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Biodiversity of the rotifers (Rotifera: Eurotatoria) of Nagaland, northeast India: Composition and ecosystem diversity

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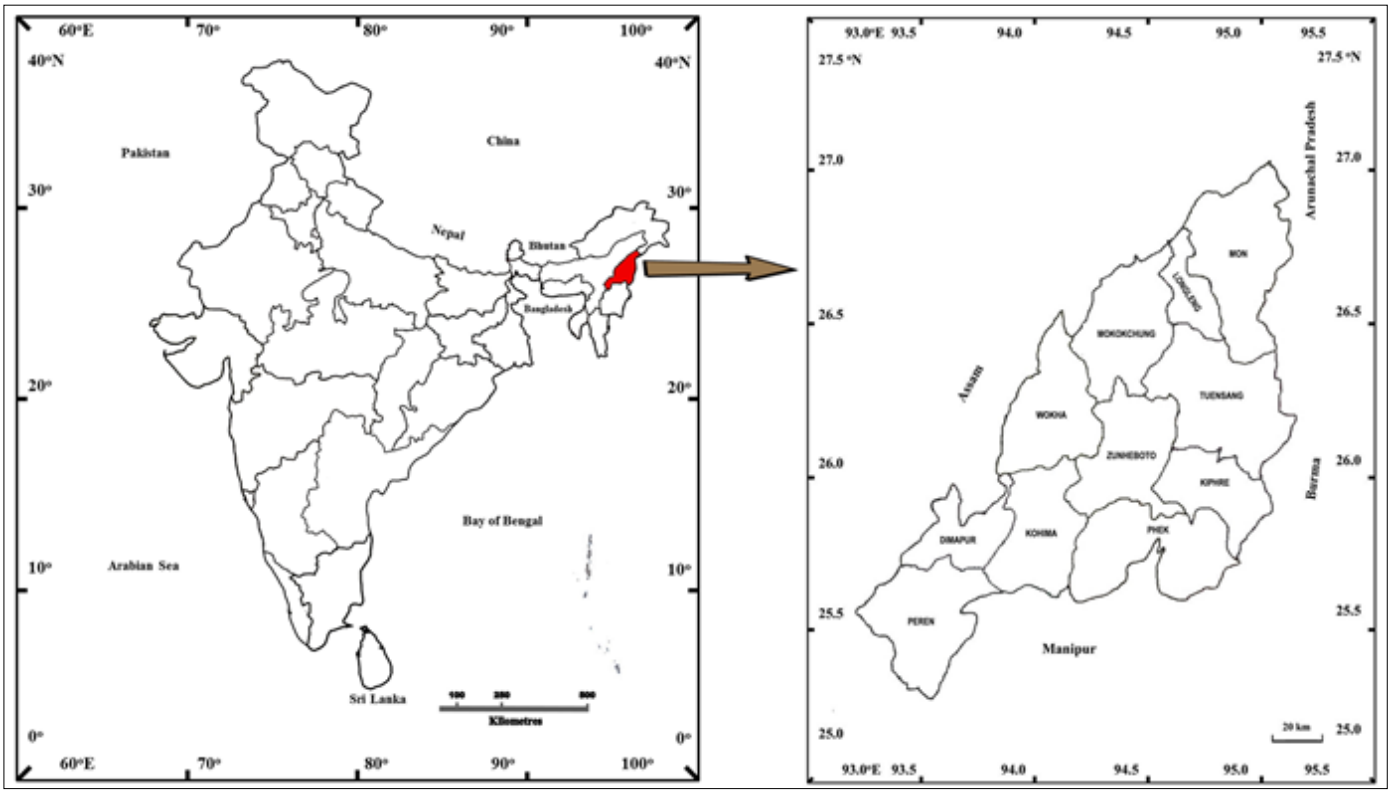
Abstract
Northeast India (NEI), an interesting 'hot-spot' for metazoan diversity, is known for diverse aquatic habitats. This study is an attempt to document Rotifera diversity of the hill state of Nagaland of NEI vis-à-vis small lentic ecosystems. A total of 150 species belonging to 37 genera and 19 families observed in our collections comprise ~36.0 % of species of the Phylum known from India and thus highlight ecosystem diversity of small water bodies. Two species are new records to India and 38 species are new to Nagaland. The globally interesting rotifers (14.7%) include four Australasian, six Oriental, nine palaeotropical, and one each of Palearctic, Indo-Chinese and cosmo (sub.) tropical species. Lecanidae > Brachionidae > Lepadellidae collectively comprise ~61.0% of the recorded species and Trichocercidae > Testudinellidae are other notable families. The speciose nature of 'tropic-centered' genus *Lecane*, the collective importance of *Lepdella* > *Brachionus* = *Trichocerca*, and high richness of cosmpolitan species are noteworthy.

Keywords: interesting taxa, metazoans, new records, richness, small lentic habitats

1. Introduction
Northeast India (NEI) is a part of the Himalayan and Indo-Myanmar biodiversity 'hot-spots' and is characterized by diverse aquatic habitats located under varied ecological conditions of its eight constituent states. NEI is highlighted to be an important region with a rich biodiversity of Rotifera [1], an important group of freshwater metazoans, but yet indicated distinct paucity of the related studies from Nagaland state. Our recent report [2] on the rotifer diversity of two small wetlands of Dimapur partially augmented the status. The present endeavor is an intensive sampling based attempt to study Nagaland Rotifera with emphasis on small water bodies which form an integral part of aquatic resources of this otherwise hill state of NEI. Importantly, the small lentic waters form an inherent part of the interconnected network of global metabolically active sites [3] and play a critical role in maintaining biodiversity [4]. Ironically, these habitats remain largely unexplored and underexplored for their metazoan diversity in India [1]. Our results on speciose and diverse rotifer assemblages of Nagaland vis-à-vis importance of small aquatic habitats is of ecosystem diversity and biogeography importance for the Indian Rotifera. We provide an inventory of the recorded species with illustrations of interesting species. Remarks are made on the documented rotifer diversity of Nagaland with reference to nature and composition of the taxon, new records, interesting species, distribution of various species and other interesting features. The results merit interest for meta-analysis of Rotifera diversity of India in general and that of the rotifer fauna of NEI in particular, as well as ecosystem diversity of these important fish-food organisms in small lentic ecosystems of this country.

2. Materials and Methods
This study is based on plankton samples collected from varied limnetic and semi-limnetic habitats from different districts (between 25º4'-27º0' N; 93º3'-93º5' E) of Nagaland state of NEI (Fig. 1, A-B) with majority of collections from southern districts of Dimapur, Kohima, Phek, Wokha and Paren. The plankton and semi-plankton samples were collected during 2014-2016 by towing a nylobolt plankton net (#50 µm) and were preserved in 5% formalin.

All samples were screened with a stereoscopic binocular microscope, the rotifers were isolated and mounted in polyvinyl alcohol-lactophenol, and were observed with a stereoscopic phase contrast microscope fitted with an image analyzer. Various rotifer taxa were identified following the works of Koste [5], Segers [6], Sharma [7] and Sharma and Sharma [8-11]. Several interesting rotifers were illustrated and measurements were given in micrometers (µm).



A **B**

Fig 1: A. Map of India indicating Nagaland state; B. Map of Nagaland indicating different districts

3. Results

Our collections from Nagaland revealed 150 species of Rotifera belonging to 37 genera and 19 families. The detailed systematic list of the documented taxa is given below:

Systematic list of Rotifera recorded from Nagaland

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

Family: **Brachionidae**

1. *Anuraeopsis coelata* De Beauchamp, 1932 ******
2. *Anuraeopsis fissa* (Gosse, 1851)
3. *Brachionus angularis* Gosse, 1851
4. *B. bennini* Leissling, 1924 ******
5. *B. bidentatus* Anderson, 1889 ******
6. *B. budapestinensis* Daday, 1885 ******
7. *B. calyciflorus* Pallas, 1766
8. *B. caudatus* Barrois & Daday, 1894
9. *B. dichotomus reductus* Koste & Shiel, 1980
10. *B. diversicornis* (Daday, 1883)
11. *B. durgae* Dhanapathi, 1974******
12. *B. falcatus* Zacharias, 1898
    B. falcatus reductus Koste & Shiel, 1987 *
13. *B. forficula* Wierzejski, 1891
14. *B. mirabilis* Daday, 1897
15. *Brachionus murphyi* Sudzuki, 1989 *
16. *B. quadridentatus* Hermann, 1783
17. *Keratella cochlearis* (Gosse, 1851)
18. *K. edmondsoni* Ahlstrom, 1943 ******
19. *K. javana* Hauer, 1937 ******
20. *K. lenzi* Hauer, 1953
21. *K. tecta* (Gosse, 1851) ******
22. *K. tropica* (Apstein, 1907)
23. *Plationus patulus* (O.F. Muller, 1786)
24. *Platyias leloupi* (Gillard, 1967)******
25. *P. quadricornis* (Ehrenberg, 1832)

Family: **Epiphanidae**

26. *Epiphanes brachionus* (Ehrenberg, 1837) ******

Family: **Euchlanidae**

27. *Beauchampiella eudactylota* (Gosse, 1886)
28. *Dipleuchlanis propatula* (Gosse, 1886)
29. *Euchlanis dilatata* Ehrenberg, 1832
30. *E. incisa* Carlin, 1939
31. *Tripleuchlanis plicata* (Levander)

Family: **Mytilinidae**

32. *Lophocharis salpina* (Ehrenberg, 1834) ******
33. *Mytilina acanthophora* Hauer, 1938
34. *M. bisulcata* (Lucks, 1912)
35. *M. ventralis* (Ehrenberg, 1830)

Family: **Trichotriidae**

36. *Macrochaetus danneelae* Koste & Shiel, 1983******
37. *M. collinsi* (Gosse, 1867) ******
38. *M. sericus* (Thorpe, 1893)
39. *Trichotria tetractis* (Ehrenberg, 1830)

Family: **Lepadellidae**
40. C*olurella adriatica* Ehrenberg, 1831 ******
41. *C. obtusa* (Gosse, 1886)
42. *C. sulcata* (Stenroos, 1898)
43. *C. uncinata* (O.F. Muller, 1773)
44. *Lepadella acuminata* (Ehrenberg, 1834)
45. *L. apsicora* Myers, 1934
46. *L. apsida* Harring, 1916
47. *L. benjamini* Harring, 1916
48. *L. biloba* Hauer, 1958
49. *L. costatoides* Segers, 1992
50. *L. dactyliseta* (Stenroos, 1898)
51. *L. discoidea* Segers, 1993
52. *L. ehrenbergi* (Perty, 1850)
53. *L. heterostyla* (Murray, 1913)
54. *L. minuta* (Weber & Montet, 1918) ******
55. *L. ovalis* (O.F. Muller, 1786)
56. *L. patella* (O.F. Muller, 1773)
57. *L. rhomboides* (Gosse, 1886)
58. *L. triptera* Ehrenberg, 1832
59. *L. triba* Myers, 1934
60. *L. vandenbrandei* Gillard, 1952
61. *Squatinella lamellaris* (O. F. Müller, 1786)

Family: **Lecanidae**
62. *Lecane aculeata* (Jakubski, 1912)
63. *L. aeganea* Harring, 1914 ******
64. *L. arcula* Harring, 1914 ******
65. *L. batillifer* (Murray, 1913) ******
66. *L. bifurca* (Bryce, 1892) ******
67. *L. blachei* Berzins, 1973
68. *L. bulla* (Gosse, 1851)
    L. bulla diabolica (Hauer, 1936)
69. *L. closterocerca* (Schmarda, 1859)
70. *L. crepida* Harring, 1914
71. *L. curvicornis* (Murray, 1913)
72. *L. decipiens* (Murray, 1913) ******
73. *L. dorysimilis* Trinh Dang, Segers & Sanoamuang, 2015 ******
74. *L. doryssa* Harring, 1914
75. *L. elegans* Harring, 1914
76. *L. flexilis* (Gosse, 1886) ******
77. *L. furcata* (Murray, 1913)
78. *L. haliclysta* Harring & Myers, 1926
79. *L. hamata* (Stokes, 1896)
80. *L. hornemanni* (Ehrenberg, 1834)
81. *L. hastata* (Murray, 1913)
82. *L. inermis* (Bryce, 1892) ******
83. *L. lateralis* Sharma, 1978
84. *L. latissima* Yamamoto, 1951
85. *L. leontina* (Turner, 1892)
86. *L. ludwigii* (Eckstein, 1883)
87. *L. luna* (Müller, 1776)
88. *L. lunaris* (Ehrenberg, 1832)
89. *L. monostyla* (Daday, 1897)
90. *L. nitida* (Murray, 1913)
91. *L. obtusa* (Murray, 1913)
92. *L. papuana* (Murray, 1913)
93. *L. pertica* Harring & Myers, 1926 ******
94. *L. ploenensis* (Voigt, 1902)
95. *L. pyriformis* (Daday, 1905)
96. *L. quadridentata* (Ehrenberg,1830)
97. *L. rhenana* Hauer, 1929
98. *L. signifera* (Jennings, 1896)
99. *L. simonneae* Segers, 1993
100. *L. stenroosi* (Meissner, 1908)
101. *L. superaculeata* Sanoamuang & Segers, 1997 ******
102. *L. syngenes* (Hauer, 1938) ******
103. *L. thienemanni* (Hauer, 1938)
104. *L. undulata* Hauer, 1938
105. *L unguitata* (Fadeev, 1925)
106. *L. ungulata* (Gosse, 1887)

Family : Notommatidae
107. *Cephalodella. gibba* (Ehrenberg, 1830)
108. *C. trigona* (Rousselet, 1895) ******
109. *Monommata longiseta* (O.F. Müller, 1786)
110. *M. maculata* Harring & Myers, 1930
111. *Notommata copeus* Ehrenberg, 1834

Family: Scaridiidae
112. *Scaridium longicaudum* (O.F. Müller, 1786)

Family: **Gastropodidae**
113. *Ascomorpha ovalis* (Bergendal, 1892)
114. *A. saltans* Bartsch, 1870 ******

Family: Trichocercidae 14
115. *Trichocerca bicristata* (Gosse, 1887)
116. *T. bidens* (Lucks, 1912)
117. *T. cylindrica* (Imhof, 1891) ******
118. *T. edmondsoni* (Myers, 1936) ******
119. *T. elongata* (Gosse, 1886) ******
120. *T. flagellata* Hauer, 1937
121. *T. hollaerti* De Smet, 1990
122. *T insignis* (Herrick, 1885)
123. *T. longiseta* (Schrank, 1802 ******
124. *T. maior* Hauer, 1936
125. *T. pusilla* (Jennings, 1903)
126. *T. rattus* (O.F. Müller, 1776)
127. *T. similis* (Wierzejski, 1893)
128. *T. tigris* (O.F. Müller, 1786)

Family: Asplanchnidae
129. *Asplanchna priodonta* Gosse, 1850

Family: Synchaetidae
130. *Polyarthra vulgaris* Carlin, 1943
131. *Pleosoma lenticulare* Herrick ******
132. *Synchaeta* sp.

Family: Dicranophoridae 1
133. *Dicranophorus. epicharis* Harring & Myers, 1928

Order: **Flosculariaceae**
Family: Flosculariidae
134. *Lacinularia flosculosa* (O.F. Müller, 1773) ******
135. *Sinantherina semibullata* (Thorpe, 1893) ******
136. *S. spinosa* (Thorpe, 1893)

Family: Hexarthridae
137. *Hexarthra mira* (Hudson, 1871) ******

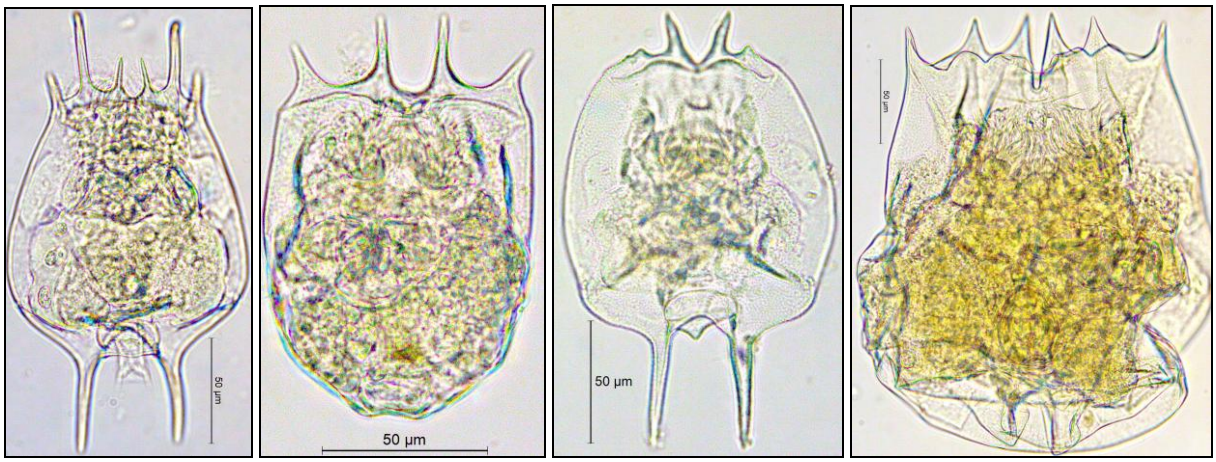
Family: Testudinellidae
138. *Pompholyx sulcata* Hudson,1885
139. *Testudinella amphora* Hauer, 1938
140. *T. brevicaudata* Yamamoto, 1951
141. *T. dendradena* de Beauchamp, 1955

142.*T. emarginula* (Stenroos, 1898)
143.*T. greeni* Koste, 1981
144.*T. parva* (Ternetz, 1892) **
145.*T. patina* (Hermann, 1783)
146.*T. tridentata* Smirnov, 1931

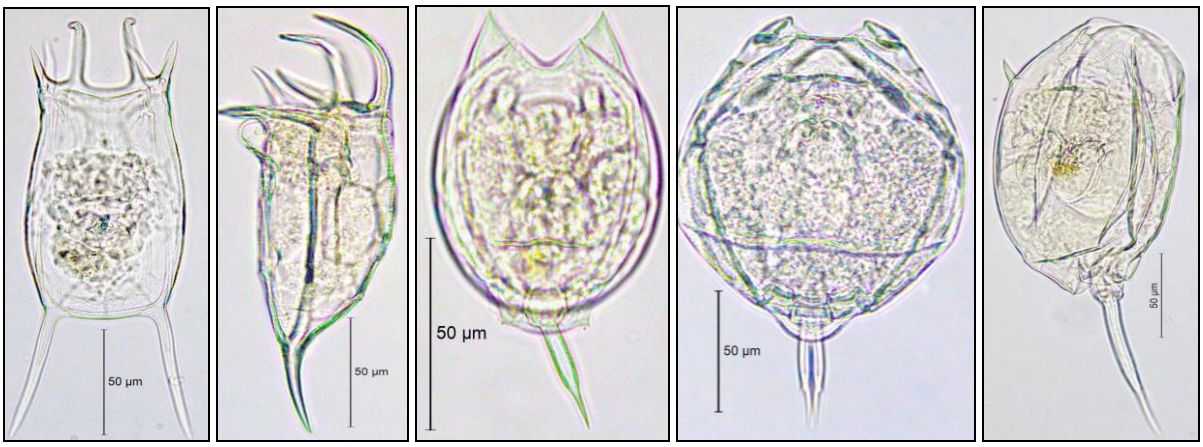
Family: Trochosphaeridae
147.*Filinia longiseta* (Ehrenberg, 1834)
148.*F. opoliensis* (Zacharias, 1898) **

Sub-class: Bdelloidea
Family: Philodinidae
149.*Dissotrocha aculeata* (Ehrenberg, 1832)
150.*Rotaria neptunia* (Ehrenberg, 1830)
*new record from India; ** new record from Nagaland

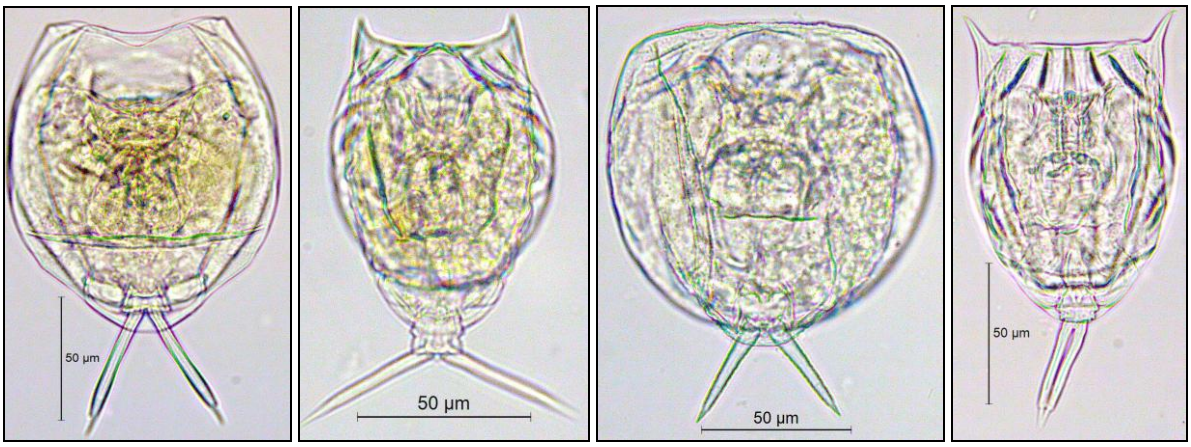
Brachionus falcatus reductus (Fig. 2A) and *B. murphyi* (Fig. 2B) are new records from India. *Brachionus dichotomus reductus* (Fig. 2C), *B. durgae* (Fig. 2D), *K. edmondsoni* (Fig. 2E), *K. javana (*Fig. 2F), *Lecane batillifer* (Fig.2G), *L. blachei* (Fig. 2H), *L. bulla diabolica* (Fig. 2I), *L. lateralis* (Fig. 2K), *L. simonneae* (Fig. 2K), *L. latissima* (Fig. 2L), *L. superaculeata* (Fig. 2M), *Lepadella discoidea*, *L. vandenbrandei*, *Macrochaetus danneelae* (Fig. 3A), *Testudinella brevicaudata* (Fig. 3B), *T. greeni*, and *Trichocerca hollaerti* (Fig. 3C) are globally interesting species. In additon, *Brachionus bennini*, *Cephalodella trigona* (Fig. 3D), *Lecane aeganea* (Fig. 3E), *L.. pertica* (Fig. 3F), *L.rhenana* (Fig. 3G), *L. syngenes* (Fig. 3H), *Platyias leleoupi* (Fig. 3I), *Testudinella amphora* (Fig. 3J), *T. parva* (Fig. 3K), *Trichocerca edmondsoni* and *T. maior* are some notable species. Thirty eight species (marked with*) are new records from Nagaland. Lecanidae, Lepadellidae, Brachionidae, Trichocercidae and Testudinellidae indicated 45, 24, 22, 14 and 9 species, respectively. *Lecane* (45 species), *Lepadella* (17 species), *Trichocerca* (18 species) and *Brachionus* (14 species) are species-rich genera while *Testudinella* and *Keratella* recorded right and six species, respectively.



A **B** **C** **D**



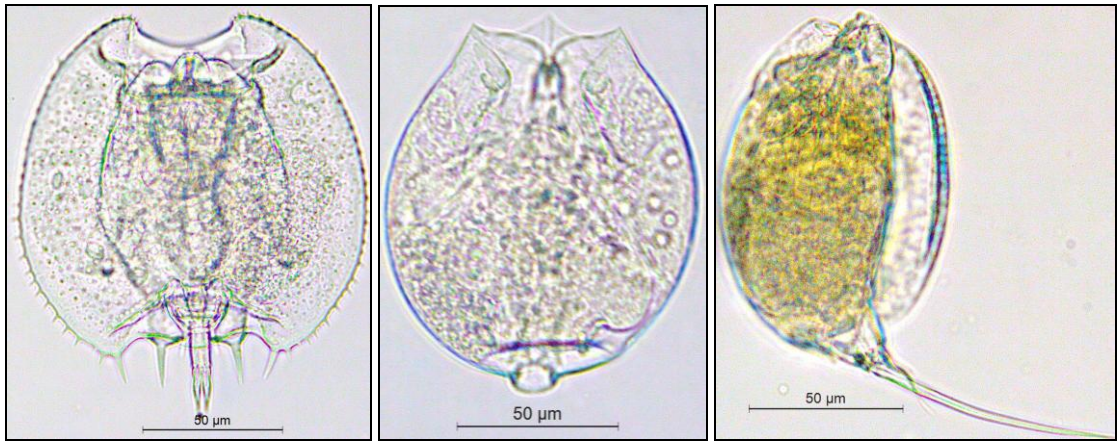
E **F** **G** **H** **I**



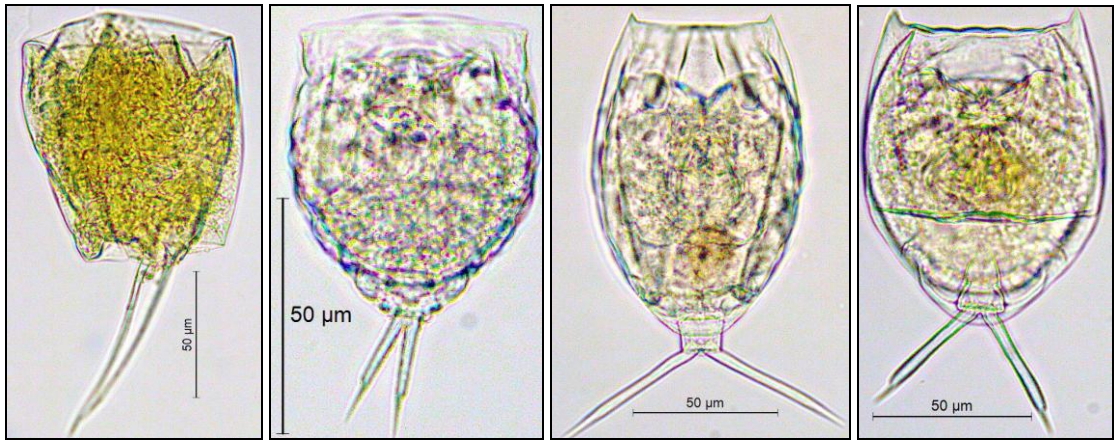
J **K** **L** **M**

Fig 2: A-M, Globally interesting Rotifera

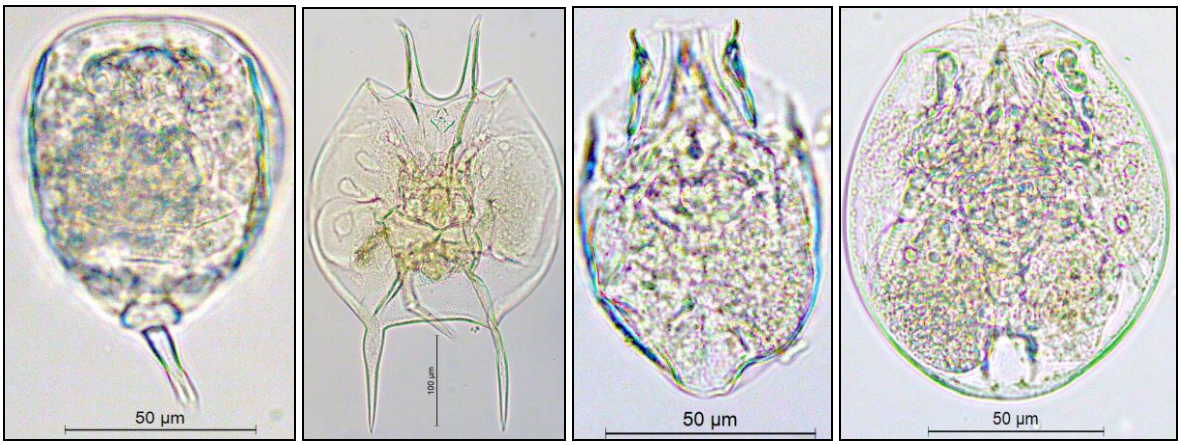
A, *Brachionus falcatus reductus* Koste & Shiel (ventral view); B, *B. murphyi* Sudzuki (ventral view); C, *B. dichotomus reductus* Koste & Shiel (ventral view); D, *B. durgae* Dhanapathi (ventral view); E, *Keratella edmondsoni* Ahlstrom (dorsal view); F, *K. javana* Hauer (lateral view); G, *Lecane batillifer* (Murray) (dorsal view); H, *L. blachei* Berzins (dorsal view); I, *L. bulla diabolica* (Hauer) (lateral view); J, *L. lateralis* Sharma (ventral view); K, *L. simonneae* Segers (dorsal view); L, *L. latissima* Yamamoto (dorsal view); M, *L. superaculeata* Sanoamuang & Segers (dorsal view).



A **B** **C**



D **E** **F** **G**



H **I** **J** **K**

Fig 3: A-K, Species of regional interest

A, *Macrochaetus danneelae* Koste & Shiel (ventral view); B, *Testudinella brevicaudata* Yamamoto (ventral view); C, *Trichocerca hollaerti* De Smet (lateral view); D, *Cephalodella trigona* (Rousselet) (lateral view); E, *Lecane aeganea* Harring (dorsal view); F, *L. pertica* Harring & Myers (ventral view); G, *L. rhenana* Hauer (dorsal view); H, *L. syngenes* (Hauer) (ventral view); I, *Platyias leloupi* (Gillard) (ventral view); J, *Testudinella amphora* Hauer (ventral view); K, *Testudinella parva* (Ternetz) (ventral view).

4. Discussion

One hundred and fifty species (S) of Rotifera reported presently from Nagaland reveal species-rich Rotifera assemblage; these merit biodiversity interest as ~36 % of species of the taxon known from India and interestingly comprise ~53% of the species reported from NEI [12]. The report of 37 genera and 19 families indicates rich higher diversity of the phylum in comparison with 67 genera and 25 families, and 50 genera and 23 families known from India and NEI, respectively [12]. Our results thus characterize rich and diverse rotifer fauna of Nagaland with regards to its species and higher (generic and family) diversity. The rotifer richness of this hill state of NEI is marginally lower, but compares well with 162 and 161 species known from the hill states of Mizoram [13] and Meghalaya [14] characterized by small lentic ecosystems, respectively. The present report is comparable with the listing of 152 species from Tripura state of NEI [9] and 148 species known from West Bengal [7] from eastern India.

Our collections are characterized by a notable fraction of species (14.7% of S) of global biogeographic interest. These include the Australasian *Brachionus dichotomus reductus*; and *B. falcatus reductus*, *Lecane batillifer*, *Macrochaetus danneelae*; six Oriental endemics: *Brachionus murphyi*, *Keratella edmondsoni*, *Lecane blachei*, *L. bulla diabolica*, *L. latissima* and *L. superaculeata*; nine palaeotropical species i.e., *Keratella javana*, *Lepadella discoidea*, *L. vandenbrandei*, *L. lateralis*, L. *simonneae*, *L unguitata*, *Testudinella brevicaudata*, *T. greeni* and *Trichocerca hollaerti*; and the Indo-Chinese *Lecane dorysimilis*, the palaearctic *Cephalodella trigona* and the cosmo(sub) tropical *Brachionus durgae.*

Brachionus falcatus reductus and *B. murphyi* are new records to India. The former was described as a new form from billabongs of the Magela creek, N.T, Australia [15]. We follow Jersabek and Leitner [16] to treat this brachionid as *B. falcatus reductus*. Originally believed to be an Australian endemic [18], it is examined elsewhere by several workers from Thailand [19]. With the present report from NEI, we consider this brachionid to be an 'Australasian element'; besides its distribution range, it is differentiated from the pantropical *B. falcatus falcatus* by distinctly reduced posterior spines. The Oriental endemic *B. murphyi* is likely to be confused with *B. budapestinensis* but differed from the same by (a) unequal antero-dorsal spines, (b) outwardly directed lateral antero-dorsal spines, and (c) relatively soft lorica. We follow Segers [19] and Jersabek and Leitner [16] to treat *B. niwati* described from Thailand [20] as a synonym of *B. murphyi*. Amongst other taxa of global interest, *Brachionus dichotomus reductus*, *Cephalodella trigona*, *Keratella javana*, *Lecane dorysimilis*, *L. dorysimilis*, *L. latissima*, *L. superaculeata*, *Lepadella vandenbrandei*, *Testudinella brevicaudata* and *Trichocerca hollaerti* are known for their distribution in India till date restricted to NEI [12] while *Lecane batillifer* deserved attention for its recent disjunct report from freshwaters of south Andaman [21]. On the other hand, *Keratella edmondsoni*, *Lecane blachei*, *L. bulla diabolica*, *L. lateralis*, *L. simonneae*, *Lepadella discoidea* and *Macrochaetus danneelae*, though known from NEI, are yet characterized by disjunct distribution in India. *M. danneelae* was reported from India from Assam [22] and in an unpublished report from Kerala [23]; both these Indian works misspelled it as *M. danneeli* following its original description from Australia [17]. Nevertheless, named after the personal (female) name Dr. Ilse Danneel, this species, however, required an ending of *– ae* [16] and thus name of this species is corrected accordingly.

Thirty eight species are new records from Nagaland; these include *Lecane aeganea*, *L. syngenes*, *Testudinella amphora*, *T. dendradena*, *Trichocerca edmondsoni* and *T insignis* with distribution in this country restricted to NEI. *Lecane pertica* and *Platyias leloupi* though recorded from NEI are known to exhibit restricted disjunct distribution elsewhere in India. Amongst other rotifers reported from Nagaland, *Lecane doryssa*, *L. elegans*, *L. haliclysta*, *L. hastata*, *L. rhenana*, *L. thienemanni*, *L. undulata*, *Lepadella benjamini*, *L. costatoides*, *L. dactyliseta*, *T. tridentata* and *T. maior* are species of regional distribution interest in the Indian sub region [2]. Amongst these, six species namely *Brachionus bennini*, *Lepadella benjamini*, *Lecane elegans*, *L. rhenana*, *L. undulata* and *Trichocerca maior* are characterized by their distribution in India till date exclusively restricted to NEI. The stated comments indicate an interesting feature of a notable

fraction of the species of Nagaland Rotifera (~15% of S) with distribution yet localized to NEI; this salient feature highlighted the importance of regional biogeography [12].
Lecanidae > Brachionidae > Lepadellidae contribute importantly to Nagaland Rotifera (~61.0% of S) and Trichocercidae > Testudinellidae deserved attention (15.3% of S). Our collections exhibit distinctly species-rich nature of 'tropic-centered' genus *Lecane* (30.0% of S). Three monogonont genera *Lepdella* > *Brachionus* = *Trichocerca* collectively form a notable component of the rotifer diversity (30.0% of S) and *Testudinella* > *Keratella* also indicated certain importance (9.3 % of S). Rotifera of small lentic habitats are largely notable for semi-planktonic littoral-periphytic assemblages. We caution on over emphasis on *Brachionus* (14 species) and *Keratella* (6 species); various species of these brachionids are rather uncommon in small lentic waters and other sampled habitats but form a useful component of plankton in limnetic habitats of certain fish ponds. The richness and common occurrence of 'tropic-centered' *Lecane* and *Brachionus*, high richness of cosmpolitan species (~59% of S) and collective importance of tropicopolitan and pantropical species (~23% of S) impart general 'tropical character' to the rotifer fauna of Nagaland following the remarks of Sharma and Sharma [1, 11, 24]. With majority of our samples collected from small water bodies, the rich and diverse character of Nagaland Rotifera highlights habitat diversity and ecosystem heterogenity of small lentic biotopes of this hill state NEI.

5. Conclusions

To sum up, this study highlights rich and diverse Rotifera vis-à-vis habitat diversity and ecosystem heterogenity of small lentic biotopes of hill state of Nagaland, NEI. The notable number of species of global and regional distribution interest is noteworthy; the latter focus interest on regional biogeography. The richness of littoral periphytic taxa of Lecanidae, Lepadellidae, Trichocercidae and Testudinellidae in particular reflects the littoral-periphytic assemblages while Brachionidae in general and species of *Brachionus* and *Keratella* recorded more richness in limnetic environs of fish ponds. Our collections are largely restricted to five districts of southern Nagaland and thus extensive sampling of other districts of this state presents scope for future Rotifera diversity update with our conservation estimate of 225+ species.

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7. References

1. Sharma BK, Sharma S. Northeast India - An important region with a rich biodiversity of Rotifera. In: Sharma BK, Dumont HJ, Wallace RL (Eds.) Rotifera XIII: Rotifer Biology - a Structural and Functional Approach. Int. Rev. Hydrobiol. 2014; 99(1-2):20-37.
2. Sharma BK, Kensibo. Rotifer assemblages (Rotifera: Eurotatoria) of two wetlands of Nagaland, northeast India: ecosystem diversity and interesting features. Int. J. Aqua. Stud. 2017; 5(2):609-617.
3. Downing JA. Emerging global role of small lakes and ponds: little things mean a lot. Limnetica 2010; 29(1):9-24.
4. Céréghino R, Boix D, Cauchie HM, Martens K, Oertli B. The ecological role of ponds in a changing world. Hydrobiologia 2014; 723(1):1-6.
5. Koste Rotatoria W. Die Rädertiere Mitteleuropas. Gebrüder Borntraeger, Berlin, Stuttgart. Plates, 1978; 2:673-234.
6. Segers H. Rotifera 2: Lecanidae. In: Dumont HJ, Nogrady T, editors. Guides to identification of the microinvertebrates of the continental waters of the world. Amsterdam, the Netherlands: SPB Academic Publishing, 1995, 1-226.
7. Sharma BK. Freshwater Rotifers (Rotifera: Eurotatoria). In: Fauna of West Bengal. State Fauna Series, Zoological Survey of India, Calcutta, 1998; 3(11):341-361.
8. Sharma BK, Sharma S. Freshwater Rotifers (Rotifera, Eurotatoria). In: Fauna of Meghalaya. State Fauna Series Zoological Survey of India, Calcutta, 1999; 4: 11-161.
9. Sharma BK, Sharma S. Freshwater Rotifers (Rotifera: Eurotatoria). In: Fauna of Tripura: State Fauna Series Zoological Survey of India, Calcutta. 2000; 7(4): 163-224.
10. Sharma S, Sharma BK. Zooplankton diversity in floodplain lakes of Assam. Rec. zool. Surv. India, Occ paper 2008; 290:1-307.
11. Sharma S, Sharma BK. Faunal diversity of aquatic invertebrates of Deepor Beel (a Ramsar site), Assam, northeast India. Wetland Ecosystem Series, plates. Zoological Survey of India, Kolkata, 2013; 17:1-227.
12. Sharma BK, Sharma S. Rotifera: Eurotatoria (Rotifers). In: Chandra K, Gopi KC, Rao, DV, Valarmathi K., Alfred JRB (Eds.) Current status of freshwater faunal diversity in India. Chapter Zoological Survey of India, Kolkata, 2017; 7:93-113.
13. Sharma BK, Sharma S. Biodiversity of freshwater rotifers (Rotifera: Eurotatoria) of Mizoram, Northeast India: composition, new records and interesting features. Int. J. Aqua. Biol. 2015; 3(5):301-313.
14. Sharma BK, Haokip PT, Sharma S. Loktak lake, Manipur, northeast India: a Ramsar with rich rotifer (Rotifera: Eurotatoria) diversity and its meta-analysis. Int. J. Aqua. Biol. 2016; 4(2):69-79.
15. Koste W, Shiel RJ. Morphology, systematics and ecology of new monogonont Rotifera from the Alligator Rivers region, Northern Territory. Trans. Roy. Soc. S. Australia 1983; 107: 109-21.
16. Jersabek CD, Leitner MF. The Rotifer World Catalog. World Wide Web electronic publication. 2013. http //www.rotifera.hausdernatur.at/ accessed {30.12.2016}.
17. Koste W, Shiel RJ. Rotifera from Australian inland waters. II. Epiphanidae and Brachionidae (Rotifera, Monogononta). Invert. Tax. 1987; **7**:949-1021.
18. Sa–Ardrit P, Pholpunthin P, Segers H. A checklist of the freshwater rotifer fauna of Thailand (Rotifera, Monogononta, Bdelloidea). J. Limnol. 2013; 72(2):361-375.
19. Segers H. Annotated checklist of the rotifers (Phylum Rotifera), with notes on nomenclature, taxonomy and distribution. Zootaxa 2007; 1564:1-104.
20. Sanoamuang L, Segers H, Dumont HJ. Additions to the rotifer fauna of south–east Asia, new and rare species

from north–east Thailand. Hydrobiologia 1995; 313/314:35-45.
21. Sharma BK. First report of freshwater Rotifers (Rotifera: Eurotatoria) from south Andaman, India: composition and interesting elements. J Asia-Pac. Biod. 2017;10:261-266.
22. Sharma BK. Rare and interesting monogonont rotifers (Rotifera, Eurotatoria) from North-Eastern India. Mitt. Mus. Nat. kd. Berlin, Zool. Reihe 2004; 80:33-40.
23. Kakkassery FK. Studies on freshwater rotifers of Kerala. Ph. D thesis, University of Calicut, Calicut, Kerala, 2003.
24. Sharma BK, Sharma S. Biodiversity of freshwater rotifers (Rotifera, Eurotatoria) from North–Eastern India. Mitt. Mus. Nat. kd. Berlin, Zool. Reihe 2005; 81:81-88.