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Gut content analysis of *Labeo rohita* in relation to phytoplankton from the fish ponds of Machhali Ghar, Doranda, Ranchi, Jharkhand

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Abstract- Fish pond, of Machhali Ghar, Doranda, Ranchi district lies between, 23.3393562 latitude, 85.3161996 longitude. These fish ponds are one of the biggest fish breeding centers of Indian major carps in Jharkhand and are also used for table size fish production. In the present investigation, the gut contents of *Labeo rohita*, popularly known as rohu were analyzed for understanding their food habits. The study was conducted during the period of July 2020 - June 2021. Results of the study conducted on three different stages mainly (fry, fingerling and juveniles) reported that the juvenile stage of *L. rohita* having mean weight (90 ± 08 g) showed positive selection of most phytoplankton organisms. The present study also revealed that the *Labeo rohita* exhibits different feeding habits in different seasons during its growth period from fry to juvenile stage.

Key words: Gut content analysis, *Labeo rohita*, phytoplankton, fingerling, adult.

INTRODUCTION

Aquaculture is one of the important and fastest developing food production sectors in the world. Feed is the crucial component of the aquaculture operations as it accounts for more than 60% of the total input cost. Therefore, understanding of food and feeding habit is fundamental for the success of aquaculture. In addition, insightful knowledge of the food and feeding habit of cultivable organism is essential as fishes are classified as herbivorous, carnivorous and omnivorous on the basis of feeding habit. The initial stages of the most species of fishes are plankton feeder that consumes both zooplankton and phytoplankton. Among the phytoplanktons, *Chlorella vulgaris, Colastrum spharicum, colastrum cambrium, Scenedesmus oblicus, Scenedesmus quardiculata, Aphanocapsa, Phormidium, Fragilaria, navicula* etc. are dominant groups in the gut of Indian major carps. The phytoplanktons mainly include unicellular to multicellular and filamentous algae. Fishes consume delicate parts of the higher aquatic plants, as well as mud sand is also taken in small quantities along with the other items of food.

Of late, numerous techniques for gut content analysis have been in vogues that includes radio isotopes, stable isotope analysis, and fatty acid analysis.[1] These approaches have both positive and negative effects. Positive in the means of it is highly precise and can divulge even those small items which cannot be recognized by microscopic studies, and negative in the means, it is costly and involve intricate procedures. Despite the development of new and other state of art technologies of gut content analysis, the old procedure of direct gut content analysis through dissection is still most trustworthy, easy and authenticate that hold great potential in biological process.[2]

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Aquatic organisms including fishes perform several physiological activities such as growth, respiration, reproduction, etc. during their lifecycle and these processes involve energy which are obtained through food. Fishes are adapted and evolved to take the available natural food materials. The understanding on the both qualitative and quantitative food analysis is imperative that aids to the knowledge of growth, abundance, as well as productivity of aquatic ecosystem.[3] In the other words, this information is valuable to describe the feeding behavior, feeding habits and the feeding patterns of fishes.[4] In the adult fish, feeding intensity declines during the spawning compared to the non-spawning seasons.[5] Further, the correlation between the fish and their food component are critical for the development, growth, production and exploitation of the fish stocks.[6] As the feeding habits of fish's changes with the availability of natural food and season of the years, hence an insightful understanding of the algal species consumed by fishes will be vital for the successful aqua farming. In this context, feeding behavior of carps have been categorized into 3 class, for example, surface feeder (*Catla catla*), column feeder (*Labeo rohita*), bottom feeder (*Cirrhina mrigala*).[7,8] It was further classified according to natural food into following 4 categories such as main or basic food, occasional or secondary food, incidental food, emergency or obligatory food.[9]

Based on the above backdrops, the aim of the study was to understand feeding habits of different stages of *Labeo rohita* (commonly consumed carp) cultured in the nursery, rearing and stocking pond.

MATERIALS & METHODS

The sample of experimental fish *Labeo rohita* were collected from fish pond, Machhali Ghar, Doranda, Ranchi, Jharkhand with the help of fisherman during the investigation period from July 2020 to June 2021 from three sampling sites of nursery, rearing and stocking ponds. During the sampling, 3 fishes from each pond were collected using the cast net in the mid of every month. Initially fry sampling was carried out in nursery pond (sampling site-1) from (July-Oct.), fingerlings were sampled from rearing pond (sampling site-2) (Nov-Feb) and juveniles from stocking pond (sampling site-3) (March-June). Post collection, the fishes were anaesthetizing with the help of clove oil (0.5ml per liter of water) at the site and then transported to the laboratory for measurement of weight, length. Then all fishes dissected with the help of sterilize dissection. All the guts were taken out carefully and treated with 10% formalin. Further the gut was cut open into smaller pieces and their content was squeezed into a clean and sterilized petridish containing 5 ml of distilled water. Subsequently, the gut content was identified with the help of available literature, compound and stereo zoom microscope in the laboratory of IIAB (Indian Instituted of Agricultural Research), Garkhatanga, Ranchi, Jharkhand.

RESULT

The regular gut content analysis of *Labeo rohita* showed that food consumed chiefly consisted of unicellular, colonial and somewhere filamentous algae that belongs to the family mainly Chlorophyceae, Cyanophyceae and Bacillariophyceae. A list of various algae which were identified in the gut is presented in Table-1. The observations showed that *Labeo rohita* exhibit selective feeding habit and basically, they prefer only certain species of algae for their food that belongs to the family, Chlorophyceae, Cyanophyceae and a number of diatoms were also recorded. Percentage contribution of major phytoplanktons groups in the gut of *Labeo rohita* from nursery rearing and stocking pond are presented in Fig.1, Fig.2 and Fig.3 respectively.

The preferred food items among the phytoplankton encountered in the gut of rohu fry from Doranda, Pond was Chlorophyceae that included *Scenedesmus quqrdiculate, Scenedesmus oblicus and chlorella vulgaris.*

In the gut of fry, the 2nd largest component were diatoms (27.02%) followed by blue green algae (24.32%).

Similar to this, the fingerlings of rohu showed strong positive selection for Chlorophycean (42.85%) members like *Scenedesmus quqrdiculate, Scenedesmus oblicus, Chlorella Pyrenoidosa* and *filametous* forms like *Oedogonium* sp., *Spirogyra* sp. were abundant. Bacillariophyceae contributed 33.33% of the total phytoplankton contribution. In Bacillariophyceae, *Synedra* sp., *Amphora* sp. and *Navicula* sp. etc. are consumed by the fingerlings and examined in the gut of *Labeo rohita.* The percentage contribution of the blue green alga family members accounted for 23.80% of major phytoplankton groups.

In contrast to fry and fingerlings, the juvenile stage of rohu showed more preference for diatoms groups and contributed (42.85) maximum to the major phytoplankton group. In Bacillariophyceae, *Surirella* sp., *Epithemia* sp.,

Synedra sp., *Fragilaria* sp., *Amphora* sp. and *Navicula* sp. etc. are consumed by the juveniles which are examined in their gut *Labeo rohita.* The 2nd highest percentage of contribution was recorded from the *Chlorophycean* members like *Scenedesmus acuminatus, Scenedesmus quarticulate, Scenedesmus oblicus, Chlamydomonas, Chlorella vulgaris*, *Chlorella pyrenoidosa* and *Chlorella filamentous* forms like *Oedogonium* sp., *Spirogyra* sp., The percentage contribution of the cyanophycean family members accounted for 20.58% of major phytoplankton groups.

Besides selective feeding habits of Indian major carp, *Labeo rohita,* the result also show that it exhibits different feeding habit during its growth period from fingerling to adult.

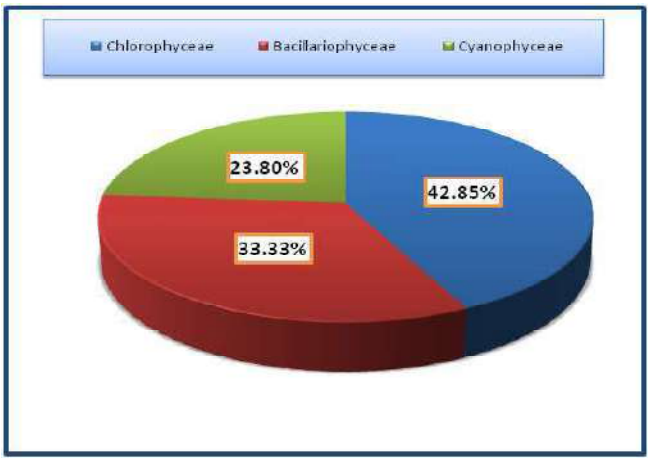

Fig. 2- Percentage contribution of major phytoplankton's groups in the gut of *Labeo rohita* from Rearing Pond.

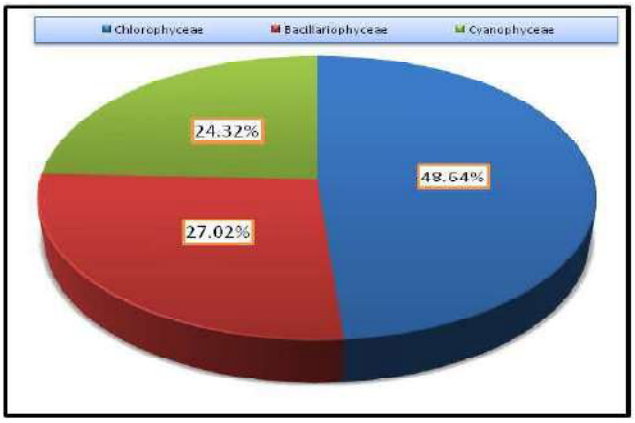

Fig. 1- Percentage contribution of major phytoplankton's groups in the gut of *Labeo rohita* from Nursery Pond.

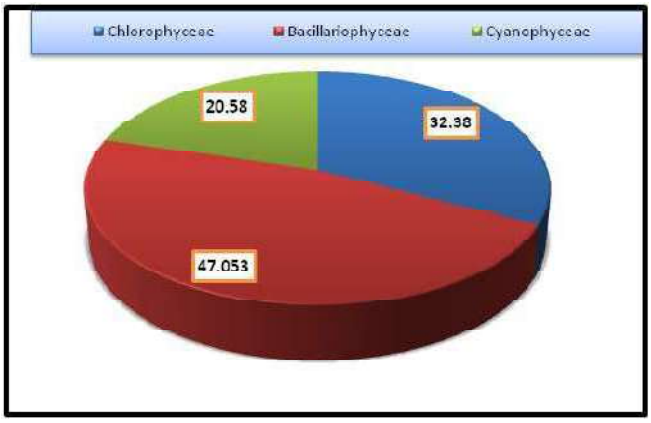

Fig. 3- Percentage contribution of major phytoplankton's groups in the gut of *Labeo rohita* from Stocking Pond.

Table 1- Gut content of different stages of *Labeo rohita* during July 2020- June 2021 in relation tophytoplankton.

Weight of fish		Nursery pond (weight of fry) (4 ± 0.43 g)				Rearing Pond (weight of fingerling) (14 ±1.13 g)				Stocking Pond (weight of juvenile) (90 ± 08 g)			
Months		July 2020	Aug. 2020	Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020	Jan. 2021	Feb. 2021	Mar. 2021	Apr. 2021	May 2021	June 2021
Sl. No.	Name of algae	CHLOROPHYCEAE											
1.	*Scenedesmus obliqus*	- -	+ +	+ +	+ +	+ +	+ +	- -	- -	+ +	+ +	+ +	+ +
2.	*Scenedesmus accuminatus*	- -	- -	+ +	- -	+ +	- -	+ +	+ +	- -	+ +	+ +	+ +
3.	*Scenedesmus quardiculata*	- -	+ +	- -	- -	+ +	- -	+ +	- -	- -	+ +	+ +	+ +
4.	*Chlamydomonas*	- -	- -	- -	- -	- -	+ +	- -	+ +	+ +	+ +	- -	- -
5.	*Chlorella vulgaris*	+ +	- -	+ +	+ +	+ +	+ +	+ +	+ +	- -	- -	- -	+ +
6.	*Chlorella pyrenoidosa*	+ +	+ +	+ +	+ +	+ +	- -	+ +	- -	+ +	- -	- -	+ +
7.	*Oedogonium*	- -	- -	- -	- -	+ +	+ +	+ +	+ +	- -	- -	- -	- -
8.	*Spirogyra*	- -	- -	- -	- -	+ +	+ +	+ +	+ +	- -	+ +	+ +	+ +
		CYANOPHYCEAE											
9.	*Microcystis flosaqua*	+ +	+ +	- -	- -	- -	- -	+ +	- -	+ +	+ +	- -	+ +
10.	*Merismopedia tenuissiama*	- -	- -	- -	- -	- -	- -	- -	- -	- -	+ +	- -	+ +
11.	*Spirulina*	- -	+ +	+ +	- -	+ +	+ +	- -	- -	- -	+ +	- -	- -
12.	*Lyngbya*	- -	- -	+ +	+ +	+ +	- -	- -	- -	+ +	- -	+ +	- -
13.	*Oscillatoria*	- -	- -	- -	- -	- -	- -	- -	+ +	- -	+ +	- -	- -
		BACILARIOPHYCEAE											
14.	*Surirella*	- -	+ +	+ +	- -	+ +	- -	- -	- -	+ +	- -	+ +	+ +
15.	*Epithemia*	- -	- -	+ +	+ +	- -	+ +	- -	+ +	+ +	+ +	- -	+ +
16.	*Fragilaria*	+ +	+ +	- -	- -	+ +	+ +	+ +	+ +	+ +	- -	+ +	+ +
17.	*Synedra*	+ +	- -	- -	- -	- -	+ +	- -	- -	+ +	+ +	- -	+ +
18.	*Amphora*	- -	- -	- -	- -	+ +	- -	+ +	- -	+ +	+ +	+ +	+ +
19.	*Navicula*	+ +	+ +	- -	- -	+ +	+ +	+ +	+ +	+ +	+ +	+ +	+ +

DISCUSSION

Labeo rohita is one of the prime candidate species for polyculture in Indian sub-continent and contributes significantly to the food basket of millions of small and marginal farmers as source of nutrition and livelihood security. The majority of the available literatures on food and feeding habits of rohu signifies it's important to utilize the column layer of pond niche in polyculture system and specifically its periphyton based feeding habit. Based on the ontogeny progression study towards different food types, rohu shows selective zooplankton feeding habitat initial stage, phytoplanktonic at later stage and at subsequent growing stage profuse algal consuming nature have been reported. Feeding habit and behavior of fish plays crucial role in the selection of the natural food available in the environment, and their availability depends on the physio-chemical characteristics of the environment, therefore fishes choose their food items which are available to them in the environment.

Algae has been ascertained to be vital natural food resources and also as significant feed additives in the large-scale commercial aquaculture system.[10] Changes in the algal feeding pattern by rohu prominently dependon their growth and development. Phytoplanktonicalgae from Chlorophyceae, Bacillariophyceae and Cyanophyceae constitutes the major algal groups during the initial development stage and shows positive selection towards zooplankton groups. Contrary to this, adults demonstrated to have strong negative selection for zooplanktonic organisms. Studies conducted by Miah *et al.* (1984)[11] reported that fry of rohu prefers zooplankton over phytoplankton, however with the ontogenic development, ingestion rate of food organisms changes in the rohu with consequent increase in the size. The ingestion rate of phytoplankton increases with growing size of rohu. Rahman *et al.* (2008)[12] noticed that above 20 cm of length of rohu, Chlorophyceae algae were recorded as the most significant food items. Thus, our findings on dominance of green algae in the gut content of rohu from rearing pond is supported with the results of Rahman *et al*. (2008)[12].

During the sample collection various algal members like*, Pediastrum, Coelastrum, Cladophora, Crucigenia, Selenastrum, Microspora, Stigeoclonium, Gloetrichia, Phormidium, Gomphonema etc.* are abundantly present in the water, however the gut content analysis reveals their absence as these were not consumed by the fishes.

Khan and Siddique (1973)[13] in their study observed high and positive elective index for both chlorophyceae and bacillariophyceae, however chlorophyceae has more preference over bacillariophyceae. The present observations also showed that *Labeo rohita* exhibit selective feeding habit and they preferredspirogyra, chlorella, chlamydomonas, scenedesmus and oedogonium that belongs to the family, Chlorophyceae. Contrary to our result, Mishra SP(2020)[14] reported highest percentage of *Bacillario phyceae* (diatoms) as food items in the gut contents of rohu fingerlings that constitute highest percentage by occurrence, which might be correlated due to variation in physic-chemical features of water or seasonality of sample analysis. In the present study, we observed more preference for Bacillariophyceae, constituted by *Surirella* sp., *Epithemia* sp., *Synedra* sp., *Fragilaria* sp. *Amphora* sp. and *Navicula* sp. etc. in the juvenile stage of rohu which is in agreement to the findings of Rahman *et al.,* (2008)[12] who attested that rohu prefers diatom with consequent increase in the size. To corroborate our results, Sharma *et al*., (2016)[15] reported dominance of diatoms (49.6%) in the gut content ofadult rohu inhabiting Kishore Sagar Lake of Rajasthan.

The present study revealed that cyanophycean family members constituted the third major phytoplankton groups in the gut content of rohu analyzed from three different ponds. Our findings of blue green algae reported in the all the three ponds was supported with the results of Sharma *et al*., (2016)[15] who found that cyanophycean members are also preferred by *Labeo rohita* next to Chlorophyceae and Bacillariophyceae members.

Over all, it is evident from the present study that, food and feeding ecology of rohu is very important that hold enormous potentiality to utilize the available natural feed. The members of different major phytoplankton contribution also change with the increasing size of the fish. Therefore, attempt should be designed to enhance feeding module in enriching the nutrients. Further strategies should be also designed to reduce the in tar specific food competition among the sticked fishes.

CONCLUSION

In conclusion, it is agreed that *L. rohita* exhibits different feeding strategy during its growth from fingerling to adult stage and also from planktonic to periphytic environment. The overall results of present study are useful

for devising the feeding strategies for the pond culture of rohu for its sustainable production and will aid in knowledge data base generation on food and feeding habit of rohu aquaculture.

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REFFERENCES

1. **Braga R. R., Bornatowski H. & Vitule J. R. S. 2012.** Feeding ecology of fishes: an overview of worldwide publications. *Reviews in Fish Biology and Fisheries*, **22(4):**915-929.
2. **Manko P. 2016.** Stomach content analysis in freshwater fish feeding ecology. University of Prešov. 1-116.
3. **Nansimole A., Sruthi S., Devi T., Lekshmi S., Balasubramaniam N., & Radhakrishnan T. 2014.** Studies on morphometry, feeding biology and sex ratio of *Saurida undosquamis* (Richardson, 1848) (Fam: Synodontidae) from Neendakara area, Kollam, South West coast of India. *Indian Journal of Scientific Research*. **5(2):**51-58.
4. **Ekpo I. E., Mandu A., Essien-Ibok and Joseph N. Nkwoji. 2014.** Food and feeding habits and condition factor of fish species in Qua Iboe River estuary, Akwa Ibom State, Southeastern Nigeria. *Int. J. Fish. Aquatic Studies*. **2(2):**38-46
5. **Sunder S., Kumar K. & Raina H. 1984.** Food and feeding habits and length-weight relationship of *Cyprinus carpio specularis* Linnaeus of Dal Lake, Kashmir. *Indian Journal of Fisheries*. **31(1):**90-99.
6. **Panicker A. C. 2000.** Ecological impact of tilapia, *Oreochromis mossambica* Peters on the indigenous fish species in two reservoirs of Kerala. Ph.D. Thesis, University of Kerala.
7. **Khan H. 1934.** Habits and habitats of food fish of Punjab. *J.Bombay. Nat. Hist. Soc.* **37:** 655-668**.**
8. **Das S. M. and Moitra S. K. 1955.** Studies on the food of common fishes of U.P. India I. The surface feeders, the mid feeders and the bottom feeders. *Proc. Nat. Acad. Sci. India*. **25(B)(1&2):**1-6.
9. **Nikol'sky G. V. 1963.** *The Ecology of Fishes*. Academic Press, London, New York, 352pp.
10. **Khatoon N., P. Sengupta, S. Homechaudhuri & R. Pal . 2010a.** Evaluation of Algae Based Feed in Goldfish (*Carassius auratus*) *Nutrition. Proc. Zool. Soc.* **63(2):** 109-114.
11. **Miah M. I. U., Dewan S., Wahiduzzaman M. 1984.** Studies on the type and amount of food taken by silver carp *Hypophthalmichthys molitrix* (val.) and its diet patterns of feeding in Bangladesh pond. *Bangladesh Journal of Fisheries*. **7:**49-54.
12. **M. M. Rahman, Y. M. Hossain, Q. Jo, S. K. Kim, J. Ohtomi, C. Meyer. 2008.** Ontogenetic shift in dietary preference and low dietary overlap in rohu (*Labeo rohita*) and common carp (*Cyprinus carpio*) in semi-intensive polyculture ponds. *Ichthyology Research.* **56:** 28-36.
13. **R. A. Khan, A. Q. Siddique. 1973.** Food selection by *Labeo rohita* and its feeding relationship with other major carps. *Hydrobiologia*. **43(3-4):**429-442.
14. **Mishra S. P. 2020.** Analysis of the gut contents of Indian major carp rohu (*Labeo rohita*) from Meeranpur lake of district sultanpur, Uttar pradesh, India. *Zenodo*, doi:10.5281/zenodo.4015975.
15. **Sharma L. L., Aery N. C., Kumar A., Gupta M. C. 2016.** Diatoms as component of fish diets in natural aquatic environment. *The Research Journal.* **2(3):**11-15

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