidence of parasites infestation or prevalence and intensity in different length and weight groups. Distribution of parasites in different sexes of host, original distribution, seasonal infestation and parasite infestation in relation to the fish food also considered.

A total of 42 fish hosts were studied throughout the period of investigation of which 20 were belonged to *Oreochromis niloticus* (Linnaeus, 1758) from Pagla, Narayanganj and 22 were belonged to *Oreochromis niloticus* from Tongi, Gazipur. Grouping of host fishes were done to study the relation between the length-weight of hosts and prevalence and mean intensity of parasites.

The total body length of the host fish was measured from the tip of the body snout to the extremity of the caudal fin by centimeter scale, (Diagonal scale, Germany) fitted with a specially designed length measurement board. A total 42 specimens of Pagla lagoon and of Tongi ranging in length from 14 to 19 cm were studied for parasites and fishes were divided into five length groups, group 1: 14-15 cm, group 2: 15.1-16 cm, group 3: 16.1-17 cm, group 4: 17.1-18 cm, group 5: 18.1-19 cm.

Weight of the specimen was taken by a very sensitive digital analytical single pan balance (cent-0-GRAM, 311 g, capacity made by USA, No. J. 44631) in grams. Before taking the weight, the specimen was dried by using tissue paper. The weight of host fish species from both locations were divided into eight weight groups, group 1: 50-59 g, group 2: 60-69 g, group 3: 70-79 g, group 4: 80-89 g, group 5: 90-99 g, group 6: 100-109 g, group 7: 110-119 g, group 8: 120-129 g.

For collecting internal parasites, fish were first placed on a dissecting tray. Then, it was cut open through the mid-ventral position of the body by an incision, proceeding from the anal region of the mouth. The surface lining of the body cavity, outer surface of the visceral organs, mainly stomach, intestine, liver, swim bladder, muscle layers, testes, ovary etc. were examined for encysted larvae, as well as for adult parasites. Each organ was kept in physiological saline solution (0.75% NaCl solution). Each organ was examined individually for parasites. The collected organs were split open by a scissors and were scrapped by the blunt end of a scalpel to dislodge the parasites which might be attached to the epithelial lining or hide in the mucus. Large parasites were then collected by using the brush, dissecting pins and droppers.

The smaller specimen that might escape from the naked eye, were observed under the stereoscopic binocular microscope with 40 times magnification and were collected by brush and dropper. The collected parasites were transferred to the fresh saline solution to make them clear from debris with a brush, dissecting pins and forceps. Then, the collected parasites were sorted out and stored into three major groups such as trematodes, nematodes and acanthocephalan using the group characteristics of the parasites following Yamaguti [15] and then the parasites were fixed in their respective fixative, cleared and stained accordingly to the methods suggested by Cable [2]. A compound microscope and a binocular microscope were used for the identification of the parasites. For systematic study, the scheme of classification adapted by Yamaguti [14-16] in three volumes of trematodes, cestodes and nematodes in the "Systema Helminthens" series was followed.

3. Results and Discussion

3.1 Water quality of two investigated locations: The water quality parameters of the Pagla lagoon did not maintain the standard value of water. According to lab test of the BCSIR, CO₂, hardness, nitrate, nitrite and ammonia were higher than the standard value, whereas dissolved oxygen, alkalinity and chloride were lower than normal value. The temperature was almost same as normal value.

According to test result of BCSIR, the water of Tongi followed the standard value which was: Temp. 28-29.5 °C, Dissolved Oxygen 6.7-8.3 ppm, PH 6.5-8.5, CO₂ 14-25 mg/L, Hardness 100-120 mg/L, Chloride 110-136 mg/L, Alkalinity 68.4-82.6 mg/L, Nitrate 50mg/L, Nitrite 0.02-0.03 mg/L and NH₃ 0.00-1.75 mg/L.

3.2 Identification and description of the parasitic species:

A total of 61 and 123 parasites were extorted from host fishes of Pagla lagoon and Tongi respectively. Each parasite was examined for taxonomic identification. A total of seven parasites were identified from three taxonomic groups. They were Trematodes: *Allocreadium mahaseri* (Pande 1938), *Clinostomum piscidium* (Southwell et. Prashad 1918), *Lecithochirium sp.* (Lihe 1900), *Opegasterditrematis* (Yamaguti, 1942). Nematodes: *Gnathostoma spinigerum* (Owen 1836), *Porrocaecum sp.* (Ralliet et. Henry 1912). Acanthocephala: *Pallisentis nandai* (Sarker 1953). *Allocreadium mahaseri*, *Gnathostoma spinigerum* and *Porrocaecum sp.* parasitic species affected commonly the host fishes of both water bodies. Only one acanthocephalan, *Pallisentis nanda* was collected from Tongi hatchery and one trematode *Lecithochirium sp.* from Pagla Lagoon.

3.3 Trematodes: Eighteen specimens of *Allocreadium mahaseri* (Pande 1938) species were collected from the intestine of fifteen *Oreochromis niloticus* (Host fish) and twenty six specimens were collected from the intestine of thirteen host fish in Tongi. A number of twenty seven specimens of *Clinostomum piscidium* (Southwell et Prashad 1918) trematodes were collected from the body cavity of sixteen host fishes of Tongi. Sixteen specimens of *Lecithochirium spp.* (Liihe, 1900) were collected from stomach and intestine of nine host fishes of Pagla Lagoon. Twenty two specimens of *Opegasterditrematis* (Yamaguti 1942) were collected from stomach and intestine of fifteen host fishes of Tongi.

3.4 Nematodes: A total number of nineteen specimens of *Gnathostoma spinigerum* (Owen 1836) were collected from the liver of thirteen specimens of host *Oreochromis niloticus* in Pagla lagoon and ten specimens of parasites were collected from the liver of seven host fishes of Tongi. Thirty two specimens of *Porrocaecum sp.* (Ralliet et Henry 1912) were collected from nineteen host fish from Tongi and eight specimens were collected from seven host fish from Pagla

lagoon, in both cases the parasites were found in the body cavity and liver of fish hosts.

3.5 Acanthocephalans: A number of six specimens of *Pallisantianandai* (Sarker, 1953) were collected from the liver of five host fish of Tongi.

3.6 Data analysis: The present study was conducted on one host named *Oreochromis niloticus* of the family Cichlidae. A total of 42 host fishes were collected from the two different locations. Out of 42 species 20 was taken from Pagla lagoon of Naraonganj and 22 species from Tongi hatchery, Gazipur. The host was identified and separated into males females. Length and weight measurements were taken and divided into five length groups and eight weight groups. The ratio of collected male and female host fishes was 1:1. The female hosts were observed to be more infested than the males (Table 1). According to Thomas [13], this might be due to lower physiological resistance of female of it might be due to the fact that the female hormone oestrogen inhibits the infestation of the parasites [6].

Table 1: Total no of parasites and total no of infested fishes (male and female) in different groups of parasites.

Group of parasite	Name of parasite	Number of parasite(Tongi)						Number of infested fishes (Tongi)					
		In male		In female		Total		In male		In female		Total	
		Tongi	Pagla Lagoon	Tongi	Pagla Lagoon	Tongi	Pagla Lagoon	Tongi	Pagla Lagoon	Tongi	Pagla Lagoon	Tongi	Pagla Lagoon
Trematode	<i>A. mahaseri</i>	14	9	12	9	26	18	7	8	6	7	13	15
	<i>C. piscidium</i>	10	-	17	-	27	-	6	-	10	-	16	-
	<i>O. ditrematis</i>	8	-	14	-	22	-	6	-	9	-	15	-
	<i>Lecithochirium sp.</i>	-	2	-	14	-	16	-	1	-	8	-	9
Nematode	<i>G. spinigerum</i>	7	9	3	10	10	19	5	6	2	7	7	13
	<i>Porrocaecum sp.</i>	13	3	19	5	32	8	9	3	10	34	19	37
Acanthocephalan	<i>P. nandai</i>	2	-	4	-	6	-	2	-	3	-	5	-

Table 2: Distribution of each parasite in different host fish organs.

Group of parasites	Name of parasites	Organ							
		Body cavity		Intestine		Liver		Stomach	
		Tongi	Pagla Lagoon	Tongi	Pagla Lagoon	Tongi	Pagla Lagoon	Tongi	Pagla Lagoon
Trematode	<i>A. mahaseri</i>	0	0	26(100%)	18(100%)	0	0	0	0
	<i>C. piscidium</i>	27(100%)	-	0	-	0	-	0	-
	<i>O. ditrematis</i>	0	-	14(63.64%)		0	-	8(36.36%)	
	<i>Lecithochirium sp.</i>	-	0	-	10(62.50%)	-	0	-	6(37.50%)
Nematode	<i>G. spinigerum</i>	0	0	0	0	10(100%)	19(100%)	0	0
	<i>Porrocaecum sp.</i>	12(37.50%)	3(37.50%)	0	0	20(62.50%)	5(62.50%)	0	0
Acanthocephalan	<i>P. nandai</i>	0	-	0	-	6(100%)	-	0	-

The parasitic infestation, prevalence and intensity of the Tongi water body were observed higher than the Pagla lagoon host

fishes and middle group fishes are more infected by parasites than other groups. Strombery *et al.* reported that, prevalence and

intensity of infestation generally increase with the host size group up to a point and then decline (Table 3). A total of sixty one and one hundred and twenty three parasites were recovered

from a host of Pagla lagoon and Tongi hatchery respectively. Each parasite was examined for taxonomic

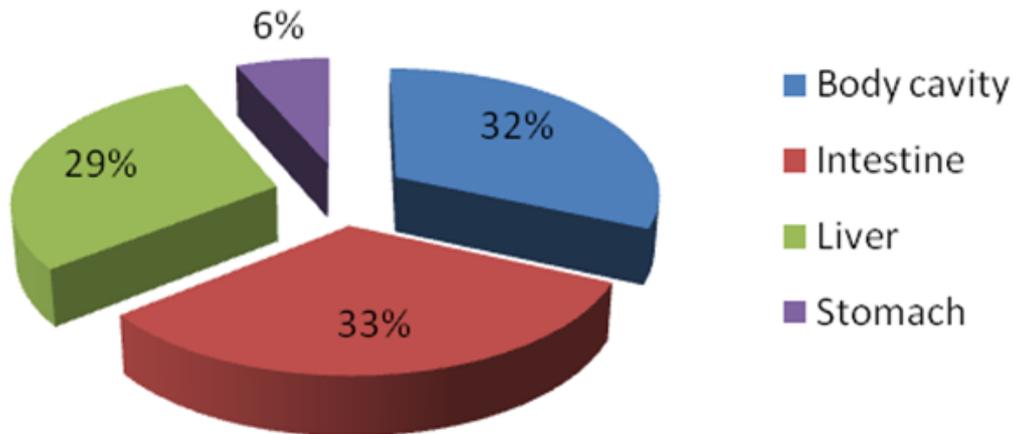


Fig 1: Organal distribution of parasites in host fishes of Tongi.

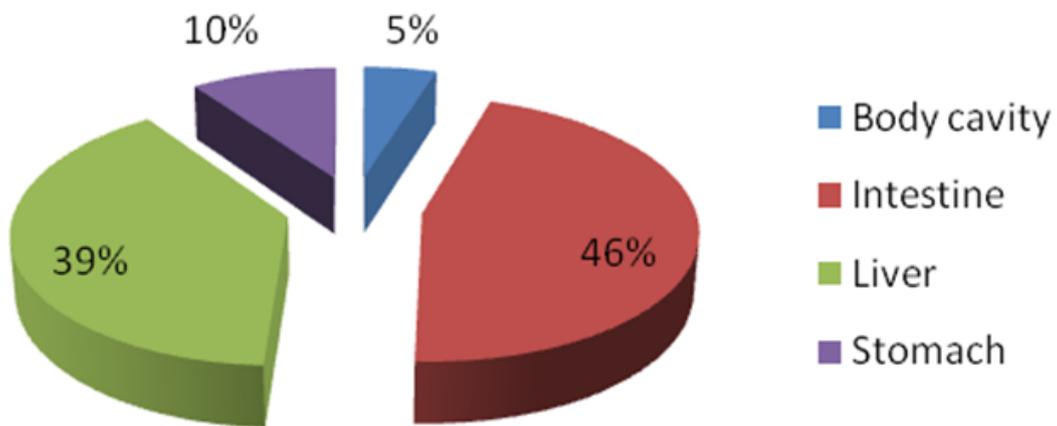


Fig 2: Organal distribution of parasites in host fishes of Pagla Lagoon

Table 3: Prevalence and intensity of different groups of parasites in host fishes (male and female).

Group of parasite	Name of parasite	Prevalence and Intensity	Gender (Tongi)			
			Male		Female	
			Tongi	Pagla Lagoon	Tongi	Pagla Lagoon
Trematode	<i>A. mahaseri</i>	Prevalence(%)	63.64	80	54.55	70
		Intensity	2	1.13	2	1.29
	<i>C. piscidium</i>	Prevalence(%)	54.55	-	90.9	-
		Intensity	1.67	-	1.7	-
	<i>O. ditrematis</i>	Prevalence(%)	54.55	-	81.82	-
		Intensity	1.33	-	1.56	-
<i>Lecithochirium</i> sp.	Prevalence(%)	-	20	-	80	
	Intensity	-	1	-	1.75	
Nematode	<i>G. spinigerum</i>	Prevalence(%)	45.45	60	18.18	70
		Intensity	1.4	1.5	1.5	1.43
	<i>Porrocaecum</i> sp.	Prevalence(%)	81.82	40	90.91	30
		Intensity	1.44	1	1.9	1.25
Acanthocephalan	<i>P. nandai</i>	Prevalence(%)	18.18	-	27.27	-
		Intensity	1	-	1.33	-

Table 4: Number of parasites in different length groups of host fishes.

Name of parasites	Group 1		Group 2		Group 3		Group 4		Group 5	
	Tongi	Pagla Lagoon								
<i>A. mahaseri</i>	2	7	6	7	9	2	7	2	2	0
<i>C. piscidium</i>	0	-	2	-	12	-	9	-	4	-
<i>O. ditrematis</i>	1	-	4	-	14	-	5	-	1	-
<i>Lecithochirium</i> sp.	-	6	-	3	-	1	-	4		2
<i>G. spinigerum</i>	0	7	5	6	4	3	1	3	0	0
<i>Porrocaecum</i> sp.	1	4	4	1	13	0	9	3	6	0
<i>P. nandai</i>	1	-	0	-	2	-	2	-	1	-

Table 5: Number of parasites in different weight groups of host fishes.

Name of parasites	Group 1		Group 2		Group 3		Group 4		Group 5		Group 6		Group 7		Group 8	
	Tongi	Pagla Lagoon														
<i>A. mahaseri</i>	0	4	0	5	3	3	5	4	3	0	5	0	8	2	2	0
<i>C. piscidium</i>	0	-	0	-	0	-	4	-	6	-	9	-	4	-	4	-
<i>O. ditrematis</i>	0	-	0	-	3	-	5	-	8	-	4	-	4	-	1	-
<i>Lecithochirium</i> sp.	-	2		4	-	2	-	2	-	2	-	0		2		0
<i>G. spinigerum</i>	0	4	0	7	1	1	4	4	2	1	2	0	1	2	0	0
<i>Porrocaecum</i> sp.	0	2	0	1	3	1	3	1	8	2	7	0	7	1	5	0
<i>P. nandai</i>	0	-	0	-	1	-	0	-	1	-	0	-	4	-	0	-

identification. A total of seven parasites were identified from three taxonomic groups. (Table 1, 2 & 3)

Allocreadium mahaseri, *Gnathostoma spinigerum* and *Porrocaecum* sp. parasitic species affected commonly the host fishes of both water bodies. Only one Acanthocephalan, *Pallisentis nandai* was collected from Tongi.

A number of six specimens were found from the liver of five host fish in Tongi. Forty parasites collected from the intestine, 39 parasites from body cavity, 36 parasites from the liver and 8 parasites from the stomach of host fishes of Tongi. In Pagla lagoon host fishes 28 parasites collected from the intestine, 24 parasites from the liver, 6 parasites from the stomach and 3 parasites from the body cavity. It is generally accepted that the

gut helminths actively select a site in the gut, which is most suitable and thus resulting an ordered distribution ^[17] (Table 2, Figure 1 & 2).

On the basis of weight group the highest number (15) of parasites were found in group-3 (70-79 gm) and the lowest number (7) of parasites were found in two groups, group-5 (90-99 gm) and group-7 (110-119 gm) for Pagla lagoon host fishes and the highest number (32) of parasites were found in group-5 (90-99 gm) and lowest number (10) of parasites were found in group-3 (70-79 gm) Tongi host fishes (Table 4 & 5). In Pagla lagoon the highest number (19) of parasites were *Gnathostoma spinigerum* and the highest number of infected fishes (15) were affected by *Allocreadium mahaseri* and in the Tongi water body

the highest number of parasites (32) were *Porrocaecum sp.* and the highest number of fishes (19) were affected by *Porrocaecum sp.* (Table 4 & 5).

In Tongi fishes the highest number of is occurred by *Porrocaecum sp.* parasites in both male and female were 81.82% and 90.91% respectively and the highest intensity is occurred by *Allocreadium mahaseri* in both male and female. In Pagla lagoon the highest prevalence was occurred by *Allocreadium mahaseri* (80%) and *Lecithochirium sp.* (80%) for both male and female respectively and the highest intensity was occurred *Gnathostoma spinigerum* (1.5) and *Lecithochirium sp.* (1.75) for both male and female respectively (Table 3 & 5).

4. Conclusion

The present study revealed that: The parasite fauna of *Oreochromis niloticus* is common in region of the Indian subcontinent. The *Oreochromis niloticus* (Linnaeus, 1758) species are more infested than other species. Female fishes are more infested than males. Generally the middle stages of length and weight groups of host fishes are more infested than other groups. There is a fluctuation in parasite numbers and in parasitic groups related to the water body condition in Bangladesh. Further studies may be attempted on the parameters of the water body which are directly related to parasitic infestation. Histopathological damages of host fish caused by the parasites, biochemical and physiological study of the parasites and population dynamics of each parasite, infra-population and diversity of parasitic species found in *Oreochromis niloticus*, may be further investigated.

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