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An Investigation on some New Records of Rotifer species occurs in Manchar Lake of Province Sindh, Pakistan

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ABSTRACT: A study was conducted to observe the occurrence and diversity of rotifer species found in the Manchar lake of Sindh, Pakistan. A total of 85 species of rotifers were recorded from six selected sampling sites i.e., Danister, Gulshah Pir, Mudiput, Central point Aroni, Garkno and Jarang at Manchar lake. The obtained results revealed that among these 85 reported species of rotifers from Manchar Lake, 25 species were those that are first newly recoded in Pakistan. Thus, it had been concluded that Manchar Lake contain rich diversity of rotifer species as compare to any other Lake in Pakistan. In additions, the frequency of the occurrence of all these rotifer species was also found to be varied among six different selected stations of Manchar Lake. The results of present study also revealed that highest density of rotifers was recorded during the summer season, while their low density was noted during the winter season. Thus, our present work will provides useful information's regarding to the distributions and diversity of rotifers species that later could be valuable for aqua culturists and fisheries managers of Pakistan.

Keywords: Rotifers, species diversity, Manchar lakes.

INTRODUCTION

Rotifers (wheel animals) are mainly an important group of the limnetic and littoral micro-invertebrates. Some are colonial, while others are sessile, living inside tubes or gelatinous holdfasts that are attached to a substrate (Sharma, 2009; Wallace and Snell, 2010). Their size ranged from 3 to 100 µm depending on aquatic medium and availability of food. These interesting organisms symbolize as one of the most primitive groups of invertebrates (Sladecek, 1983).

Freshwaters are the main source of rotifers and are supposed to be their original habitat because more than 95% rotifers are found in freshwater habitats. The rotifers are present in every inland aquatic biotope clean or contaminated. Wallace and Snell (2010) reported that rotifers can survive in both lentic and lotic environments, like Lakes, rivers and streams. An increase in rotifer population depends upon the increase of eutrophication in the lake (Park and Marshall, 2000). The rotifers are considered opportunistic in feeding, since they consume and adapt different types of food resources, while some are highly specialized feeders (Wallace and Snell, 2010). Rotifers are essential food for fish fry and because they contribute to survival and faster growth of the cultured fish. The fish larvae are also fed by the several genera of rotifers (Kitto and Bechara, 2004).

Rotifers showed high population diversities and densities. They have high acceptances to ecological and biological condition of various ecosystems (Neves *et al.,* 2003). Therefore, present study was conducted to observe the species diversity and occurrence of rotifers in Manchar Lake of Province Sindh, Pakistan. Our present work will provides useful information's regarding to diversity and newly records of some more rotifers species in Pakistan. Furthermore, such study would be useful for aqua culturists and fisheries managers that use these micro invertebrate fauna for feeding purpose of fish fry during fish culture in hatcheries.

MATERIALS AND METHODS

A. Sampling Sites

In the present investigation, six sampling stations were selected namely Danister, Gulshah Pir, Mudiput, Central point Aroni, Garkno and Jarang for the zooplankton sampling as shown in Table 1, respectively.

B. Samples Collection and Identification

Zooplankton were collected from Manchar Lake for two years study period that extends from August 2011 to July 2013 at six selected stations at Manchar Lake by using planktonic net with mesh size 55 µm.

Table 1: Showing the position and elevation of all six sampling stations.

S. No	Station	Elevation in feet	Latitude	Longitude
1	Danister	111	26º, 15 min, 54.36 sec	67º, 24 min, 50.76 sec
2	Gulshah Pir	111	26º, 15 min, 54.82 sec	67º, 24 min, 50.76 sec
3	Mudiput	111	26º, 15 min, 54.36 sec	67º, 24 min, 50.76 sec
4	Central point Aroni	99	26º, 15 min, 37.94 sec	67º, 24 min, 0.86 sec
5	Garkno	111	26º, 15 min, 51.84 sec	67º, 24 min, 12.16 sec
6	Jarang	111	26º, 15 min, 54.36 sec	67º, 24 min, 50.76 sec

Rotifera samples were collected for both qualitative and quantitative sampling by using plankton net and Kemmerer bottle (1.2 liter). Samples were brought to the laboratory and preserved in 4% formalin. The taxonomic identifications of all samples were completed by using binocular microscope (Nikon Eclipse E 200) at 40X and 100X magnifications and Sedgwick-Rafter counting chamber was used for counting of zooplanktons.

RESULTS AND DISCUSSION

A. Diversity of rotifer species

In the present study, about 85 species of the rotifers were identified and recorded during the study period that extends from August 2011 to July 2013 in the Table 2, respectively. Furthermore, among these 85 reported species, 25 were those that were first newly recorded in Pakistan.

The species *Brachionus quadridentatus* f. melhemi and *B. urceolaris* f. nilsoni were newly recorded from Pakistan. While six species of genus Keratella were recorded through the study period. Maximum number of specimens belong to this gens were detected at station 3 (Mudiput), whereas other five stations also showed considerable numbers of Katella species. *Katellavalga tropica* f. reducta was first time report from Pakistan. Fourteen species of genus *Lecane* also showed their abundance at nearly all six stations. Among the fourteen species of genus *Lecane*, Six species including *Lecane lauterborni, L. pusilla, L. tudicola, L. aculeate, L. ohioensis* and *L. subtilis* were first time reported from Pakistan. Genus Monostyla comprises 13 species that are mostly uncommon at all six stations (Table 3). *Euchlanis incise* and *Lepadella latusinus* Americana, six species of genus *Monostyla* i.e., *Monostyla acus, M. goniata, M. opias, M. pyriformis, M. tethis* and *M. stenroosi*, two species of genus Macrochaetus (i.e., *Macrochaetus collinsi* var. *braziliensis* and *M. subquadratus*), *Chonochilus unicornis, Diurella rousseleti, Epiphanes brachionus, Ploesoma truncatum, Schizocerca diversicornis* and *Synchaeta stylata* were also first time newly recorded from Pakistan in small population at some stations(see Table 3).

Single species of other genera like, *Mytilina, Testudinella, Platyias, Filinia, Colurella, Squatinella, Pompholyx, Polyarthra, Hexarthra, Gastropus, Dipleuclanis, Notholca, Notommata, Trichocerca* and *Tetramastix* displayed low population throughout the whole study period as shown in Table 2, respectively. In the present investigation, a total of 85 species of rotifers were recorded, which is the largest record of rotifer speciesas compare to any lake of Pakistan, where as, Mahar *et al.* (2000) documented only15 rotifer species from the same Manchar lake of Pakistan in the year 2000. Furthermore, many investigators had also reported different species of rotifers from different fresh water reservoirs of Pakistan including Baloch (2012) reported 16 rotifer species from Hamal Lake, 26 species from Hub Dam, whereas 13 species from Hanna Lake; Sulehria *et al.* (2012) documented 24 rotifer species from Balloki Head works. As rotifers can tolerate extreme high temperature, therefore, their growth becomes rapid with increase in temperature (Galkovskaya, 1987). As Berzins and Pejler (1989) also reported that density of rotifer is also controlled by temperature, therefore, in present study, the highest density of rotifer was recorded during the months of June and July and low density in the month of January, which was in agreement with Stephen *et al.* (2011). However, Watkar and Barbate (2013) found maximum populations of zooplankton in the months of November and December from River Kolar Saoner.

The most dominant genus of rotifer from Manchar Lake was *Brachionus* that comprises18 species. Sharma (1987) also documented 21 species of genus *Brachionus* from India. Baloch *et al*. (2005) documented *Brachionus calyciflorus* f. dorcas and *B. calyciflorus* f. amphiceros from Rawal Lake. In the present study, high population of genus *Brachionus* was reported during the summer season which was in agreement with findings of Patnaik *et al.* (1988).

Table 2: List of Rotifer species identified from Manchar Lake from August 2011 to July 2013.

S. No	Rotifera species	S. No	Rotifera species
1	*Anuraeopsis fissa* Gosse, 1851	44	*L. papuana*Murray, 1913
2	*Ascomorpha* sp. Perty, 1850	45	*L. hastate*Murray, 1913
3	*Asplanchna priodonta* Gosse, 1850	46	*L. inopinata* Harring and Myers, 1926
4	*Asplanchnopus multiceps*Schrank, 1793*	47	*L. lauterborni*Hauer, 1924*
5	*Brachionus angularis* Gosse, 1851	49	*L. pusilla* Harring, 1914*
6	*B. budapestinensis* Daday, 1885	50	*L. tudicola* Harring and Myers, 1926*
7	*B. calyciflorus calyciflorus* Pallas, 1776	51	*L. aculeate* Jakubski, 1912*
8	*B. calyciflorus* f. *amphiceros* Ehrenberg, 1838	52	*L. ohioensis*Herrick, 1885*
9	*B. calyciflorus* f. *anuraeformis* Brehm, 1909	53	*L. subtilis* Harring and Myers, 1926*
10	*B. calyciflorus* f. *dorcas* Gosse, 1851	54	*L. ludwigii* Eckstein, 1883
11	*B. caudatus* Barrois and Daday, 1894	55	*Lepadella latusinus* var. *americana*Myers, 1934*
12	*B. falcatus* Zacharias, 1898	56	*Macrochaetus collinsi* var. *braziliensis*Ahlstrom, 1938*
13	*B. forficula* Wierzejski, 1891	57	*M. collinsi* Gosse, 1867
14	*B. havanaensis*Rousselet, 1911	58	*M. subquadratus* Perty, 1850*
15	*B. leydigii* Cohn, 1862	59	*Monostyla acus* Harring, 1913*
16	*B. plicatilis* O.F Muller, 1786	48	*M. bulla* Harring, 1913
17	*B. quadridentatus* f. *brevispinus* Ehrenberg, 1832	60	*M. crenata* Harring, 1913
18	*B. quadridentatus* f. *melhemi* Barrois and Daday, 1894*	61	*M. furcata* Murry, 1913
19	*B. quadridentatus* f. *rhenanus* Lauterborn, 1893	62	*M. goniata* Harring and Myers, 1926*
20	*B. rubens* Ehrenberg, 1836	63	*M. lunaris*Ehrenberg, 1832
21	*B. urceolaris* Muller, 1773	64	*M. opias*Harring and Myers, 1926*
22	*B. urceolaris* f. *nilsoni* Ahlstrom, 1940*.	65	*M. pygmae* Daday, 1897
23	*Chonochilus unicornis* Rousselet, 1892*	66	*M. pyriformis* Bartos, 1959*
24	*Colurella* Sp.Ehrenberg, 1831	67	*M. tethis* Harring and Myers, 1926*
25	*Dipleuclanis propatula* Gosse, 1886	68	*M. quadridentata* Ehrenberg, 1832
26	*Diurella rousseleti* Jennings, 1903*	69	*M. stenroosi*Meissner, 1908*
27	*Epiphanes brachionus*Harring, 1913*	70	*M. unguitata* Fadeev, 1925
28	*Euchlanis dilatata* Ehrenberg, 1832	71	*Mytilina bicarinata* Perty, 1850
29	*E. incisa* Carlin, 1939*	72	*M. ventralis* var. *brevispina*Ehrenberg, 1832
30	*E. triquetra* Ehrenberg, 1838	73	*Notholca* sp. Gosse, 1887
31	*Filinia longiseta* Ehrenberg, 1834	74	*Notommata* sp. Gosse, 1886
32	*Gastropus* sp. Colbert, 1973	75	*Platyias quadricornis* var. *brevisinus* Ehrenberg, 1832
33	*Hexarthra mira* Hudson, 1871	76	*Ploesoma truncatum*Herrick, 1885*
34	*Keratella valga* Ehrenberg, 1834	77	*Polyarthra trigla*Ehrenberg, 1834
35	*K. valga tropica* f. *reducta* Fadeev, 1927*	78	*Pompholyx complanta*Gosse, 1851
36	*K. cochlearis* Gosse, 1851	79	*Schizocerca diversicornis* Daday, 1883*
37	*K. cochlearis* var. *tecta* Goose, 1886	80	*Squatinella mutica*Ehrenberg, 1832
38	*K. quadrata* Müller, 1786	81	*Synchaeta stylata*Wierzejski, 1893*
39	*K. tropica tropica* Apstein, 1907	82	*Testudinella patina* Hermann, 1783
40	*Lecane candida* Harring and Myers, 1926	83	*Tetramastix opoliensis* Zacharias, 1898
41	*L. curvicornis* Murray, 1913	84	*Trichocerca* sp. Lamarck, 1801
42	*L. levistyla* Olofsson, 1917	85	*Trichotria tetractis*Ehrenberg, 1830
43	*L. luna* O.F Muller, 1776		

Note: * shows the new record of rotifer species from Pakistan.

In the present study, genera Keratella, Lecane and Monostyla were most the diverse groups observed in the Manchar Lakeof Pakistan (Table 3). Most species of *Keratella, Lecane* and *Monostyla* are cosmopolitan in distribution (Arora and Mehra, 2003). Genus Keratella showed maximum population in April and July. Baloch (2010) recorded abundant population of genus Keratella from Hamal Lake and Hub Dam, while minimum number of the individuals of genus Monostylawas reported from the same water bodies. In present investigation, genus *Monostyla* appears to be sensitive indicators of changes in water quality as they showed maximum population in month of May and low population was recorded during the month of January. Whereas, Mahar (2003) reported opposite results that is higher population of this genus was observed during the colder months, while low population observed during the rest of the months of the year. Maemets (1983) described that genus *Monostyla* and *Lecane* are indicators of eutrophication in aquatic medium. In the present study, both *Euchlainsincisa* and *Epiphanes brachionus* were also newly reported from Pakistan. Maximum population of Euchlains species were reported in August and low population in February, while *Epiphanes* species showed maximum population in July. However, Baloch *et al.* (2010) observed opposite consequences from the water bodies near Jamshoro district of Sindh, Pakistan. Genus *Lecane* and *Lepadella* showed maximum population in June and low population recorded in January, which was in agreements with findings from other lakes as previously reported by Sulehria and Malik (2012). In the present study, *Synchaeta stylata*, *Macrochaetus collinsi* var. braziliensis and *M. subquadratus* are first record from Pakistan. *Hexarthra* and *Synchaeta* genera showed maximum population in April and July, while low population recorded in August.

Chalkia and Kehayias (2013) observed small population of *Hexarthra mira* and *Synchaeta* after summer. Smallest population of *Filinia longiseta* in Manchar Lake is due to low depth of water. *Filinia longiseta* prefers deeper waters as seen in Japanese lakes (Baloch *et al.*, 2000). Genus *Filinia*, *Polyarthra* and *Platyias* were also reported in low population from the Ravi River by Malik and Sulehria (2004). Although very low population of genus *Platyias* was seen throughout the present study, but Haq *et al.* (2001) also documented same genus from tanneries near Lahore city. In present study, low populations of *Tetramastix opoliensis* and *Trichotria tetractis* were documented from Manchar Lake, while in contrast, Sharma *et al.* (2013) reported the high population densities of *Tetramastix opoliensis* and *Trichotria tetractis* from lotic and lentic water bodies. Very low population of *Asplanchna priodonta* and *Anuraeopsis fissa* was also reported by Baloch (2012) from Hamal Lake.

Yalim *et al.* (2011) reported *Ascomorpha saltans* in autumn and winter months and *Pleuroxus aduncus* in winter and spring months. The seasonal variations of rotifers and concentration of oxygen may also be consider as significant factor that attributed to the activity of the rotifers and other zooplankton and can also affect the occurrence on their distribution at different stations of Manchar Lake.

B. Occurrence frequency of rotifer species

In the present study, although minimum population of *Anuraeopsis fissa*, *Ascomorpha* sp. and *Asplanchna priodonta* were observed at most of the stations of Manchar Lake, however, *Ascomorpha* species was abundantly found at station 3 (Mudiput). Large population of *Asplanchnopus* species i.e., *Asplanchnopus priodonta* and *A. multiceps* and *Brachionus* species were recorded at all six selected stations of Manchar Lake. Genus *Brachionus* contributed 18 species being the most prevailing genera among rotifers as shown in Table 3, respectively.

Table 3: Occurrence of rotifer species among six stations of Manchar Lake.

Name of Genera	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
Anuraeopsis	−	+ +	−	+	+ +	−
Ascomorpha sp.	+	−	+ +	+	−	−
Asplanchna	+	−	+	+	−	−
Asplanchnopus	+ +	+	−	−	+	+ +
Brachionus	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
Chonochilus	+	−	−	−	−	+
Colurella Sp.	+ + +	+ +	+ +	+	+ + +	+ +
Dipleuclanis	−	+	−	−	+ +	−
Diurella	+	−	−	+	−	+
Epiphanes	+ +	+	+	−	+	−
Euchlanis	+	+ +	+ +	+ +	+ +	+ + +
Gastropus sp.	−	+ +	−	+	−	−
Hexarthra	+ +	−	+	+ +	+ +	+
Keratella	+ + +	+ +	+ + +	+ + +	+ +	+ +
Lecane	+ + +	+ + +	+ +	+ +	+	+ + +
Lepadella	−	+ +	+ + +	+ + +	−	+
Macrochaetus	+	−	−	+	−	+
Mytilina	+ + +	+ +	+ +	+ +	+	+ +
Notholca sp.	−	+	−	−	+	+
Notommata sp.	+	−	−	−	+ +	−
Platyias	+ +	−	+ +	+ +	+ + +	+ + +
Ploesoma	+	+	+	−	+	−
Polyarthra	+ +	−	−	+	−	+ +
Pompholyx	+	+	−	−	−	−
Schizocerca	−	−	+	−	+	−
Squatinella	−	−	+	+ +	+	+ +
Synchaeta	−	+ +	−	+	−	−
Testudinella	+	−	+ +	+	+ +	−
Tetramastix	+	+	−	+	−	−
Trichocerca sp.	+	−	−	+ +	+	+ +

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