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## Zooplankton from a polluted river, Mula (India), with record of *Brachionus rubens* (Ehrenberg, 1838) epizoic on *Moina macrocopa* (Straus, 1820)

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**Abstract.** Rotifera and Cladocera are free living zooplankton elements known to dominate freshwater habitats. Few rotifers are known to be parasitic and epizoic living in association with other organisms. Zooplankton from the polluted river Mula, Pune, Maharashtra was sampled from January to November 2009. Eighteen rotifers and ten cladocerans were recorded during the study. Samples revealed rotifer *Brachionus rubens* (Ehrenberg, 1838) epizoic on cladoceran *Moina macrocopa* (Straus, 1820), the occurrence of which coincided with lower dissolved oxygen (DO) content. The rotifers *Asplanchnopus multiceps* (Schrank, 1793), *Lacinularia elliptica* (Shephard, 1897) and the cladoceran *Kurzia longirostris* (Daday, 1898) are new records to Maharashtra state. The present study was an attempt to monitor a polluted habitat for zooplankton fauna. Detailed studies on organically polluted eutrophic habitats could add new insights into zooplankton diversity and behaviour.

### INTRODUCTION

Freshwater zooplankton fauna comprises Rotifera, Cladocera, Copepoda and Ostracoda of which Rotifera and Cladocera are relatively abundant. Zooplankton occupies an important position in the trophic structure and plays an important role in the energy transfer of an aquatic ecosystem.

Limnological studies in India have been focused mainly on molluscs, fish and birds whereas studies on zooplankton have been fairly neglected. Of the total rotifer count world wide (2030) only 360 species have been reported from India. This accounts for only 18 % of the total global fauna. The number of cladoceran species reported in India is 190 (Raghunathan & Kumar, 2002), though only close to a hundred species have been described in detail (Michael & Sharma, 1988). The global diversity of cladocerans is more than 600 species.

River Mula (Pune, India) is highly affected by domestic organic pollution. Therefore it was our endeavour to study the zooplankton fauna from this polluted water body.

Live samples revealed rotifer *Brachionus rubens* (Ehrenberg, 1838) epizoic on the cladoceran *Moina macrocopa* (Straus, 1820) in large numbers for the first time from Maharashtra state, along with few new records to Maharashtra state.

### MATERIAL AND METHODS

The sampling was carried out at river Mula, (Pune, India) from 21<sup>st</sup> January to 21<sup>st</sup> November 2009, once every two months. River Mula originates in the Western Ghats (Mulshi, Maharashtra). Mula is a tributary of the Bhima River in Deccan Plateau, India.

Random water samples were collected from the littoral region of the river at Aundh bridge, Pune (18° 34' 06 N; 73° 48' 38 E). The collection site consisted of submerged aquatic plants *Vallisneria* and *Ipomea* species along the littoral region. The site is very close to a cemetery and a garbage depot. The site is regularly used for washing clothes and bathing.

Horizontal sampling for Rotifera was done using 53 µm mesh size Nytex nylon Plankton Net.

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Horizontal sampling for Cladocera was done using Nylon Net (150 µm). For Chydorid Cladocerans the littoral sediment was scraped using a hand net.

Samples were immediately preserved in 4% formaldehyde solution. Few live samples were also carried to the laboratory.

Temperature, pH, electric conductivity, total dissolved solids (TDS) and salinity were the parameters recorded onsite using Multiparameter PCS Tester 35 (Eutech, Singapore). Dissolved oxygen (DO) was calculated using the modified Winkler method (Montgomery, 1964) Cladocera and Rotifera were identified using Olympus Magnus (MS-24) dissecting binocular microscope and Olympus phase contrast microscope (Magnus MLXi) fitted with a digital camera (Sony DSC-W35) respectively. Identifications were made using keys by (Michael & Sharma, 1988; Korovchinsky, 1992; Smirnov, 1992; Sharma, 1983).

## RESULTS

The study revealed 18 rotifers and 10 cladocerans from the collection site (Table 1). Physical-chemical parameters, which were recorded along with monthly occurrence of species, have been

listed in (Table 2). Though the species diversity of Rotifera was comparatively high, the most dominant group in terms of abundance was Cladocera. Six species of genus *Brachionus* were recorded during this study confirming the dominance of genus *Brachionus* (33 % of total rotifer count) as previously reported (Sharma, 1983). The rotifers *Asplanchnopus multiceps*, *Lacinularia elliptica* and the chydorid *Kurzia longirostris* are new additions to current zooplankton fauna of Maharashtra. The cladoceran *Kurzia longirostris* was predominant in sediment samples.

In March 2009 numerous *Brachionus rubens* were found to be epizoic on the body surface of the cladoceran *Moina macrocopa*, the number of rotifers attached to a single host ranging from 10–35. *Brachionus rubens* was relatively more attached to the posterior region, as compared to the head, antennae and limbs (Fig. 1). Further sampling revealed no such associations although free swimming specimens of *B. rubens* and *M. macrocopa* were observed. This is the first record of rotifer-cladoceran association from Maharashtra state.

Epizoic associations between rotifers and cladoceran were seen only in March 2009 when the dissolved oxygen content was lowest.

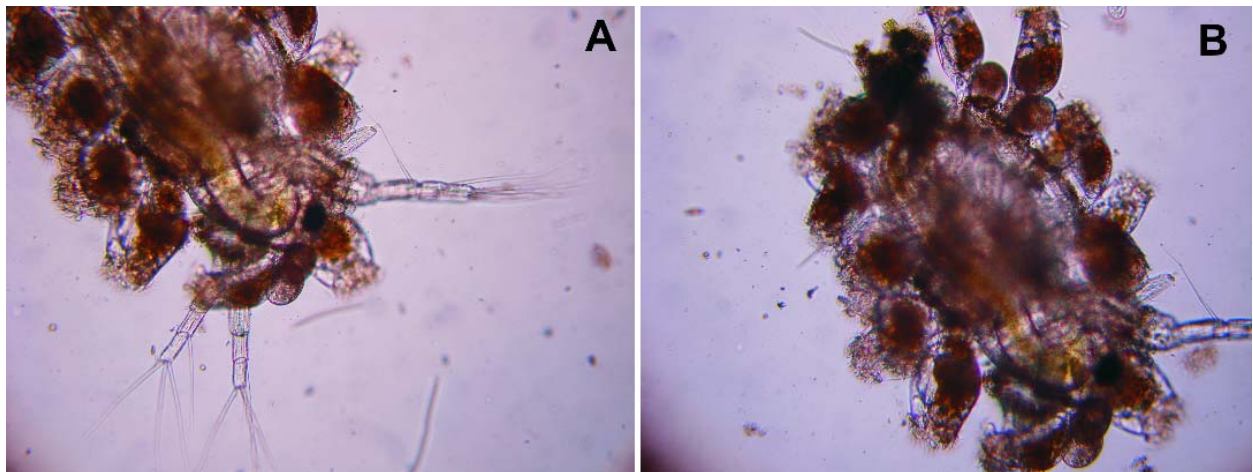


Figure 1. *Brachionus rubens* epizoic on *Moina macrocopa* from Mula River

**Table 1.** Month-wise distribution of recorded Rotifera and Cladocera (“+”: present, “-”: absent)

Zooplankton	Jan 21.01.09	March 21.03.09	May 21.05.09	Sept 21.09.09	Nov 21.11.09
<b>Rotifera</b>					
<i>Asplanchna brightwellii</i> Gosse, 1850	-	+	-	-	-
<i>Asplanchnopus multiceps</i> (Schränk, 1793)	-	+	-	+	-
<i>Beauchampiella eudactylota</i> Gosse, 1886	-	-	-	+	-
<i>Brachionus angularis</i> Gosse, 1851	-	+	+	-	-
<i>Brachionus calyciflorus</i> Pallas, 1766	-	+	+	-	-
<i>Brachionus caudatus</i> Barrois & Daday, 1894	+	+	+	-	-
<i>Brachionus falcatus</i> Zacharias, 1898	+	-	-	-	+
<i>Brachionus quadridentatus</i> Hermann, 1783	-	+	+	-	+
<i>Brachionus rubens</i> Ehrenberg, 1838	+	+	-	-	-
<i>Cephalodella</i> sp.	+	+	+	-	-
<i>Epiphanes brachionus spinosa</i> (Rousselet, 1901)	+	+	-	-	-
<i>Filinia longiseta</i> (Ehrenberg, 1834)	+	+	+	+	-
<i>Filinia terminalis</i> (Plate, 1886)	+	+	+	+	-
<i>Lacinularia elliptica</i> Shephard, 1897	-	-	-	-	+
<i>Platyonus patulus</i> Müller, 1786	+	+	+	+	-
<i>Platyias quadricornis</i> (Ehrenberg, 1832)	+	-	-	+	-
<i>Polyarthra vulgaris</i> Carlin, 1943	+	+	+	+	-
<i>Testudinella</i> sp.	+	+	-	-	+
<b>Cladocera</b>					
<i>Ceriodaphnia cornuta</i> Sars, 1885	-	-	-	-	+
<i>Ilyocryptus spinifer</i> (Herrick, 1882)	-	-	-	+	+
<i>Karualona</i> sp.	-	-	-	+	-
<i>Kurzia longirostris</i> (Daday, 1898)	+	+	+	+	-
<i>Latonopsis australis</i> Sars, 1888	-	-	-	+	-
<i>Leydigia</i> sp.	+	-	-	+	+
<i>Macrothrix spinosa</i> King, 1953	-	-	-	+	-
<i>Moina macrocopa</i> (Straus 1820)	+	+	+	-	-
<i>Moina</i> sp	+	+	+	-	-
<i>Simocephalus vetulus</i> (Mueller 1776)	-	-	-	+	+

**Table 2.** Abiotic parameters of water Mula River. (Sampling has not been done in July 2009 due to heavy monsoon rains)

Abiotic parameters	21. Jan.'09	21. Mar.'09	21. May.'09	21. Sep.' 09	21. Nov. ' 09
pH	8.2	7.8	7.6	7.5	7.3
Temp (°C)	23.8	28.1	32.0	30.2	24.7
Conductivity ( $\mu\text{S cm}^{-1}$ )	633	615	470	719	791
TDS ( $\text{mg L}^{-1}$ )	442	437	332	509	561
Salinity ( $\text{mg L}^{-1}$ )	302	299	227	351	386
DO ( $\text{mg L}^{-1}$ )	7.3	1.2	4.9	3.6	4.1

## DISCUSSION

Few rotifers are known to live in association with other aquatic organisms such as *Daphnia*, *Asellus*, *Gammarus*, crayfish and crabs (May, 1989). However, much less information is available in India regarding such associations. Similar observations have been reported from West Bengal by Sharma (1979) and Iyer & Rao (1993, 1995).

Rotifers and cladocerans are known to co-exist in freshwater habitats and share similar feeding habits. *Brachionus rubens* is a frequently encountered epizoic species found attached to a variety of aquatic organisms like cladocerans, insects and copepods (Iyer & Rao, 1995). An epizoic rotifer lives on another animal for all or part of its life, but does not feed on its host. The rotifer is said to attach to the host carapace by means of sticky secretions from the foot glands (Shiel & Koste, 1985). Such associations can be detrimental to the host as it may lead to predation and loss of movement (Iyer & Rao, 1995).

Shiel & Koste (1985) reported such associations from farm dams in Australia. Iyer & Rao (1993) found such rotifer-cladoceran associations in ponds and tubs and stated infestation of *B. rubens* on Cladocera from organically polluted stagnant waters. We report *B. rubens* epizoic on *M. macrocopa* from an organically polluted river Mula for the first time from Maharashtra, India.

Iyer and Rao (1995) predicted the possible role of predatory rotifer *Asplanchna intermedia* (Hudson, 1886) in the formation of such rotifer-cladoceran associations. The presence of two predatory rotifers *Asplanchna brightwellii* and *Asplanchnopus multiceps* could be the possible reason for the association found in this habitat.

The results clearly indicate the species richness of the water body under study, despite lesser density of hydrophytes. All the recorded species were cosmopolitan.

Extensive studies in the future will reveal the actual diversity of zooplankton from freshwater bodies. The rotifer-cladoceran association studies will also add new insights into such interesting

behaviour. The periodic association of these organisms also needs to be addressed.

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