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Rotifers Abundance, Species Composition and Temporal Distribution in a Sewage Fed Fish Pond at Pahari, Patna

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ABSTRACT

Pahari sewage fed pond receives treated effluent from Pahari Sewage Treatment Plant and is used both for fish culture and irrigation. There is no available record on biological characteristic of this pond. Objective of this study was to determine the abundance,richness, evenness and species diversity of rotifers community of this pond during the period of September 2007 to August 2009. In addition, the influence of abiotic parameters on qualitative and quantitative variations of rotifers were also analyzed. Thirty one species of rotifers were recorded, out of which fourteen belonged to Brachionidae family, four species each in Lecanidae and Trichocercidae, three to Filinidae, two to Asplanchnidae and one species each in Synchaetidae, Conochilidae, Trochosphaeridae and Testudinellidae. Different biological indexes were used to determine the diversity, species richness and evenness of the observed rotifers. Statistical calculations such as range, mean, standard deviation, correlation and regression analyses (R) were carried out to describe the degree of relationship between rotifers density and physico-chemical parameters. Rotifera population showed positive correlation with transparency (r = 0.374), DO (r = 0.372), pH (r = 0.139), alkalinity (r = 0.429), nitrate (r = 0.395), phosphate (r = 0.439) and total hardness (r = 0.509) whereas negative correlation with water temperature (r = -0.577). The Shannon's diversity index, value of Sladecek's $Q_{B/T}$ quotient (2.5) and presence of several eutrophic species in good number in this pond indicates it's eutrophic condition.

Keywords Sewage-fed fish pond, Rotifers, Abundance, Diversity, Species richness.

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INTRODUCTION

The zooplankton assemblage is a sensitive indicator of the ecological status of an aquatic ecosystem, since it can respond to environmental changes with rapid modifications in the species composition and structure (Jeppesen et al. 2005, Sousa et al. 2008) and their population is able to reflect the nature and potential of any aquatic systems (Kumar et al. 2010). They are represented by wide array of taxonomic groups viz., Protozoa, Cladocera, Copepoda and Rotifera in a freshwater ecosystem which are often armoured by different organs like spines for protecting themselves from the predator (Verma et al. 2013). Rotifers achieved more significance in freshwater by residing in littoral, limnetic and benthic regions (Pejler 1995, Sharma 2009) and most of them are cosmopolitan in distribution (Hyman 1951, Ricci and Melone 2000). They play significant role in aquatic food-chain and trophic dynamics in freshwaters because of their common occurrence, wide variety of feeding habits and rapid turn-over rates; enabling them to build up substantial populations within short time intervals (Sharma 2001). Role of rotifers as bioindicators has been advocated by several researchers (Sladecek 1983, Nogrady et al. 1993, Bonecker and Lansac-Toha 1996). The community composition and density of rotifers greatly varies with degree of eutrophication (Zankai 1984, Park and Marshall 2000). Pandit and Yousuf (2003) stated that rotifer community increases qualitatively as well as quantitatively from oligotrophy to mesotrophy then finally to eutrophy. Eutrophication of lakes which leads to deterioration of aquatic ecosystems has been of a great concern around the globe (Bennion et al. 2015). Adequate knowledge of the zooplankton communities and their population dynamics is a major requirement for better understanding of life process in a freshwater body since eutrophication influences both the composition and productivity of zooplankton (Bhora and Kumar 2004).

The studies on zooplankton throughout India were undertaken by investigators like Singh (1991), Sharma (1998), Segers and Babu (1999), Sharma and Sharma (2001), Wanganeo and Wanganeo (2006), Pandit (2008) and many more but limited study on occurrence and diversity of rotifers in sewage fed pond in Bihar.

The present study was aimed to explore the rotifer diversity in this sewage fed pond at Pahari, Patna which receives treated effluent from Pahari Sewage Treatment Plant. Present study also deals with Rotifera community of this pond with special reference to monthly variations in their richness, evenness, species diversity and abundance. In addition, the influence of abiotic parameters on qualitative and quantitative variations of Rotifera were also analyzed.

MATERIALS AND METHODS

Study area

Pahari Sewage Treatment Plant (Fig. 1) is aerated lagoon type with 25 MLD (Million Liter per Day) capacities for the treatment of city sewage from Southern Zone of Patna. The sewage after passing

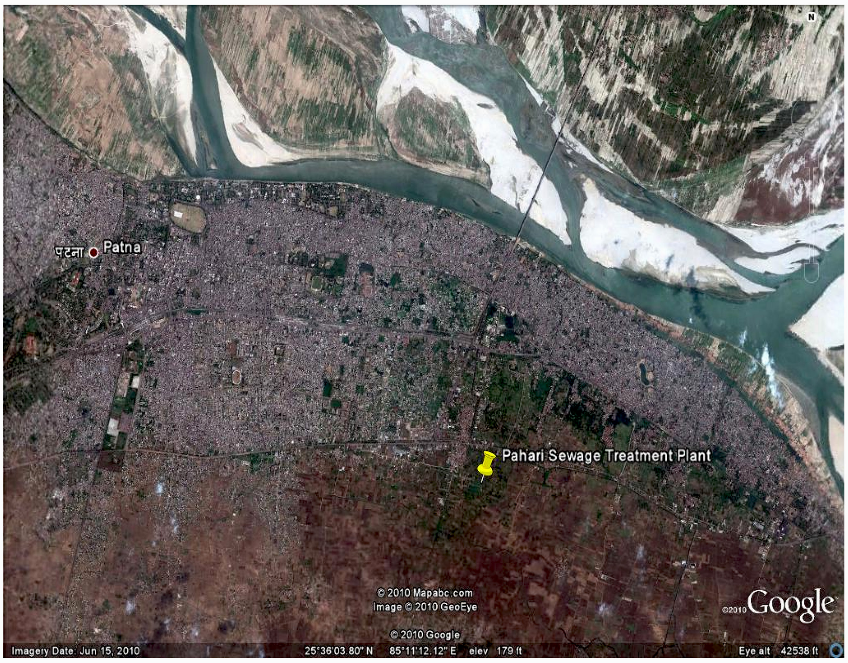

Fig. 1. Google image of Patna showing Pahari STP.

through screen chamber and grit chamber flows to distribution chamber of aerated lagoon system. It is then mechanically aerated in two parallel facultative aerated lagoons. The effluents from these lagoons are taken to the fish pond within 12 h. Area of the fish pond is 0.83 hectare and fish yield of 4.16 tons/year was estimated, @ 5 tons/ha.

Sample collection

Field sampling was conducted on monthly basis during September 2007 - August 2009 for two consecutive years.Plankton samples were collected by filtering 50 liters of water through plankton net of standard bolting silk cloth, number 21 with 77 mesh/ cm^2 and concentrated up to 15 ml. The plankton sample were preserved in 5% formalin solution on site and then brought to the laboratory for qualitative and quantitative analysis. Rotifers were identified with the help of Pennak (1978), Singh (1991) , Ward and Whipple (1992), Sharma (1983, 1986, 1987, 1998, 2001). Quantitative enumeration of Rotifera (ind/l) was done with a Sedgewick-Rafter counting cell.

The quantitative estimation of plankton was made by following formula:

$$n = \frac{a \times 1000 \times c}{L}$$

Where, N = Number of plankton per liter of water, a = Average number of plankton in 1ml of sub-sample (concentrated), L = Volume of original water sample in liters, c = ml of plankton concentrated.

Analysis of physico-chemical parameters

Water samples were collected from the pond following Standard Methods (APHA 1998). Samples for analyses were kept in 1 liter capacity bottles and transported to the laboratory in ice-box at 4^0C for further analysis. Separate samples were collected for the parameters that required specific preservation. Air temperature, water temperature, pH, conductivity. Total dissolved solids (TDS) and Dissolved oxygen (DO) were determined *in situ* whereas total alkalinity, chloride, total hardness, calcium, phosphate, nitrate, COD and BOD were analyzed in the laboratory following the Standard Methods (APHA 1998, Trivedy and Goel 1986).

Community analysis

All the data have been compiled into Microsoft Excel spreadsheet based on sampling months and basic statistical calculations such as range, statistical mean and standard deviation (SD) were made. Correlation and regression analyses (R) were carried out using data analyses tool to describe the degree of relationship between rotifer density and physico-chemical parameters. The result may show how strongly pairs of variables such as temperature, pH, dissolved oxygen and water transparency are related to Rotifera abundance.

In order to provide more information on Rotifera community dynamics, some ecological indices were calculated which were diversity indices (Shannon-Weiner index of diversity 1949), richness indices (Margalef Index 1949), evenness index (Pielou 1966), species composition and relative abundance.

RESULTS AND DISCUSSION

In the present study, a total of 31 species of Rotifera belonging to 11 genera and 9 eurotatorian families were identified (Table 1). Ahmad et al. (2011) found 11 species of rotifers in a sewage fed pond of Aligarh (UP), India. Goz`dziejewska and Tucholski (2011) found 41 species of rotifers in fish culture pond periodically fed with treated waste water in North-Eastern Polland. A total of 37 species of rotifers have been recorded from railway pond in Rohtas district, Sasaram, Bihar (Pramod et al. 2011). The high number of rotifers in freshwater ecosystem is due to their less specialized feeding habits, high fecundity and short developmental rates (Allan 1976). In fact, this pattern is common in freshwater ecosystem such as lakes, ponds, rivers and streams (Neves et al. 2003).

The range, mean and standard deviation (SD) of Rotifera have also been recorded (Table 1). Nine families of rotifers recorded were Brachionidae, Lecanidae, Trichocercidae, Asplanchnidae, Synchaetidae, Conochilidae, Filinidae, Trochosphaeridae and Testudinellidae. Maximum species were recorded

Table 1. Annual quantitative analysis of zooplankton (individuals/L) of the sewage fed fish pond during September 2007 to August 2009.

Zooplankton species	2007-2008	2008-2009	Average density	Range
Brachionodae				
Brachionus angularis	2875 ± 2669.4	4200 ± 5475.23	3537.5 ± 4266.53	300-14100
Brachionus calyciflorus	1350 ± 1421.6	5162.5 ± 6797.7	3256.25 ±5182.48	300-20400
Brachionus bidentata	1150 ± 2170.25	420 ± 946.18	785 ± 1679.22	150-7500
Brachionus rubens	725 ± 782.91	2542.5 ± 5753.56	1633.75 ± 4121.53	300-17400
Brachionus forficula	875 ± 1760.75	900 ± 1151.28	887.5 ± 1454.92	300-6300
Brachionus caudatus	125 ± 200.57	75 ± 186.47	100 ± 191.11	300-600
Brachionus diversicornis	2325 ± 4172.88	112.5 ± 264.68	1218.75 ± 3104.58	600-12300
Brachionus quadridentatus	100 ± 195.40	175 ± 451.51	137.5 ±342.39	300-1500
Brachionus leydigi	100 ± 233.55	450 ±1035.29	275 ±755.42	300-3600
Brachionus budapestinensis	450 ± 824.07	600 ± 913.53	525 ± 854.27	300-3000
Keratella tropica	375 ± 513.68	175 ± 518.96	275 ± 515.20	300-1800
Keratella procurva	225 ±386.42	25 ± 86.60	125 ± 292.29	300-1200
Keratella lenzi	150 ±202.26	337.5 ± 627.09	243.75 ± 465.63	300-1950
Anuraeopsis fissa	1250 ± 2112.95	1262.5 ±2143.82	1256.25 ±2081.67	300-7500
Lecanidae				
Lecane curvicornis	25 ± 86.60	0 ± 0	12.5 ± 61.24	300
Lecane leontina	100 ± 195.40	0 ± 0	50 ± 144.46	300-600
Lenane luna	125 ±237.89	75 ±186.47	100 ±210.59	300-600
Lecane unguilata	75 ± 186.47	0 ± 0	37.5 ±134.53	300-600
Trichocercidae				
Trichocerca cylindrica	100 ± 266.29	175 ± 372.03	137.5 ±318.71	300-1200
Trichocerca flagellata	0 ± 0	75 ± 186.47	37.5 ±134.53	300 - 600
Trichocerca similis	225 ± 445.43	150 ± 300	187.5 ± 373.366	300-1500
Trichocera rattus	175 ± 372.03	212.5 ± 328.1	193.75 ± 343.99	300-1200
Asplanchnidae				
Asplanchna brightwelli	175 ± 349.35	182.5 ± 303.38	178.75 ±320.00	300-900
Asplanchna priodonta	525 ± 941.11	1100 ±1001.82	812.5 ± 994.91	300-3000
Synchaetidae				
Polyarthra spp.	575 ± 739.93	412.5 ± 680.28	493.75 ± 700.05	300-1800
Conochilidae				
Conochilus hippocrepis	525 ± 1378.49	2620 ± 5125.99	1572 .5 ± 3823.67	600-18300
Filinidae				
Filinia longesita	387.5 ± 406.83	325 ±564.28	356.25 ± 482.14	300-1800
Filinia minuta	100 ±266.29	0 ± 0	50 ±191.11	300-900
Filinia terminalis	100 ±233.55	112.5 ± 279.71	106.25 ± 252.08	450-900
Trochosphaeridae				
Horaella spp.	100 ± 266.29	625 ±1081.35	362.5 ± 815.51	300-3300
Testudinellidae				
Pompholyx sulcata	375 ± 779.42	800 ± 1242.43	587.5 ± 1037.27	300-4200

from the family Brachionidae (14 species) which was followed by families Lecanidae and Trichocercidae (04 species), family Filinidae (03 species), family Asplanchnidae (02 species) and family Synchaetidae, Conochilidae, Trochosphaeridae and Testudinellidae (01 species). In the present study, Brachionidae family showed its dominance in rotifer group. Out of 14 species of family Brachionidae, the average density was minimum for *Brachionus caudatus* which ranged from 300-600 individuals/l (100 ± 191.11) while maximum for *Brachionus angularis* which ranged from 300-14100 individuals/l (3537.5 ± 4266.53). In Lecanidae family the density of *Lecane curvicornis* was lowest (300 individuals/l) and was observed only once (October 2007) during the study period while *Lenane luna* was highest and ranged from 300-600 individuals/l (50 ±144.46). Out of four species of family Trichocercidae, the average density was maximum for *Trichocerca rattus* 300-1200 individuals/l (193.75 ± 343.99) and minimum for *T. flagellata* 300-600 individuals/l (37.5 ±134.53). *Trichocerca flagellata* remained absent during 2007-08. Family Asplanchnidae consists of two species which include : *Asplanchna brightwelli* 300-900 individuals/l (178.75 ± 320.00) and *Asplanchna priodonta* 300-3000 individuals/l (812.5 ± 994.91). In Synchaetidae family, only one species (*Polyarthra* spp.) was recorded during the study period. All these five families belonged to order Priodonta.

In our study, four families of the order Gnesiotrocha were recorded, which are - Conochilidae, Filiniidae, Trochosphaeridae and Testudinellidae. Family Conochilidae consists of one species *Conochilus hippocrepis* 600-18300 individuals/l (1572.3 ± 3823.67). It is a colonial taxon, commonly found in polluted water bodies. Out of three species of Filiniidae family, *Filinia minuta* was observed only during 2007-2008 with 300-900 individuals/l (50 ± 191.11). Family Trochosphaeridae consists of one species, *Horaella* spp. which include 300-3300 individuals/l (362.5 ± 815.51) and family Testudinellidae was also recorded with one species *Pompholyx sulcata* with 300-4200 individuals/l (587.5 ±1037.27).

The most abundant and the most frequently noted rotifer species in this study were *Brachionus angularis, B. calyciflorus, B. diversicornis, B. bidentata, B. budapestinensis, B. rubens, Keratella tropica, Anuraeopsis fissa, Asplanchna priodonta, A. brightwelli, Conochilus, Polyarthra, Filinia longesita* and *Pompholyx sulcata.* Similar observations were also found in Raj Dighi and Harahi pond in Bihar (Nasar and Dutta-Munshi 1974, Nasar 1977, Laal 1984, Ahmad and Singh 1988) ; in sewage fed pond of Aligarh (UP) in India (Ahmad et al. 2011) and in fish culture ponds in North-Eastern Polland (Goz`dziejewska and Tucholski 2011). In this study, taxa that were believed to be reliable indicators of water trophy (Karabin 1985) were found in good numbers. They were: *Brachionus angularis. B. calyciflorus, B. rubens, B. diversicornis, Filinia longiseta, Keratella cochlearis* and *Pompholyx sulcata.* The population of *Brachionus angularis, B.calyciflorus* and *B. rubens* was marked by a periodic increase, becoming the dominant species. The genus *Brachionus* is the index of eutrophic water (Sladecek 1983) and its abundance is considered as indicator of eutrophication as this genus has ability to tolerate pollution (Sharma 1996, Sampaio et al. 2002, Mangeed 2008, Ahmad et al. 2011, Mola 2011).The above indicators of an increased content of biogenic elements are determined in anthropogenic ecosystems, such as fish ponds (Widuto et al. 1997) and in coastal brackish lakes (Paturej and Goz`dziejewska 2005). They are eurytopic organisms that adapt to a wide range of environmental conditions and are capable of surviving in changing habitats, including in shallow pond ecosystems.

Sladecek's (1983) $Q_{B/T}$ quotient depicting ratios of number of species of *Brachionus* and *Trichocerca,* an analogon of five phytoplankton quotients proposed by Thunmark (1945), Nygaard (1949), was useful to indicate trophic conditions of individual water bodies or even of individual water samples. According to this quotient, values less than 1.0 meant oligotrophy, between 1.0 and 2.0 indicated mesotrophy and those above 2.0 show eutrophy. The value obtained (2.5) vide Sladecek's quotient for the sampled pond reflected eutrophic status for sewage fed fish pond, Pahari, Patna. The reason of eutrophication in this pond may be due to addition of treated sewage containing phosphorus and nitrogen (Rao and Muley 1994). Similar

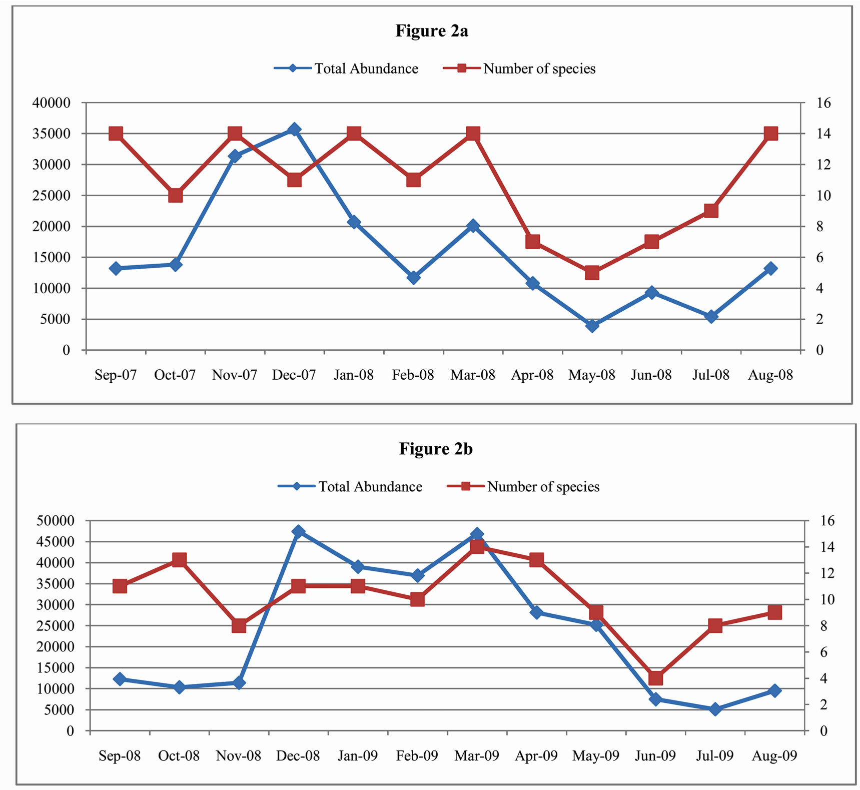

Fig. 2 a and b. Monthly variations in total count (individual/L) of Rotifera and number of species recorded in sewage fed fish pond during 2007-08 (a) and 2008-09 (b).

observations were also found in Raj Dighi pond Bihar.

Figure 2a and b show monthly variation in total count (individuals/l) of different species of Rotifera and number of species present during 2007-2008 and 2008-2009 respectively. During 2007-08 maximum number (14) of species found in September, November, January, March and August and minimum number of species (5) was recorded in May 2008 while during 2008-09 minimum species (4) was found in June and maximum number of species (14) recorded in March during the study period. The abundance of rotifers in the sewage fed pond ranged from 3900 to 35700 individuals/l (15762.5 ± 9684.3) during 2007-08 and 5100 to 47400 individuals/l (23302.5 ± 15931.9) during 2008-09. The abundance of Rotifera was higher during 2008-09 compared to 2007-08 during the present study. However the statistical analysis showed that there was no significant differences in maximum abundance of Rotifera during 2007 to 2009 (t_{stat} = 1.697, p = 0.088). Increased abundance of rotifers may be due to improved nutrient contents as they have positive correlation with the occurrence of these organisms. It was documented that nutrient availability influence the abundance of Rotifera and Copepoda particularly *Cyclops* sp.(Kumar et al. 2004). Tijare and Shastrakar (2018) found that some Rotifera are highly sensitive to water quality and slight change of nutrients can cause fluctuations in their growth. Roche (1995) described extreme impoverishment of the zooplankton community resulting from the massive growth of *Brachionus calyciflorus* and *B. angularis* due to excessive fertilization of stabilization ponds fed with treated dairy waste water. In the present study, highest population of rotifers was recorded during winter (November – February) followed by summer (March – June) while minimum during monsoon (July – October). Other researchers such

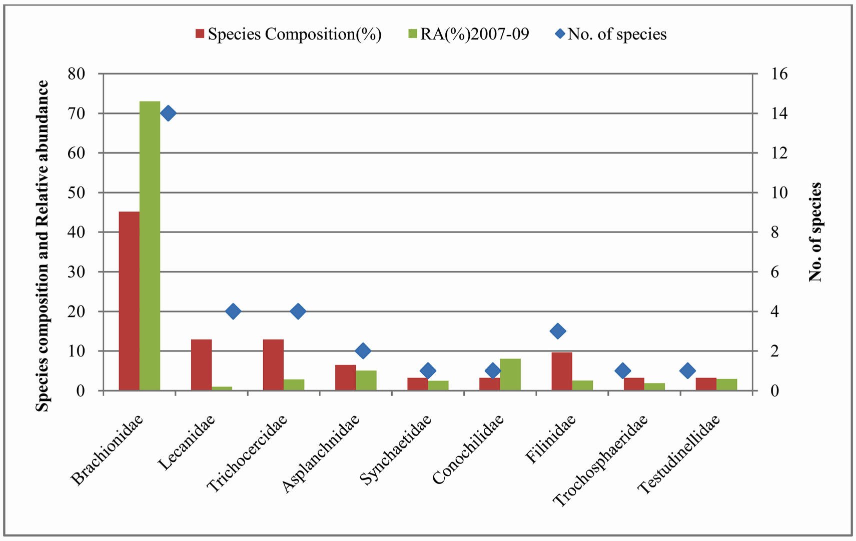

Fig. 3. Number of species, species composition (%) and relative abundance (%) of Rotifera families during 2007-09.

as Tijare and Shastrakar (2018) , Tijare and Gedekar (2015), Bera et al (2014), Pramod et al. (2011), Tijare and Thosar (2008) and Pejavar and Gaurav (2008) have made similar observations. High abundance of rotifers during winter may be due to favorable temperature, dissolved oxygen and availability of food materials, as reported by Tijare and Gedekar (2015). Kumar et al. (2010) stated that the period of August to November is the most favorable for the growth of zooplankton population and this may be due to increase of phytoplankton population. During monsoon, the flooded water may wash out the population of Rotifera (Tijare and Gedekar 2015). However the results of ANOVA ($p = 0.1495$) shows that average Rotifera population did not differ significantly with seasons.

Biological indices

The occurrence of rotifers can be used as a good indicator for biological and water quality assessment of pond. Biological indices like Shannon-Weiner diversity index, richness index and evenness index were used for the analyses. As the species diversity index and species richness index depend upon the number of species as well as number of individuals of each species they contribute equally to these index values (Ludwig and Reynolds 1988) . Hence decrease or increase in any one of these two variables will influence the overall values of these indices. The seasonal patterns of diversity, richness and evenness are shown in Fig. 3.

Shannon-Weiner diversity index measures the number of species and the number of individuals in each species. According to the Welch (1992) pattern, H’>3 represents unpolluted regions, H’<l represents polluted status and l<H’ <3 represents moderate pollution status. Chourasia (1996) reported that the diversity of rotifers and their species diversity are higher in eutrophic condition. Bhat et al. (2014) recorded Shannon-Weiner diversity index ranging between 0.96 and 2.75 in a tropical water body (Bhoj wetland) of Bhopal, India and came to the conclusion that the wetland was polluted. In our study, the value of Shannon diversity index ranged between, 0.88 and 2.34

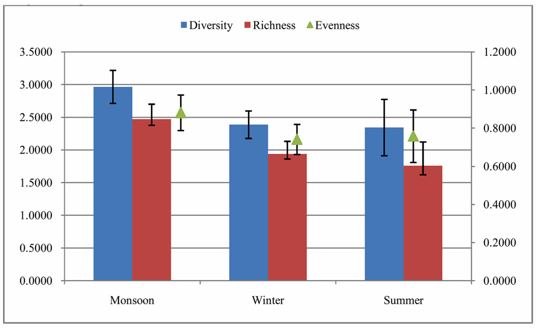

Fig. 4. Seasonal variations of Shannon-Weiner diversity, indices of richness and Pielou's evenness recorded during 2007-2009 in sewage fed fish pond Pahari, Patna.

Table 2. Mean value of physico-chemical parameters of water in the sewage fed fish pond.

Parameters	Range	Mean value
Water temperature (^{0}C)	15.7 – 32.5	25.7 ± 5.2
pH	8.2 – 9.4	8.6 ± 0.3
Transparency (cm)	6.0 – 46.0	16.6 ± 10.47
DO (mg/l)	5.4 – 16.2	12.0 ± 2.87
Toatal alkalinity (mg/l)	5.6 – 34.4	19.0 ± 8.8
Total hardness (mg/l)	112 – 313	211.0 ± 65.0
Calcium (mg/l)	31.4 – 83.7	54.5 ± 16.4
Phosphate (mg/l)	0.163 – 0.930	0.469 ± 0.247
Nitrate-nitrogen (mg/l)	0.32 – 7.04	2.80 ± 1.89
BOD (mg/l)	16.7 – 34.4	23.6 ± 4.0
COD (mg/l)	53.1 – 132.6	81.4 ± 23.4
TDS (mg/l)	225 – 510	378.7 ± 82.3

with a mean value of 1.85 indicating that the pond was moderately polluted. Seasonal Shannon-Weiner diversity index varied from 2.34 during summer to 2.96 during monsoon season (Fig. 4).

Species richness indicates the presence of various species and is calculated by the number of species in an area. An increasing number of taxa can be due to habitat diversity, suitability of water or its improved quality. The index of richness ranged between 0.34 and 1.37 with a mean value 0.97 during the study period. It fluctuated 1.76 in summer and 2.47 in monsoon (Fig.4). The high value of indices showing high taxa richness and high relative abundance of rotifers may due to increased availability of food and influence of physico-chemical factors at the study site.

Evenness index measures the evenness or equitability of the community by scaling one of the heterogeneity measures relative to its maximal value that each species in the sample is represented by the same number of individuals (Brraich and Kaur 2017). Evenness index ranges from 0 (low equitability) to 1 (high equitability). Evenness index varied from 0.47 to 0.95 with a mean value 0.803. It was 0.74 during winter to 0.88 during monsoon in the present study (Fig.4). The evenness index values of 0.74 to 0.88 supporting high equitability of Rotifera. Evenness index i.e. Pielou index value studied by Ismail and Zaidin (2015) was 0.76-0.82. This indicates that the zooplankton species found in the studied habitat is almost evenly distributed because the calculated value is closer to 1 (Frutos et al. 2009). The analysis of diversity indices and other biological indices revealed clearly the status of the water body.

Correlation between physico-chemical parameters and Rotifera

Table 2 presents mean value of physico-chemical characteristics of the sewage fed pond. To assess the overall impact of different parameters on rotifer density, correlation was made between mean rotifer density and water parameters (Table 3). Rotifera population showed notable positive correlation with transparency (0.374), DO (0.372), pH (0.139), alkalinity (0.429), nitrate (0.395), phosphate (0.439) and total hardness (0.509). Neves et al. (2003) also found rotifers density was positively correlated with water transparency. This is good evidence that an increase in water transparency leads to an increase in the zooplankton communities. On the contrary, Rotifera density was negatively correlated with water temperature (-0.577). Bera et al. (2014), Veerendra et al. (2012), Rajagopal et al. (2010), Sharma (2009) also reported the positive correlation with pH, DO, alkalinity and negative correlation with water temperature. Such findings corroborate our results. Kurbatova (2005), Tanner et al. (2005) stated that pH

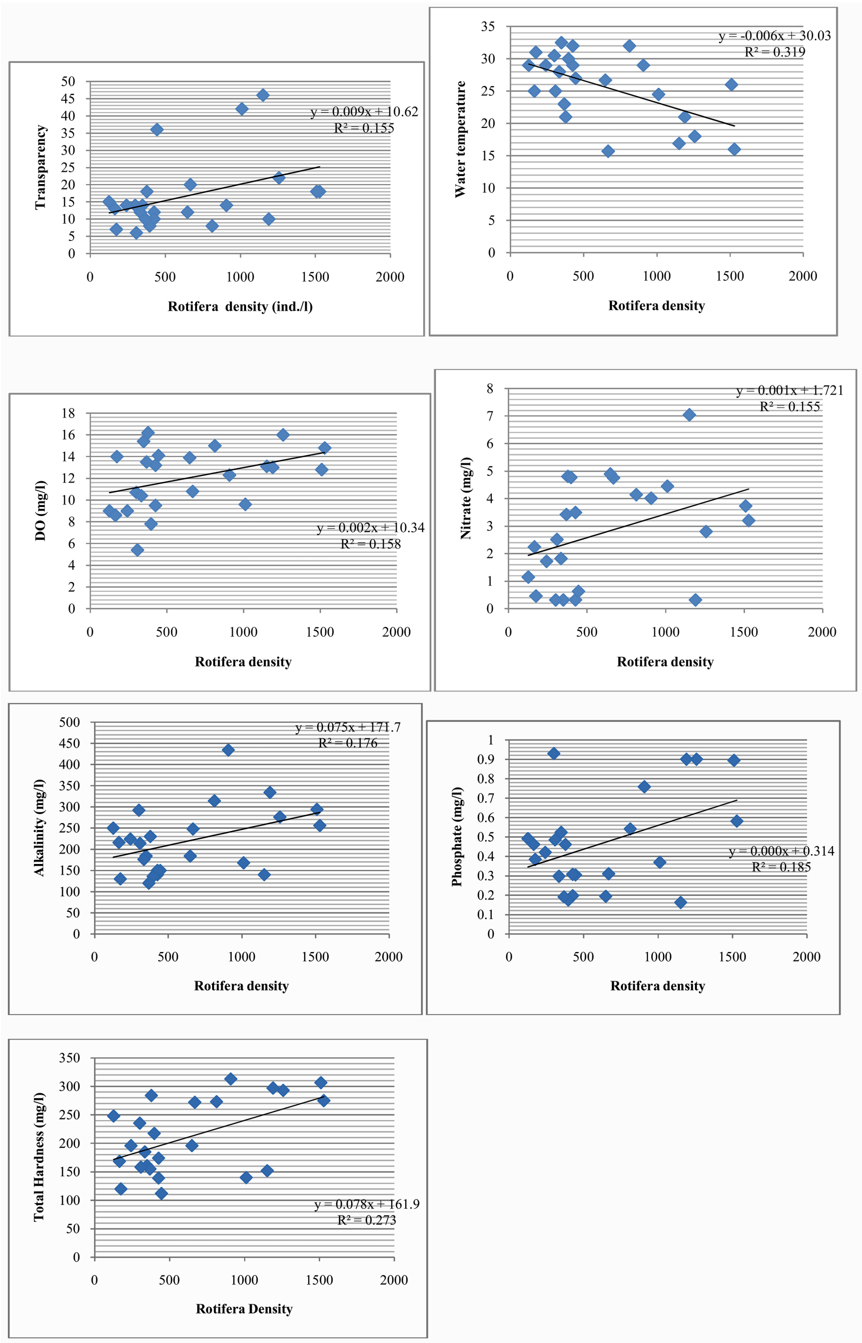

Fig. 5. Coefficients of correlation between mean density of Rotifera and physico-chemical parameters of the sewage fed fish pond.

more than 8 means highly productive nature of a water body. In the present study the average pH recorded was 8.6 units, which indicates productive nature of water body for zooplankton population . Figure 5 shows the regression correlation of Rotifera with some important physico-chemical parameters.

Table 3. Correlation matrix between density of Rotifera and physico-chemical parameters of the sewage fed fish pond during September 2007-August 2009. Bold figures represent the high significance level of correlation.

	Rotifera (ind/1)	Trans-parency	Water temperature	DO (mg/l)	pH	Alkalinity (mg/l)	Nitrate (mg/l)	Phosphate (mg/l)	Total hardness (mg/l)
Rotifera (ind/1)	1								
Transparency	0.374	1							
Water temperature	-0.577	-0.467	1						
DO (mg/l)	0.372	0.068	-0.267	1					
pH	0.139	0.048	-0.019	0.424	1				
Alkalinity (mg/l)	0.429	-0.178	-0.089	0.122	-0.325	1			
Nitrate (mg/l)	0.395	0.362	-0.429	-0.004	-0.132	-0.015	1		
Phosphate (mg/l)	0.439	-0.139	-0.058	0.212	0.047	0.805	-0.305	1	
Total hardness (mg/l)	0.509	-0.247	-0.305	0.164	-0.313	0.849	0.216	0.692	1

CONCLUSION

This study provides information on the diversity and community structure of the rotifers in the sewage fed fish pond. The higher rotifer biodiversity (31 species) observed in this pond indicates rich and diverse nature of rotifers in this pond. However, the value of Sladecek's $Q_{B/T}$ quotient (2.5), species diversity index and presence of several eutrophic species such as *Brachionus angularis, B. calyciflorus, B. rubens, B. diversicornis, Filinia longiseta, Keratella cochlearis* and *Pompholyx sulcata* in good numbers in this pond indicates it's eutrophic condition.

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