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INVESTIGATION OF PARASITE AND DISEASES AT CAGE CULTURE NILE TILAPIA (*Oreochromis niloticus*) IN SOUTHERN REGION OF BANGLADESH

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The study was carried out to identify the parasite and causative diseases on cage reared tilapia at Bakerganj upazila, Barisal district. The infected tilapia fishes were collected from the cages and brought to the laboratory to find out signs, symptoms and infection area on the fish body. Physico-chemical parameters of water, such as water temperature, pH, dissolved oxygen, nitrate, phosphate and ammonia were monitored fortnightly. The values of water temperature (°C), pH, dissolved oxygen (mg/l), nitrate (mg/l), phosphate (mg/l) and ammonia (mg/l) were 32.4±2.1, 6.2±0.3, 7.52±0.4, 0.028±.008, 11.30±2.26 and 0.09±0.02, respectively but the concentration of nitrate was so higher during the study time. Eleven species of parasites namely, *Chilodonella sp, Trichodiniasp., Gyrodactylussp.,Cichlidogyrus sp., Capillariasp, Orientocreadium sp, Eustrongylidae sp, Allocreadium sp, Euclinostomum sp, Tylodelphys sp.* and *Metagonimus sp*were were identified. Parasites were found on all the examined parts of the fish body but gill showed the most infested area of the host. Highest mortality rate was occurred in the month of October and lowest mortality rate was in July. In this circumstance, proper management system and handling are best ways to prevent diseases and reduce the mortality rate of tilapia on cage farming in the southern area.

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INTRODUCTION

Tilapia is a worldwide fish of great commercial importance and it is recognized as one of the most important species in tropical freshwater aquaculture. It is the most significant fish species which can reduce the gap of increasing worldwide demand for protein sources from fish (Ng and Romano, 2013). GIFT strain has great potential in Bangladesh and it is going to be a prime culture species in near future for both fresh and brackish water ecosystems. The main advantage of tilapia on its low production cost, availability of fry & feed and the quality of muscle. The attributes that make Nile's tilapia so suitable for fish farming because of its resistance against harsh conditions, ease of breeding, rapid growth rate, ability to efficiently convert organic and domestic wastes into high quality protein, and good taste (de Graaf *et al*. 1999).

Parasites are important components of host biology, population structure and indeed ecosystem functioning. They can be found in any fish species and within any type of aquatic culture system (Marcogliese, 2004). They range from protozoans to metazoans including myxozoans, trematodes, cestodes, acantho-cephalans, nematodes, and crustaceans (Marcogliese, 2004). The knowledge of fish parasites is important both fish health and understanding ecological problems in tropical Africa (Paperna and Thurston, 1969). Fish parasites have been recognized as a serious threat of fish both in aquaculture and fisheries (Paperna and Thurston, 1969). Recently cage culture is practiced all over the countries due to off flavor or landless people. In aspect of Bangladesh, cage culture of tilapia is more popular practice in Barisal because utilization of lotic water bodies over the area. Physico-chemical parameter has a great role on aquatic organisms especially on aquaculture productivity and cage culture fish farming. Stress, pathogens and diseases are increased when change the water quality parameter. Changes in the physico-chemical parameters may positively or negatively affect on the biota of water bodies in a number of ways such as their survival and growth rate and these may eventually result in disappearance of some species of organisms or its reproduction (Edward and Ugwumba, 2010). In cage culture system parasitic and diseases are great threat for culture species. When individual parasites can be seen with the naked eye, an intensity range is often used to describe the infectivity level within the fish host (Siquier and Ostrowski de Núñ-ez, 2009). Parasitic species presence in their host is generally at equilibrium in aquatic organisms and the most common lifestyle on the planet (Marcogliese, 2005). Sometimes pesticides, medicine are also used to prevent the diseases. But the diseases controlling is also impossible when outbreak is so high. The main objective of this study was to investigate the most common parasites of Nile Tilapia *(Oreochromis Niloticus*) in cage farming.

MATERIALS AND METHODS

Study area

The study area was located at Bakerganj upazila under Barisal district. The geographical location of the study is well place on the bank of the Burishwar River. A total number of 97 cages were installed in the study area. Bamboo and slim net were used to make the cage. For floating the cage, oil drum were used in every cage. Each cage size was 20×10×6 ft^3 where length was 20 ft, width 10 ft and depth 6 ft.

Sample collection

A total number of 400 live and dead infected fish sample were collected from the cage area. Fish were collected randomly mostly by fishing with the seine nets in the study sites. Live fish sample was taken in oxygen filled polythene bag and dead fish sample was taken in ice box to the laboratory. Study was conducted around four months from July 2017 to October 2017.

Observation of fish for parasites

The external body surface including scales, gills, fins and operculum of collected fish samples were examined for external parasites and associated pathological features. A hand lens was used for quick identification of ectoparasites on the skin and fins of the fish sample. Skin was also checked if there were capsules with metacercariae of trematodes in black dots and yellowish cysts which were sliced off the skin for

further investigation. Scrapings from the fish skin were taken with a cover slip on dorsal part of the head and ventral region of the fish from head to just after the anal point and from fins. The mucus sample is then smeared onto a clean microscope slide along with a drop of water. The sample was then covered with a coverslip and examined under microscope on 100x and 400x magnification. Gills examined in situ for the presence of macro parasites and then were removed and placed in Petri dish containing normal water. Gill rackers were detached apart by forceps and examined under stereomicroscope for the presence of worms.
For internal examination, the fish were dissected from anus ventrally along the middle of abdomen to mouth. Then the fish was opened by cutting from anus up to the lateral line, then further along the lateral line up to operculum and the detached part was removed. Pericardial cavity, kidney, liver, gonads, body cavity, sites behind the gills and other internal organs were checked for helminths by naked eyes and microscopically. The digestive tract was taken out together with pharynx, cleaned of adipose tissue and mesenteries; dissected along using scissors and investigated by parts. The inside part of the gut were examined by stereomicroscope and macro parasites were taken out using forceps. The kidneys and the liver were also examined by visual examination and under stereomicroscope after placed in a Petridish for the presence of parasites. Identification of diseases, infected part of fishes were taken on the glass slide and placed under the microscope to observe the lesion, sign & symptoms.

Study of water quality parameter

During the study period physico-chemical parameters of water were measured fortnightly. The physical parameters were measured on cage farm and for chemical parameter; 300 ml water sample was taken in the plastic bottle and measured in the laboratory at Patuakhali Science and Technology University. Water temperature was recorded in the investigation area with the help of a portable LCD Multi-Thermometer (Model: WT-2 Jiangsu, China). Dissolved oxygen was determined by a digital DO meter (HANNA instruments, model: Lutron, DO-5509, Taipei, Taiwan). pH of water was recorded by a digital pH meter (HANNA instruments, model: HI 98107 Resita, Romania).The concentration of phosphate were measured in the laboratory by a spectrophotometer (Lovibond® PCspectro, model RS232, Dortmund, Germany) using a Vario Phosphate RGT F101powder pillows.Nitrate was measured in the laboratory by a spectrophotometer (Lovibond® PCspectro, model RS232, Dortmund, Germany) using a Vario Nitrate chromotropic powder pillows.Ammonia was determined by ammonia test kit solution (HANNA Instruments Co.).

Statistical analysis

All the values were represented as mean ± standard deviation. To test the statistically significant difference among the different temperature conditions, one-way analysis of variance (ANOVA) was carried out followed by Tukey's post hoc test. We set statistical level of significance at $p < 0.05$. Statistical analyses ware carried out using Version 14.0 for Windows (SPSS Inc., Chicago, IL).

RESULTS

Parasite and diseases

A total number of 400 *O. Niloticus* fish caught randomly from the study sites those were examined for the presence of parasites. Different genera of fish parasites both from internal organs and external body surfaces of *O. Niloticus* were identified.

Disease: Trichodinosis

Symptoms and pathology: Lethargic or erratic swimming, operculum opened, scraping against walls jumping out of water, erosion of skin, fins, ulcers and caudal fins, gill hyperplasia. Fish showed abnormalities and coloration on the water surface.

Table 1. Different types of identified parasites

Site of infection	Category	Species of Parasites
		Chilodonella sp.
Body surface	Ectoparasites	*Trichodinia sp.*
		Gyrodactylus sp.
Gill	Ectoparasites	*Cichlidogyrus sp.*
		Capillaria sp.
		Orientocreadium sp.
Intestine	Endroparasites	*Eustrongylidae sp.*
		Allocreadium sp.
Gills/Kidney	Endroparasites	*Euclinostomum sp.*
Gill cavity	Endroparasites	*Tylodelphys sp.*
Skin/gills	Endroparasites	*Metagonimus sp*

Disease: Chilodonellosis

Symptoms and pathology: The gills acutely suffer resembled to necrosis, degeneration and hyperplasia. Complete destruction of the epithelium of primary and secondary lamellae may leave them with only cartilaginous rays. Sometimes respiration is drastically impaired and hampered. Most of all diseases fishes exhibited depigmentation. Scale loses of the diseases fish. The fish is irregular movement, restless and sometimes found on the water surface.

Mortality recorded during the study period

The rate of mortality was recorded in the selected tilapia cage culture. In the investigation period, October month was the highest and July month was the lowest mortality rate of tilapia. The highest rate of mortality (3.30 %) was in October and the lowest rate of mortality (0.03 %) in July (Table 2).

Table 2. Mortality of tilapias from July to October

Month	Total stocked Tilapias	Average death per week				Average mortality / month	Total survival Species	% Mortality / month
		1st	2nd	3rd	4th			
July		-	-	-	20	20	77580	0.03
August	77600	55	70	130	85	340	77240	0.44
September		125	400	850	900	2275	74965	2.95
October		680	800	525	475	2480	72485	3.30

Water Quality Parameters

The water quality parameters such as water temperature (ºC), dissolves oxygen (mg/l), pH, phosphate (mg/l), nitrate (mg/l), and ammonia (mg/l) were measured during the study period. The water temperature was varying between 29ºC to 34.5 ºC in different location and month to month during the study period. The highest temperature was measured in the month of July (34.5º C) and the lowest temperature was in the month of October (29ºC).The mean values of dissolved oxygen were found more or less same at different month and it was varied between 5.9 to 6.7 mg/l (Table 1). The highest value 6.7 (mg/l) of dissolved oxygen was recorded in the month of July and the lowest value 5.9 (mg/l) was recorded in the month of August. The ranges of pH

were varied between 7.1 to 8.1. The highest value was determined 8.1 in the month of September and the lowest value was in the month of July. The range of phosphorus in the present study was recorded from 0.023±0.24 to 0.04±0.36 mg/l. The high concentration of phosphate was recorded 0.04 mg/l in the month of October and the lowest was 0.023 mg/l in the month of July. The concentration of nitrate varied from 8.41 to 14.17 mg/l during the study period. The highest value was recorded 14.17 mg/l in the month of August and the lowest value was recorded 8.41September month. The ranges of ammonia varied between 0.06 to 0.13 mg/l in different months during the study period. The highest value 0.13 mg/l of ammonia were recorded in the month of August and the lowest values 0.06 mg/l were recorded in the month of September.

Table 3. Water quality parameter of tilapia cage farm during the study period

Parameter	Month				Mean (±SD) value
	July	August	September	October	
Water Temperature (°C)	34.5±4.4	32.7±4.9	33.4±4.2	29±4.7	32.4±2.1
Dissolve Oxygen (mg/l)	6.7±.0.4	5.9±0.7	6.2±0.5	6.1±0.7	6.2±0.3
pH	7.1±0.3	7.6±0.5	8.1±0.4	7.2±0.3	7.52±0.4
Phosphate (mg/l)	0.023±0.24	0.03±0.29	0.029±0.24	0.04±0.36	0.028±.008
Nitrate (mg/l)	8.86±0.78	14.17±0.73	8.41±0.88	10.63±0.68	11.30±2.26
Ammonia (mg/l)	0.10±0.18	0.13±0.26	0.06±0.28	0.07±0.17	0.09±0.02

DISCUSSION

The present study was conducted to understand the relationship between the water quality parameters and diseases due to the presence of parasite in tilapia cage culture in Bakerganj Upazila. The water temperature varied from 29°C to 34.5°C during the study period. This water temperature of the experiment is showed more or less similar to findings of Abedin *et. al.* (2017), and Bee *et. al*. (2015). Maintaining the optimum condition of DO which is very essential for successful production of tilapia. In the study time, the ranged of DO vary from 5.9 to 6.7 mg/l. This concentration is more or less similar to the Rashid (2008) and Haque (2007) who recorded the value from 6.31 to 8.07 mg/l and 4.1 to 6.20 mg/l respectively. The range of pH value varied from 7.1 to 8.1. But it is considered that pH value ranged from 6.5 to 8.5 is the most suitable condition for fish culture and production. The present pH value is more or less similar to Singh (2015) and Haque (2007) who found the similar condition that ranged vary from 7.3 to 8.4 and 6.80 to 8.27 respectively. Ansari *et al.* (2015) showed mean value of phosphate 0.257 that was higher than the observed value in the present study. Nitrate is extremely important as nutrient in supplying nitrogen from unpolluted fresh water. The concentration was recorded during the study time from 8.41±0.88 to 14.17±0.73 mg/l. The mean value was found 11.30±2.26 mg/l. That was clearly higher than the findings of Ansari *et. al.* (2015) who reported the mean value was 4.089±0.926 during his study time. The range of ammonia was recorded 0.06 mg/l to 0.13 mg/l which was more or less similar to Rahman (2005) who found 0.01 mg/l to 0.82mg/l during his investigation time. The finding of present study was similar to Gorlach-Lira *et. al.* (2013) who recorded physico-chemical parameters of the water, nutrients and presence of toxic compounds may influence the density of bacterial populations.

The collecting information is almost similar to Escher *et. al.*(1999) and who noted the poor & non-optimum water quality may have induced weakness and stress to the fish, resulting in a greater susceptibility to bacterial infections**.** *Trichodinia sp., Chilodonella sp.,Gyrodactylus, Eustrongylidae, Allocreadium*, *Orientocreadiu* and *Capillaria spp,* parasites are identified during the study period. *Trichodinia sp.* and *Chilodonella sp.* both are Ectoparasites but *Trichodinia sp.* found in the body surface and *Chilodonella*

sp. found in fish gill. The finding information is closely related to Walakira *et. al.* (2014) and who observed over 90% of fish samples (Tilapia and catfish) examined had own incidences of ciliated protozoans, *Trichodina sp.* and *Icthyobodo sp.* mainly observed on fish gill filament. As a result fishes showed abnormalities, lethargic swimming, discoloration, erosion of body, gill or skin and gill hyperplasia. These findings is more or less similar to Chandra (2009) who found that color of the tail turns pale and there is a cream colored coating due to excessive mucus secretion. The highest rate of mortality (3.30 %) in October and the lowest rate of mortality (0.03 %) in July. The findings rate of mortality is very low than Surachetpong, *et. al.* (2017) and who recorded the mortality rates among tilapia farms were 20%–90%; higher rates was occurred due to the secondary bacterial and parasitic infections.

CONCLUSION

Total numbers of 11 genera of external and internal parasites were found in *O. niloticus* in the study sites. External parasites such as *Trichodina sp*. and *Cichlidogyrus sp.* were found on fish but the Digenea *Tylodelphys sp*. was the most dominant parasite among them. Stocking density, water chemistry and water quality parameter which influenced on the abundance of parasites. Parasites were observed on all the examined parts of the fish but skin showed the most infested part of the host. Water temperature, ammonia, pH and phosphorus were optimum range in the study period. But the value of nitrate showed so higher. Highest mortality rate was recorded in the month of October and lowest mortality rate was in July. So, proper care and stirring are best ways to reduce diseases and mortality of tilapia on cage farming.

CONFLICT OF INTEREST

The authors declare that they have no competing interests. The authors alone are responsible for the content and writing of the paper.

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