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Article

Investigation of health condition of small indigenous species *Channa punctatus* from Sherpur and Mymensingh areas

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Abstract: Investigation on the health condition of small indigenous fish, *Channa punctatus* was carried out through clinical and histological observation from Jailka beel of Sherpur sadar, Sherpur district and Kailla beel of Ishargonj upazila, Mymensingh district for a period of six months from October 2014 to March 2015. Water quality parameters like water temperature, pH, dissolved oxygen, ammonia, total hardness, alkalinity and nitrate were recorded. Water temperature and total hardness were found at unfavorable level for fish in December and January. Clinical examinations of the fish were also carried out for any kind of abnormalities at monthly intervals. Clinically, it was observed that fish was affected with numerous red spots and patches in lateral and ventral regions, large deep whitish ulcers reached up to deep ulcers especially in December and January in both the beels. Samples of skin, muscle, gill, liver and kidney were collected and processed for histological observations. Major pathology in the skin and muscle were epidermis separated from dermis, presence of fungal granuloma, vacuums, hemorrhage and necrosis. Loss of primary and secondary gill lamellae, hypertrophy and primary gill lamellae separated, necrosis and hemorrhage were found in the gill. Large vacuums, necrosis and hemorrhage were observed in liver and kidney. Among the affected fish organs, skin and muscle, gills were found to be more affected than those of the internal organs like liver and kidney. Overall, under the clinical and histopathological observations the fish were found to be more affected in December and January. Whereas, in the months of February and March, the pathological condition of fish gradually healed up to normal except few vacuums and hemorrhage. Under histopathological observations, fish of Jailka beel were more affected than the fish of Kailla beel. In clinical and histopathological observation *C. punctatus* was more affected due to EUS.

Keywords: small indigenous species; *Channa punctatus*; clinical and histopathological observations; water quality parameters

1. Introduction

In Bangladesh small indigenous fish contribute significantly to overcome malnutrition in the country. This species of fish always remain available for daily consumption of all classes of people especially low-income groups, due to their low price, food taste and good flavor and high nutritional quality. Beels are very good natural habitat of large and small indigenous fishes of different food habits. The term 'beel' is used in other areas of the country to denote natural depression of smaller size and area. In Mymensingh area there are 1,809 beels covering an area of 22,889 ha. Among them 58% are permanent and 42% are seasonal (Rahman, 1989). The small indigenous species (SIS) of Bangladesh are generally considered to be those fishes which grow to a length of about 25 cm or inches (Felts *et al.*, 1996; Hossain and Afroze, 1991). These small fishes are available in smaller water bodies like drains, ditches and larger water bodies like pond, lakes, beels, haor, baor, rivers, stream, ephemeral water bodies of the inland and estuaries areas. SIS has high nutritional value in terms of protein, vitamin, and minerals and these micronutrients are not commonly available in other foods (Thilsted *et*

al., 1997). These groups of fish contain large amount of calcium and also iron and zinc (Tripathi, 1997). Moreover this small indigenous fish species are maintaining a stable and static condition of our aquatic food chain thus the biodiversity of our open water ecology have in smooth form. But natural populations of this small fish is rapidly decreasing due to over exploitation, lack of scientific management, draining out of beels, natural disaster (draught and siltation) and poor environmental conditions. Because the water quality of beels, baors, rivers and canals are decreasing day by day. As a result, fish species that breed and reared in natural waters are reducing quickly. Thus fishes of open water bodies are facing continuous stress, which leads to infection and disease. Health condition and disease has become a major problem in fish production both in culture system and wild condition in Bangladesh (Rahman and Chowdhury, 1996). Common diseases of open water fishes of Bangladesh are tail and fin rot, bacterial gill rot, dropsy, various types of fungal disease, protozoan disease, parasitic disease, nutritional disease, tumors (Chowdhury, 1993). With the outbreak of epizootic ulcerative syndrome (EUS) in 1988, *Channa* spp., *Puntius* spp., *Anabas* spp. and other indigenous species of fish are seriously affected (Barua *et al.,* 1989). The water quality parameters such as temperature, dissolved oxygen, pH, total alkalinity, total hardness and ammonia could be associated with outbreaks of disease (Subasinghe, 1995). It indicated the possible relationship between the occurrence of disease and the environmental parameters. Histopathological technique is one of the most important procedures for disease diagnosis in fish. It has been successfully used throughout the world. It was thus necessary to investigate health condition of fish through some suitable techniques. Considering the above facts the present study has been undertaken with the following objectives: to investigate water quality parameters of Jailka beel and Kailla beel and also observe the health status of *C. punctatus* of the two beels in relation to different months.

2. Materials and Methods

In the present investigation two beels were selected; they were Jailka beel and Kailla beel. The study was conducted for a period of six months from October 2014 to March 2015 to find out the health condition of a small indigenous species, *C. punctatus*. Water samples were collected from the Kailla beel and Jailka beel once in a month between 08.00 to 08.30 am and water quality parameters test on spot. Water quality parameters like temperature, pH, dissolved oxygen, ammonia, total hardness, alkalinity and nitrite were measured by using respective test kits. Fish samples from both regions were collected from nearby local fisherman. A total of 8 live fishes were collected during each sampling area. The sampled fishes were clinically examined by naked eye and magnifying glass to record any external signs, injury and other abnormalities. Organs like skin and muscle, gill, liver and kidney were collected with the help of a sharp scalpel and forceps and fixed in 10% neutral buffered formalin for histopathological study. After 8 hours of fixation, the samples were trimmed in order to obtain a standard size of 1 cm^3 (maximum) and placed in automatic tissue processor for dehydration, clearing and infiltration. The samples were then embedded, sectioned (5µm thickness) and stained with Haematoxylin and Eosin. Then the sections were mounted with canada balsam and covered by cover slips and examined under a compound microscope. Photomicrograph of the stained sections was obtained by using a photomicroscope. Record of structural variations and pathologies were done from the slides and photomicrographs (Ahmed *et al.*, 2012).

3. Results and Discussion

3.1. Water quality parameters

Water quality of the Jailka beel and Kailla beel was studied from October 2014 to March 2015. Data regarding water temperature, pH, dissolved oxygen (DO), ammonia, total hardness, alkalinity and nitrite were analyzed and presented in Table 1.

Water quality parameters are important considerations of fish health management. In the present study, the highest water temperature (28^0 C) was recorded in October (2014) in both the beels. On the other hand, the lowest value of temperature was recorded 21.50 ^oC – 22 ^oC in January and December in both the beels. Mondal (2012) recorded water temperature were ranged from 17 to 31^0 C in BAU fish farm. According to Akter *et al.* (2009) there was a decreased value of temperature during winter season in Kailla beel of Mymensingh. In the present experiment, the pH values were ranged from 6.8 to 7.5 in Jailka beel and 6.6 to 7.5 in Kailla beel. Mondal (2012) recorded that pH values were ranged from 7.0 to 7.7 in BAU fish farm and Swopon fish farm throughout the experimental period. Most natural water has pH values of 6.5 to 9 (Alim, 2005). According to Swingle (1967) pH value of 6.5 to 9 is suitable for fish culture. In the present experiment, the values of dissolved oxygen were ranged from 4.0 to 5.0 mg/l in Jailka beel and 4.0 to 4.5 mg/l in Kailla beel. Ahmed *et al.* (2009) reported that dissolved oxygen ranged from 5.5 to 3.0 in four beels of Mymensingh.

Table 1. Monthly variations of water quality parameters of the Jailka and kailla beels.

Parameters	Beels	Oct	Nov	Dec	Jan	Feb	Mar
Temperature (^{0}C)	Jailka beel	28.3	27.5	22	23.3	26	27.2
	Kailla beel	28	27.7	23	21.5	27	28.4
pH	Jailka beel	6.8	7.2	7.0	6.8	7.3	7.5
	Kailla beel	6.9	6.8	6.6	6.9	6.7	7.5
Dissolved oxygen (mg/l)	Jailka beel	5.0	4.3	4.0	4.2	4.5	4.7
	Kailla beel	4.3	4.5	4.0	4.0	4.0	4.5
Ammonia (mg/l)	Jailka beel	0.0	0.03	0.05	0.1	0.10	0.21
	Kailla beel	0.1	0.0	0.0	0.0	0.10	0.20
Total hardness (mg/l)	Jailka beel	80	0.0	50	60	75	100
	Kailla beel	70	80	70	50	70	110
Total alkalinity (mg/l)	Jailka beel	90	70	60	55	70	120
	Kailla beel	80	60	50	60	80	90
Nitrite (mg/l)	Jailka beel	0.1	0.1	0.1	0.05	0.05	0.1
	Kailla beel	0.1	0.1	0.1	0.0	0.07	0.1

Hossain (2000) and Kohinoor (2000) recorded dissolved oxygen values of fish ponds ranging from 3.8 to 6.9 mg/l and 2.04 to 7.5 mg/l respectively at Mymensingh region. In the present study, the values of ammonia were very much nearer that ranged from 0.0 to 0.21 mg/l in both the beels. Wahab *et al*. (1995) reported that ammonia content of 0.19 to 0.28 mg/l in their experimental areas. Akter *et al.* (2009) observed increased level of ammonia during winter period.

3.2. Clinical observations

Fish had almost normal appearance except some fin erosions were recorded in October and November. In the month of January, large deep whitish ulcers reached up to deep ulcers, red spots and patches in lateral and ventral regions (Figures 1 and 2). However, in February and March, abrasions recovered to almost normal appearance in both beels (Figure3).

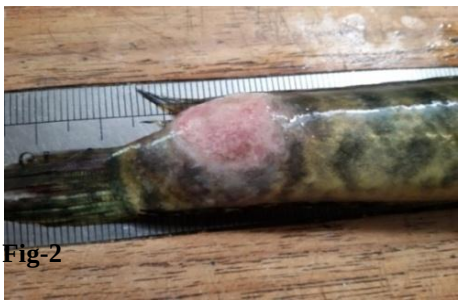

Figure 1. *C. punctatus* in December from Kailla beel having numerous red spots and patches in lateral and ventral regions.
Figure 2. *C. punctatus* in January from Jailka beel with large deep whitish ulcer reached up to deep ulcers.
Figure 3. Nearly recovered to normal *C. punctatus* in March from Kailla beel.

Table 2. Clinical observation of investigated fish of the two beels in different months.

Month / Beels	October	November	December	January	February	March
Jailka beel	Weak body	Fin erosion	Whitish deep ulcer, weak body	Large ulcer, weak body	AN	HA
Kailla beel	AN	AN	Numerous 'RS', 'WB'	'RS', weak body	AN	AN

AN=Almost normal, WB=Weak body, RS=Red spot, HA= Healthy appearance.

Clinically, *C. punctatus* had almost normal except some fin erosions were recorded in November from Jailka beel. In January, large deep whitish ulcer reached up to deep ulcers was observed from Jailka beel (Table 2). From research findings of Haque *et al.* (1999) it was observed that, large deep and whitish ulcer in the lateral and region, part of fins, scales and muscle were clinical sings of EUS affected fishes. Parveen (2001) observed that, three small indigenous fishes like *P. ticto*, *N. nandus* and *C. punctatus* from four beels of Mymensingh district, and observed that fishes were severely affected during the months of December and January. Ahmed *et al.*(2012) reported that the Tilapia was more affected from December and January and different clinical symptoms like rough skin, scale loss, red spots and dermal lesions were noticed. *C. punctatus* had numerous red spots and patches in lateral and ventral regions throughout the body in December from Kailla beel. Ahmed *et al.* (2007) also observed that scale loss, ill body and rough skin, minor ulcer and small red spots in December and January. Clinical symptoms such as abrasions were recovered to normal appearance in March from Kailla beel. From the result of the present experiment it was observed that severities of clinical signs were increased in December and January in both the beels (Table 2). In present study, *C. punctatus* was more affected from Jailka beel than Kailla beel.

3.3. Histopathological observations of the organs of investigated fish

During the month of November, gill was almost normal except some secondary gill lamellae were missing. However, in January, primary gill lamellae were separated, secondary gill lamellae were lost, necrotic and hypertrophied. Gill lamellae were almost recovered except some secondary gill lamellae yet to be recovered in the month of February in both beels. In November, dermis were separated from muscle; vacuums were seen in muscle. Whereas, in the month of January, muscle had fungal granuloma, vacuums and necrosis. However, skin was recovered but muscle had still necrosis and vacuums in February. In the month of November, liver was almost normal except vacuums. Necrosis, hemorrhage and vacuums were seen in January. However, in February, the structure of liver was almost recovered except vacuums. In the month of October, kidney was seen with normal structure. In January, large vacuum and necrosis was recorded. During the month of February, normal structure of kidney was seen. External organs likes gill and skin and muscle are severe affected than internal organs likes liver and kidney. Several research works had been conducted in Bangladesh on disease investigation of small indigenous fish with clinical and histopathological methods as disease diagnosis tools. In the present study, small indigenous fish like taki (*C. punctatus*) was considered to monitor health and disease in the Jailka beel from Sherpur and Kailla beel from Mymensingh areas of Bangladesh. The results of this study are discussed below and compared with the results of other works in the relevant field.

Histopathologically, it was observed in present study that all organs of *C. punctatus* likes gill, skin and muscle, liver and kidney was almost normal in October, mild affected in November and severely affected in December and January and infected organs were healed up to almost normal structure in February and March from both beel. Ahmed *et al.* (2012) mentioned that less affected gill were found in *Oreochromis niloticus* in November. Konika (2011) observed less pathological changes such as hypertrophy, clubbing and few lamellar missing in *Cirrhinus cirrhosus* during November. In January, primary gill lamellae were separated; secondary gill lamellae were lost, necrotic and hypertrophied in *C. punctatus* of Jailka beel. Whereas, fish organs of Kailla beel, primary and secondary gill lamellae were almost lost, hypertrophied and hyperplasic in December. According to Ahmed *et al.* (2012) *O. niloticus* gill had hypertrophy, hyperplasia, clubbing, hemorrhage in primary gill lamellae and secondary gill lamellae were lost during December and January. According to Ahmed *et al.* (2009) gills were healed up to almost normal structure in February and March. Konika (2011) observed less pathological changes such as loss of epidermis, necrotic muscles and vacuums were seen in *C. cirrhosus* during November. Muscle had fungal granuloma, vaccums and necrosis in muscle of *C. punctatus* from Jailka beel in January. However, in Kailla beel, muscle had fungal granuloma, vacuums, necrosis and hemorrhage in December. Ahmed *et al.* (2010) also observed that epidermis and dermis were partly lost, necrosis, hemorrhage, fungal hyphae were seen in *A.testudineus* during the months of December and January. Hossain *et al.* (2009) reported that severe necrosis

of hepatocytes, pyknosis, vacuoles, fat droplets and hemorrhage were observed in small indigenous species during December and January. Mondal (2012) reported that the structure of liver in *A. testudineus, B. gonionotus* and *P. hypophthalmus* had severe necrosis, vacuums and hemorrhages in investigating farms during December and January. According to Mondal (2012), during February and March, almost normal liver except few vacuums were seen in *A. testudineus, B. gonionotus* and *P. hypophthalmus* from investigated farms. Mondal (2012) reported that *Anabas testudineus* had tubular degeneration, necrosis, hemorrhage, pyknosis and vacuums from fishes of Swopon Fish Farm and in Fishes of BAU Fish Farm, had tubular degeneration, necrosis, hemorrhage and vacuums in December and January. Ahmed *et al*. (2009) also observed necrosis, vacuums, hemorrhage and blood cells in kidney tubule of *Anabas testudineus* during the months of December and January. Ahmed *et al.* (2012) observed that in February and March, kidney pathology was recovered to almost normal structure except vacuums. Khatun (2011) mentioned that kidney pathology were recovered to almost normal structure except some vacuums in March. Organ wise, internal organs such as liver and kidney were less affected than external organs like skin, muscles and gill in the present study.

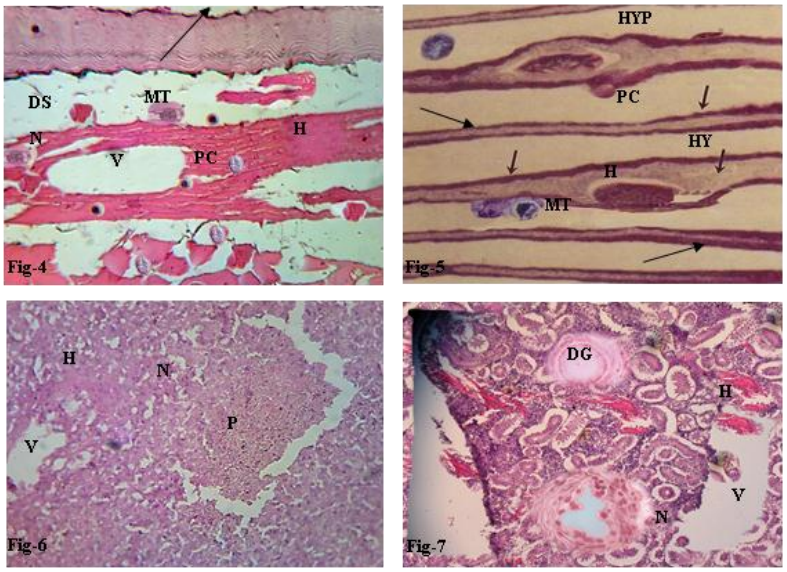

Figure 4. Photomicrograph of skin and muscle of *C. punctatus* in December from Jailka beel Having epidermal missing (arrow), dermis sloughed off (DS) from muscle, necrosis (N), vacuums (V) and haemorrhage (H) with monogenetic trematode (MT) and protozoan cysts (PC) (H & E x 130).
Figure 5. Cross section of gill of *C. punctatus* in January from Kailla beel showing monogenetic trematodes (MT) and protozoan cyst (PC). Loss of secondary gill lamellae (arrow) along with hypertrophy (HY), hemorrhage (H) and hyperplasia (HYP) (H & E x 130).
Figure 6. Section severely affected of gill of *C. punctatus* in January from Jailka beel having necrotic (N) hepatic, hemorrhage (H), pyknosis (P) and vacuums (V) (H & E x 130).
Figure 7. Section of gill of *C. punctatus* in December from Kailla beel having degenerated glomerulus (DG), vacuum (V), haemorrhage (H) and necrosis (N) (H & E x 130).

4. Conclusions

The water quality parameters were in suitable range throughout the study period except temperature and total hardness which were reduced in December and January. In December and January when water temperature was 21.5^0 C and 22^0 C, diseases like EUS occurred with marked pathological changes in various organs. Fish samples were collected at monthly intervals. In present study, sample fish was almost normal during the month of October. The fish had numerous clinical sings seen in lateral and ventral regions in December from Kailla beel. Whereas, large deep whitish ulcers reached up to deep ulcers was found during January in fish of Jailka beel. During histopathological study, normal structure was found in October from both the beels. Mild pathological changes were seen in both the beels in November. However, pathological changes were increased in the fish in December and January. The present study showed the fish species of Jailka beel were more affected than Kailla beel. Under Pathological observation, fish was affected by epizootic ulcerative syndrome (EUS). The skin and muscle in fish was more affected due to epizootic ulcerative syndrome (EUS). Thus if proper preventive and control measures can not be taken, the open water fishery will face tremendous threat in

the near future. Therefore, proper preventive measures would need to be taken through integration with other agricultural sectors in order to save this vast fishery resource.

Conflict of interest

None to declare

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