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Health condition of juvenile exotic carp *Cyprinus carpio* from various fish farms of Mymensingh area, Bangladesh

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ABSTRACT

Clinical and histopathological studies were carried out with juvenile common carp (*C. carpio*) from a Government fish farm and a NGO fish farm in Mymensingh area for a period of 9 months from April 2005 to December 2005. Clinically red spots, scale loss, weak body, hemorrhage and subcutaneous lesion were noticed especially during November and December. A moderate pathological change in the investigated organs of all fishes were recorded in summer season (April-May), whereas in rainy season (June-July) pathological symptoms were significantly reduced which was again increased to some extent in the autumn season (August-September). However, marked pathological changes such as necrosis, protozoan cyst, bacterial colony, vacuum, melanomacrophase, hemorrhage, hypertrophy, hyperplasia and clubbing were recorded in all the investigated organs like skin, muscle, gill, liver and kidney in the months of October, November and December. Among the affected organs gills were more affected with the presence of numerous protozoan cysts followed by skin, liver and the less affected organ was the muscle. Clinically and histopathologically juvenile common carp of Government fish farm were more affected compare to NGO fish farm especially in colder moths of the year.

Key words: Disease, farming systems, health status

INTRODUCTION

Indian major carps occupied an important position among the cultivable fish species of Bangladesh. At present, not only major carps but also exotic carps are commonly cultured in our inland aquaculture because it is very delicious and content high nutrients. On the other hand, they are easy to culture because it is fast growing species with minimum mortality for having disease resistant capacity and ability to tolerate wide range of environmental conditions. However, natural population of these fishes are rapidly decreasing due to lack of scientific management, and draining of beels, marshes, ditches, and similar natural habitat for meeting up the excessive market demand and also for production of paddy and other agricultural crops [3].

Disease has becomes a major problem in fish production both in culture system and wild condition in Bangladesh [13]. Extreme environmental changes may be fatal or cause stress to fish leading to secondary infections. Fish remaining in unfavourable environment which is loaded with innumerable agents like chemicals, pollutants, bacteria, virus, parasites, fungus etc., which are either individually or in combination, can inflict damage the body tissue or system producing disease of several kinds. Moreover the external and internal biology of these fishes are also altered by other physical, chemical and biological factors of the environment [12]. Common diseases of freshwater fishes of Bangladesh are ulcer type disease including epizootic ulcerative syndrome (EUS), septicemia disease, tail and fin rot, bacterial gill rot, dropsy, various types of fungal disease, protozoan diseases, parasitic diseases, nutritional diseases, tumors etc.[5,6]. In most cases hemorrhages, septicemia, different kinds of lesions, gill damage etc. are common symptoms of the affected fish. Carps are also affected by a wide range of diseases and parasites. These are dermatomycosis, saprolegniasis, dropsy, fish pox or epidermal epithelioma, branchiomycosis, dactylogyrosis, furanculosis, columnaris, tail and fin rot, bacterial gill disease, bacterial kidney disease, white spot disease, tricodiniasis, myxosporidiasis, argulosis *etc*. In fish, the most obvious external clinical signs are inflammation, erythemia and hemorrhage of fins, skin or head, frayed or eroded fins, hemorrhaged opaque eye, open necrotic and ulcerative lesions at any location on the body, lepidorthosis of scales, and excessive mucus production. A total lack of mucus, edema, an enlarged abdomen, presence of yellow, white or black spots on the skin, prolapsed anus, and exophthalmia are all clinical sings of fish disease [11]. The clinical signs, combined with parasitic investigation and histopathology may very helpful in diagnosing fish disease, which has been widely used throughout the world. In Bangladesh limited histopathological studies have been done on carp

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Table 1. Clinical observation of investigated species in different months from both the farms

Months → / Farms ↓	April	May	June	July	August	September	October	November	December
Govt. Fish Farm	HA	HA	AN	AN	RS in 'c' region	AH & gill discoloration	AN	RS, SL & subcutaneo us lesion	Red spot in 'c' region & weak body.
NGO Fish Farm	HA	HA	HA	RS in 'dv'	SL in 'dv' region & weak body	AN	AN	Loss of 'cf', weak body	Ill health, RS & SL

*All abbreviations in this table are explained as follows

AN=almost normal, HA=healthy appearance, RS=rough skin, SL= Scale loss, c=caudal, cf=caudal fin, dv=dorsoventral, gd=gill discoloration, h=hemorrhage, v=ventral.

Table 2. Histopathology of different organs of *C. carpio* from both the farms in different months

Seasons / Farms / Organs	Seasons (Months)	Summar (April-May)	Rainy (June-July-August)	Autumn (September-October)	Winter (November-December)
Govt. Fish Farm	Skin & muscle	Almost normal	'e' & 'd' lost, 'v' seen	ruptured 'm', 'd' separated, 'v' & 'mm' seen	'e' lost, ruptured 'm' & 'v' present
	Gill	Normal	'sgl' missing, 'cl', & 'n' seen	'n', 'hp', 'cl', 'bc' & loss of pillar cell in 'pgl'	'n', 'ht', 'hp', 'h' & 'pc' seen in both 'gl'
	Liver	Normal	'h', 'n', 'v' & 'h' seen	'mm', 'h', 'n' & 'v' seen	'v', 'n' & 'pk' cell observed
	Kidney	Almost normal	swollen 'kt', 'fs' & 'h' seen	necrotic 'kt', 'v', 'fs', 'h' & 'bc' seen	'h', 'v', 'pk' nuclei & swollen 'kt' seen
NGO Fish Farm	Skin & muscle	almost normal	'n', 'd' separated & ruptured 'm' seen	'v' & ruptured 'm' present	'e' lost, 'd' splitted, 'v' & 'mm' present
	Gill	More or less normal	'cl' & 'n' observed in 'sgl'	'cl', loss of pillar cell & 'h' seen	'h', 'hyp' & 'hyt' observed in both 'gl'
	Liver	Normal	ruptured 'hpt', 'pk' nuclei, 'bc' & 'h' seen	'v', 'bc' & 'n' observed in liver cell	'pk' cell, 'v' & 'h' present
	Kidney	Normal	'n', 'v', 'h' & swollen 'kt' seen	necrotic 'ht' cell, 'fs', 'v' & swollen 'kt' present	large 'v', 'n', 'p' & 'h' observed

*All abbreviations in this table are explained as follows

cl=clubbing gl=gill lamellae hp=hyperplasia fs=fat storage pgl= primary gill lamella d=dermis
h=hemorrhage n=necrotic sgl=secondery gill lamellae mm= melanomacrophage ht=hypertrophy
bc=blood cell e=epidermis hpt=hepatocytes kt=kidney tubule pc=protozoan cyst v=vacuum
c=chromatophore hat=haemotopoitic tissue m=myotome pk=pyknosis

species. So the present work was undertaken for identifying the occurrence of diseases in *C. carpio.*

MATERIALS AND METHODS

The present study was conducted considering two fish farms in Mymensingh district, Bangladesh for a period of 9 months from April 2005 to December 2005. Farms were Government Fish Seed Multiplication Farm at Kajiakandi villege, under Fulpur Upazila (25 km to east side from Mymensingh town) and the other was Society for Social Service (SSS) under NGO at Shahpur village under Fulpur Upazila (about 2 km to west side from Fulpur Upazila Office). Water quality parameters like P^H, dissolve oxygen, temperature, total hardness,

conductivity and total dissolve solids were estimated during the experimental period at monthly intervals between 8.0 AM to 9.0 AM.

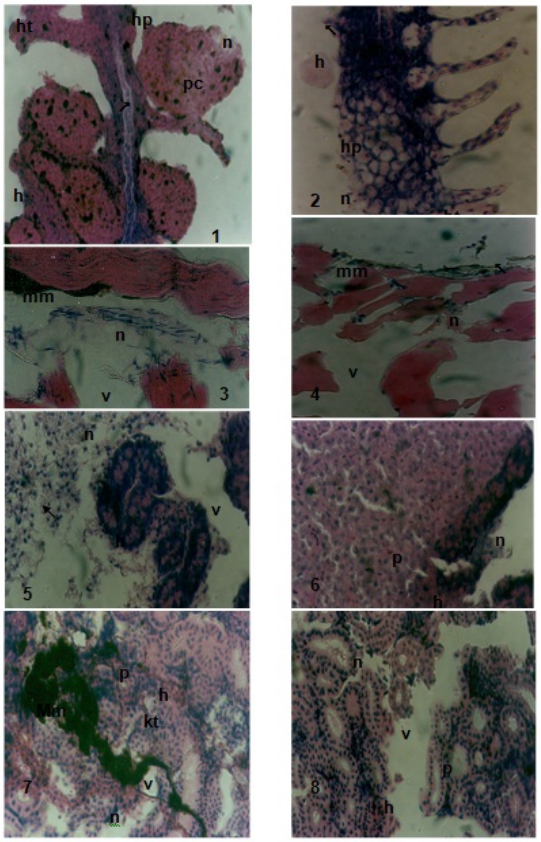

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Figure 1**.** Section of gill of *C. carpio* collected from Government fish farm in December. Protozoan cysts (pc), necrosis (n), hypertrophy (ht), hyperplasia (hp), hemorrhagic (h) and loss of pillar cells (↑) were seen. H & E ×532.

Figure 2**.** Section of gill of *C. carpio* collected from NGO fish farm in December.Hypertrophy (ht), hyperplasia hp), haemorrhage (h), necrosis (n) and loss of Secondary gill lamellae (↖). H & E × 532.

Figure 3. Section of skin and muscle of *C. carpio* collected from Government fish farm in December. Epidermis lost (↑), necrotic myotomes (n), melanomacrophase (mm) and vacuoles (v) were seen. H & E × 532.

Figure 4. Section of skin and muscle of *C. carpio* collected from NGO fish farm in December. Epidermisotally and dermis partly lost (↖), vacuole (v) and melanomacrophage (mm) in the myotomes were seen. H & E × 532.

Figure 5. Section of liver of *C. carpio* collected from Government fish farm in November & December. Vacuoles (v), necrosis (n), hemorrhage (h) & pyknotic cell (p) were seen. H & E × 532.

Figure 6. Section of liver of *C. carpio* collected from NGO fish farm in July and August. Necrotic hepatocytes (n), pyknotic nuclei (p), vacuum (v) and hemorrhage (h) were seen. H& E × 532.

Figure 7. Section of kidney of *C. carpio* collected from Government fish farm in December. Hemorrhage (h), necrosis (n), vacuole (v), pyknotic nuclei (p), melanomacrophage (mm) and swollen kidney tubules (kt) were seen. H & E × 532.

Figure 8. Section of kidney of *C. carpio* collected from NGO fish farm in November & December. Large vacuole (v), necrosis (n), pyknosis (p) and hemorrhage (h) were seen. H & E × 532.

Standard procedures and methods were followed by using HACH'S kit (Model FF-1A). Sampling was carried out at monthly intervals. During each sampling, 6 fishes of *C. carpio* were collected from each farm with the help of seine net. Fish samples were transported to the Fish Disease Laboratory of the Faculty of Fisheries with plastic bags. The sampled fishes were examined just after taking out of the container to observe external symptoms and recorded any injury, infection and other abnormal conditions of fish body. Various organs such as skin and muscle, gills, liver and kidney were collected by a sharp scalpel and forceps, which were fixed in 10% neutral buffered formalin. Then the samples were placed in an automatic tissue processor for dehydration, clearing and infiltration (SHANDON, CITADEL 1000). The samples were then embedded, sectioned (5 μm) and stained with Haematoxylin and Eosin. Then the sections were mounted with Canada balsam and covered by a cover slip and examined under a compound microscope (OLYMPUS). Photomicrographs were then taken by using a photomicroscope (OLYMPUS, Model CHS, Japan). Pathological observations were made from the slides and photographs. Clinical and pathological comparisons were made from the slides and photographs and compared among the months and between the farms.

RESULTS AND DISCUSSION

Among all the water quality parameters only water temperature become unfavourable for fish culture in December. The values of water temperature of Government and NGO fish farm were more or less similar. The highest value of water temperature of Government fish farm was recorded 31 ^{0} C in July and lowest 18 ^{0} C in December 2005.On the other hand, the highest value of water temperature of NGO fish farm was recorded 30 ^{0} C in June and lowest 19 ^{0} C in December 2005. [8] described that, when water temperature was the lowest, the out break of disease was the highest. They also concluded that in low temperature fish immune system could not work strongly and eventually the fish would become more susceptible to disease. According to [16], a sudden

drop of temperature in water was supposed to be an important predisposing cause of disease outbreak.
On the other hand, clinically *C. carpio* of both farms were in healthy appearance in the months of April, May, June and July and almost normal in September and October. The fishes were more affected during the months of winter (November and December). In NGO fish farm, clinically scale loss, weak body and red spot were observed in *C. carpio* in December (Table 1). Whereas, the fishes that were collected from Government fish farm showed clinical signs such as red spot, scale loss and weak body, hemorrhage, and subcutaneous lesion in November and December (Table 1). [15] observed that in *N. nandus* rough skin and scale loss in October and November.
In NGO farm, both the primary and secondary gill lamellae were considerably less affected in comparison with the gills of species obtained from the Government fish farm. In NGO fish farm, hypertrophy, hyperplasia, hemorrhagic and necrotic gill lamellae were observed in November and December (Table 2, Figure. 2). But in Government fish farm, protozoan cysts were observed between the primary and secondary gill lamellae. Tips of the secondary gill lamellae had hyperplasia, hypertrophy and necrosis. Primary gill lamellae were hypertrophied, hemorrhagic and loss of pillar cells was also observed during this period (Table 2, Figure 1). In government farm, it was observed that in *C. carpio* both layer of skin were lost, dermis and myotomes were ruptured , thus vaculation were created in the month of November and December (Table 2, Figure 3).
On the other hand, pathological signs such as epidermis lost, dermis splitted into few parts, vacuoles and melanomacrophage (mm) were noticed in the affected skin and muscle of *C. carpio* collected from NGO fish farm (Table 2, Figure 4). [7] also made a similar observations that epidermis and dermis were sloughed off in most cases, and numerous protozoan cysts with full of spores were lying side by side underneath the scale fold in *C. mrigala.* [1] reported that epidermis and dermis were totally lost and necrotic muscle in *A. testudineus* during December and January.

Structures of liver were almost normal in *C. carpio* during April and May in both the farms. During the months of June, July and August haemorrhage, necrosis, pyknotic nuclei and vacuums were seen (Table 3, Figure 6). In November and December the liver showed ilets of lengerhans, vacuums, pyknotic nuclei, degenerated and necrotic hepatocytes (Table 2, Figure 5). According to [15] hemorrhage and ruptured hepatocytes were seen in *N. nandas* and *P. sophore* in November and December. [14] also made similar opinion that liver exhibited varying degrees of pathological changes including cytoplasmolysis, nuclear pyknosis and necrosis leading to complete degeneration of hepatocytes. However, in the present experiment less pathological changes such as pyknotic nuclei, and vacuums were found in the hepatocytes of fishes of NGO farm (Table 3).

Like other internal organs, kidney had normal structure during April and May in fish of both the farms. But from June to August, swollen kidney tubules, necrosis, haemorrhagic and ruptured haemopoietic tissues observed in kidney (Table 2). However, in October kidney tubles were necrotic having wide vaccums and pyknotic nuclei. Similar pathological symptoms of kidney of major carp were observed by other authors like [2,9]. From the above result we can mention here that *C. carpio* from both farms were severally affected during colder months.
Among the organs, gills were more affected than others organs in fish of both the farms from November and December. [3] reported that external organs like gill and skin were more affected than internal organs such muscle, liver and kidneys of *Channa punctatus* and *Nandus nandus*. [2] were found opposite result that histologically the internal organs like kidney and liver were more affected than external organs and disease like EUS occurred during the months of December and January.

From the clinical and histopathological point of view, the investigated fish species were normal in April and May. Less pathological changes were observed in June, July and August. On the other hand marked pathological changes were recorded in October and severities of pathological changes were gradually increased during November and December. [10,2,4] found similar observations on EUS outbreaks in the Philippines, Bangladesh and Thailand respectively. From the experiment, clinically and histopathologically juvenile carp fishes of NGO fish farm were less affected compare to Government fish farm especially in colder moths of the year.

Most of the examined juvenile carps from different farms of Mymensingh area seemed to be healthy, but under clinical and histological observation it was found that a great percentage of fish were affected by different infectious agents. Again large percentage of fishes was affected specially during the cold period. So, proper preventive measure should be taken before out break of such diseases. From the management point of view, NGO fish farm seemed to be better than the Government fish farm where lower percentages of infestation were recorded. Thus it could be suggested that more precautionary measures would need to be carried out in the Government fish farm to prevent and control disease in order to save the species. Introduction of pathogens and infected fish to the water bodies from other sources should be prevented as far as possible. Steps should be taken to prevent the pollution and habitat destruction. However, more research works are essential in order to draw a final conclusion on the cause of disease outbreak in juvenile carps of nursery ponds in Bangladesh through histological techniques.

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