The Biodiverse Rotifers (Rotifera: Eurotatoria) of Small Wetlands of the Brahmaputra River Floodplains of Lower and Upper Assam, Northeast India

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**ABSTRACT**

Rotifera assemblages of small floodplain wetlands (dobas or dubies) of lower and upper regions of the Brahmaputra river basin of Assam state of northeast India (NEI) reveal 157 species, belonging to 34 genera and 18 families, and highlight notable speciose constellation of up to 50 species/sample. One species, each is new to the Oriental region and Assam, and species of global and regional biogeographic interest form notable fractions. The biodiverse rotifer fauna and various interesting species are hypothesized to habitat diversity of the sampled dobas or dubies, impact of 'the Assam-gateway': an important biogeographic corridor of India, and location of the study area in the Indo-Burmese biodiversity hot-spot. Lecanidae and Lepadellidae are species-rich families, both of lower and upper Assam wetlands; upper Assam wetlands, in particular, are characterized by a distinct paucity of the Brachionidae and Brachionus spp., the relative paucity of Trichocerca, Keratella and Mytilina species, rare occurrence of Asplanchna and Filinia species, and lack of species of Conochilidae and Hexarthridae. Our results indicate the littoral-periphytic nature and tropical character of the rotifers. Overall, this study is an important contribution to Rotifera biodiversity of small lentic habitats of India, Asia and that of the tropics and subtropics.

**Keywords:** Biodiversity, dobas, dubies, interesting species, 'Rotifera paradox'

**How to Cite**

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**Introduction**

Small lentic ecosystems form over 90% of the standing water resources of our biosphere and ~30% of the global lentic biotopes by surface area and are thus suggested to be more explicitly considered in analyses of biodiversity, limnology and global processes (Céréghino et al. 2014). They are recognized as hotspots both in terms of species composition and biological traits (EPCN 2008) and are often considered as keystone systems for the conservation of biodiversity (Oertli et al. 2010; Céréghino et al. 2014; Vad et al. 2017; Oertli 2018). The management of these biotopes and that of their metazoan diversity is usually neglected (Céréghino et al. 2008; Oertli 2018) despite more vulnerability to severe threats of extinction and habitat degradation (Moss et al. 2011). The small lentic biotopes have attracted relatively more attention in hydro-biological works from India, but the relevant literature largely depicts paucity of studies on zooplankton diversity. A critical analysis attributes this lacuna to the limited sampling, ad-hoc reports by amateurs loaded with incomplete species lists, and lack of taxonomic expertise. Nevertheless, our studies from NEI (Sharma and Sharma 2015a; Sharma and Kensibo 2017; Sharma et al. 2017) hypothesized these water bodies to be one of the biodiverse habitats of the Indian sub-region vis-à-vis Rotifera - an important group of freshwater zooplankton, an integral link of aquatic food-webs, and food for larvae and adult fish (Tuna and Ustaoğlu 2016; Apaydın Yağcı et al. 2017).

The state of Assam of NEI, a part of the Indo-Burmese biodiversity hotspot, is notably known for the fluvial floodplains of the Brahmaputra river with characteristic small lentic wetlands (commonly known as dobas or dubies) forming an integral part of the rural landscape of the Brahmaputra valley. Sharma and Sharma (2014) first indicated ecological diversity importance of small wetlands in context of...
Rotifera of NEI and suggested their detailed assessment. The present study is thus an endeavor to analyze and compare species composition and richness of the rotifer assemblages of small wetlands of lower and upper reaches of the Brahmaputra river floodplains of Assam state. We provide an inventory of the documented taxa, illustrate interesting species, and comment on nature and composition of the rotifer fauna with reference to species richness, new records, important taxa, extraordinary high species consortium and elements of global and regional distribution interest. This study merits biodiversity and biogeographic interest for Rotifera of the floodplains of India, Asia as well as that of the rotifer heterogeneity of the small lentic ecosystems of the Indian sub-region.

**Material and Methods**

The present study is based on analysis of plankton and semi-plankton samples collected, on several occasions during 2005-2015, from small floodplain wetlands (*dobas* or *dubies*) from scattered localities (Figure 1.A-C) of Dhubri, Goalpara, Kokrajhar, Bongaigaon, Barpeta, Kamrup, Nalbari and Dispur districts of lower Assam (24°8′-26°8′N; 89°8′-92°2′E), and from Biswanath, Golaghat, Jorhat, Majuli, Lakhimpur, Sibsagar, Dhemaji, Dibrugarh, and Tinsukia.

**Figure 1.** A-C: A, map of India indicating northeast India (NEI) and the state of Assam; B, map of Assam; C, map indicating the sampled districts of Lower Assam and Upper Assam [1-Dhubri; 2-Goalpara; 3-Kokrajhar; 4-Bongaigaon; 5-Barpeta; 6-Kamrup; 7-Nalbari; 8-Dispur; 9-Biswanath; 10-Golaghat; 11-Jorhat; 12-Majuli; 13-Lakhimpur; 14-Sibsagar;15-Dhemaji;16-Dibrugarh;17-Tinsukia]
Sibsagar, Dhemaji, Dibrugarh and Tinsukia districts of upper Assam (26°4'-27°8'N; 93°8'-95°6'E). All the collections were made by towing nylobolt plankton net (# size 50µm) and were preserved in 5% formalin. Individual samples were screened with a Wild stereoscopic binocular microscope; the rotifers were isolated and mounted in polyvinyl alcohol–lactophenol and were observed with Leica DM 1000 stereoscopic phase contrast microscope fitted with an image analyzer. Various rotifer taxa were identified following the works of Koste (1978), Segers (1995), Sharma (1998), Sharma and Sharma (1999, 2000, 2008), and Jersabek and Leitner (2013) except for two indeterminate species warranting more specimens. The biogeographic remarks were made by vide Sørensen (2007), Sharma and Sharma (2017) and Jersabek and Leitner (2013). The microphotographs were provided for interesting species and measurements were indicated in micrometers (µm). The percentage similarity between the rotifer communities was calculated vide Sørensen’s index (Sørensen 1948). The voucher collections are submitted to the holdings of Zoological Survey of India, Kolkata.

Results
The plankton and semi-plankton collections examined from small wetlands of the Brahmaputra River floodplains of lower and upper Assam reveal 157 species belonging to 34 genera and 18 families. A detailed systematic list of the observed taxa is presented below:

Systematic list of Rotifera recorded from small wetlands of upper and lower Assam

| Phylum | Rotifera |
|--------|----------|
| Class  | Eurotatoria |
| Subclass | Monogononta |
| Order  | Ploima |
| Family | Brachionidae |

1. Anuraeopsis fissa Gosse, 1851
2. Brachionus angularis Gosse, 1851
3. B. bernini Leissling, 1924
4. B. bidensatus Anderson, 1889
5. B. budapestinensis Daday, 1885
6. B. calyciflorus Pallas, 1766
7. B. caudatus Barrois & Daday, 1894
8. B. dichotomus reductus Koste & Shiel, 1980 #@
9. B. diversicornis (Daday, 1883)
10. B. durgae Dhanapatii, 1974
11. B. falcatus Zacharias, 1898
12. B. forficula Wierzejski, 1891
13. B. kosti Koste, 1983 #@
14. B. mirabilis Daday, 1897
15. B. nilsoni Ahlstrom, 1940

16. B. quadridentatus Hermann, 1783
17. B. rubens Ehrenberg, 1838
18. Keratella cochlearis (Gosse, 1851)
19. K. edmondsoni Ahlstrom, 1943 #
20. K. javana Hauer, 1937 #@
21. K. lenzii Hauer, 1953
22. K. tecta (Gosse, 1851)
23. K. tropica (Apstein, 1907)
24. Planorbus patulus (O.F. Muller, 1786)
25. Platyias leloupi Gillard, 1967
26. P. quadricornis (Ehrenberg, 1832)

Family : Euchlanidae

27. Beuchampiella eudactyloita (Gosse, 1886)
28. Dipleuchlanis propatula (Gosse, 1886)
29. Euchlanis dilatata Ehrenberg, 1832
30. E. incisa Carlin, 1939
31. E. tricruetas Ehrenberg, 1838
32. Tripleuchlanis plicata (Levander, 1894)

Family : Mytilinidae

33. Lophochlanis salpina (Ehrenberg, 1834)
34. Mytilina acanthophora Hauer, 1938
35. M. bisulcata (Lucks, 1912)
36. M. brevispina (Ehrenberg, 1830)
37. M. michelangelii Reid & Turner, 1988
38. M. ventralis (Ehrenberg, 1830)

Family : Trichotriidae

39. Macrochlanis longipes Myers, 1934
40. M. sericus (Thorpe, 1893)
41. Trichotria tetractis (Ehrenberg, 1830)
42. Wolga spinifera (Western, 1894)

Family : Lepadellidae

43. Colurella Adriatica Ehrenberg, 1831
44. C. obtusa (Gosse, 1886)
45. C. uncinita (O.F. Muller, 1773)
46. Lepadella acuminata (Ehrenberg 1834)
47. L. apsicora Myers, 1934
48. L. apsidula Harring, 1916
49. L. benjanimi Harring, 1916
50. L. biloba Hauer, 1958
51. L. costatoides Segers, 1992
52. L. dactyliseta (Stenroos, 1898)
53. L. desmetii Segers and Chattapun, 2001**#@
54. L. discoidea Segers, 1993 #
55. L. ehrenbergi (Perty, 1850)
56. L. heterostyla (Murray, 1913)
57. L. minuta (Weber & Montet, 1918)
58. L. ovalis (O. F. Muller, 1786)
59. L. patella (O.F. Muller, 1773)
60. L. quinquecostata (Lucks, 1912)
61. L. rhomboideos (Gosse, 1886)
62. L. triperta Ehrenberg, 1830
63. L. vandenbrandei Gillard, 1952 #@
64. Squatinella lamellaris (O. F. Muller, 1786)
| Family | Lecanidae |
|--------|-----------|
| 65     | Lecane aculeata (Jakubski, 1912) |
| 66     | L. aeganea Harring, 1914 |
| 67     | L. arcula Harring, 1914 |
| 68     | L. bifurca (Bryce, 1892) |
| 69     | L. blachei Berzins, 1973 # |
| 70     | L. bulla (Gosse, 1851) |
| 71     | L. calcarea Harring & Myers, 1926 @@ |
| 72     | L. clara (Bryce, 1892) # |
| 73     | L. closterocerca (Schmarda, 1898) |
| 74     | L. crepida Harring, 1914 |
| 75     | L. curvicornis (Murray, 1913) |
| 76     | L. decipiens (Murray, 1913) |
| 77     | L. dorysimilis Trinh Dang, Segers & Sanoamuang, 2015 @# |
| 78     | L. doryssa Harring, 1914 |
| 79     | L. elegans Harring, 1914 |
| 80     | L. flexilis (Gosse, 1886) |
| 81     | L. furcata (Murray, 1913) |
| 82     | L. halicylsta Harring & Myers, 1926 |
| 83     | L. hastata (Murray, 1913) |
| 84     | L. hamata (Stokes, 1896) |
| 85     | L. hormannii (Ehrenberg, 1834) |
| 86     | L. inermis (Bryce, 1892) |
| 87     | L. inopinata Harring & Myers, 1926 |
| 88     | L. lateralis Sharma, 1978 # |
| 89     | L. leontina (Tumer, 1892) |
| 90     | L. ludwigii (Eckstein, 1883) |
| 91     | L. luna (O. F. Müller, 1776) |
| 92     | L. lunaris (Ehrenberg, 1832) |
| 93     | L. monostyla (Daday, 1897) |
| 94     | L. nitida (Murray, 1913) |
| 95     | L. niwati Segers, Kotehip & Sanoamuang, 2004 @# |
| 96     | L. obtusa (Murray, 1913) |
| 97     | L. pappana (Murray, 1913) |
| 98     | L. ploenensis (Voigt, 1902) |
| 99     | L. pusilla Harring, 1914 |
| 100    | L. pyriformis (Daday, 1905) |
| 101    | L. quadridentata (Ehrenberg, 1830) |
| 102    | L. rehana Hauer, 1929@ |
| 103    | L. rhizoida Harring & Myers, 1926@ |
| 104    | L. signifera (Jennings, 1896) |
| 105    | L. stenroosii (Meissner, 1908) |
| 106    | L. stichoclysta Segers, 1993 @ # |
| 107    | L. thienemanni (Hauer, 1938) |
| 108    | L. undulata Hauer, 1938 |
| 109    | L. ungulata (Fadeev, 1925) # |
| 110    | L. ungulata (Gosse, 1887) |

| Family | Notommatidae |
|--------|---------------|
| 111    | Cephalodella forficula Ehrenberg, 1830 |
| 112    | C. gibba (Ehrenberg, 1830) |
| 113    | C. trigona (Rousselet, 1895) # @ |
| 114    | Monommatra grandis Tessin, 1890@ |
| 115    | M. longiseta (O.F. Müller, 1786) |
| 116    | Notommatra pachyura (Gosse, 1886) |

| Family | Scardiidae |
|--------|------------|
| 117    | Scardium longicaudum (O.F. Müller, 1786) |

| Family | Trichoceridae |
|--------|---------------|
| 118    | Trichocera bicornuta (Gosse, 1887) |
| 119    | T. bidens (Lucks, 1912) @ |
| 120    | T. capucina (Wierzejski & Zacharias, 1893) |
| 121    | T. cylindrica (Imhof, 1891) |
| 122    | T. elongata (Gosse, 1886) |
| 123    | T. flagellata Hauer, 1938 |
| 124    | T. hollaeerti De Smet, 1990@# |
| 125    | T. insignis (Herrick, 1886) @ |
| 126    | T. longiseta (Schrink, 1802) |
| 127    | T. major (Hauer, 1935) # |
| 128    | T. pusilla (Jennings, 1903) |
| 129    | T. rattus (O.F. Müller, 1776) |
| 130    | T. scio (Gosse, 1886) @ |
| 131    | T. similis (Wierzejski, 1893) |
| 132    | T. tenuior (Gosse, 1886) |
| 133    | T. tigris (O.F. Muller, 1786) |
| 134    | T. weberi (Jennings, 1903) |

| Family | Asplanchnidae |
|--------|---------------|
| 135    | Asplanchna brightwelli Gosse, 1850 |
| 136    | A. priodonta Gosse, 1850 |

| Family | Synchaetaidae |
|--------|---------------|
| 137    | Polyarthra vulgaris Carlin, 1943 |

| Family | Dicranophoridae |
|--------|-----------------|
| 138    | Dicranophorus forcipatus (O.F. Müller, 1786) |

| Order | Flosculariidae |
|-------|----------------|
| 139    | Fygiura sp. |
| 140    | Sinartheris socialis (Linne, 1758) |
| 141    | S. spinosa (Thorpe, 1893) |

| Family | Conochilidae |
|--------|--------------|
| 142    | Conochilus unicornis Rousselet, 1892 |

| Family | Hexarthridae |
|--------|-------------|
| 143    | Hexarthra mira (Hudson, 1871) |

| Family | Testudinellidae |
|--------|----------------|
| 144    | Pompolys sulcata Hudson, 1885 |
| 145    | Testudinella amphiura Hauer, 1938 @# |
| 146    | T. brevicaudata Yamamoto, 1951#@ |
| 147    | T. dentradena de Beauchamp, 1955 #@ |
| 148    | T. emarginula (Stenoos, 1898) |
| 149    | T. parva (Ternetz, 1892) |
| 150    | T. patina (Herrman, 1783) |
| 151    | T. tridentata Smirnov, 1931@ |
| 152    | Testudinella sp. @ |

| Family | Trochospheiridae |
|--------|-----------------|
| 153    | Filinia cannesia Myers, 1938 |
| 154    | Filinia longiseta (Ehrenberg, 1834) |
| 155    | F. apolynsis (Zacharias, 1898) |

| Subclass | Bdelloidea |
|----------|------------|
| Order    | Philodinidae |
| Family   | Philodinidae |
| 156      | Dissotrocha aculeata (Ehrenberg, 1832) |
| 157      | Rotaria neptunia (Ehrenberg, 1830) |

*Lecane clara* (Bryce) is a new record (Figure 2.A) from the Oriental region (marked as *).
Lepadella desmeti Segers and Chittapun (Figure 2.B) is a new record from Assam state (marked as **). Brachionus dichotomus reductus (Figure 2.C), B. kostei (Figure 2.D), Cephalodella trigona, Filinia camasecla (Figure 2.E), Keratella edmondsoni, K. javana, Lecane blachei (Figure 2.F), L. calcarea (Figure 3.A), L. niwati (Figure 3.B), L. dorysimilis (Figure 3.C), L. lateralis, L. stichoclysta, L. unguitata, Lepadella desmeti, L. discoidea, L. vandenbrandei, Testudinella amphora, T. brevicaudata (Figure 3.D), T. dendradena, Trichocerca hollaerti (Figure 3.E) and T. maior are species of global biogeographic interest (marked as #). Testudinella (Figure 3.F) sp. is yet an un-determined species awaiting description pending examination of more specimens. Our collections indicate 23 species (marked as @) with their distribution in India known to be restricted to NEI.

We report 152 and 125 rotifer species from lower and upper Assam collections, respectively (Table 1) with consistent importance of Lecanidae (45 and 42 species), Lepadellidae (21 species each) and Trichocercidae (16 and 13 species). The comparison of Rotifera species composition of the two study areas records lower richness of the Brachionidae (14 species), Brachionus (6 species) and paucity of species of Keratella and Mytilina especially in our collections from upper Assam wetlands (Table 1).

Figure 2. A-F: Rotifers of biogeographic interest (A, Lecane clara (Bryce) (dorsal view); B, Lepadella desmeti Segers and Chittapun (ventral view); C, Brachionus dichotomus reductus Koste & Shiel (ventral view); D, Brachionus kostei Shiel (ventral view); E, Filinia camasecla Myers with parthenogenetic egg (dorsal view); F, Lecane blachei Berzins (dorsal view).
Figure 3. A-F: Rotifers of biogeographic interest (A, *Lecane calcaria* Harring & Myers (ventral view); B, *Lecane niwati* Segers, Kotethip & Sanoamuang (ventral view); C, *Lecane dorysimilis* Trinh Dang, Segers & Sanoamuang (ventral view); D, *Testudinella brevicaudata* Yamamoto (ventral view); E, *Trichocerca hollaerti* De Smet (lateral view); F, *Testudinella* sp. (ventral view)

Table 1. Comparison of Rotifera composition of small wetlands of lower and upper Assam

| Taxa          | This study | Lower Assam | Upper Assam |
|---------------|------------|-------------|-------------|
| Species       | 157        | 152         | 125         |
| Genera        | 34         | 34          | 30          |
| Families      | 18         | 18          | 16          |

Important families: species (%)

| Family          | This study | Lower Assam | Upper Assam |
|-----------------|------------|-------------|-------------|
| Lecanidae       | 46 (29.3%) | 45 (29.6%) | 42 (33.6%)  |
| Brachionidae    | 26 (16.6%) | 26 (17.1%) | 14 (11.2%)  |
| Lepadellidae    | 22 (14.0%) | 21 (13.8%) | 21 (16.8%)  |
| Trichocercidae  | 17 (10.9%) | 16 (10.5%) | 13 (10.4%)  |
|                 | 111 (70.8%)| 108 (71.0%)| 90 (72.0%)  |

Other notable families: species (%)

| Family          | This study | Lower Assam | Upper Assam |
|-----------------|------------|-------------|-------------|
| Testudinellidae | 8          | 8           | 7           |
| Euchlanidae     | 6          | 6           | 6           |
| Notommatidae    | 6          | 5           | 5           |
| Mytilinidae     | 6          | 6           | 3           |
|                 | 26 (16.6%) | 25 (16.4%) | 21 (16.8%)  |

Important genera: species (%)

| Genera         | This study | Lower Assam | Upper Assam |
|----------------|------------|-------------|-------------|
| *Lecane*       | 46 (29.3%) | 45 (29.6%) | 42 (33.6%)  |
| *Lepadella*    | 18 (11.4%) | 16 (10.5%) | 17 (13.6%)  |
| *Trichocerca*  | 17 (10.9%) | 16 (10.5%) | 13 (10.4%)  |
| *Brachionus*   | 16 (10.2%) | 16 (10.5%) | 06 (4.8%)   |
|                 | 97 (61.8%) | 93 (61.2%) | 78 (62.4%)  |

Other notable genera: species (%)

| Genera         | This study | Lower Assam | Upper Assam |
|----------------|------------|-------------|-------------|
| *Testudinella* | 7          | 7           | 6           |
| *Keratella*    | 6          | 6           | 4           |
| *Mytilina*     | 5          | 5           | 3           |
|                 | 18 (11.4%) | 18 (11.8%) | 13 (10.4%)  |
Discussion

Our collections from *dobas* or *dubies* of the Brahmaputra river basin reveal 157 species, belonging to 34 genera and 18 families; the richness comprises ~65%, ~52% and ~27% of species of *Rotifera* known from Assam state, NEI and India (Sharma and Sharma 2017), respectively and thus affirms biodiverse nature of the rotifer assemblage. Besides, 152 and 125 species observed from lower and upper Assam, respectively depict species-rich rotifers of the two study areas individually, while higher community similarity (85.2% vide Sørensen’s index) depicts overall homogeneity in species composition but with certain differences.

*Lecane clara*, a new record from the Oriental region, is diagnosed by its soft lorica and characteristic elongate toes. This lecanid is yet known (Segers 2007) from the African, Neotropical, Nearctic, Pacific, and Palaearctic regions, while our report extends its distribution to the Oriental region. *Lepadella desmeti*, described from Thailand (Segers and Chittapun 2001), is known elsewhere from Neotropical and Pacific regions (Segers 2007). The only earlier record of this species from the Indian sub-region (Sharma and Sharma 2015b) relates to Loktak Lake (a Ramsar site), Manipur state; the present study further extends its distribution within NEI to Assam state. In addition, *Lecane calcaria* and *L. stichoclysta* deserve mention in view of the restricted reports from south Assam (Sharma and Sharma 2019a) and the eastern Himalayas (Sharma and Sharma 2019b).

Interestingly, *Rotifera* of *dobas* or *dubies* invariably record species consortia of maximum 30-35 species/sample while a few small wetlands from the Majuli River Island and the Dibru-Saikhowa Biosphere reserve of upper Assam indicate speciose constellations of up to 50 species/sample. We categorize these reports as ‘Rotifera paradox’ following analogy to the classical ‘the paradox of the plankton’ highlighted by Hutchinson (1961); the former, in turn, is hypothesized to the intriguing possibility of the co-existence of a number of species in ‘a relatively isotropic or unstructured environment of small wetlands’.

This study records biodiverse rotifers than the reports from *dobas* or *dubies* of the Majuli River Island (Sharma 2014), small lentic biotopes of Mizoram (Sharma and Sharma 2015a) and Nagaland (Sharma and Kensibo 2017, Sharma et al. 2017), and the Kashmir Himalayan floodplains (Sharma and Sharma 2018). The richness is marginally lower than the reports from small lentic biotopes of the eastern Himalayas (Sharma and Sharma 2019a) and the floodplains of Barak valley of south Assam (Sharma and Sharma 2019b). The comparisons highlight *dobas* or *dubies* of the Brahmaputra floodplains to be one of the biodiverse rotifer environs of India; this generalization is hypothesized to the function of habitat diversity of the sampled wetlands and sampling intensity vides Fontaneto et al. (2012). Interestingly, this study registers higher rotifer richness than certain global floodplain reports i.e., the Rio Pilcomayo National Park, Argentina (Jose de Paggi 2001); Oguta and Iyi-Efi lakes of the Niger delta (Segers et al. 1993) of Africa; Lake Guarana (Bonecker et al. 1994), and Lago Camaleao (Koste and Robertson 1983) of Brazil; Thale-Noi Lake, Thailand (Segers and Polphunthin 1997); and it compares well with 151 species known from Rio Tapajos (Koste 1974) of Brazil.

Our collections reveal notable examples of global and regional biogeographic interest. The former include 21 species (13.4%) namely (i) the Australasian *Brachionus dichotomus reductus* and *B. kosteii*; (ii) the Oriental endemics *Filinia camasecla*, *Keratella edmondsoni*, *L. blachei* and *L. niwati*; (iii) the paleotropical *K. javana*, *Lecane lateralis*, *L. stichoclysta*, *L. unguitata*, *Lepadella discoidea*, *L. vandenbrandei*, *Testudinella brevicaudata* and *Trichocerca hollaerti*; (iv) the Indo-Chinese *Lecane dorysimilis*; (v) the Holarctic *Trichocerca maior*; and (vi) five other species namely *Cephalodella trigona*, *Lecane calcaria*, *Lepadella desmeti*, *Testudinella amphora* and *T. dendradena*. The Australian elements affirm affinity of the rotifer assemblage with Southeast Asian and Australian faunas, while other categories impart affinities with Southeast Asian *Rotifera* (Sharma and Sharma 2014, 2017). In addition, 23 species (~15%) are known for their Indian distribution till date restricted to NEI, while ~12% species namely *Brachionus durgae*, *Colurella adriatica*, *Lecane aeganea*, *L. doryssa*, *L. elegans*, *L. halichysta*, *L. hastata*, *L. pusilla*, *L. thienemanni*, *Lepadella benjamini*, *L. dactyliseta*, *L. discoidea*, *L. quinquecostata*, *Macrochaetus longipes*, *Mylitina michelangelii*, *Platyias leloupia*, *Testudinella parva*, *Trichocerca flagellata* and *Wolga spinifera* depict regional distribution interest vis-à-vis the Indian *Rotifera* (Sharma and Sharma 2017). We hypothesize overall biodiverse rotifer assemblage of *dobas* or *dubies* of the Brahmaputra river floodplains and occurrence of sizable fractions of specie of biogeographic interest to impact of ‘the Assam-gateway’ - a vital biogeographic corridor of India that facilitated extensive interchanges between the Indian and Asian biota (Mani 1974), thus changing the modern biotic composition of the
epigean ecosystems of India into one of ‘predominantly Oriental’ nature (Ranga Reddy 2013).

Lecanidae > Brachionidae > Lepadellidae > Trichoceridae, collectively form large fraction (~77%) of the rotifer species known vide this study as well as from lower Assam wetlands. On the other hand, upper Assam wetlands indicate corresponding cumulative importance of these Eurotatoria families (72%) but are characterized by a notable paucity of Brachionidae (14 species). Testudinellidae, Euchlanidae, Notommatidae, and Mytilinidae also deserve attention for collective contributions of 16.4% and 16.8% from lower and upper Assam wetlands, respectively. The ‘tropic centered’ Lecane is most speciose genus both of lower (45 species) and upper Assam (42 species) rotifers. Lepadella = Trichocerca = Brachionus are notable in lower Assam wetlands (31.5%), while Lepadella > Trichocerca > Brachionus (29.8%) deserve attention in upper Assam wetlands but with a distinct paucity of Brachionida spp. (6 species; 4.8%). In general, the paucity of the brachionid Rotifera of upper Assam wetlands, concurs with the reports from the floodplains of the Majuli River Island (Sharma 2014) and our results from the states of Meghalaya (Sharma and Sharma 1999), Mizoram (Sharma and Sharma 2015a), Nagaland (Sharma et al. 2017), and Arunachal Pradesh (Sharma and Sharma 2019a) of NEI. Further, the collections from upper Assam are notable for relative paucity of Trichocerca, Keratella and Mytilina species; rare occurrence of Asplanchna and Filinia species and lack of species of Conochilidae and Hexarthridae. The richness of important Eurotatoria families and genera assigns the littoral-periphytonic nature to Rotifera of dobas or dubies of the Brahmaputra floodplains, in conformity with the reports from the floodplains of Africa (Segers et al. 1993; Green 2003), Brazil (Koste 1974; Koste and Robertson 1983), Thailand (Segers and Pholpunthin 1997), Argentina (Jose De Paggi 2001) and NEI (Sharma and Sharma 2008, 2014). The high richness of ‘tropic centered’ Lecane and that of Brachionus in lower Assam wetlands, large fraction of cosmopolitan species (~67%) and occurrence of several (~20%) pantropical and cosmotsropical species imparts ‘tropical character’ to the rotifer assemblages of dobas or dubies following the reports on the tropical rotifer faunas (Fernando 1980; Segers 2008; Sharma and Sharma 2008, 2014, 2017, 2019a).

To sum up, this study is an important contribution to Rotifera biodiversity of small lentic habitats of India, Asia, and tropics and subtropics. The biodiversity of rotifers affirm habitat and environmental heterogeneity of dobas or dubies of the Brahmaputra floodplains. ‘Rotifera paradox’ hypothesizes niche diversification enabling co-existence of several species within an unstructured environment of small wetlands. The diverse species composition is attributed to the location the sampled study areas within the key biodiversity area of the Indo-Burma Hotspot as well as the historical influence of the Assam-gateway’ facilitating incursion of species from Asian and the Oriental faunas. Such studies need to be extended to other small lentic wetlands of NEI and elsewhere in India to explore ecosystem diversity value of small water bodies vs. biodiversity of Indian Rotifera.

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