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Study of Morpho Histology of Alimentary Canal in Relation to Feeding Behaviour of Channa Punctatus From the Wetlands (Chaur) of Begusarai District N. Bihar india

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ABSTRACT

Murrels are very common fish available in the wetland (chaurs) of North Bihar India. In the present study one of the most important species of murrels the Channa punctatus has been selected for the study of its morphohistology and its relation with the feeding behaviour .The study will be helpful for the culture and farming of Channa species.

The Anatomy and histology of alimentary canal of Channa punctatus was found to be of carnivorous type . The alimentary canal has a short relatively broad oesophagus, stomach with cardiac and pyloric region with two pyloric ceaca, intestine of moderate size and rectum is not externally differentiated. The histological structure consists of four layers mucosa, submucosa, muscularis and serosa. Histologically the different region of the alimentary canal has their own peculiarity. The stomach has cardiac and pyloric region the cardiac part has gastric glands .The intestine has numerous mucosal folds for absorption.

Channa punctatus is a carnivorous and surface feeder fish .Its food consist of mainly of fish, crustaceans, insects, mollusk, shells, plant parts and semi digested food. The feeding intensity is minimum during breeding season and the food varies according to the season and avaibility of food. Average R L G value was .85 throughout the study period.

KEYWORDS : Channa punctatus, wetlands, feeding behavior, alimentary canal, carnivorous.

Introduction:

Murrels are very common fish available in the wetland (chaurs) of North Bihar India. The *Channa* Species are known as snake heads .Murrels are air breathing fish survive in low oxygen water bodies ,hence suitable for the wetland (chaurs), atleast thirty species of Channa has been reported in global scenario. Haniffa, (2011); Five species of channa are obtained from the wetlands of N. Bihar. These fishes are preferred for human consumption of the local people of the locality because it has high nutritional value, easily available, tasty and cheap.

In the present study one of the most important species of murrels the *Channa punctatus* has been selected for the study of its morphohistology and relation with the feeding behavior .The study will be helpful for the culture and farming of channa species in the chaurs of Begusarai district (Bihar) .

A detail of study of anatomy and histology of fish digestive tracts in relation to their feeding behavior have been well documented in the literature Dharmrajan, (1936); Al-Hussaini(1946,1948,1949);Mohsin,(1941,1946and1962);Sarbahi,(1951);Kapoor,(1953);Pasha,(1963,64);Moitra and Bhowmik, (1967); Moitra and Sinha, (1971,1972); Mercy and Pillai,(1985); Salem, (1991); Das Gupta (2011). Abdulhadi, (2005); Khojasteh etal (2009).

Many workers in home and abroad have been studied the food and feeding habits of different fishes. Mookerjee et al (1946), Hynes (1950), Alikunhi (1952). Das and Moitra (1955), Darnell and Meiorotto (1962), Ahmed and Akhtar (1967), Dewan and Saha (1979),Kapoor et al (1975), Mustafa et al (1981), Nargis and Hossain (1987), Bhuiyan (1987), Bhuiyan and Islam (1988), Bhuiyan et al (1992, 1994, 1999), Sarkar and Deepak (2009) etc.

It is very interesting that the murrels are very common and abundant in the wetland (chaurs) during the summers when the water level falls and the oxygen content is also very low these murrel can withstand the stress very easily. These fishes are predaceous in nature, they voraciously eat away all the small fishes of the water body hence one of the survivors are murrels of the chaur.

In the present work the relationship between the structure of alimentary canal and the feeding habit of *Channa punctatus* has been studied from June 2007 to March 2008.

Material and Methods:

The sample for the present study was collected from the chaur (Wetlands) Begusarai (N.Bihar.India) by using different type of local nets from the month of June2007 to March 2008.The samples were collected once in every month and preserved in 10 % formalin.

For anatomical and histological study: The Body cavity of fresh specimen was cut opened and the alimentary canal was exposed for clear view. The different region of the gut was measured for morphometry and was fixed in 10%neutral buffered formaldehyde and Buins fluid, embedded in wax, 5µm section cut in microtome and dewaxed sections were stained with haemotoxyline and eosine and microphotographs were captured in Olympus SP 310.

For food and feeding: The specimens were studied by examining the stomach of 10 to15 fishes each month .immediately after the collection 5% formalin was injected in the gut .The entire gut was carefully removed by dissecting the fish and the food item was examined under binocular microscope .The SL and ACL was measured for RLG.

Observation:

Anatomy of the gut:

The alimentary canal of *Channa punctatus* has following parts, buccalcavity, oesophagus, stomach, pyloric ceaca, intestine and rectum.

The buccal cavity is bounded by lips .Teeth are borne by premaxilla, maxilla, vomers and palatine and the denteries ,the teeth are small villiform and homodont .The number of teeth on the maxillary are 8-10 .A prominent tongue is present between the jaws originating from the posterior palate.

Pharynx: the pharynx is broad chamber provided with gill clefts. Pharyngeal teeth are present on the gill arches .these are small stubby in appearance.

Oesophagus: It originates from the pharynx and ends into the stomach region. The oesophagus is a small distensible, thick walled 2.00 cm long tube. The diameter of the opening of oesophagus is recorded

1.0 cm.

Stomach: the stomach is a thick walled comparatively small bag like structure hanging from the junction point of oesophagus and intestine. The length of stomach in *C. puntatus* is found to ranging between 2 – 3.5 cm.

Pyloric caeca: One pair of pyloric caeca hangs fom the anterior part of intestine.

Intestine: The intestine of *Channa punctatus* is thick walled of moderate size .originally placed encircling the stomach. The average length of intestine in *Channa punctatus* is ranging 5.5 – 15.0 cm.

Rectum: - The posterior part of the intestine is rectum. The rectum of *Channa punctatus* is not morphologically demarcated, but the diameter is somehow broader than intestine.

Anus: It is placed at posterior end of rectum.

Liver & Pancreas:-The liver of *Channa punctatus* is a bilobed structure. The right lobe is larger than the left one. The left lobe is further subdivided into two lobes. Liver is situated ventral to the alimentary canal. The colour of liver is yellow or reddish brown. Pancreas is a diffused Structure

Histology of the gut: The gut of *Channa punctatus* is of usual four layers Mucosa, submucosa muscular and serosa.

The oesophagus: The oesophagus has numerous goblet cells on the mucosa layer. In the submucosa layer collagen fibre are in between the mucosal folds .Very prominent bundles of longitudinal fibres and circular muscles are present .

Stomach: Histologically the stomach has two parts the cardiac and the pyloric region .The muscular region of the stomach is thick, the cardiac stomach has gastric glands and the pyloric stomach is devoid of it. The pyloric stomach shows the junction of pyloric caeca.

Intestine: The mucosa of the small intestine thrown into numerous folds known as villi having goblet cells. The thick submucosa layer has many blood vessels.

Rectum: The rectum is distinguished from the intestine by having blunt and flat mucosal folds. The mucosal lining has epithelial cells with multiple goblet cells encircling the entire lumen.

Liver: A microscopic observation of *Channa punctatus* liver shows that it consists of a large number of polyhedral hepatic cells. Numerous bile ductules and blood capillaries with pancreatic cells are scattered in between the hepatic cells. Plate No. -2(F)

RELATIVE LENGTH OF GUT (RLG) :

150 specimens of of *Channa punctatus* are examined for the study of the RLG. The total length of the body and alimentary canal was measured .The standard length of the fish ranged from 9 to 24 cm and the length of alimentary canal was7 to22 cm to the respective fishes.

The maximum value of RLG is recorded as 0.85 and the minimum as 0.4 with the mean value of 0.54. Table no.—1

Gut content analysis:

Total 150 gut was examined monthly from June 2007 to March 2008. The fishes were classified according to their fullness of the stomach. Full, 3/4 full, 1/2 full, and empty. This was done on visual examination of the gut. Maximum number of full stomach was observed in the month of February and minimum number was observed in the month of July .Maximum number of empty stomach was observed in the month of August and minimum in October.

The gut content analysis of 150 specimens of *Channa punctatus* has shown the following % food items , insects , fishes , crustaceans , mollusks and plant matter.

Insects

Insects constitute the main bulk of (52.93%) of food content of *Channa punctatus*. The item includes coleopterons, odonates, diapterans, hemipterans, insect, larvae and other parts of insects. Among these coleopterans dominates among the insects groups and form 17.37 % of the total insect food items which is followed by odonates (8.11%) , hemipterans (3.63%) and dipterans (2.07%) .table no. show different groups of insects food items present in the gut and plotted on the graph no

Fishes

Fishes as food of *Channa punctatus* constitutes (23.43%) of the total stomach content . the highest percentage value of fishes in the gut of *Channa punctatus* is noticed in the month of September while during November , fish food is not observed in the stomach of *Channa punctatus*. Graph no.

Crustaceans

About 17.62 % of the total stomach content of *Channa punctatus* is made by crustaceans, these are mainly represented by osteraceds, copepods, cladocerans and copepods. The highest percentage is recorded in September (28%) and it is zero in the month of november table no. graph no.

Molluscs

Molluscs form 5% of the total gut of *Channa punctatus* larvae of unio and pila, viviparous bengalensis are the molluscs food items recovered from the stomach of this fish.

During the course of study from September to December molluscs are only observed in the month of November (20%) . Graph no.1

Plant matter & algae

The food items form a minute portion (1.03%) of the total stomach content of *Channa punctatus* the highest percentage is reported in the month of September and during October the food item is completely absent from the gut of *C.punctatus*. Graph no.1

Semidigested food:very minute volume of semidigested food was present in the gut of *Channa punctatus*.

DISCUSSION

Teleosts have successfully adapted themselves to every type of aquatic habit. This versatility is reflected in their mode of feeding. Fishes inhabiting the same habitat resort to different types of feeding to avoid competition for food and also to utilize every available sources of food. They can be broadly classified into carnivorous, herbivorous and omnivorous. It is only natural that depending on the kind of food the alimentary canal should undergo suitable modification for maximum utilization of the food taken. In the case of *Channa punctatus*, the morphology and histology of the alimentary canal of this fish show several peculiarities which can be correlated with its feeding behavior.

The large and highly protractile mouth of *C. punctatus* helps the fish in engulfing the large sized prey. One of the organs of the alimentary system which which shows adaptive modification to a large extent is the teeth. Presence of teeth on both the jaws of *C. punctatus* indicates a carnivorous feeding habit. The maxillary, vomerine and mandibular teeth present in the buccal cavity serve to prevent the prey from escaping and the well developed pharyngeal teeth help to crush the food organisms. Sarbahi (1939), Al-Hussaini (1946) and Das and Moitra (1955) have observed that the pharyngeal teeth are mainly used to crush the food. Das and moitra (1955) suggested that the gill rackers, pharyngeal teeth and other teeth patches are all responsible for sieving, crushing and masticating food in omnivorous and carnivorous fishes. The gill racker of *C. punctatus* is modified into pointed teeth like rasping organ. Khanna (1961) and Kapoor (1957) belived that in carnivorous fishes the gill rackers have been modified to form pointed teeth like structures and supplemen the teeth in macerating and preventing the escape of ingested prey. The present observation in *C. punctatus* confirms this. *C. Punctatus* possess a longer and distensible oesophagus which helps the fish to ingest the large sized food item eg, insects etc. Mohsin (1941) has been reported a small tubular oesophagus in the carnivorous perch Anabas testudineus. Venkateswanilu (1962) observed that structurally there is no difference in the nature of oesophagus of herbivorous and carnivorous fishes. But according to Mehrotra and Khanna (1969) carnivorous and piscivorous fishes preying on larger organisms have generally larger distan-

cible oesophagus. Sarkar (1959) also observed a short and narrow oesophagus in the carnivorous fish *Mystus seenghala*.

The stratified epithelium of the oesophageal mucous protects the oesophagus from injuries during the passage of solid particles in oesophagus and numerous mucous secreting cells help in rapid passage of food. The wall of osophagus is comprised inner longitudinal and outer circular muscle fibres. Such an arrangement of muscle layer appears to be associated with the carnivorous feeding habits of this fish *C. punctatus*. This type of musculature arrangement provides additional strength to the oesophageal mucosal folds and increases their elasticity to facilitate the swallowing of the larger organism. The present findings confirms the findings of Domenehini et al (1998) who reported that the thick layer of muscularis mucosa of the oesophagus strengthers the wall of oesophagus and protect it from being engorged during swallowing solid food materials.

C. punctatus has a true stomach. The stomach is thick walled large sac like structure which helps the fish to store food materials.. The differentiation of cardiac and pyloric stomach has been established in *C. punctatus*. Similar observations have been reported by Pasha (1946b) chandy & George (1960), in other fishes.

The numerous digestive or gastric glands are present in the cardiac stomach help in the proper digestion of the food particles. Sis et al (1979), Grau et al (1992) have been made the similar observation.

The intestine of *C. punctatus* is short. Jacobshajen (1913) found a direct correlation between the nature of the food and the length of the intestine. According to him, carnivorous fishes have short intestines and plant and mud feeders have long intestine. The short length of intestine appears to indicate that *C. punctatus* is a carnivorore. However Barrington (1957) suggested that the length of the intestine dependent on more than one factor. Al-Hussaini (1949) showed that the shortness of the gut in a fish may be compensated by the increase in the complexity of its mucosal folds and thus the length of the gut is affected by its average mucosal area.

Al-Hussaini (1949) also gave an opinion that the secondary folding are more in fishes with shorter intestine to ensure optimum absorptive surface. The mucosal folds of intestine of *C. punctatus* show an agreement with this.

Pyloric caeca is present in between the stomach and the intestine having similar histological arrangements as in intestine appears to increase the obsorption area for digested food. Similar observation is made by Abdulhadi (2005) in sea bream, *Mylio cuvieri.*

The rectum is not morphologically demarcated in *C. punctatus*. However, an ileo rectal valve is present which differentiate the rectum from rest of the intestine. Dawes, (1929); Blake (1930); Al-Hussaini (1946) ; Mohsin, (1946) Khanna, (1961). This valve helps the fish to retain the already digested food in the intestine for a longer duration, till the absorption is complete. This is needed since the alimentary canal is comparatively short. Thomas (1975) also reported an ileo rectal valve in the rectum of fishes having short intestine. The mucosal layer of the rectum bears numerous mucous glands. Al-Hussaini (1945), Islam (1955), Kapoor (1953), Moitra and Sinha (1971) have reported the presence of mucous cells in the rectal mucousa of the fishes studied by them. Similar type of glands has been reported by Moitra (1984) in *Clarias batrachus*.These numerous mucous cells lubricate the food materials and help in easy defecation. The mucosal folds of rectum are short and simple.

RELATIVE LENGTH OF GUT (RLG):

RLG of a fish is a ratio of the total length of the alimentary canal of the fish to its total body length. The length of the alimentary canal largely depends upon the feeding behavior of a particular fish. This establishes a correlationship between the value of RLG and the feeding behavior of a fish. Many of the workers have been reported a high degree of correlation between the feeding behaviors and RLG of fishes. Sugehiro, 1945, Mookerjee and Das, 1945; Al-Hussaini, 1949, Das and Moitra, 1958).

The higher value of RLG indicates the herbivorous feeding habit of the fish where as the less value shows that the fish is a carnivore while an intermediate value indicates the omnivorous feeding nature of the fish.In case of *C. punctatus* the value of RLG is significantly low and ranges between (0.4-0.8).TVA Mercy and N.K. Pillai (1984-85) recorded the RLG value (0.4) for the blind catfish *Heraglanis krishnai* (Menon), which is a carnivorous fish. The low RLG value of *C. punctatus* supports this and sounds about the carnivorous feeding habit of the fish having more than 75% of the animal matter as food.

RLG value show a close relationship with the nature of the gut content which increases with the increase in the vegetable matter and decreases when there is an increament of animal matter, (Dasgupta, 2011).The present findings of the RLG value of *C. punctatus* (0.4-0.8) show an agreement with Dasgupta (2011). These findings are also in accordance with the gut lengths listed by Smith (1978). as 0.2-2.3, 0.6-8 and 0.8-15 times of the body length in carnivorous, Omnivorous and herbivorous fishes respectively. The present finding agrees with the findings of Kuru, 2001).

TABLE NO: 1

LENGTH RANGE OF FISHES EXAMINED(CM)	NO OF FISHES EXAMINED	RLG	MEAN RLG
5-10	17	0.4	
10-15	14	0.5	0.54
15-20	10	0.6	
20-25	9	0.85	

Food items	June '07	July '07	Aug '07	Sep '07	Oct '07	Nov '07	Dec '07	Jan '08	Feb '08	Mar '08	Mean
Plant matter & algae	0.00	0.20	0.50	2.63	1.02	1.43	2.03	1.63	0.47	0.4	1.35
Fish	0.00	4.70	28.50	68.50	25.25	20.35	54.00	14.25	10.75	08.00	23.43
Molluscs	0.00	0.00	03.50	18.50	04.00	03.50	12.00	03.00	03.50	02.00	05.00
Crustaceans	0.80	0.70	18.90	38.00	35.00	20.30	27.48	12.22	18.80	04.00	17.62
Coleopteran	1.70	2.30	04.00	38.00	12.50	14.00	63.00	15.70	14.30	08.20	17.37
Odoneta	0.00	1.10	02.00	20.00	12.50	07.39	22.57	09.54	04.00	02.00	08.11
Diptera	0.00	0.00	01.41	04.00	01.00	01.13	07.16	03.00	02.00	01.00	02.07
Hemiptera	0.00	0.00	00.65	08.10	05.40	14.55	03.50	02.50	01.10	00.50	03.63
Parts of insects	0.00	4.50	15.50	61.70	20.30	31.50	43.50	15.60	14.40	10.50	21.75

TABLE-2 Gut contents of C.punctatus
GRAPH NO: 1

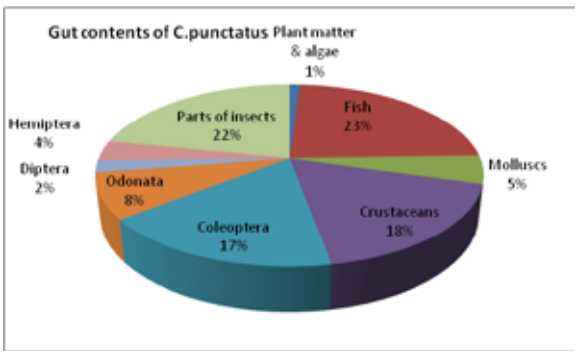


PLATE:1

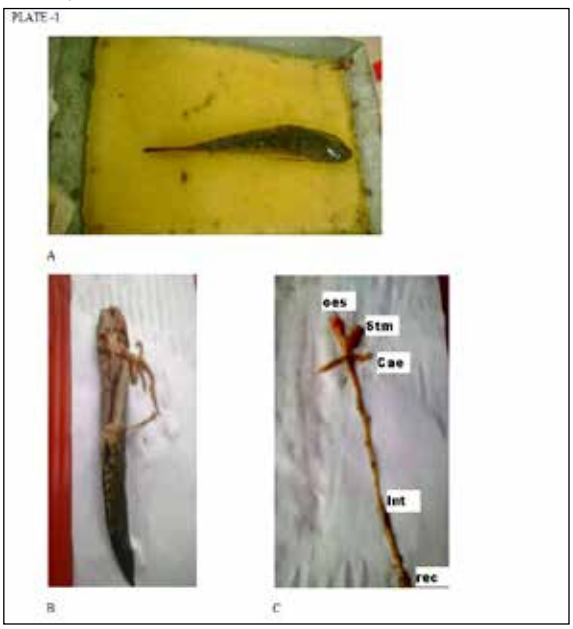
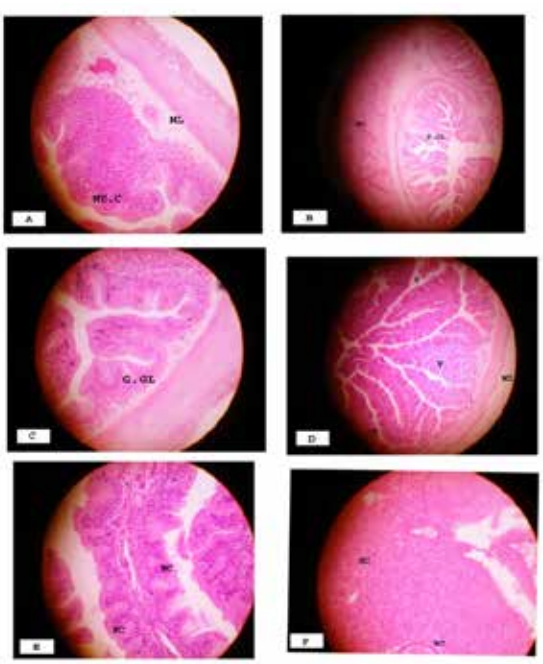


PLATE:2



EXPLANATION OF PLATE NO-1

A ***Channa punctatus***
B **Dissected fish showing Alimentary canal**
C **Alimentary canal of Channa punctatus**

Abbreviation:
Int: Intestine
Oes:oesophagus
Stm:stomach
Cae: Pyloric caeca
Int: Intestine
Rec: Rectum

EXPLANATION OF PLATE NO- 2

A. T. S. of Oesophagus X400
B. T. S of Stomach X100
C. T. S of Stomach X 400
D. T. S. of Intestine X100
E. T .S .of Intestine X400
F. T.S. of liver X400

Abbreviations:
Mu.c.-Mucus cell
M.L-Muscular layer
G.Gl.-Gastric glands
M.L- Mucosa layer
H.C- Hepatic cell

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