



# Food and Feeding Habit of *Brachydanio rerio* (Ham), an Important Ornamental Fish of Assam, India

Sharmistha Paul <sup>a++\*</sup> and Sushil Kumar Sarmah <sup>b#</sup>

<sup>a</sup> Arya Vidyapeeth College, Guwahati – 781016, India.

<sup>b</sup> Guwahati College, Guwahati -781021, India.

## Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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## ABSTRACT

*Danio rerio* formerly known *Brachydanio rerio* (Ham) is an important fish globally both for experimental studies as well as ornamental fish. *Brachydanio rerio* is a carnivorous fish. The basic food of the species consists of insect part, chlorophyceae and plant matter. The victual spectra trend of the gut contents of the fish has been studied through the breeding and non breeding period. The breeding and the non breeding season has been estimated by the Gonodo somatic index of the fish. The RLG ranges from 0.61 to 0.77 in fish group of TL from >30-35mm. The hepatosomatic index (HSI) of the species depicts the feeding intensity of the test species. The HSI in the female of the test species shows more or less decreasing trend than the overall HSI. The species is very well adapted to feed voraciously in between surface zone, column zone and bottom

<sup>++</sup> Associate Professor;

<sup>#</sup> Rtd. Associate Professor;

<sup>\*</sup>Corresponding author: Email: [paulsharmistha2000@yahoo.com](mailto:paulsharmistha2000@yahoo.com);

zone as observed in aquarium condition. In *B. rerio*, the gill raker are fewer (20) and smaller in size (0.1-0.25mm), shorter, spiny and minutely serrated. Gill raker pattern reveals that *Brachydanio rerio* is basically carnivorous but at the time of environmental stressed condition it changes to omnivore mode of feeding.

**Keywords:** Feeding habit; fish; fish growth; fish breeding; food habit; breeding season.

## 1. INTRODUCTION

*Danio rerio* formerly known as *Brachydanio rerio* (Ham) is a small Cyprinid fish with vibrant body colouration. It is also known as Zebra Danio and is found in wetlands, ponds, small streams and especially rice fields of Northeastern India. The fish grows to a maximum size of 35mm. In life the species has silvery grey back, with yellowish white belly, flanks with shining prussian blue colour, with transverse four well defined beautiful shining gold stripes from head to caudal fin. The anal fin has beautiful blue gold stripes and dorsal fin olive green with hyaline paired fins. The fish is hardy, easy to feed, inoffensive by nature and disease resistant. These characteristics make it an ideal aquarium fish and it is a favourite among aquarists.

Northeastern states, West Bengal, Kerala and Tamil Nadu are blessed with vast indigenous ornamental fish diversity. Presently the ornamental fishery has a great scope in India due to its rich biodiversity. India is lagging behind in ornamental fish export and its overall contribution to global export remains only Rs 8.4 crores (0.32%) (Sinha, 2020). Ornamental fish trade is based on wild catch from Northeastern states. India with an increasing growth rate in ornamental fish trade, and Assam with its diverse ornamental fauna should venture into reproduction of indigenous ornamental fish species. *Brachydanio rerio* (Ham) is widely used for experimental purposes as well as ornamental fish. Therefore it is pertinent that aquarists must develop formulated food for the culture and breeding of *Brachydanio rerio*. Its vibrant colouration makes it an important aquarium fish both in India as well as globally. The most important criteria for rearing and breeding of *Brachydanio rerio* is food. Nutrition is crucial in ornamental fish culture for promoting good health as well as maintenance of colouration. Nutritional requirements have not yet been defined, and comprehensive feeding protocols are yet to be standardized. Hence, there is a need to develop a widely accepted standard diet for zebrafish [1]. For commercial production of the test species, natural diet is important for food formulation. The

study focuses on the natural food and feeding behavior of the test species during breeding and non breeding season. The breeding and non breeding season are estimated by the Gonadosomatic index (GSI) of the species. The GSI of *Brachydanio rerio* indicates a primary breeding season in the month of June and a secondary breeding season in the month of October. However, the second breeding period is not successful in laboratory condition as the primary breeding period [2].

Study on food and feeding behaviour of different fishes have been made by many researchers like Moffet and Hunt [3] Khan [4] Karim and Hossain [5] Doha [6] Dewan and Saha [7] Bhuiyan and Islam [8] Reddy and Rao (1993), Akpan and Isangedhi, [9] Khabade [10] Tamlurkar (2018), Naganyal and Saxena [11] Fowler [12] Paul [13] and Stevens [14]. In Northeastern India Dey and Sarmah [15] made empirical studies on the nutrition of some native ornamental fish species. The present work focuses on the natural food and feeding behavior of *Brachydanio rerio* during breeding and non breeding seasons hitherto remained unattended will help in the formulation of feed for the culture and reproduction of the test fish for commercial trade.

## 2. METHODS AND MATERIALS

The study was conducted from November 2021 to October 2022. Fish species were collected using drag nets from wetlands of Guwahati. The sexual dimorphic characters were determined through various morphological characters such as body shape, colouration of body and fin profile. The sexual dimorphic characters are identified both in breeding and non breeding season. The body profile of the male is slender, narrow and the ventral profile is straight whereas in case of the female the body is stumpy and deep. The anal fin is longer in male than in the female whereas the caudal fin in male is moderately forked compared to the female which is deeply forked. The colour of the body of the male is bright with prominent peacock blue horizontal stripes but the females are dull in colour. The bionomics study was made separately for male and female test species

during breeding and non breeding season. For victual spectra study, an average of c 50 fishes per season were collected and preserved in 8-10% formaldehyde. A total of 200 fishes were analyzed during the period of study. The gut content of *Brachydanio rerio* (Ham) was analyzed after Hynes [16] Lagler [17] and Blessing et al. [18]. The entire digestive tube was cut open lengthwise and the contents were emptied into petri-dishes for analysis and different food items were separated. The large food items were isolated and identified and the smaller food constituents were identified with the aid of microscope. All the food items were ascertained up to the genus or the family level, depending upon the completeness of the organism and the extent of digestion. If digestion has progressed to an advanced state making identification difficult, it is treated as digested. The food items are identified according to authoritative sources. The relative length of the gut (RLG) exhibits the precise relation between the gut dimensions to the actual body length. The RLG was analysed after Jacobshagen [19] using

the formula  $RLG = \frac{GL}{TL}$ , where GL – gut length and TL – total length of the fish in mm. The hepato-somatic index (HSI), which is an

estimation of the feeding intensity of the fish, was calculated by the formula,  $HSI = \frac{w \times 100}{W}$ ,

where w and W are the weight of the gut content and the fish respectively. The gills of the test species are dissected out and studied under the microscope to find out the gill raker condition and correlated with food habit after Nikolsky (1963). Lineament of feeding was observed in the aquarium.

### 3. RESULTS AND DISCUSSION

The food spectrum of *Brachydanio rerio* was studied separately in male and female during the breeding season and non breeding season is purported below

#### Male:

**Breeding season:**Chlorophyceae (17.4)> Insect parts (17.0)> Plant matter (14.6)> Decaying organic matter (11.6)> Bacillariophyceae (11.0)> Crustacea (9.0)> Euglenophyceae (4.66)> Myxophyceae (2.0)> Rotifera (1.5)> Protozoa (1.29)> and Sand and debris (1.0). Pictorial representation of the victual spectrum is represented in Fig. 1.

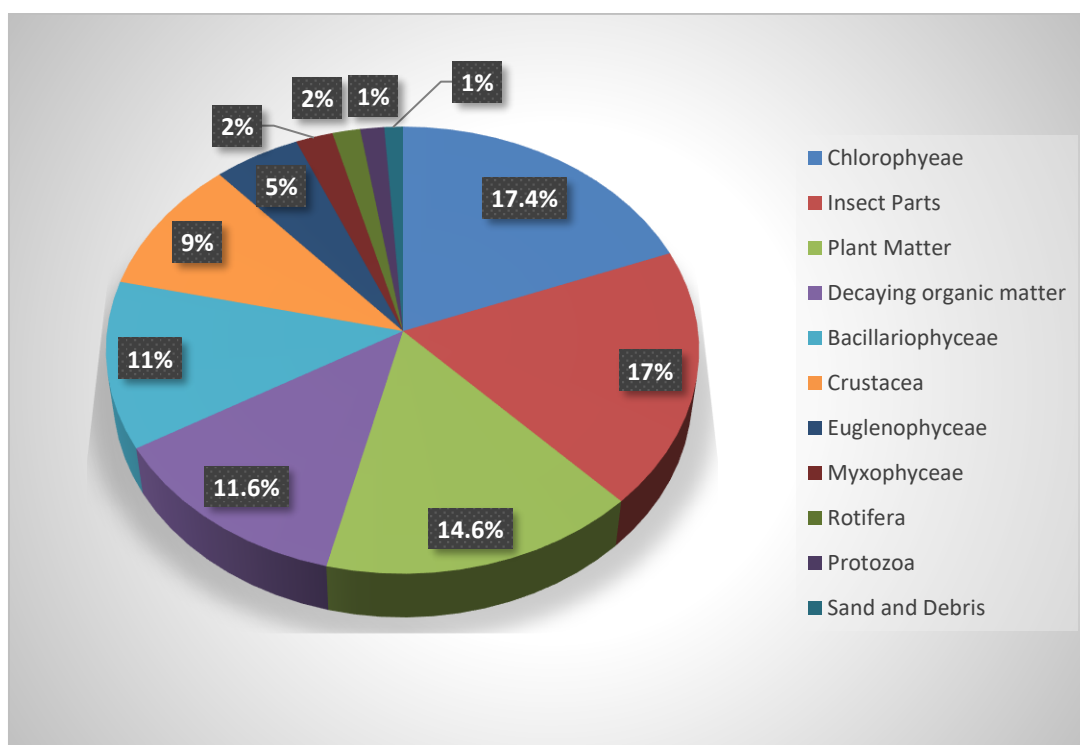


Fig. 1. Pie chart showing occurrence of food matter in breeding season (Male)

**Non-breeding season:** Insect parts (28.12)> Chlorophyceae (13.77)> Plant matter (13.37)> Bacillariophyceae (11.67)> Decaying organic matter (10.0)> Crustacea (8.7)> Myxophyceae (3.6)> Euglenophyceae (3.5)> Sand and debris (3.3)> Protozoa (2.0) and Rotifera (1.52). Pictorial representation of the victual spectrum is represented in Fig. 2.

**Female:**

**Breeding season:** Plant matter (19.97)> Decaying Organic matter (19.29)> Chlorophyceae (17.97)> Bacillariophyceae

(12.04)> Insect parts (10.27)> Crustacea (6.47)> Euglenophyceae (5.4)> Myxophyceae (3.0)> Sand and debris (2.59)> Rotifera (1.75)> and Protozoa (1.25). Pictorial representation of the victual spectrum is represented in Fig. 3.

**Non-breeding season:** Insect part (30.0)> Chlorophyceae (16.77)> Plant matter (13.7)> Bacillariophyceae (11.4)> Crustacea (8.52)> Decaying organic matter (7.12)> Euglenophyceae (4.3)> Myxophyceae (2.37)> Sand and debris (2.52)> Rotifera (2.05)> and Protozoa (1.25). Pictorial representation of the victual spectrum is represented in Fig. 4.

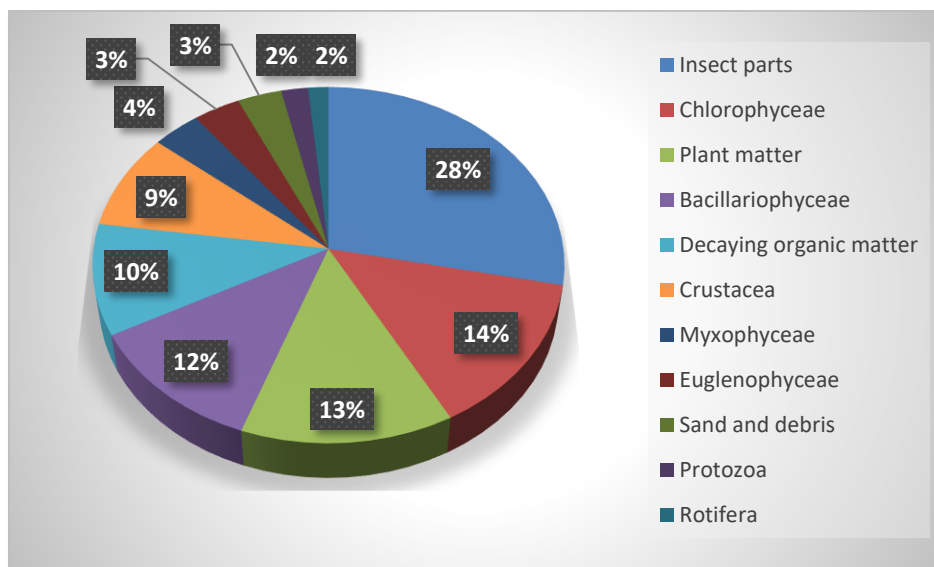


Fig. 2. Pie chart showing occurrence of food matter in non-breeding season (Male)

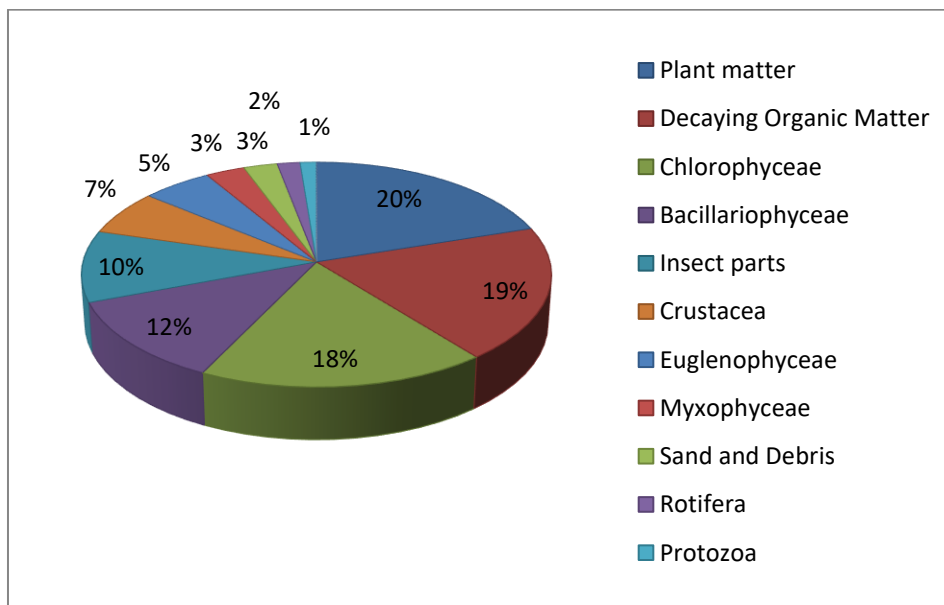


Fig. 3. Pie chart showing occurrence of food matter percentage (Female)

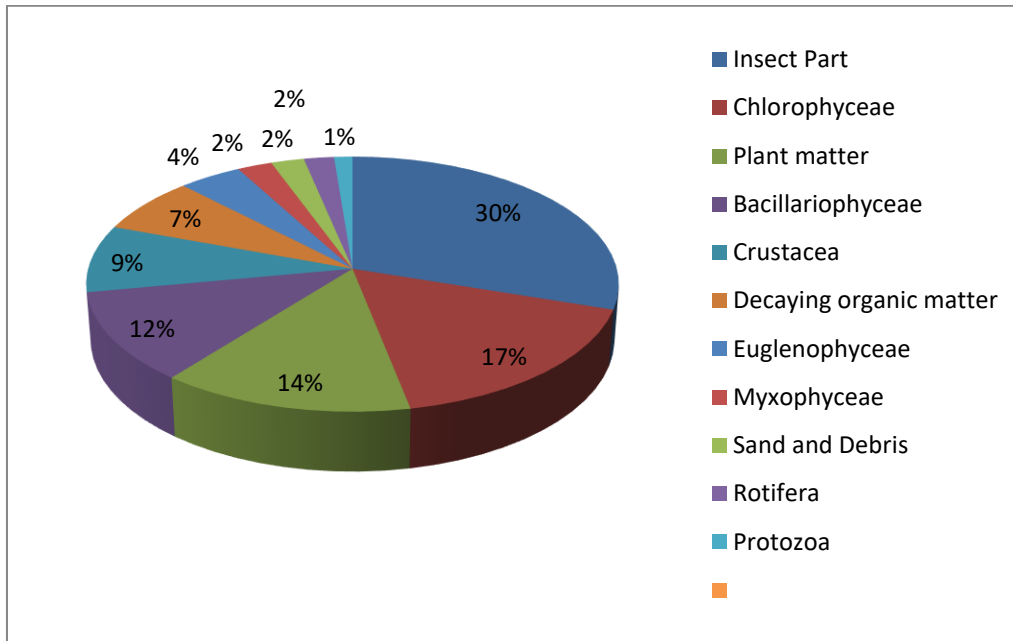


Fig. 4. Pie chart showing occurrence of food matter in Non-breeding season (Female)

**Lineament of feeding:** Move to surface level — intake food — return to upper column and stay for sometime — again move to surface level — intake food — return to mid column — swimming in the column for sometimes — move to the bottom zone — intake food — return to the column stratum.

**Relative gut length (RLG):** The relative gut length of the species investigated in respect of size is given in tabular form:

Table 1. Relative gut length of the species

Sl. No.	Size Range (TL in mm)	RLG
1	0 - 20	0.77
2	>20 - 25	0.72
3	>25 - 30	0.65
4	>30 - 35	0.61

The RLG ranges from 0.61 to 0.77 in fish group of TL from >30-35mm. In *B. rerio* the raker are shorter in both limbs of arch but slightly longer in central arch. All the rakers are spiny and minutely serrated.

Table 2. List of parameters for Gill Rakers in ranges

Parameter	
Size range of fish	30-35
No. of gill raker/ gill arch	20
Size of gill raker	0.1- 0.25
Length of gill lamellae	1.0- 1.12
Length of gill arch	2.5-3.0

In order of predominance, the basic food of the test species consists of insect part, chlorophyceae and plant matter [20]. The secondary food consists of euglenophyceae, myxophyceae, rotifera and protozoa. Sand and debris consists of incidental food. The above trend is almost similar in both male and females of the species in non breeding season. The selectivity in feeding among the male and female of a species during breeding season is poorly reported by earlier workers. Sex wise food spectra of the present OFS reveal that the test species is euryphagic but prefer more animal food mainly the insect part during non breeding season. Euryphagism Nikolsky 1963, Paul [13] has evolved as an adaptation to unstable supply of food. Significantly, both male and female of the test species prefer plant and algal food during breeding. This is primarily because of the availability of food in their habitat. *B. rerio* is a mid surface dweller. But the trend is not found to be binding to them under all circumstances. Although, their preference zone of feeding may be in the said precise order, given no option, they are very well adapted to feed voraciously in between surface zone, column zone and bottom zone as observed in aquarium.

The RLG values it can be inferred that the *Brachydanio rerio* is carnivorous but during stressful environmental condition becomes omnivorous. However, in breeding season, the HSI in the female of the test species shows more

or less decreasing trend than the overall HSI. The matured gonads which occupy maximum space of the coelom, exert pressure on the intestinal bulb to cause cession in feeding [13] during the spawning season. The low feeding during breeding may be attributed to the development of gonads during spawning seasons which occupy the major space of the abdominal cavity [21,22,23], and Desai, (1970). Thus it can be inferred that the intensity of feeding shows a downward trend in the approach of the maturation phase and ingestion only improve when the spawning period is over. In *Brachydanio rerio*, the Gill Raker are fewer (20) and smaller in size (0.1-0.25mm), shorter, spiny and minutely serrated. Gill Raker pattern reveals that *Brachydanio rerio* is basically carnivores but at the time of environmental stress which are the months of January and February when the water level of streams and ponds decreases and food is scarce it changes its feeding habit to omnivores.

#### 4. CONCLUSION

The present investigation, hitherto remained unattended, will depict a clear study of the food spectra of the fish, *Brachydanio rerio* which in turn will lead to economic benefit for entrepreneurs and aquarists engaged in the OFS trade as well as unemployed youths for taking up freshwater ornamental fish trade and help generate income sources among the mass.

#### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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