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Histo-morphology of the alimentary canal in two freshwater snakehead fish *Channa punctata* and *Channa striata*

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Abstract

The histo-morphological study of the alimentary canal of two carnivore freshwater snakehead fish *Channa punctata* and *C. striata* was carried out from October 2013 to July 2014. It revealed that three major parts like oesophagus, stomach and intestine composed of short thick-walled body. The oesophagus begins with buccopharynx. Structure and arrangement of both villiform and canine teeth on jaws in *C. striata* are more extendable and stronger than *C. punctata* and thereby made the former one more successful predator. The availability and arrangement pattern of mucous pits and taste bud pores in oesophagus are also prominent in *C. striata*. The TS of stomach of both the species has broad GM devoid of goblet mucous cells, but surface layer CC and basal layer GG open through gastric pits. The length of intestine (16.0 cm) and intestinal pyloric caeca (5.5 cm) in *C. striata* are larger than *C. punctata* (7.0 cm and 1.5 cm, respectively). However, the TS of intestinal Sr. 0.05 mm; MM. 0.8 mm; Mu 0.5 mm suggest in favour of carnivore habit of both the species.

Keywords: Alimentary canal, histo-morphology, *Channa punctata*, *Channa striata*

INTRODUCTION

By nature, most of the fishes have certain specialty in food and feeding habits. These habits together with the ratio of plant and animal materials ingested determine the overall morphology of the alimentary canal of the respective fishes. Such a change as reflected in the ratio of total body length and alimentary canal led the earlier fishery scientist to denote the main food habits of the fish as herbivorous, carnivorous and omnivorous (Das and moitra 1958, 1963).

In fishes also alimentary canal begins with lip and bucco-pharynx and ended through intestine and rectum. Within the length, the first two parts provided with either teeth or teeth like structure and many layered stratified epithelium but lacking a strong and compact musculature, are mainly used to select capture, degulation and finally predigestive preparation of food. Even the later parts, such as, stomach and intestine is consisted of well developed musculature system and a single layered columner epithelium for digestion and absorption of the degulated and predigested food.

Meanwhile, several studies related to the morphology and anatomical features of the alimentary canal of different freshwater fishes are studied by a number of scientists in Bangladesh (Nabi 1993; Ara 2013).Whereas, with the introduction of polyculture technique in fish, scientists have changed their research interest towards the structural and functional peculiarities of the cell of alimentary canal in order to get more clear picture about the food and feeding habits of sibling species. The present study was undertaken to disclose the probable variations in the microanatomy of the oesophagus and stomach of two fresh water snake-head fish *C. punctata* and *C. striata* with any diverse nature of food and feeding habits.

METHODOLOGY

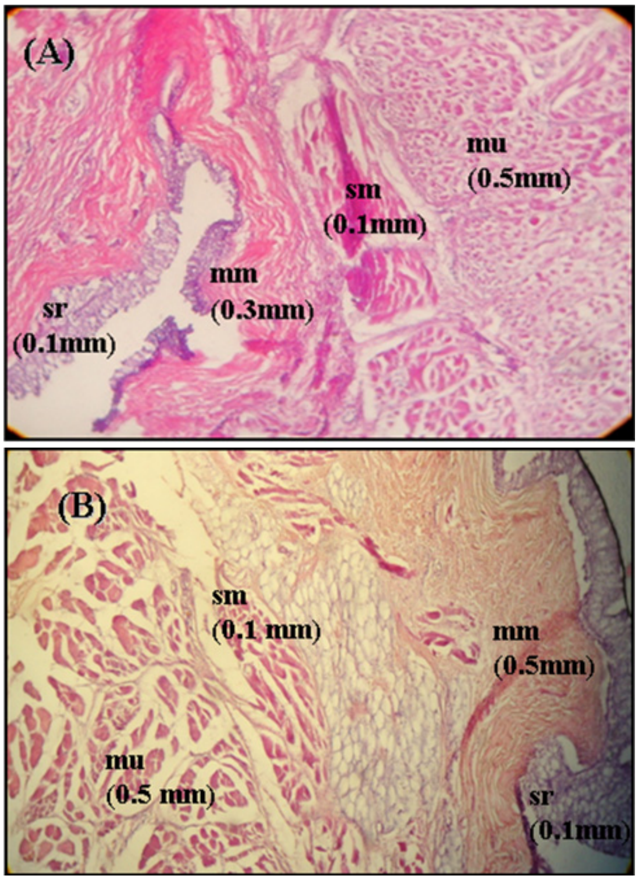
The experiment was carried out from October 2013 to July 2014 at Limnology and Fishery Sciences Laboratory, Department of Zoology, Jahangirnagar University. The required number of fish samples was collected from the different ponds and flooded areas of Nabinagar, Savar, Dhaka, Bangladesh. Collected fishes were washed with sufficient amount of fresh tap water and preserved in 5-6% formalin solution over night in order to make all kinds of body tissue stiff and easy handle able. Later, the abdomen of some fishes was dissected on a wax embedded dissection tray with the help of a point headed scissors keeping up-ward tension. Thereafter, the liver and other accessory fat bodies were removed with the help of a needle and forceps and finally all mesenteries (if any) were separated to get the straight structure of the gut. In this condition, the entire gut beginning from the oesophagus up to the last part of intestine were cut out and instantly washed with distilled water in a Petri dish to clean any dirt and blood. Then, the entire gut was kept in Buin's fluid for 24 hours to 72 hours as a fixative and thereafter the different parts like oesophagus, stomach and intestine were separated and preserved in 70% alcohol for further histological studies. Histological slides were prepared following standard procedure (Carson 2007).

After the preparation of histological slides in different parts of gut *i.e.* oesophagus, stomach, and intestine, both stained tissue samples were examined its different microstructures and justified the quality of slide preparation under a compound microsope. Digital images were obtained using an Olympus BX51 microscope equipped with a Camedia C3040ZOOM digital camera (Olympus America Inc., Melville, NY, USA). All images were taken under 20 × magnifications.

RESULTS AND DISCUSSION

In an apparent magnitude, the oesophagus of both studied species was a short and thick- walled tube, provided with longitudinal mucosal folds running parallel to each other throughout its entire length. This tubular region begins through a buccopharynx, which is made up of pre-maxilla, maxilla, dentary, angular, palatine, ectopterigoid, metapterigoid, quadrate and symplectic bones. The structure and arrangement of teeth in jaw suggest that the *C. striata* has more extendable and stronger lower jaw than *C. punctata,* as such, made the former one more successful predator over a number piscine and other aquatic species. The piscivorous and predatory as well as carnivorous habits of both the species have also opined by Tandon and Goswami (1968), Mehrotra and Khanna (1969), Khanna and Mehrotra (1970 and 1971).

The micro-histology of oesophagus reveals the presence of systematically packed oval or rounded columnar cells (RCC) with their tips form irregular and closely set numerous minute microridges (MR). Besides, large mucous pits (MP) and taste bud pores (TBP) in the luminal surface of the anterior oesophagus have also been observed in both the species (Figure 1). The availability and arrangement pattern of all these cells, mucous pits and taste pores are comparatively prominent in *C. striata* except the longitudinal mucosal folds (LMF). These LMF usually help by expansion to easy movement of large size ingested food towards the stomach (Sinha and Chakrabarti 1989). The number and arrangement of canine teeth in *C. striata* probably help to make small pieces of captured food and thereby minimize the function of LMF here. As oesophagus and buccopharynx in the fish are mainly concerned with pre digestive process of food, thus it is not unusual for copious secretion of related enzymes and mucous form the existing cells.



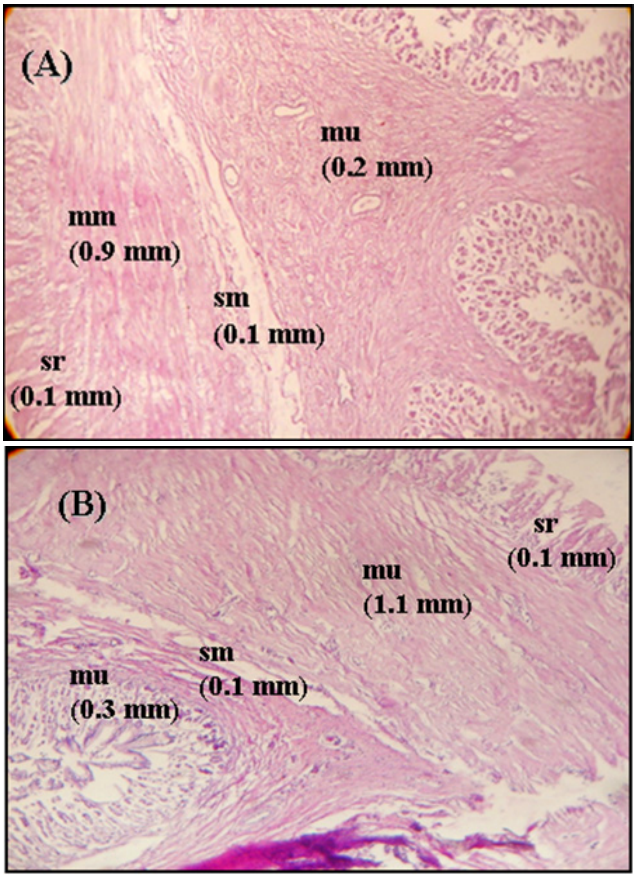
sr- serosa; mm- muscularis mucosa; sm- submucosa; mu-mucosa. (40x) (showing the width in bracket)

Figure 1: Transverse section of oesophagus of *Channa punctata* (A) and *C. striata* (B).

The presence of stomach is a characteristic feature of predatory and carnivorous fishes (Islam 1951, Roy and

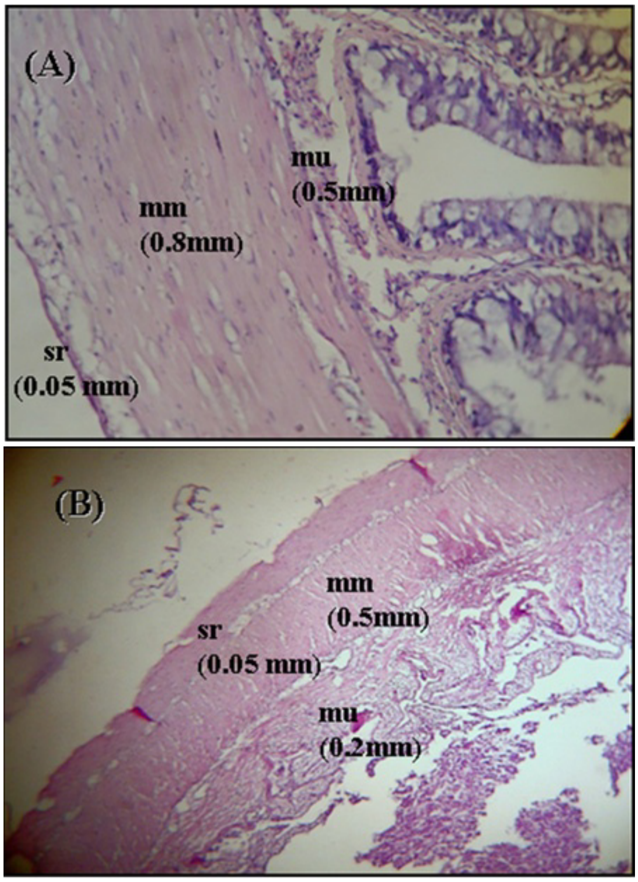
Moitra 1982). The transverse section of stomach of *C. punctata* and *C. striata* (Figure 2) reveals broad gastric mucosal (GM) folds subdivided into primary and secondary folds. Here is both the species, the GM devoid of goblet type mucous cells but the surface layer consisting of columnar cells (CC) and a basal layer containing gastric gland (GG) that open through gastric pits. Similar nature of the gastric columnar cells along with gastric epithelium has been reported for different fish species by employing histological and histochemical methods (Tandon and Goswami 1968, Mehrotra and Khanna 1969) Moreover, the similar staining reaction of both the TS of stomach makes it difficult to categorize various functional cell types like neck, oxyntic and peptic cells and thus suggest the secretion of pepsinogen and acid by the same cell (Tandon and Goswami 1968). Histochemical study of stomach of freshwater teleosts reported about the secretion of AL Pase, ATPase, TPpase and Esterase by several Indian scientists. They also opined that the distribution of these enzymes varies greatly from one region to the other and also from species to species. Similarly, in case of *C. punctata*, the number of GG is numerous but less prominent than *C. striata*.

The length of the intestinal pyloric caeca (5.5 cm) and intestine (16.0 cm) are comparatively larger in *C. striata* than *C. punctata*, which consisted of 1.5 cm and 7.0 cm respectively in relation to that of the body (Table 1). These caeca is a characteristic feature of carnivore fish used to increase the intestinal surface and even contains similar histological characteristics as those of intestine (Khanna and Mehrotra 1971, Moitra and Roy 1977). The transverse section shows regular arrangement of serosa (Sr. 0.05 mm), muscularis mucosa (MM.0.8 mm) mucosa (Mu 0.5 mm) in favour of carnivore habit of the species (Table 2). This mucosal layer extends into prominent slender folds called villi which have intestinal glands (Figure 3). The histo-morphological characteristics of each villi further reveal that underneath the mucosal epithelium there are columnar, absorptive and goblet type of mucus- secreting cells, lymphocytes and various granulocytes. Moitra and Roy 1979 reported that the secretion of enzymes, ALPase, ACPase, ATPPase, and TPPase at a variety of locations in *Channa* species and other teleostean intestine.



sr- serosa; mm- muscularis mucosa; sm- submucosa; mu-mucosa. (40x) (showing the width in bracket)

Figure 2: Transverse section of stomach of *Channa punctata* (A) and *C. striata* (B).



sr- serosa; mm- muscularis mucosa; sm- submucosa; mu-mucosa. (40x) (showing the width in bracket)

Figure 3: Transverse section of intestine of *Channa punctata* (A) and *C. striata* (B).

Table 1: Comparative measurement of several parts of alimentary canal of *Channa punctata* and *C. striata*

Parts of alimentary canal	***C. punctata (Length in cm)***	***C. striata (Length in cm)***
Total length	11.5	20.0
Oesophagus	1.5	1.5
Stomach	2.5	3.0
Intestine	7.0	16.0
Intestinal caeca	1.5	5.5

Table 2: Comparative measurement of the layer different parts of alimentary canal of *Channa punctata* and *C. striata*

Part of alimentary canal	***Layers of different parts***	***C. punctata (width in mm)***	***C. striata (width in mm)***
Oesophagus	Serosa	0.1	0.1
	Muscularis mucosa	0.3	0.5
	Sub-mucosa	0.1	0.1
	Mucosa	0.5	0.5
Stomach	Serosa	0.1	0.1
	Muscularis mucosa	0.9	1.1
	Sub-mucosa	0.1	0.1
	Mucosa	0.2	0.3
Intestine	Serosa	0.05	0.05
	Muscularis mucosa	0.8	0.5
	Sub-mucosa	0.1	0.1
	Mucosa	0.5	0.2

CONCLUSION

It is interesting that in both the species, the alimentary canal in well adapted to their respective food and feeding habits. The histomorphology of different important parts of the alimentary canal so far studied under a light microscope suggest that each part of both the species has some specialities in respect of function. Moreover, further study under high resolution photograph or an image on a computer would be a great help in the determination of actual food and feeding habits of any fish species and thereby suggest making accurate artificial feed for the respective fish.

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