Diversity of rotifer in fishery ponds from Amarapura Township (Mandalay Division)

Myanmar

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Abstract

Study of the diversity of rotifer in fishery ponds from Amarapura Township near Taungthaman Lake was carried out from December 2013 to March 2014. The rotifer samples were collected by plankton nylon net with a mouth diameter of 12 cm and 50 µm mesh size. Field sampling were conducted bimonthly from the two sampling ponds. A total of 16 species of freshwater rotifers were recorded. Brachionus angularis was the most dominant species and second dominant species was Polyarthra vulgaris in both ponds. The least dominant species was Brachionus forficula in pond I and Filinia terminalis in pond II. The Shannon- weaver diversity index value (H') ranged from (1.44-1.87) in pond I (1.58-1.95) in pond II. In this result, although H' value were no significant differences between these two ponds, the relative abundance of the rotifer population is higher in pond I (69.36%) than pond II (40.20%).

Keywords: diversity, rotifer, Taungthaman Lake, Amarapura Township
1. Introduction

The zooplankton communities are important for their role in the energy transfer in an aquatic ecosystem. They provide food for fishes in freshwater ponds, lakes and play a major role in fish production. The occurrence and abundance of zooplankton depends on productivity of lakes which in turn is influenced by abiotic factors and the level of nutrients in the water (Sitre and Zade, 2012).

Rotifers are often common denizens of the ecosystem and they have been considered as an indicator species of inhabited waters. Population of rotifer is sensitive indicators of aquatic ecosystem. One of the major priorities in conserving rotifer in monitoring their population to find methods with diversity indices is useful for long term survival (Dhembare, 2011).

In general, there have been two approaches to measuring species diversity, both of which incorporation information on the number of species (species richness) and the relative abundance of individuals within each species (species abundance). Therefore the aim of the present study was to compare variation in species richness and abundance of rotifer population between two fish culture ponds during the study period.

2. Materials and Methods

2.1 Study Area

The fish culture pond is located in Amarapura Township (Mandalay Division) between North latitude 21° 53’ to 21° 54’ and East Longitude 96°03’ to 96°05’ (Fig. 2.1).
2.2 Study Period

The study was carried out from December 2013 to March 2014.

2.3 Collection of Samples

Water samples were collected bimonthly from the sampling sites of the two fish culture ponds near Taungthaman Lake. The two ponds were selected, pond I was pig and fish culture pond and pond II was normal fish culture pond. Pig tank is built side bank of the pond I. The plankton samples were collected by filtering 1 litre of water through plankton net with a mouth diameter of 12 cm and 50 µm mesh size. The plankton samples were hauled horizontally from the surface water.

Fig. 2.1 Map showing the location of the sampling sites (Source from Google)

Plate 1 Sampling sites of fish culture pond

A. Pond I pig and fish culture pond
B. Pond II normal fish culture pond
### 2.4 Preservation and Identification

The final volume of the filtered sample 150 ml, which was transferred to another 150ml plastic bottle and labeled mentioning the time, date and place of sampling. The samples collected in 150 ml plastic bottles were preserved by adding 2 ml of 4% formaldehyde solution. The quantitative analyses of plankton populations were done by counting the numbers in each species. The rotifers were identified under a compound microscope at 10×, 40× magnification using keys and illustrations given by Edmonson (1966) and Pennak (1989). The specimens were measurement by using calibrated eyepieces micrometer. Microphotographs were taken with canon digital camera attached to compound microscope.

### 2.5 Analysis of Data

Diversity index of rotifer species were calculated according to the Shannon –Weaver Diversity Index (1949).

Shannon-Weaver Diversity index (1949) formula is given as follow:

\[ H = -\sum_{i=1}^{s} p_i \ln p_i \]

\[ p_i = \frac{n_i}{N} \]

Pi=The proportion of species i relative to the total number of Species

\[ n_i = \text{The number of individual of i species of the sample} \]

\[ N = \text{The total number of individuals in the sample} \]

The species richness of rotifers were calculated by Margalef (1969)

Margalef’s species Richness index (1969) is given as follow:

\[ R = \frac{(s - 1)}{\ln N} \]
R= Margalef’s Species Richness Index

S=The number of Species

N=The total number of Species individuals

The Index of Dominance (ID) represents the percentage of abundance contributed by two most abundant species and calculated according to formula by Menhinick(1964).

$$\text{ID} = 100 \times \frac{Y_1 + Y_2}{Y}$$

$Y_1 =$ most abundant species

$Y_2 =$ second abundant species

$Y =$ total abundance of all species
3. Results and Discussion

A total of 16 rotifer species were recorded in the present study. Species list of rotifer from two fish culture ponds in Amarapura Township near Taungthaman Lake was as shown in Table 1 and plate II.

A. *Asplanchna herricki*        B. *A.priodonta*        C. *Anuraeopsis fissa*        D. *Brachionus angularis*

E. *B.calyciflorus*        F. *B.caudatus*        G. *B.diversicornis*        H. *B.falcatus*

I. *B.forficula*        J. *B.quadridentatus*        K. *B.ruben*        L. *Keratella tropica*

M. *Polyarthra vulgaris*        N. *Trichocerasimilis*        O. *Filiniaterminalis*        P. *Hexathramira*
| Phylum     | Class   | Order   | Family        | Species                  |
|------------|---------|---------|---------------|--------------------------|
| Rotifera   | Monogon | Ploima  |               | *Brachionus*              |
|            |         |         |               | *falcatus* Zacharias,1898 |
|            |         |         |               | *Brachionus*              |
|            |         |         |               | *forficula* Wierzejski,1891 |
|            |         |         |               | *Brachionus*              |
|            |         |         |               | *quadridens* Hermann,178  |
|            |         |         |               | 3                        |
|            |         |         |               | *Brachionus*              |
|            |         |         |               | *ruben* Ehrenberg,1838    |

*Table 1. List of rotifer species from Fish culture ponds of Amarapura Township*
3.1 Percentage composition in pond I

The number of species recorded in pond I ranged from 10 to 13 species. The higher number of 13 species was occurred in January 2\textsuperscript{nd} week and lower number of 10 species was occurred in December 1\textsuperscript{st} week and February 2\textsuperscript{nd} week (Table 2.A).

Family Brachionidae represent 10 species (67.95%), Asplanchnidae (1.26%), Synchaetidae (26.08%), Trichocercidae (0.71%), Testudinellidae (0.79%) and Hexathridae (3.22%) were recorded in pond I (Fig. 3.2A). The relative abundance of the rotifer population in pond I was 69.36% (Table 2.A).

3.2 Percentage composition in pond II

The number of species recorded in pond II ranged from (8-12) species. The higher number of 12 species was occurred in December 2\textsuperscript{nd} week and the January 2\textsuperscript{nd} week and the lower number of 8 species was occurred in January 1\textsuperscript{st} week (Table 2B).

Family Brachionidae represent 8 species (73.88%), Asplanchnidae (4.5%), Synchaetidae (18.72%), Trichocercidae (0.02%), Testudinellidae (0.29%) and
Hexathridae (1.6%) were recorded in pond II (Fig. 3.1 B). The relative abundance of the rotifer population in pond II was 40.20% (Table 2B).

**Fig. 3.1** Comparison of percentage composition of total rotifer population from fish culture pond I and pond II during the study period
Table 2: Diversity index of pond I and pond II throughout the study period

A. Diversity index in pond I

| No. | Sampling period               | No. of species | No of individual | Species richness index \( R \) | Diversity index \( H' \) |
|-----|-------------------------------|----------------|-----------------|--------------------------------|-------------------------|
| 1   | December First Week           | 10             | 138             | 1.83                           | 1.87                    |
| 2   | December Second Week          | 12             | 242             | 2.01                           | 1.87                    |
| 3   | January First Week            | 11             | 161             | 1.97                           | 1.44                    |
| 4   | January Second Week           | 13             | 98              | 2.62                           | 1.85                    |
| 5   | February First Week           | 11             | 239             | 1.83                           | 1.73                    |
| 6   | February Second Week          | 10             | 395             | 1.51                           | 1.18                    |
|     | Total                         |                | 1273            |                                |                         |

Relative abundance = 69.36%

B. Diversity index in pond II

| No. | Sampling period               | No. of species | No of individual | Species richness index \( R \) | Diversity index \( H' \) |
|-----|-------------------------------|----------------|-----------------|--------------------------------|-------------------------|
| 1   | December First Week           | 11             | 130             | 2.05                           | 1.89                    |
| 2   | December Second Week          | 12             | 194             | 2.09                           | 1.85                    |
| 3   | January First Week            | 8              | 54              | 1.76                           | 1.58                    |
| 4   | January Second Week           | 12             | 33              | 3.15                           | 1.95                    |
| 5   | February First Week           | 11             | 174             | 1.94                           | 1.88                    |
| 6   | February Second Week          | 9              | 104             | 1.72                           | 1.73                    |
|     | Total                         |                | 689             |                                |                         |

Relative abundance = 40.20%
3.3 Comparison of total number of rotifer in Pond I and Pond II

In comparing the pond I and pond II, the total number of rotifer individuals in each sampling dates were higher in pond I than pond II during the present study (Fig. 3.2). Total numbers of rotifer species were compared in pond I and pond II. Pond I contain 15 species and 14 species in pond II. Species composition of rotifer in pond I was found to be higher than that of pond II. The relative abundance of rotifer population in pond I (69.36%) was higher than that of pond II (40.20%) (Table 2 A and B).

![Graph showing variation in total rotifer individuals in each sampling dates of pond I and pond II during three month study](image)

**Fig. 3.2** Variation in total rotifer individuals in each sampling dates of pond I and pond II during three month study

In the present investigation a total of 16 species of rotifer belonging to order Ploima and Flosculariceae were observed. Under the order-Ploima include four families; Asplanchnidae, Brachionidae, Synchaetidae, Trichocercidae whereas the order Flosculariceae includes two families Testudinellidae and Hexathridae were recorded.

The most diversified genera were *Brachionus* under the family-Brachionidae represented by 10 species. The least diversified genera were *Asplanchna* represented by two species and a single species were *Polyarthra vulgaris, Trichocerca similis, Filinia terminalis* and *Hexathra mira* during this study.
Among the genus *Brachionus*, *Brachionus angularis* was the most dominant species and second dominant species was *Polyarthra vulgaris* in two ponds during three month study and mostly with high density. *B. forficula* show lower density in pond I and *Filinia terminalis* in pond II.

14 species of rotifer were recorded in the rotifer diversity in Lake Masunda, genus *Brachionus* was represented by 6 species *Brachionus calyciflorus*, *Brachionus caudatus*, *Brachionus angularis*, *Brachionus diversicornis*, *Brachionus falcatus* and *Brachionus forficula* are same with the present study and thus making it significant genera. *Brachionus angularis* is one of the important rotifer species with respect to indication of eutrophic state. (Somani and Pejaver (2003)

In the present study among the genus *Brachionus*, *B. angularis* was the more dominant species in both ponds. Somani and Pejaver (2003) suggested that genus *Brachionus* is a continuous breeder and hence one or the other species of *Brachionus* breeds in every months resulting in the dominance of this genera. This data had consistency with present research work.

In the present study, family-Brachionidae represents 10 species (67.95%) of the total rotifer population in pond I and 8 species (73.88%) in pond II. The rotifer communities of Ahansar Lake are characterized by notably high richness of Brachionidae (Irfan, Yousuf & Parveen 2013) and this family was high species richness in pond I and pond II during this study. *Brachionus* is the index of eutrophic water (Sladeck, 1983) and its abundance is considered as a biological indicator of eutrophication.

The diversity includes the species richness and the relative abundance of this species in the community. In comparing pond I and pond II, the species richness index value is low, when the number of species is low and the species richness index value is high when the number of species is high in both ponds during this study. The Shannon-
weaver diversity index value (H') ranged from (1.44-1.87) in pond I (1.58-1.95) in pond II. In this result, although H' value were no significant differences between these two ponds, the relative abundance of the rotifer population is higher in pond I (69.36%) than pond II (40.20%). This may due to pond I water was influenced by fertilizers coming from a pig tank which caused a large nutrient substance to be released in the pond water. These nutrients can be stimulating the algal growth.

4. Conclusion

In the present study, the most dominant species was *Brachionus angularis* and second dominant species was *Polyarthra vulagaris* in both ponds. The least dominant species were *Brachionus forficula* in pond I and *Filinia terminalis* in pond II during this study. Present results indicate that in the study period, species richness and the relative abundance of rotifer species are better indicators of lake water. The present study might contribute to the freshwater rotifers are used in fish tanks to clean the water, to prevent clouds of waste water. Rotifers affect in species composition of algae in ecosystem through their choice in grazing.

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