

Seasonal Abundance and Diversity of Rotifers of Shahanoor Dam, Amravati District, India

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Abstract:

The present study was designed to study the seasonal variation and diversity of rotifers from the Shahanoor dam reservoir, district Amravati, Maharashtra. In the study period from January 2011 to December 2013, total 25 species of rotifers belonging to 14 genera were identified. *Keratella tecta* was the most dominant rotifer, followed by *Keratella serrulata* and *Monostyla copies*. Percentage and population of each species of rotifer was studied. Further seasonal variation among the rotifers was also noted. Highest number of rotifers were recorded in summer season while lowest rotifer count was in winter season. Rotifer species like *Keratella tecta*, *Keratella serrulata*, *Monostyla copies*, *Monostyla pyriformes*, *Monostyla clastocerca*, *Lecanae mira*, *Lecanae flexilis* were abundant while *Collurella uncinata*, *Harringia rosa*, *Trichocera* and *Vonoyella globosa* were rarely found throughout the study period. The main objective of the present study was to assess the composition of rotifers and determine their response to seasonal variations. As the water from this reservoir is supplied to different villages nearby, such study will help to know the water quality and general environmental status of water body.

Keywords: Rotifers, Seasonal Variation, Shahanoor Dam, Diversity.

1.0 Introduction:

Zooplanktons are key components of aquatic ecosystems and constitute as an important elements of the food chain. They play vital role in transferring the energy from producers to large invertebrates and fish. Zooplanktons are heterotrophic and sometimes detritivorous. They feed on detritus and dead phytoplanktons and thus help in monitoring water pollution (Tyor et al., 2014). Zooplanktons have been used as bioindicator of eutrophication (Sharma and Tiwari, 2011). Zooplankton community comprises of five groups such as Protozoa, Rotifera, Copepoda, Cladocera and Ostracoda.

Rotifers are soft bodied invertebrates which found in both, marine and fresh water environment. They are small sized organisms, but their abundance make them important component of the aquatic ecosystem (Herzig, 1987; Starkweather, 1987; Walz, 1997). Rotifers play a crucial role in many ecosystems as the fish, aquatic crustaceans and their larvae feed on them. Presence of some rotifer species indicates the pollution level of water body. Rotifers are used as

good indicator for pollution level and eutrophication state of aquatic ecosystem because of their sensitivity to the changes in water environment (Boltovskoy and Mazzoni, 1998). Rotifer diversity and distribution is influenced by deteriorating quality of water in fresh water ecosystem. Since rotifers constitute a considerable position of total zooplanktons, the limnological investigations of rotifers is important as part of study. The present study is undertaken to investigate the seasonal abundance, diversity and distribution of rotifers from the Shahanoor dam, district Amravati.

2.0 Materials and Methods:

2.1 Description of the Study Area:

The study area selected in the present investigation is Shahanoor dam situated near the town Anjangaon surji, Amravati district, Maharashtra, India. The dam is located in hill ranges of Satpuda at latitude 21.15'21' and longitude 77.19'30'. The length of dam is 795 meters and height of the dam is 56.45 meters. The total catchment area of the dam site is 53.74 sq miles. The water from the dam is used for

irrigation and hydroelectricity. The water from the dam is also supplied for drinking for 160 villages and 2 towns in Anjangaon surji, Daryapur and Bhatkuli of Amravati district which is called as saline track of Amravati district. The whole network is run by gravity. Hence power supply is not required. The gravity based supply system is unique and only one of its kind in India, which is recorded in 'Limca Book of Record'.

2.2 Sample Collection:

For the study of rotifers, samples were collected seasonally from January 2011 to December 2013. Samples were collected from three different sampling sites, viz site 1 (West side), site 2 North

side) and site 3 (South side) of the reservoir in the morning time. Analysis was carried out during the three seasons of the year-summer, monsoon and winter. Collected samples were mixed well and brought to the laboratory for analysis. Water sample of 25 litres was filtered through the plankton net of bolting silk no. 25 of mesh size 63 micron. The filtered zooplankton sample was preserved in 4% formalin (Zabbey et.al.2008). Few drops of glycerine were added to it to prevent hardening of rotifers. All zooplanktons were allowed to settle down at the bottom. Supernatant plankton free water was removed by siphoning with pipette and the sample was reduced to the desired volume of 25 ml.

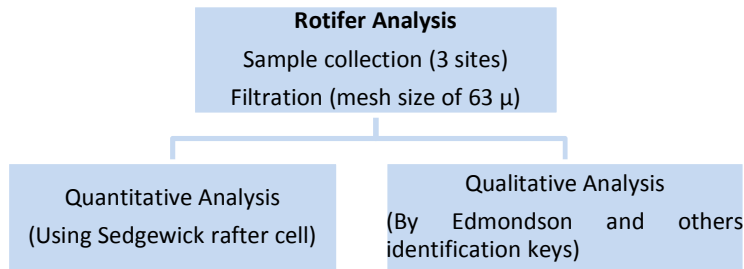


Figure a: Diagrammatic Representation of Methodology



Geographical Location and Study Site of Shahanoor Dam
Figure b

2.3 Quantitative analysis of rotifers:

For quantitative estimation of rotifers, 'Sedgewick Rotifer Cell' was used. Number of rotifers in the S-R cell was derived from the following formula (.APHA,1998).

$$\text{Number / mL} = \frac{C \times 1000 \text{ mm}}{L \times D \times W \times S}$$

Here,

- C = No. of organisms counted
- L = Length of each stripe (mm)
- D = Depth of each stripe (mm)
- W = Width of each stripe
- S = No. of each stripe.

2.4 Qualitative analysis of rotifers:

Rotifers were identified upto the genus/species level based on the minute morphological details by observing them under the microscope and using standard identification key as described by Edmondson (1965), Needham (1966), Sharma & Tonapi (1980).

2.5 Statistical analysis:

The data collected were analysed by using the standard Bio-stastical method i. e. standard error of mean \pm SE and Shannone Weaver index (H).

2.6 Standard Error of Mean :

Standard Error of mean was applied to all readings of planktonic rotifers found was used for further interpretation by using standard methods in Biostatistics.

$$\text{S.E.} = \frac{\text{SD}}{\text{Root of N}}$$

Where SD is Standard deviation
N = Number of observations

Diversity indices were calculated by using Shannone Wiener Index.

Shannone Wiener diversity index is expressed as the formula:

$$H = - \sum [(P_i) \times \ln (P_i)]$$

H = Shannone Wiener diversity index.

P_i = Proportion of total sample represented by species

P_i = Number of particular species i / Total number of samples

3.0 Result and Discussion:

The present study reports the rotifer density (68%) and diversity (25 species) from the Shahanoor dam reservoir from the January 2011 to the December 2013. In total 25 species of rotifers belonging to 14 different genera were

recorded (Table 1). As evident from the table, the most abundant species was *Keratella tecta* while *keratella serrulata* and *Monostyla copies* were secondly dominated among the rotifers.

In the analysis of water samples collected from Shahanoor dam, highest number of rotifers were found in the summer season and least were found in winter during the study period from January 2011 to December 2013. In summer of 2013 highest number of rotifers (2619 org / l) were recorded and lowest (1535 org/l) in the winter season of 2012. Similar trends of rotifer distribution were recorded by Sukand and Chavan (2013) in Malprabha river and Jafari N. et al (2011) in Haraz river in Northeast Iran. Maximum number observed in summer showed the positive correlation between temperature and rotifers population. Similar pattern was observed by Arora and Mehra (2003), Jadhav et al (2010), Reeya Jose and Sonalkumar M. G. (2012) & N.A.Bhat et al. (2015). In summer less quantity of water in reservoir and sufficient food availability due to decomposition of organic matter contribute to increase the density of rotifers. Many researchers are of the opinion that the abundance and occurrence of planktonic rotifer depends upon the availability of food (Nayer & Nair 1969, Sharma 1983, Sharma, 1988).

However different trend was also observed by some researchers. Saumen Chakrabarti revealed highest rotifer density in the winter and rainy season and lowest in the summer while studying the pond ecosystem of Tripura. Similar trend was observed by King 1967, Backer, 1979, Patra & Datta 2004, Edmondson, 1992, Nasar, 1997). Similar results were reported by Shivakami et al. (1996; 2007; 2011, 2013), Paulose and Maheswari (2008). During the study of rotifer density of temple ponds of Nashik district highest density of rotifers in monsoon was observed by Tidame S.K. & Shinde S. S. in 2010.

Pollution indicator species from rotifers such as *Lepadella*, *Monostyla*, *Keratella* were identified. Abundance of genus of the family Brachionidae i.e. *Keratella tecta*, *Keratella serrulata* and of the family Lecanaeidae i.e. *Lecanae mira*, *Lecanae innermis*, *Lecanae flexilis*, *Lecanae unguate* are indicator of eutrophication (Baloch et al. 2000). Species *Trichocera* was absent during monsoon of 2013 while *Vonoyella globosa* was completely absent during monsoon period of 2012 and 2013. Absence of these rotifer species can be

attributed to turbulence generated by the excess water flow during this season.(Chakraborty, I.2004)

Diversity of the plankton community depends on the species richness and species evenness. Species diversity in the study was impressive. The Shannon Wiener diversity index of the rotifers showed in the table no. 4 which shows even distribution of rotifers in all seasons.

Table 1: Seasonal and Quantitative distribution of rotifers (org/ lit) in Shahanoor from Jan 2011 to Dec 2011

S.N.	Rotifera	Seasons			Mean	±SE
		Summer	Monsoons	Winter		
1.	<i>Keratell tecta</i>	320	263	231	271.33	26.02
2.	<i>Ketatella serrulata</i>	316	260	149	241.66	49.07
3.	<i>Brachioums sp</i>	45	40	42	42.33	1.45
4.	<i>Asplanchna brightwelli</i>	54	40	39	44.33	4.84
5.	<i>Anuraeopsis fissa</i>	96	62	60	72.66	36.69
6.	<i>Anureopsis navicula</i>	43	26	40	36.33	5.23
7.	<i>Ascomorpha saltans</i>	34	42	46	40.66	3.52
8.	<i>Monostyla copies</i>	280	260	183	241	29.56
9.	<i>Monostyla pyriformes</i>	183	144	127	151	16.57
10.	<i>Monostyla clastocerca</i>	146	85	104	111.66	19.32
11.	<i>Lecanae inermis</i>	86	65	43	64.66	12.41
12.	<i>Lecanae mira</i>	140	129	88	119	18.53
13.	<i>Lecanae flexilis</i>	114	85	65	88	14.22
14.	<i>Lecanae unguolata</i>	102	44	96	80.66	18.41
15.	<i>Euchlanis sp</i>	180	60	40	93.33	43.71
16.	<i>Euchlanis deflexa</i>	32	52	39	41	5.18
17.	<i>Euchlanis oblongata</i>	44	40	33	39	3.21
18.	<i>Lepadella patella</i>	48	18	26	30.66	8.96
19.	<i>Lepadella accuminata</i>	80	24	65	56.33	16.73
20.	<i>Collurella adriatica</i>	58	48	24	43.33	10.08
21.	<i>Collurella uncinata</i>	60	28	27	38.33	10.83
22.	<i>Harringia rousseleti</i>	40	8	19	22.33	9.38
23.	<i>Habratrocha rosa</i>	9	22	20	17	4.04
24.	<i>Trichocera</i>	10	14	15	13	1.52
25.	<i>Vonoyella globosa</i>	15	28	10	17.66	5.41
	Total Rotifers	2425	1887	1631	1981	233.08

Table 2: Seasonal and Quantitative distribution of rotifers (org/ lit) in Shahanoor from Jan 2012 to Dec 2012

S.N.	Rotifera	Season			Mean	±SE
		Summer	Monsoon	Winter		
1.	<i>Keratella tecta</i>	260	227	208	231.66	15.19
2.	<i>Keratella serrulata</i>	240	202	120	187.33	35.40
3.	<i>Branchionus sp</i>	72	127	48	82.33	20.33
4.	<i>Asplnachana brightwelli</i>	62	41	55	52.66	6.97
5.	<i>Anuraeopsis fissa</i>	28	40	33	33.66	5.44
6.	<i>Anuraeopsis navicula</i>	35	43	32	36.66	3.28
7.	<i>Ascomorpha sultans</i>	60	72	48	60	6.92
8.	<i>Monostyla copies</i>	130	206	69	135	39.62
9.	<i>Monostyla pyriformes</i>	90	120	86	98.66	10.72
10.	<i>Monostyla clastocerca</i>	178	108	106	130.66	23.66
11.	<i>Lecanae inermis</i>	66	42	30	46	10.58
12.	<i>Lecanae mira</i>	109	139	60	102.66	23.02
13.	<i>Lecanae flexilis</i>	192	152	161	168.33	12.11
14.	<i>Lecanae ungulata</i>	81	85	64	76.66	6.43
15.	<i>Euchlanis sp</i>	71	66	78	71.66	3.47
16.	<i>Euchlanis deflexa</i>	65	57	25	49	12.60
17.	<i>Euchlanis oblongata</i>	62	58	31	50.33	9.73
18.	<i>Lepadella patella</i>	44	34	36	38	3.05
19.	<i>Lepadella accuminata</i>	60	31	68	53	11.23
20.	<i>Collurella adriatica</i>	66	81	55	67.33	7.53
21.	<i>Collurella uncinata</i>	43	27	41	37	5.03
22.	<i>Harringia rousseleti</i>	36	19	25	26.66	4.96
23.	<i>Habratrocha rosa</i>	16	--	14	10	5.03
24.	<i>Trichocera</i>	13	13	22	16	3
25.	<i>Vonoyella globosa</i>	20	--	20	13.33	6.66
	Total Rotifers	2099	1978	1519	1874.66	104.4 7

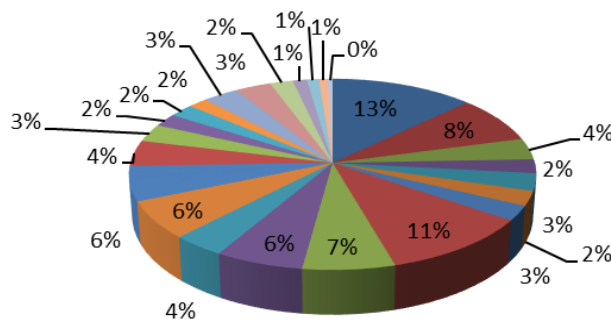
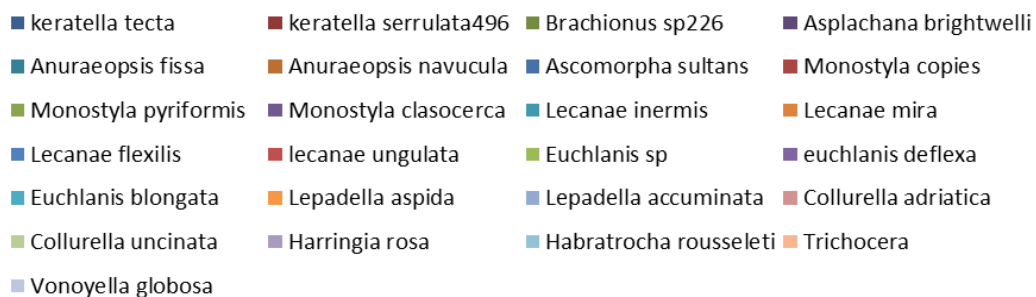


Figure c: Percentage contribution of each rotifer species of the Shahanoor dam

Table 3: Seasonal and Quantitative distribution of rotifers (org/ lit) in Shahanoor from Jan 2013 to Dec 2013

S.N.	Rotifera	Season			Mean	±SE
		Summer	Monsoon	Winter		
1.	<i>Keratella tecta</i>	322	240	235	265.6	28.20
2.	<i>Keratella serrulata</i>	213	148	135	165.33	24.12
3.	<i>Branchionus sp</i>	100	76	50	75.33	14.43
4.	<i>Asplnachana brightwelli</i>	61	40	45	48.66	6.33
5.	<i>Anuraeopsis fissa</i>	87	43	52	60.66	13.42
6.	<i>Anuraeopsis navicula</i>	69	37	48	51.33	6.15
7.	<i>Ascomorpha sultans</i>	45	55	57	52.33	3.71
8.	<i>Monostyla copies</i>	280	260	140	226.6	43.71
9.	<i>Monostyla pyriformes</i>	135	159	114	136	13
10.	<i>Monostyla clastocerca</i>	154	93	144	130	18.89
11.	<i>Lecanae inermis</i>	140	45	50	78.33	25.17
12.	<i>Lecanae mira</i>	177	135	88	133.33	17.82
13.	<i>Lecanae flexilis</i>	171	119	78	122.66	26.90
14.	<i>Lecanae ungulata</i>	99	42	129	90	25.51
15.	<i>Euchlanis sp</i>	84	69	35	62.66	14.49
16.	<i>Euchlanis deflexa</i>	67	30	39	45.33	11.14
17.	<i>Euchlanis oblongata</i>	56	42	39	45.66	6.66
18.	<i>Lepadella patella</i>	57	25	27	44.35	5.12
19.	<i>Lepadella accuminata</i>	77	47	75	66	9.68
20.	<i>Collurella adriatica</i>	70	61	68	66	2.73
21.	<i>Collurella uncinata</i>	57	40	31	42.66	7.62
22.	<i>Harringia rousseleti</i>	45	15	18	26	9.5
23.	<i>Habratroch arosa</i>	20	15	32	22.33	5.04
24.	<i>Trichocera</i>	23	--	25	16	8.26
25.	<i>Vonoyella globosa</i>	10	--	18	9.33	3.55
	Total Rotifers	2619	1836	1772	2075.66	173.24

Table 4: Shannon wiener diversity indices (H) value of rotifers of Shahanoor dam during Jan 2011 – Dec 2013

Year/Seasons	Summer	Monsoon	Winter
2011	2.872	2.824	2.924
2012	2.956	2,878	2.987
2013	2.975	2.846	2.994

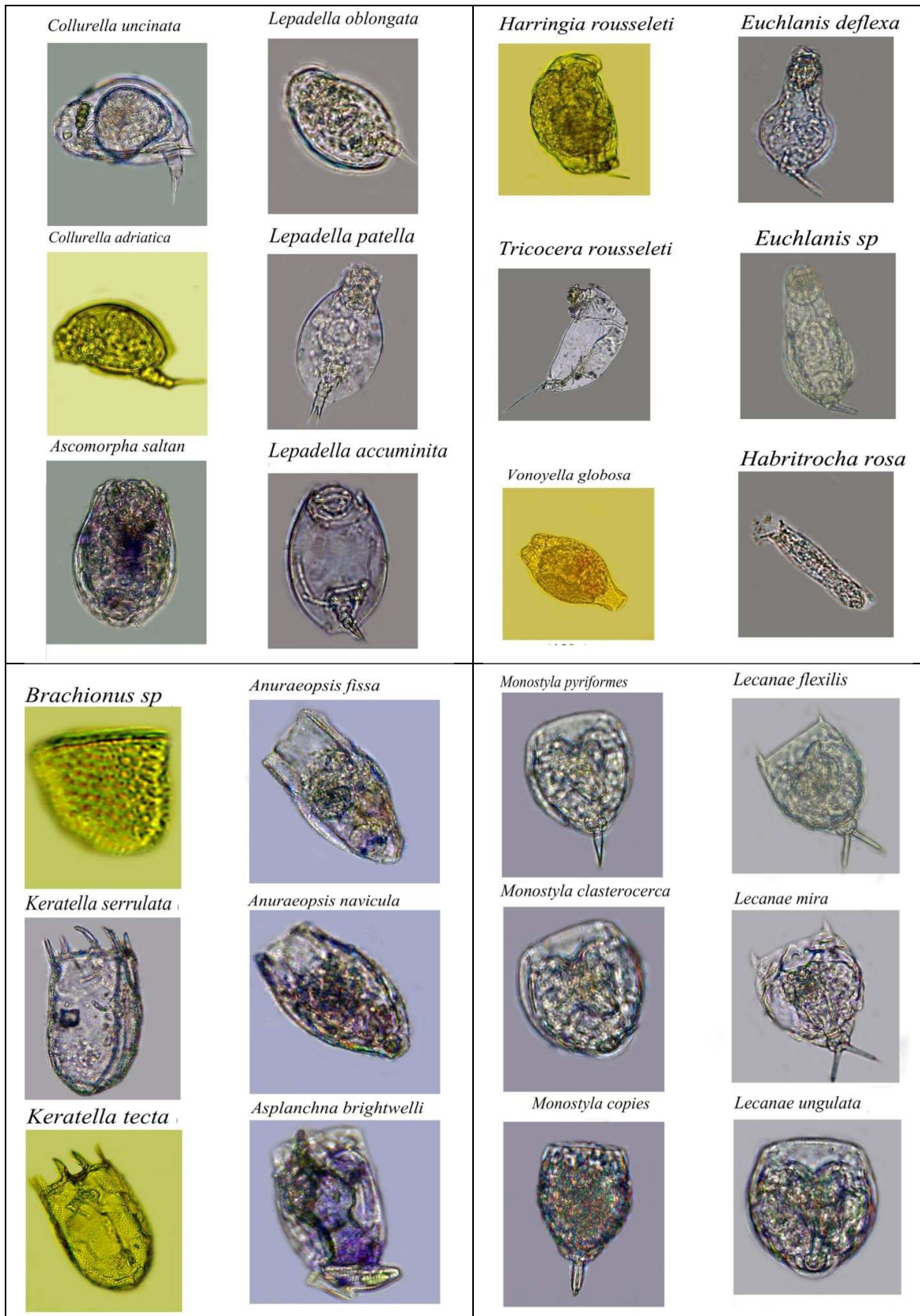


Figure d: Rotifer Species from Shahanoor dam (Amravati, Maharashtra) India

Lecanae inermis (Bryce, 1892)



4.0 Conclusion:

The present study infers that there is an abundance of rotifers in the Shahanoor dam reservoir. Also, the distribution of rotifers showed a seasonal variation which might be due to the physico-chemical factors of the water body. Few pollution indicator species were also recorded in all the seasons indicating the urgent need of proper purification system in the dam.

5.0 Acknowledgement:

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