

DEEPOP BEEL – A RAMSAR SITE OF INDIA:
AN INTERESTING HOT-SPOT WITH ITS RICH
ROTIFERA BIODIVERSITY

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This study analyzed biodiversity of planktonic Rotifera of Deepor Beel, a Ramsar site of India and an important floodplain lake of the Brahmaputra river basin of northeast India. Our report of total 154 species, belonging to 38 genera and 20 families, from this wetland is one of the richest ever known for Phylum Rotifera and hypothesized environmental heterogeneity of this biodiversity ‘hot-spot’. Three species are new to India, one species is new to northeast India and 20 species are new records from Deepor Beel. Our collections are characterized by occurrence of eleven biogeographically interesting elements namely the Australasian *Brachionus dichotomus reductus* and *Notommata spinata*; the Oriental *Brachionus donneri*, *Keratella edmondsoni*, *Lecane blachei* and *Filinia camasecla*; and the paleotropical *Lepadella discoidea*, *Lecane lateralis*, *L. unguitata*, *Testudinella greeni* and *T. brevicaudata*. A number of species showed regional distributional importance in the Indian sub-continent. The Rotifera taxocoenosis of this Ramsar site is characterized by ‘tropical character’, richness of the littoral-periphytonic species, occurrence of many small-sized taxa and qualitative importance of Lecanidae > Brachionidae > Lepadellidae > Trichocercidae while *Lecane* > *Lepadella* > *Brachionus* > *Trichocerca* are species-rich genera.

Key words: Rotifera, composition, distribution, interesting species, tropical floodplain lake

INTRODUCTION

The tropical and subtropical floodplain lakes are hypothesized (SEGERS *et al.* 1993) to be the richest habitat for Rotifera. Our initial report of 110 species (SHARMA & SHARMA 2005a) based on 2002–2003 plankton collections from Deepor Beel, a Ramsar site of India and an important floodplain lake of Northeast India, firstly affirmed SEGERS’s hypothesis in the Indian subcontinent. The report of 120 Rotifera species from Loktak Lake (SHARMA 2009a), another Ramsar site of India, re-affirmed our results. Realizing the biodiversity value of the Indian floodplain lakes *vis-a-vis* the role of extensive sampling, the author’s again undertook a detailed limnological survey (August 2008–July 2010) of Deepor Beel and added 21 rotifer species as new records (SHARMA & SHARMA 2011). Subsequent in-depth analysis of our collections revealed three species new to India, one species is new to northeast India and 20 species are new records from this important floodplain

lake of the Brahmaputra river basin of Assam. The present study raised the total tally of Rotifera known from this Ramsar site to 154 species which is one of the richest biodiversity ever known for this Phylum. Besides, our collections revealed several species of global and regional distributional interest. This paper presents an inventory of the rotifer species recorded so far from Deepor Beel. Remarks are made on various biogeographically important elements and on distribution of interesting species. In addition, the nature and composition of the observed rotifer diversity are discussed.

MATERIALS AND METHODS

The present study is based on plankton samples collected by the authors (November 2002–October 2003 and August 2008–July 2010) from Deepor beel (long.: 91°35′–91°43′E, lat.: 26°05′–26°11′N; area: 40 km²; altitude: 42 m a.s.l.), the Kamrup district of Assam state of Northeast India (Fig. 1). This floodplain lake is covered with various aquatic macrophytes namely *Hydrilla verticillata*, *Eichhornia crassipes*, *Vallisneria spiralis*, *Utricularia flexuosa*, *Trapa bispinosa*, *Euryale ferox*, *Najas indica*, *Monochoria hastaeifolia*, *Ipomea fistulosa*, *Hygrorhiza aristata*, *Polygonum hydropiper* and *Limnophila* sp.

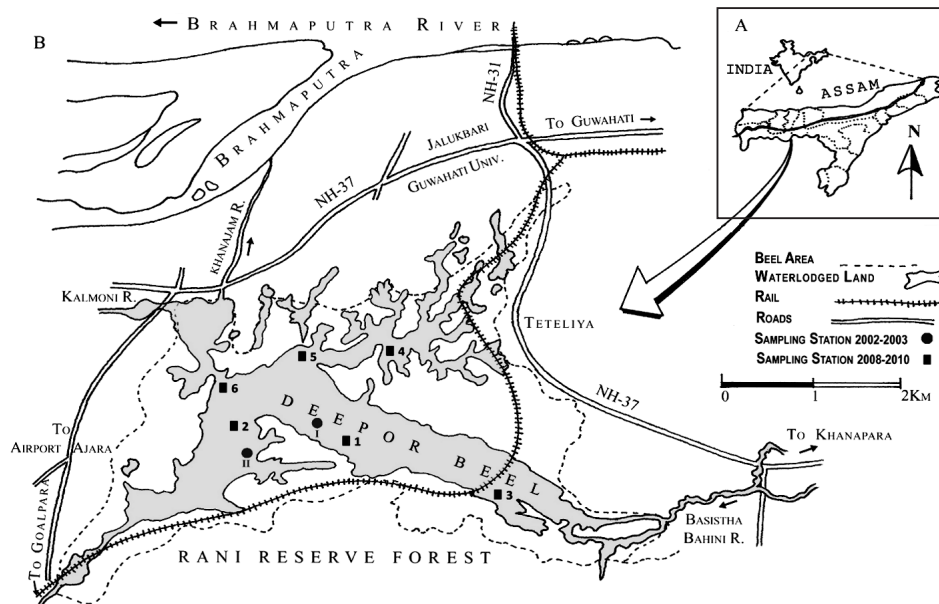


Fig. 1. A = map of indicating location Deepor Beel, B = map showing sampling sites (2002–2003 and 2008–2010)

Qualitative plankton samples were collected monthly by towing a nylobolt plankton net (No. 25), earlier (November 2002–October 2003) at two sampling stations and presently (August 2008–July 2010) at six sampling stations, from this Ramsar site and were preserved in 5% formalin. On each sampling occasion, aquatic vegetation was disturbed before towing plankton net to facilitate collection of planktonic and semi-planktonic (littoral-periphytonic) rotifers. All plankton samples were screened; the rotifer taxa were isolated and mounted individually in polyvinyl alcohol-lactophenol mixture. Different species were identified following KOSTE (1978), SEGERS (1995), SHARMA (1998a) and SHARMA and SHARMA (1999, 2000, 2008). Photographs were taken with a Leica DM1000 image analyzer. SEGERS (2002) was followed for the recent system of nomenclature of Rotifera and remarks on the distribution were made *vide* SEGERS (1995, 1996, 2001, 2007, 2008) and SHARMA and SHARMA (2005b, 2008). The rotifer community similarities were calculated following Sørensen's index (SØRENSEN 1948). The reference materials were deposited in the holdings of Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong.

RESULTS

A total of 154 species of Rotifera spread over 38 genera and 20 families are documented from Deepor Beel, based on our 2002–03 and 2008–10 collections, and their systematic list is presented below.

Systematic list of the recorded Rotifera

- Phylum: Rotifera
 Class: Eurotatoria
 Subclass: Monogononta
 Order: Ploima
 Family: **Brachionidae**
Anuraeopsis fissa GOSSE, 1851
A. navicula ROUSSELET, 1911*
Brachionus angularis GOSSE, 1851
B. bidentatus ANDERSON, 1889
B. budapestinensis DADAY, 1885**
B. calyciflorus PALLAS, 1766
B. caudatus BARROIS & DADAY, 1894
B. caudatus aculeatus (HAUER, 1937)
B. caudatus personatus (AHLSTROM, 1940)
B. dichotomus reductus KOSTE & SHIEL, 1980*
B. diversicornis (DADAY, 1883)
B. donneri BREHM, 1851 #
B. durgae DHANAPATHI, 1974*
B. falcatus ZACHARIAS, 1898
B. forficula WIERZEJSKI, 1891
B. forficula minor (VORONKOV, 1913)
B. mirabilis DADAY, 1897
B. quadridentatus HERMANN, 1783
B. rubens EHRENBERG, 1838 #
Keratella cochlearis (GOSSE, 1851)
K. edmondsoni AHLSTROM, 1943*
K. lenzi HAUER, 1953
K. procurva (THORPE, 1891)**
K. quadrata (O. F. MULLER, 1786) #
K. tecta (GOSSE, 1851)**
K. tropica (APSTEIN, 1907)
Platyias leloupi GILLARD, 1957*
P. quadricornis (EHRENBERG, 1832)
Plationus patulus (O.F. MULLER, 1786)
P. patulus macracanthus (DADAY, 1905)
 Family: **Epiphanidae**
Epiphanes brachionus (EHRENBERG, 1837)
E. senta (O. F. MULLER, 1773)**
 Family: **Euchlanidae**
Euchlanis dilatata EHRENBERG, 1832
E. incisa CARLIN, 1939
E. triquetra EHRENBERG, 1838
Dipleuchlanis propatula (GOSSE, 1886)
Tripleuchlanis plicata (LEVANDER, 1894)

Beauchampiella eudactylota (GOSSE, 1886)

Family: Mytilinidae

Lophocharis salpina (EHRENBERG, 1834)

Mytilina acanthophora HAUER, 1938 *

M. bisulcata (LUCKS, 1912)

M. ventralis (EHRENBERG, 1830)

M. ventralis longidactyla WULFERT, 1965

Family: Trichotriidae

Macrochaetus collinsi (GOSSE, 1867) **

M. longipes MYERS, 1934 *

M. sericus (THORPE, 1893)

Trichotria tetractis (EHRENBERG, 1830)

Family: Lepadellidae

Colurella obtusa (GOSSE, 1886)

C. sulcata (STENROOS, 1898) *

C. uncinata (O.F. MULLER, 1773)

Lepadella acuminata (EHRENBERG, 1894)

L. apside HARRING, 1916

L. benjamini HARRING, 1916 *

L. biloba HAUER, 1938

L. costatoides SEGERS, 1992 **

L. dactyliseta (STENROOS, 1898) **

L. discoidea SEGERS, 1993

L. elongata KOSTE, 1992 **

L. eurysterna MYERS, 1942 *

L. minuta (WEBER & MONTET, 1918)

L. ovalis (O.F. MULLER, 1786)

L. patella (O.F. MULLER, 1773)

L. rhomboides (GOSSE, 1886)

L. rhomboidula (BRYCE, 1832) #

L. triptera EHRENBERG, 1832

L. triptera alata (MYERS, 1934)

L. (H.) apsicora MYERS, 1934

L. (H.) ehrenbergi (PERTY, 1850)

L. (H.) heterostyla (MURRAY, 1913)

Squatinnella mutica (EHRENBERG, 1832) #

Family: Lecanidae

Lecane aculeata (JAKUBSKI, 1912)

L. arcula HARRING, 1914 *

L. crepida HARRING, 1914

L. curvicornis (MURRAY, 1913)

L. doryssa HARRING, 1914 *

L. elegans HARRING, 1914 **

L. flexilis (GOSSE, 1886)

L. haliclysta HARRING & MYERS, 1926 *

L. hastata (MURRAY, 1913) #

L. hornemanni (EHRENBERG, 1834)

L. inermis (BRYCE, 1892)

L. lateralis SHARMA, 1978 *

L. leontina (TURNER, 1892)

L. ludwigii (ECKSTEIN, 1883)

L. luna (O.F. MULLER, 1776)

L. nana (MURRAY, 1913)**

L. nitida (MURRAY, 1913)

L. ohioensis (HERRICK, 1885)

L. papuana (MURRAY, 1913)

L. paxiana HAUER, 1940 *

L. pertica HARRING & MYERS, 1926

L. ploenensis (VOIGT, 1902)

L. pusilla HARRING, 1914 **

L. signifera (JENNINGS, 1896)

L. sola HAUER, 1936 #

L. tenuiseta HARRING, 1914 **

L. unguata (GOSSE, 1887)

L. (Hm.) blachei BERZINS, 1973 *

L. (Hm.) inopinata HARRING & MYERS, 1926

L. (Hm.) sympoda HAUER, 1929 **

L. (Monostyla) bulla (GOSSE, 1851)

L. (M.) closterocerca (SCHMARDA, 1859)

L. (M.) decipiens (MURRAY, 1913) #

L. (M.) furcata (MURRAY, 1913)

L. (M.) hamata (STOKES, 1896)

L. (M.) lunaris (EHRENBERG, 1832)

L. (M.) monostyla (DADAY, 1897)

L. (M.) obtusa (MURRAY, 1913)

L. (M.) pyriformis (DADAY, 1905)

L. (M.) quadridentata (EHRENBERG, 1830)

L. (M.) stenroosi (MEISSNER, 1908)

L. (M.) thienemanni (HAUER, 1938)

L. (M.) unguitata (FADEEV, 1925)

Family: Notommatidae

Cephalodella forficula (EHRENBERG, 1830)

C. gibba (EHRENBERG, 1830)

C. mucronata MYERS, 1934 #

Monommata longiseta (O. F. MULLER, 1786)

Notommata spinata KOSTE & SHIEL, 1991 *

Family: Scaridiidae

Scaridium longicaudum (O. F. MULLER, 1786)

Family: Gastropodidae

Ascomorpha saltans BARTSCH, 1870 **

Family: Trichocercidae

Trichocerca bicristata (GOSSE, 1887) *

T. bidens (LUCKS, 1912) **

T. capucina (WIERZEJSKI & ZACHARIAS, 1893)

T. cylindrica (IMHOF, 1891)

T. elongata (GOSSE, 1886) #

- T. flagellata* HAUER, 1937 *
- T. iernis* (GOSSE, 1887) *
- T. insignis* (HERRICK, 1885) **
- T. longiseta* (SCHRANK, 1802)
- T. porcellus* (GOSSE, 1851) #
- T. pusilla* (JENNINGS, 1903) *
- T. rattus* (O. F. MULLER, 1776)
- T. similis* (WIERZEJSKI, 1893)
- T. sulcata* (JENNINGS, 1894) **
- T. tigris* (O. F. MULLER, 1786) **
- Family: **Asplanchnidae**
- Asplanchna priodonta* GOSSE, 1850
- Family: **Synchaetidae**
- Polyarthra vulgaris* CARLIN, 1943
- Family: **Dicranophoridae**
- Dicranophoroides caudatus* (EHRENBERG, 1834) *
- Dicranophorus forcipatus* (O. F. MULLER, 1786) **
- Order: **Flosculariaceae**
- Family: **Floscularidae**
- Floscularia ringens* (LINNAEUS, 1758)
- Lacimularia flosculosa* (O. F. MULLER, 1773)
- Limnias ceratophylli* SCHRANK, 1803
- Sinantherina socialis* (LINNE, 1758)
- S. spinosa* (THORPE, 1893)
- Family: **Conochilidae**
- Conochilus unicornis* ROUSSELET, 1892
- Family: **Hexarthridae**
- Hexarthra mira* (HUDSON, 1871)
- Family: **Testudinellidae**
- Testudinella brevicaudata* YAMAMOTO, 1951#
- T. emarginula* (STENROOS, 1898)
- T. greeni* KOSTE, 1981
- T. parva* (TERNETZ, 1892) **
- T. patina* (HERMANN, 1783)
- Pompholyx sulcata* HUDSON, 1885
- Family: **Trochosphaeridae**
- Filinia brachiata* (ROUSSELET, 1901) #
- F. camasecla* MYERS, 1938
- F. longiseta* (EHRENBERG, 1834)
- F. opoliensis* (ZACHARIAS, 1898)
- F. pejleri* HUTCHINSON, 1964 #
- Trochosphaera aequatorialis* SEMPER, 1872
- Sub-class: **Digononta**
- Family: **Philodinidae**
- Rotaria neptunia* (EHRENBERG, 1830)
- R. rotatoria* (PALLAS, 1766)

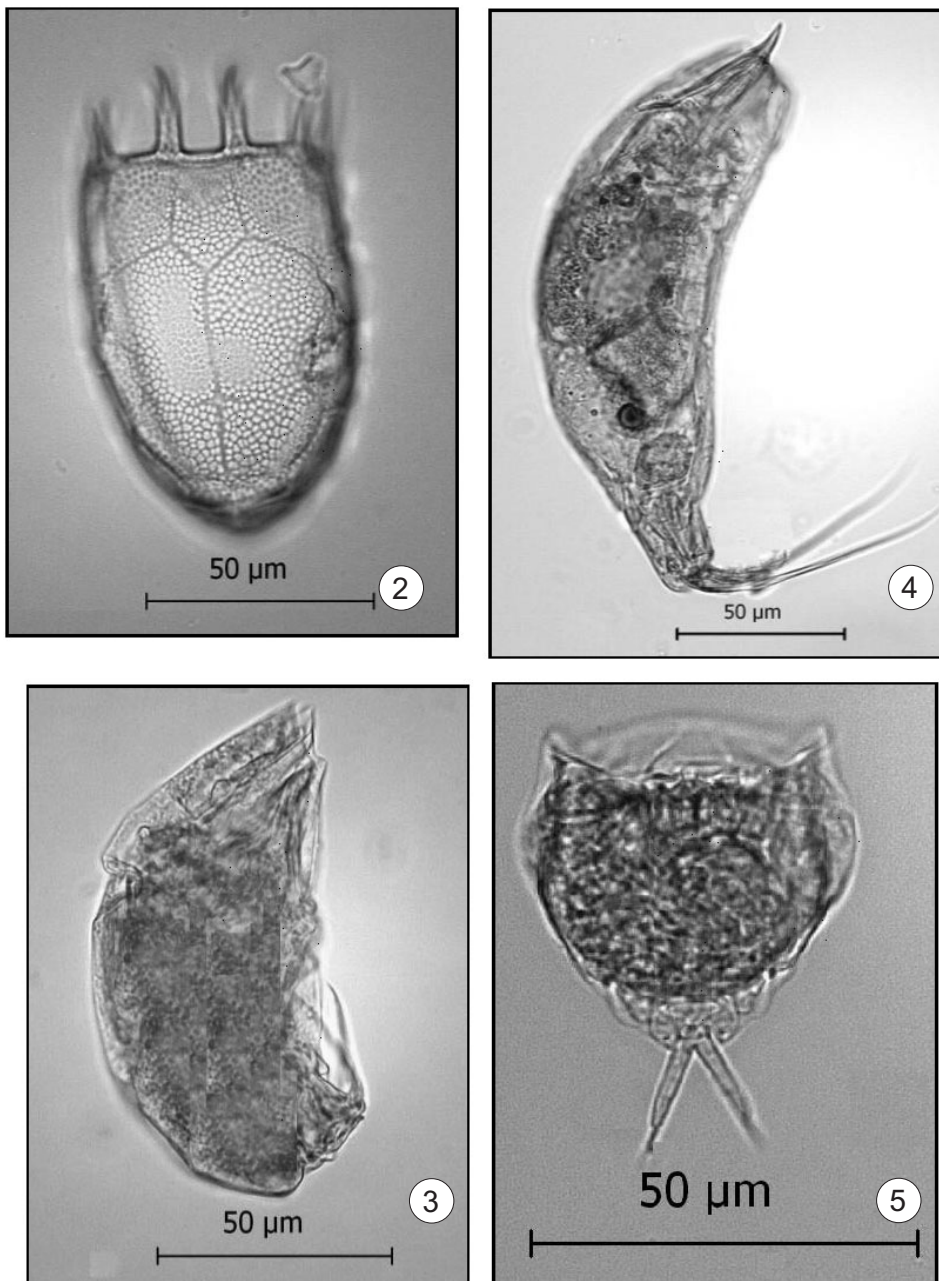
* New records from Deepor Beel (*vide* SHARMA & SHARMA 2011)

** New records from Deepor Beel (present report)

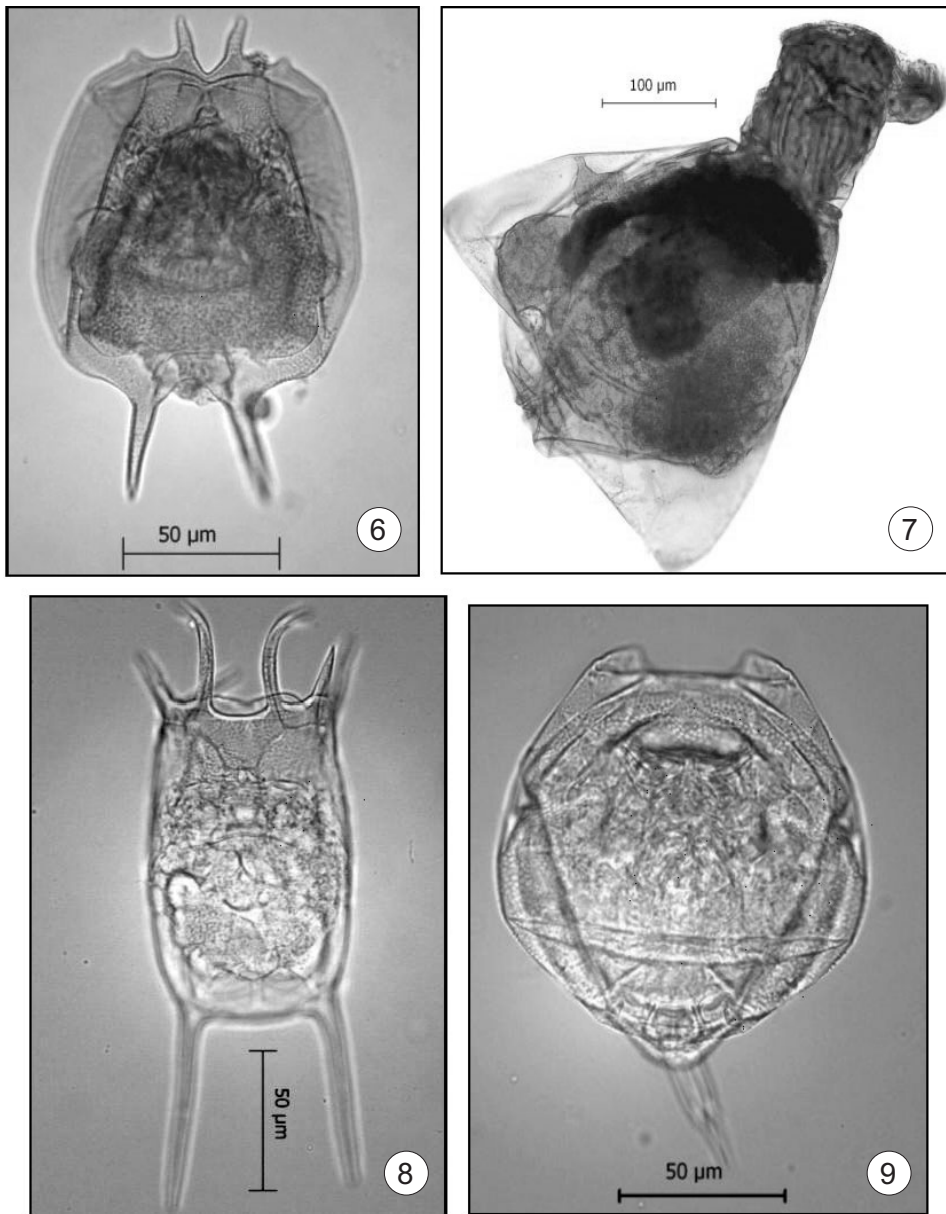
Not observed in our 2008–2010 collections

DISCUSSION

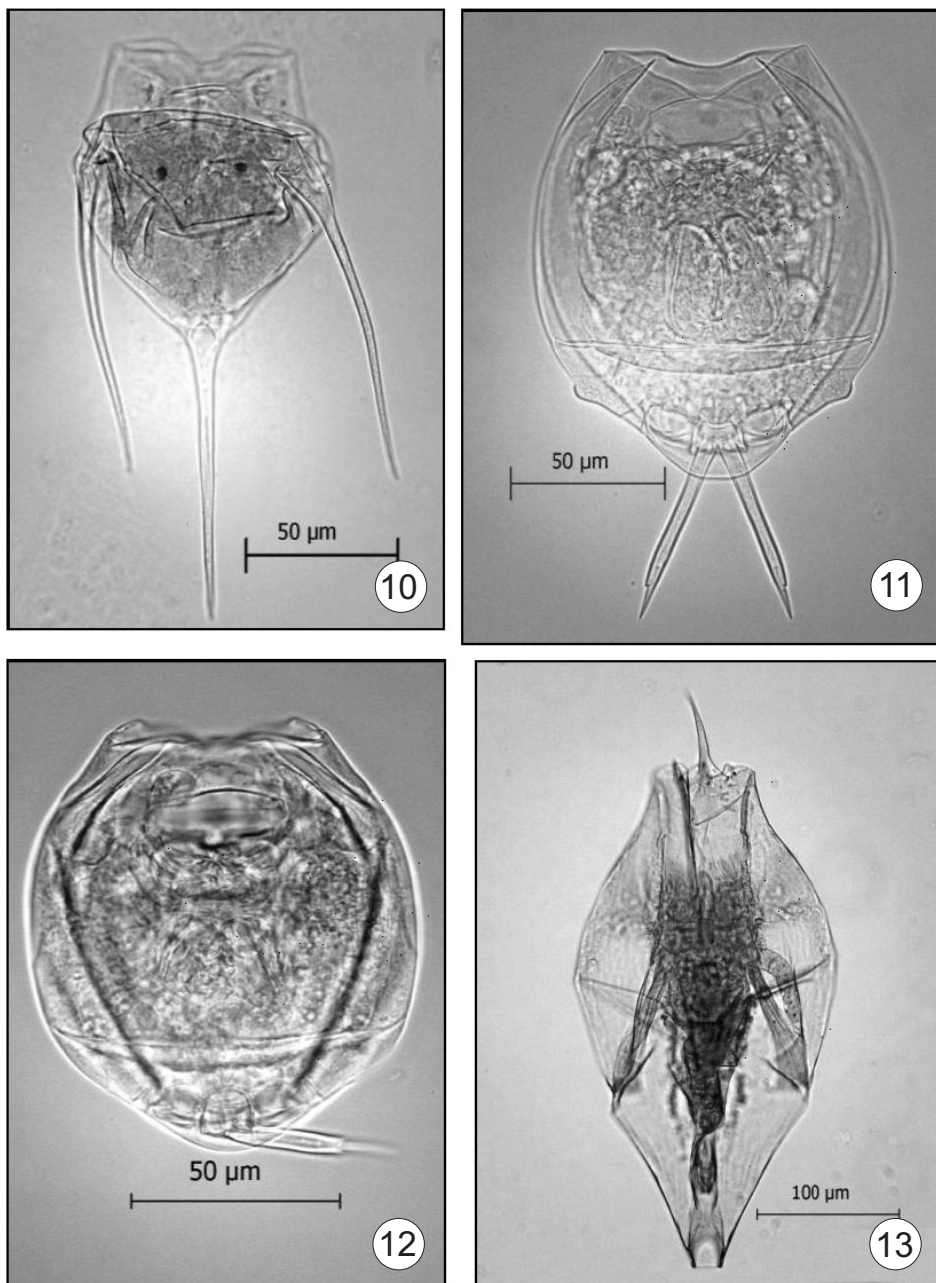
Plankton samples collected from Deepor Beel, during our 2002–2003 and 2008–2010 surveys, revealed a total of 154 species which is the richest biodiversity of Phylum Rotifera known till date from any freshwater ecosystem of South and Southeast Asia and also one of the richest ever known for rotifers. These salient features supported hypothesis of SEGERS *et al.* (1993) indicating (sub) tropical floodplains to be the world's richest habitats for rotifers. *Keratella tecta* (Fig. 2), *Trichocerca bidens* (Fig. 3) and *T. tigris* (Fig. 4) are new to India; *Lecane paxiana* (Fig. 5) is new to northeast India while 20 species are new records from Deepor Beel. The documented species comprised notable component i.e., 68.3% of rotifer fauna of Northeastern India and 39.2% of the Indian Rotifera. Further, amongst 43 genera and 22 families as well as 65 genera and 25 families of this phylum known from Northeast India (SHARMA & SHARMA 2005b) and India (SHAR-



Figs 2–5. 2 = *Keratella tecta* (GOSSE), dorsal view, 3 = *Trichocerca bidens* (LUCKS), lateral view, 4 = *Trichocerca tigris* (MÜLLER), lateral view, 5 = *Lecane paxiana* HAUER, dorsal view



Figs 6–9. 6 = *Brachionus dichotomus reductus* KOSTE et SHIEL, dorsal view, 7 = *Notommata spinata* KOSTE et SHIEL, dorsal view, 8 = *Keratella edmondsoni* AHLSTROM, dorsal view, 9 = *Lecane blachei* BERZINS, dorsal view



Figs 10–13. 10 = *Filinia camasecla* MYERS, dorsal view, 11 = *Lecane lateralis* SHARMA, ventral view, 12 = *Lecane unguitata* (FADEEV), ventral view, 13 = *Testudinella greeni* KOSTE, ventral view

MA & SHARMA 2008) respectively, 38 genera and 20 families known from Deepor Beel reflected rich higher diversity of this group. The species-rich and diverse nature of rotifer communities of Deepor Beel hypothesized environmental heterogeneity of this Ramsar site. The diverse rotifer fauna affirmed biodiversity value of this beel and also concurred with reports from the floodplain lakes of Argentina (JOSE DE PAGGI 1993), Brazil (BONECKER *et al.* 1998) and Australia (SHIEL *et al.* 1998).

The present tally of rotifers (154 species) known from Deepor Beel was higher than the reports of 111 species from the floodplains of Argentina (JOSE DE PAGGI 1993); 124 species (Oguta lake) and 136 species (Iyi-Efi lake) in the Niger delta (SEGERS *et al.* 1993); 130 species from Lake Guarana, Brazil (BONECKER *et al.* 1994); 106 taxa from Thale-Noi Lake, a Ramsar site in Thailand (SEGERS & PHOLPUNTHIN 1997); 104 species from Laguna Bufeos, Bolivia (SEGERS *et al.* 1998); and 114 taxa examined from the Rio Pilcomayo National park (a Ramsar site), Formosa, Argentina (JOSE DE PAGGI 2001). Our list exceeded previous highest Indian report of 120 species from Loktak Lake (a Ramsar site), Manipur (SHARMA 2009a). This report is also distinctly high than the record of 103 species (SHARMA, 2005) from the Dighali Beel, Assam (Northeast India). The richness, however, presented a distinct contrast to 67–103 species (SHARMA 2005) and 69–93 species (SHARMA & SHARMA 2008) reported from different beels of Assam; 62–73 species reported from 14 floodplain lakes (pats) of Manipur (SHARMA 2009b). The authors, however, caution about careful analysis of comparing species richness on absolute numbers as it was likely to be influenced by sampling intensity (DUMONT & SEGERS 1996). We wish to caution against comparisons with other Indian works because of incomplete species inventories, inadequate samplings or frequent over-looking identification of small taxa.

The rotifer communities of Deepor Beel were characterized by occurrence of eleven biogeographically interesting elements (7.1% of the recorded species) because of their restricted distribution and/or endemic nature; these included two Australasian elements namely *Brachionus dichotomus reductus* (Fig. 6) and *Notommata spinata* (Fig. 7); four Oriental endemics *Brachionus donneri*, *Keratella edmondsoni* (Fig. 8), *Lecane blachei* (Fig. 9) and *Filinia camascela* (Fig. 10) and the Palearctic *Lepadella discoidea*, *Lecane lateralis* (Fig. 11), *L. unguitata* (Fig. 12), *Testudinella greeni* (Fig. 13) and *T. brevicaudata*.

The report of Australasian elements from this Ramsar site was noteworthy and affirmed earlier remarks of SHARMA (2005) and SHARMA & SHARMA (2008) reflecting the affinity of Assam Rotifera with those of Southeast Asia and Australia. This salient feature was in contrast to the rotifer faunas of other regions of India. The record of disjunct populations of the *reductus* vicariant of *B. dichotomus*

from Deepor Beel supported the remarks of SEGERS (2001) hypothesizing the recent expansion of these populations to Southeast Asia with Australia as possible origin of this taxon. Further, both *B. dichotomus reductus* and *Notommata spinata* were observed till date from Northeast India only; the former was known from Assam (SHARMA 2005; SHARMA & SHARMA 2008) and Tripura (SHARMA 2009b) while the latter was apparently restricted to the floodplain lakes of Assam (SHARMA 2005; SHARMA & SHARMA 2011).

Of the Oriental endemics, *Brachionus donneri* was noticed in our 2002–2003 collections (SHARMA & SHARMA 2005a) from Deepor Beel while it was interestingly not observed in our recent (2008–2010) survey. *Lecane blachei*, originally described from Cambodia (BERZINS 1973), was known from Thailand (SANOAMUANG 1998); its Indian reports referred to disjunct populations from Assam and Meghalaya, West Bengal and Delhi. *Keratella edmondsoni*, a close relative of pantropical *K. procurva*, was described from Tamil Nadu (AHLSTROM 1943) as *K. quadrata* var. *edmondsoni* while NAYAR (1965) raised it to the status of a distinct species. This interesting brachionid was reported elsewhere from Northeast Thailand only. *Filinia camasecla* was now known for its single Neotropical report from Panama; this report was believed to be an example of its possible introduction (SEGERS 2007).

The Palaeotropical *Lepadella discoidea*, *Testudinella brevicaudata* and *T. greeni* were known till date only from the floodplain lakes of Assam in Northeast India. *Lecane lateralis*, described from West Bengal (SHARMA 1978), was categorized as an Eastern Hemispheric rotifer (SEGERS 2001, SAVANTENALINTON & SEGERS 2005) while it was now considered as palaeotropical element (SEGERS 2007, SHARMA & SHARMA 2008). *Lepadella discoidea* was known from Indonesia, Australia, Zaire, Nigeria and Papua New Guinea while its Indian reports were from Delhi and the northeastern state of Assam.

Ascomorpha saltans, *Brachionus durgae*, *B. mirabilis*, *Keratella procurva*, *K. lenzi*, *Lecane doryssa*, *L. elegans*, *L. haliclysta*, *L. nana*, *L. paxiana*, *L. pusilla*, *L. tenuiseta*, *L. thienemanni*, *Lepadella benjamini*, *L. dactyliseta*, *L. costatoides*, *L. elongata*, *Lophocharia salpina*, *Mytilina acanthophora*, *M. bisulcata*, *Macrochaetus longipes*, *Platyias leloupi*, *Testudinella parva*, *T. emarginula*, *Trichocerca bicristata*, *T. iernis*, *T. insignis*, *T. insulana*, *T. flagellata*, *Tripleuchlanis plicata* and *Trochosphaera aequatorialis* were examples of regional distributional importance in the Indian sub-continent. Of these, *B. durgae* was described as a new species from Andhra Pradesh (DHANAPATHI 1976) while its distribution now extended to the African, Neotropical, Oriental and Palearctic regions (SEGERS 2007). *Lepadella elongata* was reported from Brazil, Ecuador and Nigeria and its only report from the Oriental region was from Thailand (SANOAMUANG & SAVATENA-

LINTON 1999). The sole previous Indian report of *Lecane paxiana* was from the backwaters of the river Yamuna at Delhi (ARORA & MEHRA 2003) in north India; this study extended its distribution range to northeast India. *Lepadella benjamini* and *Lecane elegans* were examined from Manipur (SHARMA 2007) and this study further extended their distribution within northeast region. Interestingly, *Lecane haliclysta*, *L. doryssa*, *L. pusilla*, *L. tenuiseta*, *Lepadella dactyliseta*, *L. costatoides*, *Platyias leloupi*, *Macrochaetus longipes* and *Trichocerca iernis* were known till date from northeast India. On the other hand, *Mytilina acanthophora*, *M. bisulcata*, *Lophocharia salpina*, *Trichocerca bicristata*, *T. flagellata*, *Tripleuchlanis plicata* and *Trochosphaera aequatorialis* exhibited disjunct distributions in India.

A distinct richness of the littoral-periphytonic elements and paucity of eu-planktonic species, the salient features of the rotifer communities of Deepor Beel, hypothesized lack of definite pelagic habitats (DE MANUEL 1994). These, in turn, could be attributed to excessive growth of aquatic macrophytes and shallow nature of this floodplain lake. The frequent occurrence of both planktonic and non-planktonic species in the littoral zone of this Ramsar site with marginal vegetation affirmed occupation of different niches as hypothesized by BONECKER *et al.* (1998). Our collections are characterized by species-rich nature of four Eurotatoria families namely Lecanidae (43 species) > Brachionidae (26 species) > Lepadellidae (22 species) > Trichocercidae (15 species) which collectively formed main component (68.8%) of rotifer species known from this Ramsar site. Further, their importance concurred with the reports from the floodplains of South America (JOSE DE PAGGI 1993, 2001, BONECKER *et al.* 1994, 1998, SEGERS *et al.* 1998), Africa (SEGERS *et al.* 1993), Thailand (SANOAMUANG 1998) and India (SHARMA & SHARMA 2001, 2008, SHARMA 2005, 2009). In addition, Euchlanidae = Testudinellidae = Trochosphaeridae > Flosculariidae > Mytilinidae = Trichotriidae, together (20.1% of the recorded species), deserved mention. In general, importance of the stated families affirmed high richness of non-planktonic rotifers in our collections.

Deepor Beel Rotifera was characterized by large number of small-sized species particularly belonging to *Lecane*, *Lepadella*, *Trichocerca*, *Colurella* and *Anuraeopsis* as well as occurrence of majority of species in low densities; the latter is supported by earlier results of SHARMA (2010). These interesting features could be attributed to conditions of low concentrations of food (PAPINSKI 1990) and predation by juvenile fish and invertebrates (BAUMGARTNER *et al.* 1997). The former aspect was supported by lower phytoplankton density and primary productivity of Deepor Beel (BKS unpublished) though specific observations were yet desired to confirm predation hypotheses.

Latitudinal variations in the distribution, directly or indirectly induced by climatological factors were well known in Rotifera (GREEN 1972, DE RIDDER 1981, DUMONT 1983, SEGERS 1996). SEGERS (2001) stressed the role of thermopiles in

the rotifer fauna of Southeast Asia and indicated the qualitative significance of *Lecane*. This salient feature was affirmed by species-rich nature of *Lecane* (43 species, 27.9%) in Deepor Beel; the importance of this genus concurred with the reports from the floodplain rotifer faunas studied by SEGERS *et al.* (1998b), JOSE DE PAGGI (2001). Three other species-rich genera namely *Lepadella* (18 species) > *Trichocerca* (15 species) > *Brachionus* (14 species) represented 30.5% of the recorded species. Interestingly, 'temperate-centered' *Keratella* included 7 species while *Filinia* and *Testudinella* included 5 species each. Cosmopolitan species showed high richness (69.2% of the listed species) while Cosmotropical (14.1%) Pantropical (9.6%) were well represented in our collections. The stated features, coupled with qualitative significance of 'tropic-centered' genera *Lecane* and *Brachionus*, imparted a general 'tropical character' to the rotifer fauna of Deepor Beel and also concurred with the composition of the tropical faunas from different parts of the globe (GREEN 1972, PEJLER 1977, FERNANDO 1980, DUSSART *et al.* 1984, SEGERS 1996, 2001), SHARMA (1996, 1998b, 2005) and SHARMA and SHARMA (2008).

This study showed notable variations in species observed in our 2002–2003 (*vide* SHARMA & SHARMA 2005a) and 2008–2010 collections; this interesting feature was supported by only 64.8% community similarities (*vide* SØRENSEN index) between two study periods. The difference was further endorsed by the fact that our 2008–2010 collections revealed 21 new records from this Ramsar site (SHARMA & SHARMA 2011); these included *Anuraeopsis navicula*, *Brachionus dichotomus reductus*, *B. durgae*, *Keratella edmondsoni*, *Platylas leloupi*, *Mytilina acanthophora*, *Macrochaetus longipes*, *Colurella sulcata*, *Lepadella benjamini*, *L. costatoides*, *Lecane arcua*, *L. blachei*, *L. doryssa*, *L. haliclysta*, *L. lateralis*, *Notomata spinata*, *Trichocerca bicristata*, *T. flagellata*, *T. iernis*, *T. pusilla* and *Dicranophoroides caudatus*. Further, 24 species (including three new to India, one new to northeast India and 20 new records from Deepor Beel) were exclusively observed in 2008–2010 survey. On the contrary, 16 species reported in earlier 2002–2003 samples (SHARMA & SHARMA 2005a) were not observed in our recent collections; these included *Anuraeopsis navicula*, *Brachionus bidentatus*, *B. donneri*, *B. rubens*, *Keratella quadrata*, *Lepadella rhomboidula*, *Squatinella mutica*, *Lecane hastata*, *L. decipiens*, *L. thienemanni*, *Cephalodella mucronata*, *Trichocerca elongata*, *T. porcellus*, *Testudinella brevicaudata*, *Filinia brachiata* and *F. pejleri*. The rotifer fauna of Deepor Beel registered 78.9% community similarity with that of Loktak Lake (SHARMA 2009a); the differences between Rotifera of these two Ramsar sites of India were attributed to less number of species of *Lecane* (34 species) and distinct paucity of *Brachionus* spp. (5 species) in the latter.

Various acidophilus rotifers (*vide* KOSTE 1978) recorded from Deepor Beel included *Platyonus patulus macracanthus*, *Dipleuchlanis propatula*, *Euchlanis tri-*

quetra, *Mytilina bisulcata*, *Lepadella acuminata*, *Lecane pertica*, *Monommata longiseta* and *Testudinella emarginula*. These are corroborated by slightly acidic – circum neutral nature of waters of this Ramsar site. The relative paucity of *Brachionus* spp. (11 species) and restricted occurrence of majority of them in the recent samples was noteworthy as compared to our earlier report of 14 species (SHARMA & SHARMA 2005a) from this beel. Only 16 rotifers namely *Brachionus caudatus*, *B. falcatus*, *B. quadridentatus*, *Platyonus patulus*, *Platytias quadricornis*, *Keratella cochlearis*, *K. tropica*, *Euchlanis dilatata*, *Lecane bulla*, *L. leontina*, *L. unguitata*, *Asplanchna priodonta*, *Polyarthra vulgaris*, *Sinantherina socialis*, *Conochilus unicoloris* and *Testudinella patina* were perennial elements.

Brachionus falcatus, *B. quadridentatus*, *Keratella cochlearis*, *K. tropica*, *Platyonus patulus*, *Euchlanis dilatata*, *Mytilina ventralis*, *Trichotria tetractis*, *Lepadella rhomboides*, *Lecane bulla*, *L. curvicornis*, *L. luna*, *L. leontina*, *L. papuana*, *L. unguilata*, *L. lunaris*, *Polyarthra vulgaris*, *Testudinella patina*, *Trichocerca similis*, *T. rattus*, and *Filinia longiseta* occurred commonly in Deepor Beel. On the other hand, *Brachionus mirabilis*, *B. donneri*, *B. durgae*, *Keratella edmondsoni*, *Platytias leloupi*, *Tripleuchlanis plicata*, *Mytilina acanthophora*, *M. bisulcata*, *Lepadella apsida*, *L. minuta*, *L. discoidea*, *Lecane hastata*, *L. monostyla*, *L. nana*, *L. paxiana*, *L. pusilla*, *L. tenuiseta*, *L. furcata*, *L. sola*, *L. pyriformis*, *L. thienemanni*, *Notommata spinata*, *Filinia brachiata*, *Testudinella brevicaudata* and *T. greeni* were categorized as rare elements.

To sum up, Rotifera of Deepor Beel exhibited species-rich and diverse nature with occurrence of global and regional biogeographically interest. The species list of local diversity was one of the richest ever known for Phylum Rotifera. The rotifer fauna depicted general tropical character, predominance of non-planktonic littoral-periphytic species, qualitative significance of ‘tropic-centered’ genera *Lecane* and *Brachionus*, large number of small-sized species. Our plankton collections were biased towards sampling monogonont taxa. The studies on benthic, sessile and bdelloids were desired to up-date Rotifer inventory of this Ramsar site. Investigations on rotifer species associations with diverse aquatic macrophytes in this floodplain plain and their seasonal variations merit future interest due to lack of such works from India.

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