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RESEARCH ARTICLE

QUANTITATIVE AND QUALITATIVE GUT CONTENT ANALYSIS OF *MACROBRACHIUM ASSAMENSE PENINSULARE* FROM RAWASAN STREAM OF GARHWAL HIMALAYA, UTTARAKHAND, INDIA.

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Abstract

Food is an essential for any organism, for growth, reproduction and culture aspects. Study on food and feeding of *Macrobrachium assamense peninsulare* has been carried out by quantitative and qualitative gut content analysis methods. Prawns were collected monthly from August 2013 to July 2015 and analyses of stomach content were made to know the natural food of these prawns. From the overall analysis it has been reported that these prawns are omnivorous in nature and generally eat up the microscopic food, either animal or plant matters. Food consists of fragments of aquatic plants, algae, animal matter, diatoms, sand grains and highest percentage of amorphous mass. Results indicate that the adults are mostly predators of benthic invertebrates rather than detritus feeders/scavengers.

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Introduction:-

Macrobrachium assamense peninsulare, a minor prawn, found in the low velocity water bodies in the Uttarakhand, are economically used as food by the local habitants. However, their supply is primarily totally from the wild catch and is limited due to the inadequate source of availability in their natural habitat. The members of genus *Macrobrachium* are adapted themselves to a wide range of food of both plant and animal origin. It has been shown from earlier study that these minor prawns are omnivores in their feeding habits (Sharma and Subba, 2005).

Information about the natural food of the prawn and their nutritional characteristic is essential and act as an evidence for artificial diet during aquaculture. Due to mass culture practices in prawn, the significance of artificial food is recognized. The selection of experimental diet has frequently been assessed in term of food conservation ratio (Froster, 1976; Reddy & Shakuntala, 1986). Accurate diet and feeding habits description helps to understand the tropical interaction of aquatic animals with their food web. Feeding is the most important function of an organism and most of the time in their daily life devoted by these organisms in the search of proper food. Although many authors have studies food and feeding of prawn species earlier (Chopra, 1939; Panikkar, 1952; Sharma & Subba, 2005; Hall, 1962; Thomas, 1972; Marte, 1980; Khan, et al., 2001; Basker et al., 2013; Bakhtiyar et al., 2014)

This paper deals with the study of stomach contents of *Macrobrachium assamense peninsulare* collected from its natural habitat from Rawasan stream to know the natural food composition.

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Materials and Methods:-

To understand the food intake of *Macrobrachium assamense peninsulare* the qualitative and quantitative analysis of gut contents were made on monthly basis for an interval of two years (2013-2015). For this study 10 male and female were fixed in 70% alcohol soon after their capture, in order to stop the digestion of food in the alimentary canal (Williams, 1981) and brought to the laboratory for further analysis. In the laboratory before processing for the microscopic examination of the food contents, total weight of the individual intact prawn and that of its gut contents were recorded separately. In each specimen the carapace was opened from the dorsal side of the body and gut was removed carefully. A visual examination of fullness of intestinal bulb was also made immediately after its removal (Devi et al., 2013). The microscopic analysis was carried out as hurriedly as possible and was never overdue from more than 4 day after capturing the animal.

Analysis of Gut contents:-

In prawn, the food which reaches the gut is very fine crushed and is meshed due to the presence of powerful mandible. It is further churned in the mill itself and thus, the food items were identified up to the level which was possible. Different type of food item and their percentage was calculated on the basis of fractional analysis, by taking 1 ml of well shaken and thoroughly mixing stomach content suspension from petri dish into the Sedgewick rafter chamber and examined under binocular microscope to obtain percentage composition of different food items. Various food items were examined using binocular microscope and identified to the lowest possible taxonomical level with the help of keys and photographs provided by Ward and Whipple (1959); Needham and Needham (1962) and (APHA, 2012). The quantitative analysis was made and point was given purely on the basis of observation of food items.

Observations:-

Food and feeding habits:-

The mode of feeding in *Macrobrachium assamense peninsulare* was observed visually in the field during the study. It was observed that prawn, by habit is an omnivorous species and exhibits feeding activity in day time in comparison to the other species. These prawns are also shy in nature and hide them self in their micro habitats and found under the stones, crevices near the bank of the stagnant water during study.

Quantitative study:-

Monthly visual observation was also made and recorded the degree of fullness (%) of gut in *Macrobrachium assamense peninsulare* (Table 2). It is clearly proved that fullness of gastric content is directly related with seasonal variation and 100% fullness of gastric content was never observed during the study period of two years. Quantitative analyses revealed less than 6% population as empty stomach, 59.8% of stomach as actively fed including, 100%, 75% and 50% diet contents and poorly fed having 40.9% of stomach including, trace, empty and 25% gut content.

Qualitative study:-

On the basis of microscopic examination of the gastric content, food was identified and categorized into seven groups viz., those containing fragments of aquatic plants, algae, animal matter, diatoms, sand grains and unidentified organisms. Different food items percentage in male and female prawn shown in Fig 1 (a & b). Composition of gut contents of *Macrobrachium assamense peninsulare* in relation to size groups were presented in the Table 1. During the observation no sex related trend with relation to different food types was observed. During the microscopic observation in the laboratory several food items identified from gut contents were recorded as.

- a. **Fragments of aquatic plants:** These types of food comprised of different types of green grass, parts of seeds, leaves and root materials often found in the gut of the both sexes in all size groups. It ranked fifth (7%) in female and sixth (5 %) in male among food items during study.
- b. **Fragment of animals:** Fragments of animals were observed throughout the year during the study and ranked second both in female and male prawn gut i.e. (19%) and (23%) respectively. Animal matter consisted of parts of cuticles, exoskeletons and parts of polychaetes represented by bristles, jaw, legs and fragment of body parts, fragments of zooplanktons such as antenna, pleopods and some parts of aquatic insects their nymphs and larva.
- c. **Algae:** Fragment of green and blue green algae were observed throughout the study in both sexes and also in all size groups. Algae forms the third important constituent of prawn food item having (19%) in female and (14%) in male. The most important genera of algae were *Cladophora*, *Anabaena*, *Zygnema*, *Volvox*, *Oscillataria* etc.

- d. **Diatom:** Represented mainly by *Fragilaria*, *Pinularia*, *Nitzschia*, and *Gomphonema* and ranked fourth among the food items in *Macrobrachium assamense peninsulare* having (8%) in male and (7%) in female.
- e. **Unidentified organisms:** These were probably parts of the undigested food items of both aquatic plants and animal. These were observed in the gut throughout the study periods and dominated in the size group of 20-30 mm body length prawn and ranked fifth among the food items in male (6%) and sixth (4%) in female.
- f. **Amorphous mass:** Amorphous mass or unidentified debris comprised of fragments of decomposing organic matter which could not be accurately identified due to their tiny size and poor physical appearance. This types of food items showed the dominance in gut content, i.e. male (44%) and female (41%) in *Macrobrachium assamense peninsulare* and was recorded maximum in 20-30 mm size group in male (43.2%) in male and (41%) in female individual.
- g. **Sand grains:** Sand grains were found in inadequate percentage 1- 2% in the gut of both sexes throughout the study. This item was possibly an accidental inclusion along with other food items, even though *M. a. peninsulare* is bottom feeder were mostly prefer dead and decay matter.

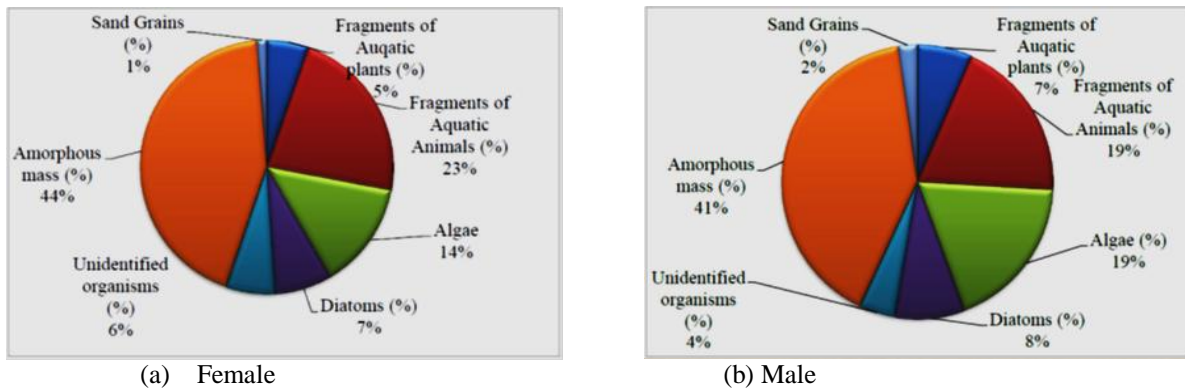


Fig. 1:- Percentage of food items (%) in *Macrobrachium assamense peninsulare*

Table 1:- Percentage composition of gut contents of *M. assamense peninsulare* in relation to size groups

Size (mm)	No. Examined	Fragments of Aquatic plants	Fragments of Aquatic Animals	Algae	Diatoms	Unidentified organisms	Amorphous mass	Sand Grains
Male								
20-30	16	5.3	23	13.6	7.3	6.2	43.2	1.3
30-40	60	9.3	32	8.78	4.6	4.9	37.9	3
40-50	70	11	34	11.3	3	3.3	35.2	2.8
50-60	39	10	32	15.7	7	1.8	32.6	1.5
60-70	4	12	37	4.22	4	3.8	34.6	5.6
Female								
20-30	13	6.6	19.4	19	8.3	4.26	41	2.3
30-40	87	8.6	21.4	15	9	3.23	40	3.4
40-50	84	10	23.1	12	7.5	2.72	42	2
50-60	27	11	33.2	9.6	6.8	2.92	35	1.8
60-70	-	-	-	-	-	-	-	-

Table 2:- Monthly variation in the degree of fullness of guts (%) in *M. assamense peninsulare*

Months	No. Of Examined	Degree of fullness (%)						
		Poor fed			Actively fed			
		Empty	Trace	25	50	75	100	
August	10	9.76	11.89	16.96	29.78	31.78	-	
September	10	11.34	11.26	20.98	39.5	17.35	-	
October	10	6.34	12.45	27.56	26.55	27.67	-	
November	10	2.67	9.95	18.79	45.6	23.45	-	
December	10	0	13.78	25.56	35.56	25.45	-	
January	10	0	13.75	27.33	21.95	39.78	-	
February	10	5.98	14.43	19.75	24.46	35.98	-	
March	10	4.89	18.45	17.78	19.78	39.43	-	
April	10	9.67	18.57	15.47	14.26	42.56	-	
May	10	12.4	15.03	17.02	15.22	40.78	-	
June	10	0	16.67	23.35	17.87	42.34	-	
July	10	0	16.22	24.56	14.68	45.67	-	
Total	120	5.2542	14.371	21.259	25.434	34.353	-	

Discussions:-

Diet of *Macrobrachium assamense peninsulare* is generally microscopic, containing minute animal and plant matter showing its omnivorous nature. It is evident from gut content analysis that the organic detritus (unidentified debris) appears quite regular in the diet of the *Macrobrachium assamense peninsulare* (Table 1) throughout the study period in different size groups although its efficacy as food source seen to be important to grown-up prawns when it leads to benthic existence. Organic detritus was readily consumed when the other preferred food items were less available. **Pringle et al. (1993) and Pringle (1996)** mentioned that the decapods crustaceans are omnivores and detritivores. Present finding also get support from the studies on feeding habits and food of *M. acanthurus* (**Albertoni et al., 2003a**), *M. lamarrei* (**Sharma and Subba, 2005**), *M. vollenhovenii* (**Jimoh et al., 2011**) and *M. carcinus* (**Lima et al., 2014**) which were found to be omnivorous in nature. Quantitative estimation of gut contents of *Macrobrachium assamense peninsulare* is in agreement with the result of **Raman (1967); Rao (1967); Ling (1969) and Coasta and Wanninayake (1986)**, who have reported that prawn are omnivores in feeding habitat. **Bakhtiyar et al. (2014)** also reported that the *M. dayanum* has been categorized as detriti-omnivorous feeding on both animal and plant matter with detritus as dominant food items and similar observation was recorded in *Macrobrachium macrobrachion* in Nigeria by **Joseph et al. (2013)**.

Gut content of *Macrobrachium assamense peninsulare* consisted of fragments of aquatic plants, fragments of aquatic animals, algae, diatoms, amorphous mass, sand grains and unidentified organisms, which represented different trophic level. All types of food item were observed throughout the study period in variable proportion. In comparison to the observation of **Subramanyam (1963a)** and in agreement with **Gopalkrishnan (1952)**, neither the size nor the sex had any relationship with the feeding habits of the prawn and the similar observation was observed in our study in Rawasan prawn. Present study was also comparable with the finding of **Lee et al. (1992)** analysis from gut contents of shrimp *Lucifer faxoni*. **Dall (1968)** had reported that the gut contents of various penaeid shrimps i.e. *M. acleayi*, *P. plebejus*, *P. osculentes* and *P. merguensis* were mainly comprised of animal body parts (Jaw, legs, chitin fragments and seta) and some unidentified matters. **Panikker (1952)** reported food of young penaeid as of tiny organism, alga and detritus. Animals are classified as herbivorous, omnivorous and carnivores on the base of food type they eat (**Chopra, 1939**). Presence of fish scale by accidental entry along with detritus was observed in the gut content of *M. rosenbergii* (**Raman, 1967**) and *M. equidens* (**Murthy & Rajagopal, 1990**), whereas as no such material were reported from the gut contents of the *Macrobrachium assamense peninsulare* during the study.

Rao (1967) reported that the *M. rosenbergii* eat up their exuvia after molting and **Natraj (1947)** also made similar observation in *P. idea*. During present study, we also observed *M. assamense peninsulare* by eating exuvia during the laboratory inspection in aquarium and sometime in the field observation. **Murthy and Rajagopal (1990)** recorded that in *M. equidens* the most of the food items consist of crustacean appendages, some parts of decay organic matter, sand and mud similar observations were recorded in our study.

The percentage of empty stomach showed an increasing trend in *M. assamense peninsulare* toward the end of the onset of the breeding season and it was due to the less food intake by female prawn due to gonadal maturation, which occupy major portion of the cephalothorax and this is well compared with the studies of *M. malcolmsoni* Ibrahim (1962) where in a reduced feeding was noticed in mature female.

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