

Original Research Article

Species Diversity of Rotifers in Lentic Ecosystem of Dhukeshwari Temple Pond Deori with Reference to Cultural Eutrophication

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ABSTRACT

Keywords

Eutrophication,
Rotifer,
Brachionus,
diversity,
Dhukeshwari
Temple Pond

The species diversity of rotifers is one of the most important biotic components of the freshwater ecosystem. Biological and ecological adaptation and rich species diversity of Rotifers is considered as an important for health and homeostasis of aquatic ecosystems. The present work was carried out to study on the cultural eutrophication in lentic ecosystem of Dhukeshwari Temple Pond Deori of Gondia district. This pond is under anthropogenic pressure. During the present study, 46 species of rotifers belonging to 15 families from 3 orders were recorded. In the present investigation, the role of Rotifers in determination of the trophic status of pond is discussed.

Introduction

Eutrophication is a process characterized by an increase in the aquatic system productivity, which causes profound changes in the structure of its communities. Owing to the high environmental sensitivity of planktonic species, the study of their communities can indicate the deterioration of the environment (Gazonato Neto *et al.*, 2014). The Importance of plankton communities, in the trophic dynamics of freshwater ecosystems has long been recognized, as these organisms, not only regulate the aquatic productivity by occupying almost middle position in food chain, but also indicate environmental status in a given time. These organisms are regarded as valuable bio-indicator to depict the trophic status of water quality of their environments within

limnosaprobity (Sladeczek, 1983). The importance of zooplankton, especially, Rotifers have immense role on account of their heterotrophic nature; which helps in the subsequent transfer of the bound energy at the primary level thus forming a basic link in the food chain for higher aquatic animals; particularly fish. In the structure of lentic ecosystem rotifers constitute a significant planktonic component of secondary production; they occur as pelagic forms, periphytonic plankters, in the littoral area and as inhabitants of benthic water, rich in detritus and bacteria. In the trophic web, rotifers as ciliary filter feeders which ingest phytoplankters. Rotifers are highly nutritious food for the larvae of aquatic crustaceans and fish, aquaculture technologies have been

producing enormous quantities of rotifers in very large culture systems for more than 30 year. In this regard rotifers may be seen as living nutrients that is tin, free swimming food for crustaceans and fishes. Some rotifers are highly specialized but most are opportunistic feeders since they consume and assimilate different types of food (Wallace *et al.*, 2006 and Wallace and Snell, 2010) reaching high population densities and diversities, as well as high tolerances to environmental conditions, thus making them among the most diverse group in environment (Verma, *et al.*, 2014).

The biological and ecological adaptations of rotifers confer on them rich species diversity which is important for health and homeostasis of aquatic ecosystems. During the last couple of decades considerable reports are available on rotifers, Sewell (1934), Ahlstrom (1940), Brehm (1950), Arora (1962, 1966) and so on. Among the aquatic habitats relatively less work is done on zooplankton in general and rotifers in particular from lakes in urban environments.

These habitats are undergoing fast environmental degradation with a very fast rate of eutrophication due to direct introduction of raw domestic sewage from settlements in the catchment area. Present study is primarily based on the work conducted on the cultural eutrophication in lentic ecosystem of Dhukeshwari temple pond situated at Deori. The Dhukeshwari temple pond is under environmental stress on account of anthropogenic pressure.

Materials and Methods

The zooplankton samples were collected from the 2 sampling points for the year 2014-2015. The water was filtered through plankton net, made of bolting silk cloth and concentrate was collected in glass bottle, fixed in 4% formalin and specimens were identified according to key from Edmondson

(1959), Battish (1992) and Dhanapathi (2000), and photographed were made with Metzger-M-Co-axial trinocular digital research microscope vision plus-5000 DTM.

Study site

Dhukeshwari Temple pond was constructed about 50 years ago by impounding natural low lying areas nearby Goddesses "Dhukeshwari" Temple (N 21^o 4' 29.4405", E 80^o 21' 44.6565") along the National Highway No. 6, mainly for agricultural and irrigational purposes. Expanding urbanization in the catchments area with consequent increase in anthropogenic activities, culminating in the introduction of untreated domestic sewage and immersion of idols and other socio-cultural practices also contributed to nutrient enrichment of this pond.

Results and Discussion

In the present study, 46 species of rotifers belonging to 15 families from 3 orders were recorded. The systematic list of the species recorded from the Dhukeshwari temple pond is given below.

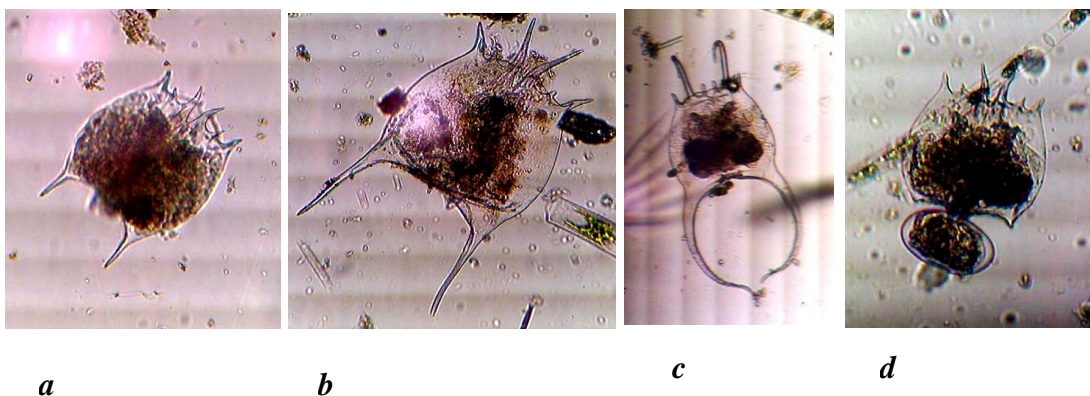
The rotifers invariably constitute a dominant component of freshwater zooplankton and contribute significantly to their dynamics and production (Sharma, 1991). In the present study 46 species of fresh water rotifers belonging to 15 families from 03 orders were recorded from the lentic ecosystem of Dhukeshwari temple pond, Deori District Gondia. These organisms are regarded as valuable bioindicator to depict the trophic status of water quality (Pejler 1989). Arora (1963) reported that species of *Brachionus* have a wide range of occurrence and are found from potable water to diluted sewage tanks. In much polluted water they occur in small number but abundant in moderately polluted waters.

Table.1 List of Rotifer species recorded from Dhukeshwari Temple pond

Sr. N.	CLASSIFICATION
	Phylum: Rotifera
	Subclass: Eurotatoria
	Superorder: Monogononta
	Order: Ploumida
	Family: Brachionidae
1	<i>Brachionus calyciflorus</i>
2	<i>Brachionus falcatus</i>
3	<i>Brachionus durgae</i>
4	<i>Brachionus plicatilis</i>
5	<i>Branchionus quadrientatus</i>
6	<i>Brachionus quandridentatus var entzi</i>
7	<i>Brachionus quandridentatus var melhini</i>
8	<i>Brachionus quandridentatus var brevispinus</i>
9	<i>Brachionus ureceolaris</i>
10	<i>Platyas quadricornis</i>
11	<i>Platyas quadricornis andhraensis</i>
	Family: Euchlanidae
12	<i>Beauchampiella eudactylosum</i>
	Family: Epiphanidae
13	<i>Epiphanes macrourus</i>
	Family: Colurellidae
14	<i>Lepadella patella</i>
15	<i>Lepadella lepadella ovalis</i>
16	<i>Colurella adriatica</i>
	Family: Lecanidae
17	<i>Lecane bidentata</i>
18	<i>Lecane cornuta</i>
19	<i>Lecane decipiens</i>
20	<i>Lecane donnerianus ventral</i>
21	<i>Lecane hamata</i>
22	<i>Lecane obtuse</i>
23	<i>Lecane pyriformis</i>
	Family: Trichocercidae
24	<i>Trichocerca rattus</i>
25	<i>Trichocerca tigris</i>
	Family: Trichotriidae
26	<i>Trichotria tetractis</i>
27	<i>Trichotria similis</i>
	Family: Trichosphaeridae
28	<i>Horaella brehmi</i>
	Family: Asplanchnidae
29	<i>Asplanchna intermedia</i>

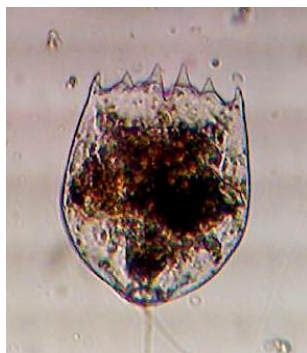
30	<i>Asplanchnopus bhinnavaramensis</i>
31	<i>Asplanchna brighwelli</i>
	Family: Gastropodidae
32	<i>Ascomorpha ecaudis</i>
	Family: Notommatidae
33	<i>Cephalodella forficula</i>
34	<i>Cephalodella gibba</i>
35	<i>Cephalodella panarista</i>
36	<i>Scaridium longicaudatum</i>
37	<i>Esophora anthadis</i>
	Family: Mytilinidae
38	<i>Mytilina ventralis</i>
	Order: Gnesiotrocha
	Suborde: Glosculariacea
	Family: Testudinellidae
39	<i>Testudinella patina</i>
40	<i>Testudinella semiparva</i>
41	<i>Testudinella mucronata</i>
	Family: Filinidae
42	<i>Filinia species</i>
	Super order: Digononta
	Subclass: Bdelloidea
	Order: Bdelloida
	Family: Philodinidae
43	<i>Rotaria neptunia</i>
44	<i>Rotaria rotatoria</i>
45	<i>Macrotrachela quadricornifera</i>
46	<i>Philodina spp</i>

Photo plate.1 Rotifers from Lentic ecosystem of Dhukeshwari Temple Pond





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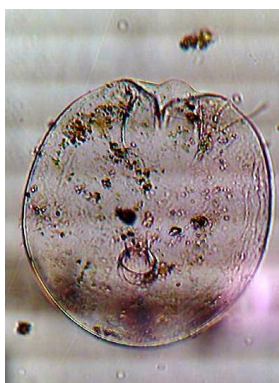
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Name of rotifers of photo plate I:

- a. Brachionus quadridentatus*
- b. Brachionus quadridentatus var melhini*
- c. Brachionus falcatus*
- d. Brachionus quadridentatus var entzi*
- e. Brachionus durgae*
- f. Brachionus ureceolaris*
- g. Beauchampiella eudactylosum*

- h. Esophora anthadis*
- i. Colurella adriatica*
- j. Cephalodella gibba*
- k. Testidunella mucronata*
- l. Lecane obtuse*
- m. Platyas quadricornis*
- n. Lecane decipiens*
- o. Tricocerca rattus*
- p. Trichotria tetractis*

Recorded *B. calyciflorus*, *B. caudatus*, *B. falcatus* and *B. quadridentatus* from heavily polluted Jumma Tank and *B. urceolaris* from from oxidation ponds of NEERI Nagpur.

In the present findings the family Brachionidae is dominant with 11 species; of which genera *Brachionus* with 09 species and two species of *Platyas* is recorded. Some species of *Brachionus* were considered as indicators of mesotrophic and eutrophic conditions in several Central Indian waters by Unni (1985). Bhandarkar *et al.*, (2008) reported 07 species of *Brachionus* from the highly Eutrophic Kalikar pond in Bramhapuri. 09 species of rotifers were recorded from the different productive water bodies of Lakhani Dist. Bhandara by Bhandarkar and Paliwal, (2012). Likewise 19 species of rotifers were also recorded from the various water bodies in Bramhapuri region by Bhandarkar and Bhandarkar (2008). High rotifer population in the lake waters indicate pollution due to direct entry of untreated domestic sewage from input area (Arora, 1966). A number of studies have evaluated *Brachionus sp.* as indicator of eutrophication (Mahajan et al 1981, Sladeck 1983). Chandrashekhar and Kodarkar (1995) described six species of *Brachionus* from Saroornagar lake Hyderabad and reported that *B. calyciflorus* was most dominant followed by *B. caudatus* in term of seasonal occurrence and biomass and ununiform occurrence of *B. forficula*, *B. durgae*, *B. bidentata* and *B. angularis* in monthly collections due to changes in water quality associated with nutrient concentration in summer. Somani & Pejawar (2003) in Lake Masunda Thane reported the dominance of these tolerant genera as an indication of onset of eutrophication in the ecosystem.

In the present observation too, *Brachionus spp* was most dominant. The occurrence of these species indicates the water of this pond

is polluted. Some species flourish in highly eutrophic waters while others are very sensitive to organic or chemical wastes (El-Enany, 2009). In addition to the above described species, some others rotifers were also considered as indicators of eutrophy. The species like *B. quadridentatus*, *Lepadella* have better tolerance for alkalinities, *Platyas quadricornis*, *epiphanus*, and *Rotaria rotatoria* have been recorded from Eutrophic and heavily polluted waters (Pattnaik, 2014). Dominance of rotifers further confirmed the Eutrophic nature of the lake (Pejler, 1965; Arora, 1961, 1966; Unni, 1985; Sharma, 1987). However further detailed studies on seasonal variation in diversity and biomass would be helpful in evaluation their bio-indicator role in eutrophication.

In conclusion, Rotifers comprises major community in the zooplankton assemblage of the Dhukeshwari Temple pond. *Brachionus* formed the dominant and diversified genus among the rotifers throughout the study period. *Lecane* also formed second dominant and are often present in tropical aquatic body. From the present study it is disclosed that the rotifer fauna can be linked with favorable conditions and availability of abundant food in the form of bacteria, micro-phytoplankton, nano-plankton, animal waste and suspended detritus in the pond water.

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References

- Ahlstrom, E.H. 1940. A revision of the rotatorian genera, *Brachionus* and *Platyas* with description of one new species and two new varieties. *Bull. Amer. Nat. Hist.*, 77: 143 - 184.
- Arora, H. C. (1963), Studies on Indian Rotifera - II. *J. Zool. Soc. India.*, 15: 112 - 121.
- Arora, H.C. (1962). Studies on Indian Rotifera - I. *J. Zool. Soc. India.*, 14: 33-44.
- Arora, H.C. (1966). Studies on Indian Rotifera - III. *J. Zoo. Soc. India.*, 16: 1-6.
- Battish, S. K. (1992). Freshwater zooplankton of India. Oxford and IBH Publishing Co., New Delhi. 233pp.
- Bhandarkar, S. V. and Bhandarkar, W. R. (2008). Comment on Rotifer Diversity in Two Water Bodies of Bramhapuri, Maharashtra. *J. Curr, Sci.* 12 (2):505-510
- Bhandarkar, S. V. and Paliwal, G. T. (2012). Observation on the Collection of Zooplankton in Lakhani Lake, Lakhani, District Bhandara, Maharashtra. *Int. J. Environ. Rehabil. Con.* III (1) 2012 [38 – 41
- Bhandarkar, W. R, Bhandarkar, S. V. and Murkute, V. B. (2008). Observation on Species Diversity of *Brachionus* (Rotifera) from Kalikar Pond, Bramhapuri, District Chandrapur. *M.S. J. Aqua. Biol. I &II* 23 (2): 4-7.
- Brehm, V. (1950). Contributions to the fresh water fauna of India. Part-2, *Rec. Ind. Mus.*, 48:9- 28.
- Chandrasekhar, S.V.A. and Kodarkar, M. S. (1995). Studies on *Brachionus* from Saroornagar lake, Hyderabad. *J. Aqua. Biol.*, 10 (1 & 2): 48 -52.
- Dhanapathi, M.V.S.S.S. (2000). Taxonomic notes on the rotifers from India (from 1889-2000) IAAB. Publishing no. 10 Hyderabad, India. 169pp.
- Edmondson, W.T. (1959). Rotifera. In: Fresh water Biology (Eds. H.B.Ward and G.C. Whipple). John Willey & Sons Inc. New York: 420-497.
- El-Enany, HR. (2009). Ecological studies on planktonic and epiphytic microinvertebrates in lake Nasser. Egypt. PhsD thesis, Zoology Department, faculty of Science, Benha University.
- Gazonato Neto, A.J., Silva, L.C., Saggio, A. A., Rocha, O. (2014). Zooplankton communities as Eutrophication bioindicators in tropical reservoirs. *BiotaNeotropica* 14 (4):1-12.
- Mahajan, C. L. (1981). Zooplankton as indicators for assessment of water pollution *ibid.* PP: 135-148.
- Pattnaik, B. S. (2014). Determination of Rotifer Distribution to Trophic Nature of Ponds. *Indian Journal of Applied Research.* 4(4) 25-26.
- Pejlar, B. 1965. Regional ecological studies of Swedish freshwater zooplankton, Uppsala. *Zoo. Bidrag Fran.*, 36: 407-515.
- Sewell, R.B.S. (1934) Fauna of salt Lakes, Calcutta. *Rec Ind. Mus.*, 36: 61-80.
- Sharma, B. K. (1991). Rotifera, (Animal Resources of India-State of Art ZSI).
- Sharma, B.K (1987). Indian *Brachionidae* (Eutrotaria: Monogononta) and their distribution. *Hydrobiologia*, 144: 269-273.
- Sharma, B.K. (1980). Contributions to the rotifer fauna of Orissa. *Hydrobiologia.*, 70: 225 - 233.
- Sladeczek, V. (1983). Rotifers as indicators of water quality. *Hydrobiologica* 100. 169-171.

- Somani, V. and M. Pejawar (2003). Rotifer diversity in Lake Masunda, thane (Maharashtra). *J. Aqua. Biol.*, 18 (1): 23-27.
- Unni, K. S. (1985). Comparitive limnology of several reservoirs in Central India. *Int. Revue ges. Hydrobiol.* 70 (6): 845-856.
- Verma, D. R., Ahmad, T. and Bajpai, S. (2014). Population Dynamics of Rotifer fauna in two Eutrophic ponds of Bahraich district Uttar Pradesh. *Cibtech Journal of Zoology.* 3(2) May-August.pp37-42.
- Wallace R. L., Snell T. W, Ricci, C. and Nogrady, T. (2006). Rotifera: Biology, Ecology and Systematics In: Guides to the Identification of the Microinvertebrates of the Continental Waters of the World edited by Segers H and Dumont HJ (23 Kenobi Productions, Ghent, Backhugs Publishers, Leiden).299.
- Wallace R.L. and Snell T. W. (2010). Rotifera. In: Ecology and Classification Fresh Water Invertebrates edited by Thorp JF Covich AP (Elsevier, Oxford) 173-235.