COMPARATIVE MORPHOLOGY OF ALIMENTARY CANAL IN RELATION TO FEEDING HABIT OF INDIAN RASBORINE FISHES

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ABSTRACT

The fishes of subfamily Rasborinae of family Cyprinidae are small sized individuals with a streamlined body and have been adjudged as a group of great economic importance from aesthetic, medical, fisheries and game points of view. In the present study, the structure and morphometrics of alimentary canal of Rasborine fishes (11 species belonging to 8 genera) are described in relation to their food and feeding habits. The general pattern of alimentary canal was found to be similar but according to their feeding habit some morphological features was showing dissimilarity. The pattern and length of alimentary canal indicated inter and intraspecific variations. The stomach content analysis revealed that Amblypharyngodon mola, Aspidoparia morar, Barilius bendelisis, Esomus danricus mainly depended on vegetable matter whereas Barilius barila Hamilton, Barilius barna Hamilton, Barilius vagra Hamilton, Branchydanio reno, Danio devario Hamilton, Raiamas bola, Rasbora (Rasbora) daniconius daniconius depended on animal matter. It has been observed that the rasborine fishes are predominantly larvivorous i.e. feeding on insect larvae except for Raiamas which is a carnivore.

Keywords: Alimentary Canal, Morphological features, Rasborinae, Food and Feeding, Stomach content

INTRODUCTION

The fishes of the subfamily Rasborinae of family Cyprinidae are small sized individuals with a streamlined body and have been adjudged as a group of great economic importance from, aesthetic, medical, fishery and game points of view (Jain and Tilak, 2010). These fishes are all small, surface-feeding forms with a symphysial knob in lower jaw which fits into the emargination in the upper jaw and mouth opening directed obliquely upwards. The special characteristics render these fishes most efficient and useful as larvivorous fishes (Jain, 1987).

The adaptations of the alimentary canal of fishes to their food are particularly evident in the form of mouth, size, shape and structure of the oropharynx, dentition, gill rakers, structure of the oesophagus, presence or absence and shape of stomach and the intestine and relative length of the gut (Dasgupta, 2000). All these structures are subject to diverse and significant variations and modifications in accordance with the feeding habits of different fishes. The diversity in feeding habits that the fishes exhibit is particularly the result of evolution leading to structural adaptation for getting food from the equally great diversity of situations that have evolved in the environment. Conversely, the importance of food in the daily life of a fish is "reflected" in the form of mouth and jaws and length and pattern of alimentary canal etc., therefore, the difference in their feeding habits.

MATERIALS AND METHODS

The material for the present study has been collected from different places in Uttar Pradesh. Immediately after collection the specimens were transferred in ice box, brought to laboratory and were
preserved in 10% formalin. Total length of each individual specimen was measured to the nearest of 0.1 cm using a standard measuring scale. Guts of the specimens were carefully dissected out, uncoiled and total length and total weight of gut was recorded and measurements were taken for individuals of different lengths as for length from lip to stomach, length of stomach, and length of intestine. Alimentary canal of all the species were studied morphometrically and gut contents were also analyzed to know their feeding habit. For estimation of food organisms the “point method” was followed. The alimentary canal and the head portion of these species were figured.

The following representative genera and species of subfamily Rasborinae form this basis of the study:

1. **Amblypharyngodon mola** (Hamilton)
2. **Aspidoparia morar** (Hamilton)
3. **Barilius barila** Hamilton
4. **Barilius barna** Hamilton
5. **Barilius bendelisis** Hamilton
6. **Barilius vagra** Hamilton
7. **Branchydanio rerio** (Hamilton)
8. **Danio devario** Hamilton
9. **Esomus danricus** (Hamilton)
10. **Raiamas bola** (Hamilton)
11. **Rasbora (Rasbora) daniconius daniconius** (Hamilton)

Several samples were studied for each species and each lot consisted of both male and female specimens of adult size; immature specimens.

**OBSERVATIONS**

In the present work 11 species of subfamily Rasborinae of family Cyprinidae were studied for morphometric of alimentary canal and to know their food and feeding habit. The structure of alimentary canal of all the 11 species fits into the general description. It has been observed that the rasborine fishes are predominantly larvivorous i.e. feeding on insect larvae except for *Raiamas* which is a carnivore. The structure of alimentary canal and the head portion of these species were figured.

**Amblypharyngodon mola** (Hamilton): Figure 1 a, 1 b

The alimentary canal of *A. mola* is highly coiled and the loops are arranged in concentric circles (Fig. 1 a). It has a well-marked stomach. The length of gut contained 3.32 times in total length of the fish. It is a surface feeder fish with mouth directed upwards and lower jaw longer (Fig. 1 b). It is a herbivore, feeding mainly on algae and aquatic plants. The study of alimentary canal of *A. mola* revealed that this species depended mainly on vegetable matter. The gut content showed 90% vegetable matter and 10% animal matter.

**Aspidoparia morar** (Hamilton): Figure 2 a, 2 b

The alimentary canal of *A. morar* (Fig. 2 a) is long, tube like structure folded into three lengths of almost equal size and contained 1.22 times in total length of fish. It is a bottom feeding fish with lower lip absent (Fig. 2 b) and the jaw possessing a cutting edge; the upper jaw is longer. It is a omnivorous fish. The
gut content analysis showed 67% vegetable matter and 23% animal matter.

**Barilius barila** Hamilton : Figure 3 a, 3 b

The alimentary canal of *B. barila* is tubular, stomach can be distinguished by a slight bulge (Fig. 3 a). It contained 0.49 times in total length of the fish. It is a column feeder with carnivorous feeding habits, feeding mainly on insects and their larvae with mouth opening directed upwards, lower jaw with well defined symphysial knob (Fig. 3 b). The Study of alimentary canal showed 80% animal matter and 20% vegetable matter.

**Barilius barna** Hamilton : Figure 4 a, 4 b

The alimentary canal of *B. barna* is tubular with a slight bulge in the stomach region (Fig. 4 a) and it contained 0.63 times in total length of the fish. It is a column feeder with a terminal mouth having a symphysial knob on the lower jaw (Fig. 4 b). It is carnivorous and feeds mainly on insects and their larvae. The study of alimentary canal showed 70% animal matter and 30% vegetable matter.

**Barilius bendelisis** Hamilton : Figure 5 a, 5 b

The alimentary canal of *B. bendelisis* is a long tubular structure (Fig. 5 a) with no trace of stomach and it contained 1.10 times in total length of the fish. It is omnivores, preferring insects and their larvae, crustaceans, algae etc. It is a column feeder, having an anteriorly placed mouth (Fig. 5 b). The lower and upper jaws form a pipe-like feeding tube. Small and stumply gill-rakers help in sieving the food. The gut content analysis showed 70% vegetable matter and 30% animal matter.

**Barilius vagra** Hamilton : Figure 6 a, 6 b

The alimentary canal of *B. vagra* is tubular (Fig. 6 a) and it contained 0.62 times in total length of the fish. It feeds mainly on insects and their larvae. It is a larvivorous fish. It is a column feeder with a terminal mouth and symphysial knob in the lower jaw (Fig. 6 b). The stomach content analysis showed 67% animal matter and 23% vegetable matter.

**Branchydanio rerio** (Hamilton) : Figure 7 a, 7 b

The alimentary canal of *B. rerio* is tubular (Fig. 7 a) and it contained 0.59 times in total length of the fish suggesting a non-vegetarian mode of feeding. It is a surface feeder fish with a small mouth directed upwards, the lips are thin (Fig. 7 b). It is an insect feeding fish. Since it is an aquarium fish, the studies were conducted on it. The gut content analysis showed 67% animal matter and 20% vegetable matter.

**Danio devario** Hamilton : Figure 8 a, 8 b

The alimentary canal of *D. devario* is thick, tubular with hardly any demarcation between the stomach and intestine (Fig. 8 a). It contained 0.67 times in total length of the fish. It is a surface feeder with mouth directed upwards, lower jaw being longer with a well defined knob (Fig. 8 b). It is larvivores fish preferring to feed on insect larvae. The stomach content analysis showed 72% animal matter and 27% vegetable matter.

**Esomus danricus** (Hamilton) : Figure 9 a, 9 b

The alimentary canal of *E. danricus* (Fig. 9 a) contained 2.39 times in total length of the fish. Intestinal bulb is clearly marked off. Intestine is thin, tube-like coiled. It is an omnivore fish feeding mainly on algae, aquatic plants and insects. It is a surface feeder with mouth directed upward, with lower jaw longer. (Fig. 9 b). The gut content analysis showed 80% vegetable matter and 20% animal matter.

**Raiamas bola** (Hamilton) : Figure 10 a, 10 b

Intestine is very short (Fig. 10 a) and its extends almost straight from the stomach to the vent. The
intestine from the stomach to the vent is only about half the length of the stomach, the length of the fish. The alimentary canal is 0.75 times the total length of the fish. It is a carnivorous fish, feeding on smaller fish (piscivorous) and insects. The stream-lined body, wide mouth (Fig. 10 b) form and structure are well-adapted for predacious life. Pharyngeal teeth are sharp and pointed at their tips are modified for tearing up and holding the prey (Hora, 1937). The Study of alimentary canal showed 65 % animal matter and 25% vegetable matter.

*Rasbora (Rasbora) daniconius daniconius* (Hamilton) : Figure 11 a, 11 b

The alimentary canal of *R. daniconius* is a tubular structure with no stomach (Fig. 11 a). It contained 0.88 times in total length of the fish. It is an omnivorous fish feeding mainly on the insects and their larvae, diatoms, crustaceans etc. This fish is a surface feeder with mouth directed upwards and a well-developed knob at the symphysis of the lower jaw which is longer than the upper jaw (Fig. 11 b). Pharyngeal teeth masticatory. The stomach content analysis showed 60 % animal matter and 30 % vegetable matter.

**DISCUSSION**

In the present study, the general plan of the alimentary canal was found to be genus specific i.e. each genera viz. *Amblypharyngodon, Aspidoparia, Barilius, Danio, Esomus, Brachydania, Rasbora and Raiamas* had a pattern of their own, most of them were omnivores preferring to feed on insect and their larvae except *Amblypharyngodon* which is herbivore and *Raiamas* carnivore. This is also supported by the relative gut length and stomach content analysis of these species. The relationship between the structure of the alimentary canal and feeding habits has been studied by Sharma (1984), Datta and Dasgupta (1986), Bose and Islam (1986), De and Datta (1990), Dasgupta (1995, 1997). According to Das and Moitra (1955) carnivorous and predatory fishes that feed on prey of large size also possess a larger buccal cavity, a longer and distensible oesophagus and a more or less straight and short intestine. The percentage of different components in the entire alimentary tract vary considerably in different fishes with different feeding habits. The variations can be clearly understood if we consider the food taken by different species of fishes (De Groot, 1971). It is evident that R.L.G. value has a close relationship with the nature of food of the fishes. In the herbivorous fishes such as *Labeo rohita and L. gonius* (Das and Moitra, 1956 a, b) the R.L.G. values were about 12.0 and 9.5 respectively. In omnivorous fishes (Das et al., 1965) the R.L.G. values were lower e.g. *Puntius conchonius* had 3.3 and *Barbus hexastichus* had 2.3. In carnivorous fishes the R.L.G. values are generally low, as in *Bagarius bagarius* (0.8) and *Notopterus chitala* (0.4) according to Das and Moitra (1956a). The R.L.G. value showed a close relationship with the nature of gut content in *Channa* species and showed an increase with the increase in the vegetable matter. In *C. orientalis* the gut content consisted of 60% vegetable matter and the R.L.G. value was found to be 1.14. In *C. punctatus* the gut content consisted of 27% vegetable matter and 70% animal matter and the R.L.G. value was found to be 0.69. In *C. striatus* the gut content consisted of animal matter only and the R.L.G. value was accordingly very low (0.57). In *C. marulius* the gut content consisted of 20% vegetable matter and 80% animal matter and the R.L.G. value was found to be 0.82 (Dasgupta, 2000). Kafuku (1958) attempted to work out the speciation in cyprinid fishes on the basis of intestinal differentiation. The present work can be of much value in tracing the phylogeny and affinity of Indian rasborine.
REFERENCES


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