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Original Article

Rotifer assemblages (Rotifera: Eurotatoria) of the floodplain lakes of Majuli River Island, the Brahmaputra river basin, northeast India

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Abstract: Our plankton and semi-plankton collections from twelve floodplain lakes (beels) of Majuli River Island, Upper Assam reveal 124 rotifer species (32 genera and 17 families); these merit biodiversity value as ~52.0% and ~30.0% of species, ~68.0 and ~45.0% of genera and ~74.0 and ~65.0% of the families of the Phylum known from northeast India (NEI) and India, respectively. Two species are new to India with *Trichocerca uncinata* as new record to the Oriental region. Eleven species are new to the study area and we provide an updated list (144 species) for following meta-analyses of Majuli Rotifera. Biogeographically important elements include one Australasian, four Oriental, four Palaeotropical and one cosmo (sub) tropical species while several species are of regional distribution interest. The rotifer fauna is predominantly tropical and Lecanidae > Lepadellidae collectively include ~53.0% species but it records paucity of *Brachionus* species. Individual beels record total richness of 60-100 (77 ± 12) species, monthly richness between 24 ± 7-34 ± 7 species and maximum up to 54 species/sample. The results are characterized by high community similarities (59.7-90.4% vide Sørensen's index), more rotifer homogeneity amongst beels, lack of any pattern of temporal richness variations and much limited influence of abiotic parameters.

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Introduction

Segers et al. (1993) hypothesized (sub) tropical floodplain lakes to be the globally rich habitats for rotifer diversity. This hypothesis is extended to the rotifer assemblages of the floodplain lakes (beels) of Assam (Sharma, 2005; Sharma and Sharma, 2005a, 2008, 2012a, 2014a) and pats of Manipur (Sharma, 2009a, 2009b) states of NEI. Various ad-hoc works and incomplete inventories from other Indian floodplains, however, do not facilitate any generalization. The present study is an attempt to analyze this salient feature as well as to examine ecosystem diversity of Rotifera in twelve beels of Majuli (commonly called 'Majoli' or land in the middle of two parallel rivers) - a geographically interesting landform of fluvial geomorphology of the Brahmaputra river system in Assam state of NEI. This largest river island, the world-heritage site and hotspot for flora and fauna is alarmingly shrinking due to erosion and is threatened to cease existence on the world map. We present an inventory of the examined rotifer species with comments on richness, composition, interesting elements, community similarities and influence of abiotic parameters. This report is of biodiversity and ecology value besides providing an update for following meta-analyses on the rotifer diversity of Majuli studied earlier vide Sharma (2014).

Materials and Methods

Our observations are based on water and plankton and semi-plankton samples collected, during September, 2010-August, 2012, from twelve floodplain lakes (beels) of Majuli River Island

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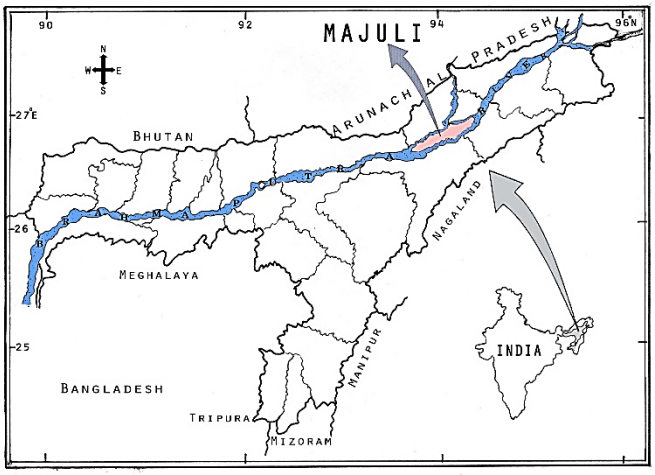

Figure 1. District map of Assam state indicating location of Majuli River Island (insert Map of India indicating Assam state of northeast India).

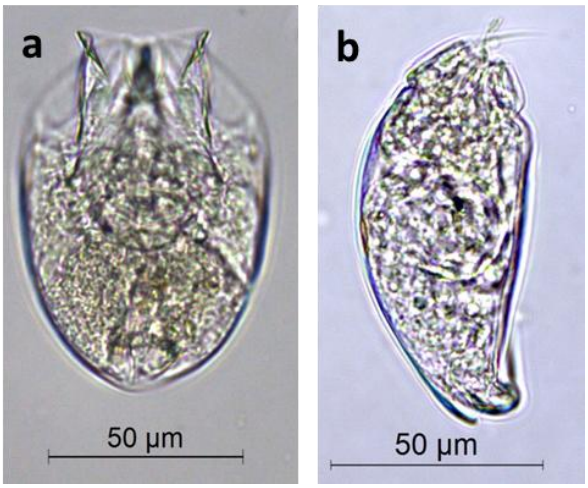

Figure 2. (a) *Testudinella amphora* Hauer and (b) *Trichocerca uncinata* (Voigt).

(Long.: 93°95'E, Lat.: 25°27'N), upper Assam (Fig. 1, Table 1). The sampled beels possessed different aquatic macrophytes' namely *Eichhornia crassipes*, *Hydrilla verticellata*, *Utricularia flexuosa*, *Trapa natans*, *Lemna major*, *L. minor*, *Pistia striates*, *Salvinia* sp., *Nymphaea* spp., *Nymphoides* spp., *Potamageton* spp., *Azolla pinnata*, *Euryale ferox*, and *Sagittaria* sp.

The collections were obtained monthly from six beels (marked with*) and seasonally from rest of the beels (Table 1). Water samples were examined for abiotic parameters. Water temperature, specific conductivity and pH were recorded by the field probes; dissolved oxygen was estimated by Winkler's method while free CO_2, total alkalinity and total hardness were analyzed following APHA (1992). The qualitative plankton samples were collected by towing a plankton net (# 50 µm) from the littoral, limnetic/semi-limnetic regions of different beels and were preserved in 5% formalin. All samples were screened with WILD (M8) dissecting microscope, different rotifers were isolated and mounted in polyvinyl alcohol-lactophenol mixture, and micro-photographs were taken with Leica (DM 1000) stereoscopic phase contrast microscope fitted with an image analyzer. The different species were identified following Koste (1978), Segers (1995) and Sharma and Sharma (1999, 2000, 2008, 2013).

The percentage similarities between rotifer assemblages of the sampled beels were calculated vide Sørensen's index (Sørensen, 1948) and hierarchical cluster analysis was performed using SPSS (version 20). Ecological relationships between abiotic factors and richness were calculated by Pearson's correlation coefficients (r); their P values were determined and significance was ascertained after Bonferroni corrections. The reference collections were deposited in the holdings of Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong.

Results

The details of the sampled beels and their recorded abiotic parameters (Mean ± SD) are indicated in Table 1. Water temperature ranged between 23.4 ± 1.9-24.2 ± 2.3°C; pH between 6.51 ± 0.16-7.04 ± 0.19; specific conductivity between 110.2 ± 20.8-210.4 ± 41.3 µS/cm; dissolved oxygen between 5.1 ± 1.8-7.8 ± 0.7 mg/l; free CO_2 between 10.3 ± 2.4-14.8 ± 4.6 mg/l; total alkalinity between 62.2 ± 13.4-113.5 ± 24.6 mg/l; and total hardness varied between 60.8 ± 13.6-113.0 ± 23.8 mg/l.

We observed a total of 124 species including two new records from India namely *Testudinella amphora* (Fig. 2a) and *Trichocerca uncinata* (Fig. 2b) and globally interesting *Brachionus kostei* (Fig.3a); *Keratella edmondsoni* (Fig. 3b), *Lecane blachei* (Fig.

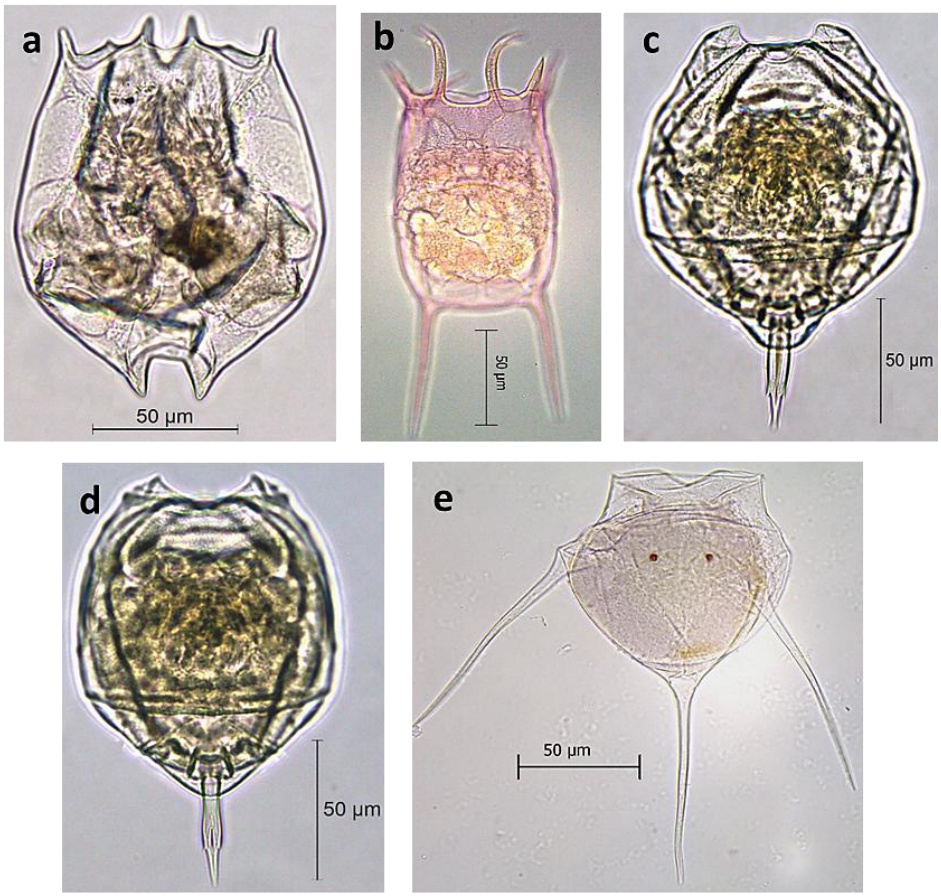

Figure 3. (a) *Brachionus kostei* Shiel (after Sharma, 2014), (b) *Keratella edmondsoni* Ahlstrom, (c) *Lecane blachei* Berzins, (d) *Lecane niwati* Segers, Kothetip and Sanoamuang and (e) *Filinia camascela* Myers.

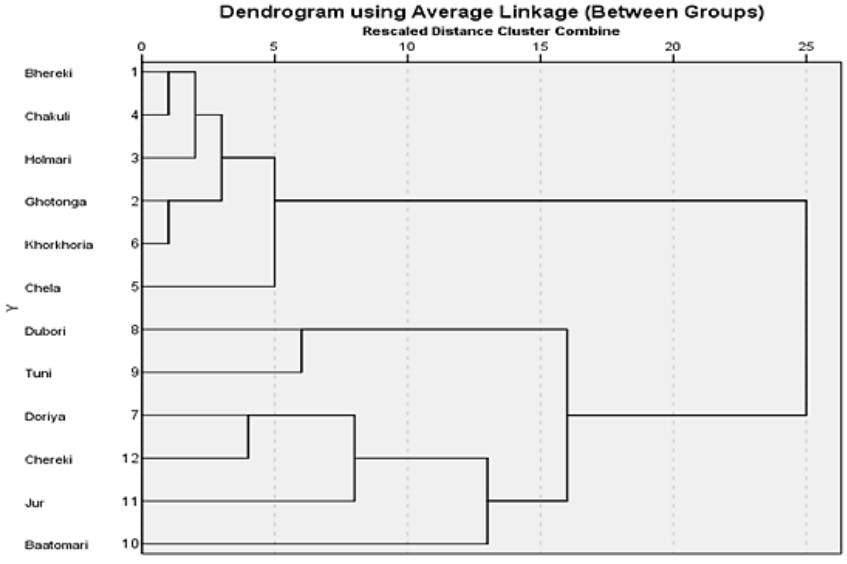

Figure 4. Hierarchical cluster analysis of Rotifer assemblages of different beels.

3c), *L. niwati* (Fig. 3d) and *Filinia camasecla* (Fig. 3e). In addition, *Brachionus durgae*, *Keratella tecta*, *Colurella adriatica*, *Conochilus unicornis*, *Lecane bifurca*, *Lepadella lindaui*, *L. minuta*, *L. triba*, *Mytilina michelangellii*, *Pleosoma lenticulare* and *Trichocerca scipio* are new records to Majuli Rotifera thus updating their total tally to 144 species (Appendix I). Total richness in individual beels (Appendix II) ranged between 60-100 species and recorded 59.7-90.4% community similarities vide

Table 1. The sampled beels of Majuli and their abiotic parameters (Mean ± SD).

Parameters↓ Beels→	**Bhereki***	**Ghotonga***	**Holmari***	**Chela***	**Chakuli***	**Khorkhoria***
Latitude	26°57′09.1″N	27°01′52.7″N	26°59′17.3″N	27° 04′58.2″N	26°56′40.3″N	26° 56′47.4″N
Longitude	94°12′23.0″E	94°15′28.7″E	94°12′30.6″E	94° 17′51.9″E	94°09′01.9″E	94°12′28.8″E
Altitude	67 m ASL	73 m ASL	75 m ASL	89 m ASL	69 m ASL	74 m ASL
Water Temperature °C	23.7 ± 1.7	23.9 ± 1.7	23.6 ± 1.7	23.4 ± 1.9	23.6 ± 1.9	23.9 ± 1.8
pH	6.67 ± 0.23	6.51 ± 0.16	6.87 ± 0.13	7.04 ± 0.19	6.82 ± 0.18	6.80 ± 0.24
Sp. Conductivity µS/cm	140.7 ± 24.4	121.4 ± 26.8	173.6 ± 32.5	210.4 ± 41.3	180.8 ± 37.8	172.1 ± 44.4
Dissolved oxygen mg/l	6.3 ± 0.9	6.2 ± 1.0	7.1 ± 0.8	7.8 ± 0.7	6.2 ± 0.8	6.4 ± 1.2
Free CO_2 mg/l	13.6 ± 4.0	13.8 ± 3.4	10.2 ± 2.8	10.3 ± 2.4	14.8 ± 4.6	13.9 ± 5.0
Total Alkalinity mg/l	70.3 ± 20.7	62.2 ± 13.4	92.3 ± 14.2	113.5 ± 24.6	105.8 ± 29.0	90.2 ± 29.9
Total Hardness mg/l	69.8 ± 20.3	60.8 ± 13.6	89.3 ± 16.9	113.0 ± 23.8	104.0 ± 26.2	88.8 ± 27.2
Parameters↓ Beels→	**Doriya**	**Dubori**	**Tuni**	**Baatomaari**	**Jur**	**Chereki**
Latitude	26°57′27.7″N	26°57′01.9″N	26° 58′35.3″N	26°59′25.9″N	26°59′45.3″N	26°58′25.4″N
Longitude	94°10′02.4″E	94°16′13.8″E	94°15′57.8″E	94°13′08.0″E	94°14′34.4″E	94°10′38.7″E
Altitude	70 m ASL	70 m ASL	67 m ASL	71 m ASL	71 m ASL	67 m ASL
Water Temperature °C	24.2 ± 2.3	24.1 ± 1.9	23.9 ± 2.1	24.0 ± 1.9	23.9 ± 2.5	24.2 ± 1.7
pH	6.70 ± 0.32	6.61 ± 0.19	6.69 ± 0.14	6.87 ± 0.13	6.71 ± 0.14	6.62 ± 0.21
Sp. Conductivity µS/cm	110.2 ± 20.8	132.4 ± 18.6	123.6 ± 23.0	114.2 ± 20.5	130.8 ± 24.6	128.2 ± 33.2
Dissolved oxygen mg/l	5.8 ± 1.2	7.0 ± 0.9	5.1 ± 1.8	6.2 ± 0.9	5.9 ± 1.1	6.1. ± 1.0
Free CO_2 mg/l	12.0 ± 5.2	11.8 ± 4.2	12.2 ± 1.9	11.4 ± 1.9	12.7 ±3.5	12.1 ± 3.6
Total Alkalinity mg/l	67.3 ± 12.2	72.2 ± 11.4	82.3 ± 12.3	91.5 ± 16.2	88.9 ± 12.9	90.8 ± 16.6
Total Hardness mg/l	62.8 ± 12.6	70.8 ± 10.6	79.1 ± 15.6	89.0 ± 12.8	81.4 ± 12.0	86.9 ± 17.0

* Sampled monthly between September, 2010–August, 2012; others sampled during winter (December/January), pre-monsoon (March-May), monsoon (June-August) and post-monsoon (September-October) between September, 2010–August, 2012.

Table 2. Percentage similarities between Rotifera assemblages of Majuli beels.

Beels	1	2	3	4	5	6	7	8	9	10	11	12
1	-	89.9	83.8	90.4	87.7	86.7	73.4	66.2	66.2	71.7	71.1	71.8
2		-	84.1	84.7	80.6	88.2	74.2	70.0	72.7	75.3	69.6	76.0
3			-	87.0	81.0	83.5	67.9	65.3	63.8	66.7	74.5	73.5
4				-	80.0	84.1	72.0	65.8	62.9	65.7	75.0	71.5
5					-	85.7	67.9	61.0	62.2	66.7	69.1	63.8
6						-	73.3	64.9	64.9	73.0	68.4	70.5
7							-	73.3	66.7	73.6	80.9	82.4
8								-	79.5	65.4	70.0	77.3
9									-	72.0	59.7	75.4
10										-	67.5	75.4
11											-	76.0
12												-

1-Bhereki, 2-Ghotonga, 3-Holmari, 4-Chakuli, 5-Chela, 6-Khorkhoria, 7-Doriya, 8-Dubori, 9-Tuni, 10-Baatomari, 11-Jur, 12-Chereki.

Sørensen's index (Table 2). The hierarchical cluster analysis between Rotifer assemblages of different beels is shown in Figure 4.

Discussion

Water temperature concurred with geographical location of the sampled beels. The slightly acidic to circum-neutral and well-oxygenated waters of different beels are notable for low ionic concentrations as reflected by specific conductivity values; the latter warrant inclusion of these ecosystems under 'Class I' category of trophic classification vide Talling and Talling (1965). Free CO_2 occurred in all beels during the study period which, in turn, are characterized by 'bicarbonate alkalinity' and 'moderately hard' to 'hard-water' character.

A total of 124 species, belonging to 32 genera and 17 families, observed from beels of Majuli River Island reflect rich Rotifera assemblage and are of biodiversity value as ~52.0% and ~30.0% species of the taxon known till date from northeast India (NEI)

and India, respectively. Besides, our collections from this limited geographical study area include rich higher diversity of the taxon comprising ~68.0 and ~45.0% of genera and ~74.0 and ~65.0% of the families known from NEI and India, respectively. *Testudinella amphora* and *Trichocerca uncinata* are new additions to Indian Rotifera. The former is known from Australian, Neotropical and Oriental regions (Segers, 2007); it is examined from the last region from Thailand (Sa-Ardrit et al., 2013) and Vietnam (Trinh Dang et al., 2013), and the present report extends its distribution to the Indian sub-region. The Holarctic *Trichocerca uncinata* is a noteworthy new report from the Oriental region; the eastern Himalayan tropical-latitude populations of this cold-water species may represent glacial relicts as hypothesized by Segers (1996).

This study adds eleven species to the rotifer fauna of Majuli studied vide Sharma (2014), thereby, raising their total tally to 144 species and thus affirm our hypothesis (Sharma, 2005, 2009a; Sharma and Sharma, 2008, 2014a) on habitat diversity and environmental heterogeneity of the Brahmaputra river basin floodplains. The sampled beels are species-rich than 110 rotifer species (Arora and Mehra, 2003) known from the backwaters of Yamuna River at Delhi while these are distinctly diverse than the reports of 48 species from 37 beels (Sarma, 2000) and 64 species from 12 beels of the Pobitora Wildlife Sanctuary (Sharma, 2006) of Assam state of NEI; 27 species from two floodplain lakes of Kashmir (Khan 1987); and 38 species from four ox-bow lakes and nine floodplain lakes of South-eastern West Bengal (Khan, 2003). We caution on over-emphasis on comparisons with some ad-hoc Indian reports with incomplete species inventories and inadequate sampling.

The occurrence of biogeographically interesting elements namely the Australasian *Brachionus kostei*; the Oriental endemics *Keratella edmondsoni*, *Lecane blachei*, *L. niwati* and *Filinia camasecla*; the Palaeotropical *Lepadella discoidea*, *L. vandenbrandei*, *Lecane lateralis* and *L. unguitata*; and cosmo (sub) tropical *Brachionus durgae* imparts biodiversity value to our report. Of these, *Brachionus kostei*, *Lecane niwati* and *Lepadella vandenbrandei* are observed till date from this country from NEI with *L. niwati* known only from Majuli and Loktak basin (Sharma and Sharma, 2014b). Amongst the species of regional distribution interest, *Lepadella benjamini*, *L. dactyliseta*, *L. elongata*, *L. quinquecostata*, *Lecane doryssa*, *L. pusilla*, *Macrochaetus longipes*, *Mytilina michelangellii* and *Testudinella tridentata* are known to be restricted to NEI.

Total richness in individual Majuli beels (60-100, 77 ± 12 species) needs cautious analysis with two beels indicating 100 species each while below average richness noticed in seven beels; the latter is hypothesized to invasion of *Eichhornia crassipes* in these wetlands. The results, however, broadly concur with 69-93 species listed from various beels of Assam (Sharma and Sharma, 2008) and also with 71 and 75 species reported from Utra and Waithou pats, respectively of Manipur (Sharma, 2011) but differ from relatively lower richness (62-73 species) observed from 15 floodplain lakes (pats) of Manipur (Sharma, 2009b). On the other hand, Majuli beels record lower rotifer diversity than the reports of 151 (Koste 1974) and 148 species from Rao Tapajos and Lago Camaleao (Koste and Robertson, 1983), respectively; 130 species from Lake Guarana, Brazil (Bonecker et al., 1994); 136 species (Iyi-Efi Lake) and 124 species (Oguta lake) from Niger delta (Segers et al., 1993). Further, Majuli rotifers are less diverse than that of 106 taxa from Thale-Noi Lake, Thailand (Segers and Pholpunthin, 1997); 104 species from Laguana Bufeos, Bolivia (Segers et al., 1998); and 114 taxa from the Rio Pilcomayo National park, Formosa, Argentina (Jose De Paggi, 2001).

High rotifer community similarities amongst the sampled beels (59.7-90.4% vide Sørensen's index) and ~ 61.0% instances in the matrix with similarity values between 71-90% reflect more homogeneity in their composition. This is attributed to common occurrence of several *Lecane* and *Lepadella* species in various beels in particular. Peak similarity

between Bhereki and Chakuli beels is corroborated by their cluster groupings while lowest similarity value is observed between Tuni and Jur beels. Rotifera assemblages of Holmari and Khorkhoria beels with high similarity (88.4%) also exhibit closer affinity vide hierarchical cluster analysis. On the other hand, Dubori beel indicates greatest divergence in its species composition and is followed by Baatomari beel.

The rotifer taxocoenosis (overall and in individual beels) is predominantly tropical with rich diversity of 'tropic centered' *Lecane* (42 species; 21-37, 28 ± 5 species) and common occurrence of several cosmotropical and pantropical species while Lecanidae > Lepadellidae collectively contribute the bulk of species (66 species, ~53.0%) as well as in individual beels (31-57, 42 ± 8 species). The relative consistency of the importance of periphytic taxa of the two most diverse families (~51.0-59.0%) supports hypothesis of Green (2003) on the possibility of assemblage rules for the periphytic rotifer community. On the contrary, paucity of *Brachionus* spp. is noteworthy; it may partly be attributed to the lack of definite pelagic habitats (De Manuel, 1994) in the floodplains, shallow nature and the growth of aquatic macrophytes. The specific observations are, however, desired to highlight factors limiting their occurrence in Majuli beels particularly in light of the report of 18 *Brachionus* species in Assam state (Sharma and Sharma, 2014c) with 16 species occurring in the Brahmaputra floodplains (Sharma and Sharma, 2014d).

Of the six monthly sampled beels, the monthly rotifer richness varied between 24 ± 7 species (Chela beel) - 34 ± 7 species (Khorkhoria beel); it lacked any pattern of monthly or annual variations. Amongst seasonally sampled six beels, the richness varied between 33 ± 5 species (Doriya beel) - 42 ± 7 species (Chereki beel) with maximum up to 53 and 54 species/sample in Doryia and Chereki beels, respectively but indicated no pattern of seasonal variations. The individual abiotic factors indicate much limited significant on the richness with significant positive and inverse correlations with rainfall only in Holmari ($r = 0.551$, $p = 0.0026$) and Chela ($r = -0.588$, $p = 0.0013$) beels, respectively. This generalization concurred with the results of Sharma (2005, 2009b) and Sharma and Sharma (2012b) but is in contrast to notable influence of abiotic factors reported by Sharma and Sharma (2005b) and Sharma (2009a).

In conclusion, this study indicates rich and diverse Rotifera assemblage of Majuli beels in the Indian context with various interesting species and is a useful contribution to the rotifer diversity in the floodplain ecosystems of India. Our collections are yet biased towards planktonic and semi-planktonic taxa while specific analyses of periphytic, benthic and sessile taxa are likely to up-date the species inventory. The rotifers-aquatic macrophytes associations in these fluvial wetlands, the flushing influence of the Brahmaputra waters on the rotifer assemblages and their subsequent re-colonization merits attention due to lack of such works from India.

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Appendix I: Systematic list of Rotifer taxa known from Majuli River Island

Phylum: Rotifera
Class: Eurotatoria
Subclass: Monogononta
Order: Ploima

Family: Brachionidae

1. *Anuraeopsis fissa* Gosse, 1851
2. *Brachionus angularis* Gosse, 1851
3. *B. durgae* Dhanapathi, 1974**
4. *B. calyciflorus* Pallas, 1766
5. *B. dichotomus reductus* Koste & Shiel, 1980
6. *B. diversicornis* (Daday, 1883)
7. *B. falcatus* Zacharias, 1898
8. *B. kostei* Shiel, 1983
9. *B. quadridentatus* Hermann, 1783
10. *Keratella cochlearis* (Gosse, 1851)
11. *K. edmondsoni* Ahlstrom, 1943
12. *K. lenzi* Hauer, 1953
13. *K. tecta* (Gosse, 1851)**
14. *K. tropica* (Apstein, 1907)
15. *Platyias quadricornis* (Ehrenberg, 1832)
16. *Plationus patulus* (O.F. Müller, 1786)

Family: Euchlanidae

17. *Beauchampiella eudactylota* (Gosse, 1886)
18. *Euchlanis dilatata* Ehrenberg, 1832
19. *E. incisa* Carlin, 1939
20. *E. triquetra* Ehrenberg, 1838
21. *Dipleuchlanis ornata* Segers, 1993
22. *D. propatula* (Gosse, 1886)
23. *Tripleuchlanis plicata* (Levander, 1894)

Family: Mytilinidae

24. *Lophocharis oxysternon* (Gosse, 1851)
25. *Mytilina acanthophora* Hauer, 1938
26. *M. bisulcata* (Lucks, 1912)
27. *M. michelangellii* Reid & Turner**
28. *M. ventralis* (Ehrenberg, 1830)

Family: Trichotriidae

29. *Macrochaetus collinsi* (Gosse, 1867)
30. *M. longipes* Myers, 1934
31. *M. sericus* (Thorpe, 1893)
32. *Trichotria tetractis* (Ehrenberg, 1830)

Family: Lepadellidae

33. *Colurella adriatica* Ehrenberg, 1831**
34. Co*lurella colurus* (Ehrenberg, 1830)
35. *C. obtusa* (Gosse, 1886)
36. *C. uncinata* (O.F. Müller, 1773)
37. *Lepadella acuminata* (Ehrenberg, 1834)
38. *L. apsida* Harring, 1916
39. *L. benjamini* Harring, 1916
40. *L. biloba* Hauer, 1958
41. *L. costatoides* Segers, 1992
42. *L. dactyliseta* (Stenroos, 1898)
43. *L. discoidea* Segers, 1993
44. *L. elongata* Koste, 1992
45. *L. eurysterna* Myers, 1942
46. *L. latusinus* (Hilgendorf, 1899)
47. *L. lindaui* Koste, 1981**
48. *L. minuta* (Weber & Montet, 1918)**
49. *L. ovalis* (O.F. Müller, 1786)
50. *L. patella* (O.F. Müller, 1773)
51. *L. quinquecostata* (Lucks, 1912)
52. *L. rhomboides* (Gosse, 1886)
53. *L. triptera* Ehrenberg, 1832
54. *L. triba* Myers, 1934**
55. *L. vandenbrandei* Gillard, 1952
56. *L.* (*Heterolepadella*) *apsicora* Myers, 1934
57. *L.* (*H.*) *ehrenbergi* (Perty, 1850)
58. *L.* (*H.*) *heterostyled* (Murray, 1913)
59. *Squatinella lamellaris* (O. F. Müller, 1786)

Family: Lecanidae

60. *Lecane aculeata* (Jakubski, 1912)
61. *L. arcula* Harring, 1914
62. *L. bifurca* (Bryce, 1892)**
63. *L. blachei* Berzins, 1973
64. *L. bulla* (Gosse, 1851)
65. *L. closterocerca* (Schmarda, 1859)
66. *L. crepida* Harring, 1914
67. *L. curvicornis* (Murray, 1913)
68. *L. decipiens* (Murray, 1913)
69. *L. doryssa* Harring, 1914
70. *L. elongata* Harring & Myers, 1926
71. *L. flexilis* (Gosse, 1886)
72. *L. furcata* (Murray, 1913)
73. *L. haliclysta* Harring & Myers, 1926
74. *L. hamata* (Stokes, 1896)
75. *L. hornemanni* (Ehrenberg, 1834)
76. *L. inermis* (Bryce, 1892)
77. *L. inopinata* Harring & Myers, 1926
78. *L. lateralis* Sharma, 1978
79. *L. leontina* (Turner, 1892)
80. *L. ludwigii* (Eckstein, 1883)
81. *L. luna* (O.F. Müller, 1776)
82. *L. lunaris* (Ehrenberg, 1832)
83. *L. monostyla* (Daday, 1897)

84. *L. nitida* (Murray, 1913)
85. *L. niwati* Segers, Kotethip & Sanoamuang, 2004
86. *L. obtusa* (Murray, 1913)
87. *L. ohioensis* (Herrick, 1885)
88. *L. papuana* (Murray, 1913)
89. *L. paxiana* Hauer, 1940
90. *L. ploenensis* (Voigt, 1902)
91. *L. pusilla* Harring, 1914
92. *L. pyriformis* (Daday, 1905)
93. *L. quadridentata* (Ehrenberg, 1830)
94. *L. rhytida* Harring & Myers, 1926
95. *L. signifera* (Jennings, 1896)
96. *L. simonneae* Segers, 1993
97. *L. stenroosi* (Meissner, 1908)
98. *L. styrax* (Harring & Myers, 1926)
99. *L. tenuiseta* Harring, 1914
100. *L. thienemanni* (Hauer, 1938)
101. *L. undulata* Hauer, 1938
102. *L. unguitata* (Fadeev, 1925)
103. *L. ungulata* (Gosse, 1887)

Family : Notommatidae

104. *Cephalodella forficula* (Ehrenberg, 1830)
105. *C. gibba* (Ehrenberg, 1830)
106. *Monommata longiseta* (O. F. Müller, 1786)
107. *M. maculata* Harring & Myers, 1930
108. *Notommata pachyura* (Gosse, 1886)

Family: Scaridiidae

109. *Scaridium longicaudum* (O.F. Müller, 1786)

Family : Trichocercidae- 13/1

110. *Trichocerca abilioi* Segers & Sarma, 1993
111. *T. bicristata* (Gosse, 1887)
112. *T. cylindrica* (Imhof, 1891)
113. *T. elongata* (Gosse, 1886)
114. *T insignis* (Herrick, 1885)
115. *T. insulana* (Hauer, 1937)
116. *T. pusilla* (Jennings, 1903)
117. *T. rattus* (O.F. Müller, 1776)
118. *T. scipio* (Gosse, 1885)**
119. *T. similis* (Wierzejski, 1893)
120. *T. tenuior* (Gosse, 1886)
121. *T. tigris* (O.F. Müller, 1786)
122. *T. uncinata* (Voigt, 1902)*
123. *T. voluta* (Murray, 1913)
124. *T. weberi* (Jennings, 1903)

Family : Asplanchnidae

125. *Asplanchna priodonta* Gosse, 1850

Family : Synchaetidae

126. *Pleosoma lenticulare* Herrick, 1885**
127. *Polyarthra vulgaris* Carlin, 1943

Family : Dicranophoridae

128. *Dicranophoroides caudatus* (Ehrenberg, 1834)
129. *D. forcipatus* (O. F. Müller, 1786)

Order: Floscullariaceae
Family: Conochilidae

130. *Conochilus unicornis* Rousselet, 1892**

Family : Flosculariidae

131. *Sinantherina socialis* (Linne, 1758)
132. *S. spinosa* (Thorpe, 1893)

Family : Hexarthridae

133. *Hexarthra mira* (Hudson, 1871)

Family : Testudinellidae

134. *Testudinella amphora* Hauer, 1938*
135. *Testudinella emarginula* (Stenroos, 1898)
136. *T. patina* (Hermann, 1783)
137. *T. tridentata* Smirnov, 1931
138. *Pompholyx sulcata* Hudson,1885

Family : Trochosphaeridae

139. *Filinia camasecla* Myers, 1938
140. *F. longiseta* (Ehrenberg, 1834)
141. *Trochosphaera aequatorialis* Semper, 1872

Sub-class : Digononta
Order : Bdelloidea
Family : Philodinidae

142. *Philodina roseola* Ehrenberg, 1832
143. *Rotaria neptunia* (Ehrenberg, 1830)
144. *R. rotatoria* (Pallas, 1766)

***** New record from India, ****** New record from Majuli River Island

Appendix II: Species composition of Rotifera of *beels* of Majuli River Island.

Taxa↓ Beels Sr. No.→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Order: Ploima												
Family: Asplanchnidae												
1. *Asplanchna priodonta* Gosse	+	+	+	+	-	+	+	+	-	+	+	+
Family: Brachionidae												
2. *Anuraeopsis fissa* Gosse	+	+	-	-	+	+	+	+	+	+	+	-
3. *Brachionus angularis* Gosse	-	-	-	-	-	-	+	-	-	+	+	+
4. *B. durgae* Dhanapathi	-	-	-	-	-	-	+	+	-	-	-	+
5. *B. falcatus* Zacharias	-	-	-	-	-	-	+	-	+	+	-	+
6. *B. kostei* Shiel	-	-	-	-	-	-	+	-	+	-	-	-
7. *Brachionus quadridentatus* Hermann	+	+	+	+	+	+	+	+	+	+	+	+
8. *Keratella cochlearis* (Gosse)	+	+	+	+	+	+	+	+	+	+	+	+
9. *K. edmondsoni* Ahlstrom	-	-	-	-	-	-	-	-	-	-	-	+
10. *K. lenzi* Hauer	+	+	-	+	+	+	-	-	-	+	-	+
11. *K. tecta* (Gosse)	-	+	-	-	-	-	+	+	+	-	-	+
12. *K. tropica* (Apstein)	+	-	+	+	+	+	+	-	+	+	+	+
13. *Platyias quadricornis* (Ehrenberg)	+	+	+	+	+	+	+	+	+	+	+	+
14. *Plationus patulus* (O.F. Müller)	+	+	+	+	+	+	+	+	+	+	+	+
Family: Euchlanidae												
15. *Beauchampiella eudactylota* (Gosse)	+	+	+	+	-	+	+	-	-	+	+	+
16. *Dipleuchlanis propatula* (Gosse)	+	-	+	+	+	+	+	+	+	+	+	+
17. *Euchlanis dilatata* Ehrenberg	+	+	+	+	+	+	+	+	+	+	+	+
18. *E. triquetra* Ehrenberg	+	+	-	-	+	-	-	-	+	+	+	+
19. *Tripleuchlanis plicata* (Levander)	-	+	+	+	-	+	-	+	+	-	-	+
Family: Flosculariidae												
20. *Sinantherina socialis* (Linne)	-	+	-	-	-	+	+	+	+	+	-	+
21. *S. spinosa* (Thorpe)	+	+	+	+	+	+	+	+	+	+	+	+
Family: Lecanidae												
22. *Lecane aculeata* (Jakubski)	+	+	+	+	+	+	+	-	-	+	+	+
23. *L. arcula* Harring	-	-	-	-	-	-	+	+	-	+	+	-
24. *L. bifurca* (Bryce)	-	-	-	-	-	-	-	+	+	+	-	+
25. *L. blachei* Berzins	-	+	+	+	-	+	+	+	+	-	+	+
26. *L. bulla* (Gosse)	+	+	+	+	+	+	+	+	+	+	+	+
27. *L. closterocerca* (Schmarda)	+	+	+	+	+	+	+	+	+	+	+	+
28. *L. crepida* Harring	-	+	+	-	-	-	+	-	-	+	+	+
29. *L. curvicornis* (Murray)	+	+	-	+	+	+	+	+	+	+	+	+
30. *L. decipiens* (Murray)	-	-	-	-	-	-	+	-	-	-	+	+
31. *L. doryssa* Harring	+	+	-	-	+	+	+	-	+	+	-	+
32. *L. flexilis* (Gosse)	-	-	-	-	-	-	-	+	+	+	-	+
33. *L. furcata* (Murray)	+	+	+	+	+	+	+	+	-	+	+	+
34. *L. haliclysta* Harring & Myers	-	-	-	-	-	-	+	-	-	-	+	+
35. *L. hamata* (Stokes)	+	+	+	+	+	+	+	+	+	+	+	+
36. *L. hornemanni* (Ehrenberg)	+	+	+	+	+	+	+	-	-	-	+	+
37. *L. inermis* (Bryce)	+	+	+	+	-	+	-	-	+	-	-	+
38. *L. inopinata* Harring & Myers	+	+	-	-	-	+	+	-	-	-	-	-
39. *L. lateralis* Sharma	+	+	+	+	+	-	+	+	+	-	+	+
40. *L. leontina* (Turner)	+	+	+	+	+	+	+	+	+	+	+	+
41. *L. ludwigii* (Eckstein)	+	+	+	+	+	+	+	+	+	+	-	+
42. *L. lunaris* (Ehrenberg)	+	+	+	+	+	+	+	+	+	+	+	+
43. *L. luna* (O.F. Müller)	+	+	+	+	+	+	+	+	+	+	+	+

Appendix II: Species composition of Rotifera of beels of Majuli River Island (contd.).

Taxa↓ Beels Sr. No.→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
44. *L. monostyla* (Daday)	-	+	-	-	+	+	+	-	+	+	+	-
45. *L. nitida* (Murray)	-	+	+	-	-	-	-	+	+	-	-	+
46. *L. niwati* Segers, Kotethip & Sanoamuang	-	-	-	-	-	-	+	-	-	-	+	+
47. *L. obtusa* (Murray)	+	+	+	+	+	+	+	-	-	+	+	+
48. *L. ohioensis* (Herrick)	+	+	-	+	-	-	+	+	+	+	+	+
49. *L. papuana* (Murray)	+	+	+	+	+	+	+	+	+	+	+	+
50. *L. paxiana* Hauer	-	-	-	-	-	-	+	-	-	+	+	-
51. *L. ploenensis* (Voigt)	+	+	+	+	+	+	+	+	+	-	+	+
52. *L. pusilla* Harring	-	+	+	-	-	-	-	+	-	+	+	+
53. *L. pyriformis* (Daday)	+	+	+	+	+	+	+	-	-	+	+	+
54. *L. quadridentata* (Ehrenberg)	+	+	+	+	+	+	+	+	+	+	+	+
55. *L. rhytida* Harring & Myers	-	-	-	-	-	-	+	+	-	-	-	-
56. *L. signifera* (Jennings)	+	+	+	+	+	+	+	+	+	+	+	+
57. *L. stenroosi* (Meissner)	+	+	+	+	-	+	+	-	-	+	+	+
58. *L. styrax* (Harring & Myers)	-	-	-	-	-	-	+	+	+	+	+	+
59. *L. tenuiseta* Harring	-	-	-	-	-	-	+	-	+	-	-	+
60. *L. thienemanni* (Hauer)	-	-	-	-	-	-	+	+	-	-	+	-
61. *L. undulata* Hauer	-	+	-	-	-	-	+	+	+	+	-	+
62. *L. unguitata* (Fadeev)	+	+	+	+	+	+	+	+	+	+	+	+
63. *L. ungulata* (Gosse)	+	+	+	+	-	+	+	+	+	+	+	+
Family: Lepadellidae												
64. *Colurella adriatica* Ehrenberg	-	-	-	-	-	-	-	+	+	-	-	+
65. *Colurella obtusa* (Gosse)	+	+	+	+	+	+	+	+	+	+	+	+
66. *C. uncinata* (O.F. Müller)	+	+	+	+	+	+	+	+	+	+	+	+
67. *Lepadella acuminata*(Ehrenberg)	+	+	+	+	+	+	+	-	-	-	-	+
68. *L. apsida* Harring	+	+	-	+	-	+	-	+	-	+	-	+
69. *L. benjamini* Harring	+	+	+	+	+	+	+	+	-	-	+	+
70. *L. biloba* Hauer	-	-	-	-	-	-	+	-	+	+	+	+
71. *L. costatoides* Segers	-	-	-	-	-	-	+	+	+	-	+	+
72. *L. dactyliseta* (Stenroos)	-	-	-	-	-	-	+	+	-	-	+	-
73. *L. discoidea* Segers	+	+	+	-	+	+	+	-	+	+	-	+
74. *L. elongata* Koste	+	+	-	+	+	+	+	-	-	-	-	-
75. *L. lindaui* Koste	-	-	-	-	-	-	+	-	-	-	+	+
76. *L. minuta* (Weber & Montet)	-	-	-	-	-	-	-	+	+	-	-	-
77. *L. ovalis* (O.F. Müller)	+	+	+	+	+	+	+	+	+	+	+	+
78. *L. patella* (O.F. Müller)	+	+	+	+	+	+	+	+	+	+	+	+
79. *L. quinquecostata* (Lucks)	-	-	-	-	-	-	+	+	-	-	-	+
80. *L. rhomboides* (Gosse)	+	+	+	+	-	-	+	+	+	-	+	+
81. *L. triba* Myers	-	-	-	-	-	-	+	+	-	-	+	+
82. *L. triptera* Ehrenberg	-	-	-	-	-	-	-	+	+	+	-	+
83. *L. vandenbrandei* Gillard	-	-	-	-	-	-	+	+	-	-	+	+
84. *L. (Heterolepadella) apsicora* Myers	-	-	-	-	-	-	+	+	+	-	+	-
85. *L. (H.) ehrenbergi* Perty	+	+	+	+	+	+	+	+	+	+	+	+
86. *L. (H.) heterostyla* (Murray)	-	+	-	+	-	+	+	+	+	+	+	+
87. *Squatinella lamellaris* (O.F. Müller)	+	+	-	+	+	+	+	+	-	-	-	-
Family: Mytilinidae												
88. *Lophocharis oxysternon* (Gosse)	-	-	+	+	-	+	+	-	-	-	+	+
89. *Mytilina acanthophora* Hauer	+	+	-	-	-	+	-	+	+	+	-	-
90. *M. bisulcata* (Lucks)	+	-	+	+	+	-	+	+	-	-	+	+

Appendix II: Species composition of Rotifera of beels of Majuli River Island (contd.).

Taxa↓ Beels Sr. No.→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
91. *M. michelangellii* Reid & Turner	-	-	-	-	-	-	+	+	+	+	-	+
92. *M. ventralis* (Ehrenberg)	+	+	+	+	+	+	+	-	-	+	+	+
Family: Notommatidae												+
93. *Cephalodella forficula*	-	+	+	-	+	+	-	-	+	+	-	-
94. *C. gibba*(Ehrenberg)	+	+	+	+	+	+	+	+	+	-	+	-
95. *Monommata longiseta*(O.F. Müller)	+	+	+	+	+	+	+	-	-	-	+	+
Family: Scaridiidae												
96. *Scaridium longicaudum* (Müller)	+	+	+	+	+	+	+	+	+	+	-	+
Family: Synchaetidae												
97. *Pleosoma lenticulare* Herrick	-	-	-	-	-	-	+	+	-	-	+	+
98. *Polyarthra vulgaris* Carlin	+	+	+	+	+	+	+	+	+	+	+	+
Order: **Flosculariaceae**												
Family: Conochilidae												
99. *Conochilus unicornis* Rousselet	-	-	-	-	-	-	+	+	+	+	-	+
Family: Hexarthridae												
100. *Hexarthra mira* (Hudson)	-	-	-	-	-	-	+	-	-	-	+	+
Family: Testudinellidae												
101. *Testudinella amphora* Hauer	-	-	-	-	-	-	+	-	-	-	-	-
102. *Testudinella emarginula* Stenroos	+	+	+	-	+	+	+	+	+	+	-	+
103. *T. patina* (Hermann)	+	+	+	+	+	+	+	+	+	+	+	+
104. *T. tridentata* Smirnov	-	-	-	-	-	+	+	-	-	+	-	+
105. *Pompholyx sulcata* Hudson	+	+	+	+	-	-	-	+	+	-	-	+
Family: Trichocercidae												
106. *Trichocerca bicristata* (Gosse)	-	-	-	-	-	-	+	+	+	+	-	+
107. *T. cylindrica* (Imhof)	+	+	+	+	+	+	+	-	-	+	+	+
108. *T. elongata* (Gosse)	-	-	-	-	-	-	-	+	+	-	+	+
109. *T. insignis* (Herrick)	+	+	+	-	+	+	+	+	-	+	-	+
110. *T. rattus* (O.F. Müller)	+	+	+	+	-	-	+	+	+	+	+	+
111. *T. scipio* (Gosse)	-	-	-	-	-	-	-	+	+	-	-	+
112. *T. similis* (Wierzejski)	+	+	+	+	+	+	+	-	-	+	+	-
113. *T. tigris* (O.F. Muller)	+	+	-	-	+	+	+	+	+	-	-	+
114. *T. uncinata* (Voigt)	-	-	-	-	-	-	-	+	-	-	-	-
115. *T. weberi* (Jennings)	-	-	-	-	-	-	-	+	-	+	+	+
Family: Trichotriidae												
116. *Macrochaetus longipes* Myers	-	+	+	-	-	+	-	-	+	+	-	+
117. *M. sericus* (Thorpe)	+	+	+	+	+	+	+	+	+	-	+	+
118. *Trichotria tetractis* (Ehrenberg)	+	+	+	+	+	+	+	+	+	+	+	+
Family: Trochosphaeridae												
119. *Filinia camasecla* Myers	-	-	-	-	-	-	+	-	-	+	-	-
120. *Filinia longiseta* (Ehrenberg)	+	+	+	+	+	+	-	+	+	-	+	+
121. *Trochosphaera aequatorialis* Semper	-	-	-	-	-	+	+	+	-	-	-	-
Sub-class: Bdelloidea												
Family: Philodinidae												
122. *Philodina citrina* Ehrenberg	+	+	+	+	+	+	-	+	-	-	+	-
123. *Rotaria neptunia* (Ehrenberg)	+	+	-	+	-	-	+	-	+	+	-	-
124. *R. rotatoria* (Pallas)	-	-	+	-	+	+	-	+	-	-	+	-
Total richness (species)	**70**	**79**	**66**	**65**	**60**	**73**	**100**	**82**	**75**	**75**	**79**	**100**

1-Bhereki, 2-Ghotonga, 3-Holmari, 4-Chakuli, 5-Chela, 6-Khorkhoria, 7-Doriya, 8-Dubori, 9-Tuni, 10-Baatomari, 11-Jur, 12-Chereki.