Rec. zool. Surv. India : **104** (Part 3–4) : 41-55, 2005

FRESHWATER ROTIFER TAXOCOENOSIS (ROTIFERA : EUROTATORIA) OF ORISSA, WITH REMARKS ON COMPOSITION AND DISTRIBUTION

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INTRODUCTION

Although taxonomic studies on the Indian freshwater Rotifera began more than one century ago, adequate information about bio-diversity of the members of this phylum from different regions/ states of this country is hitherto lacking (Sharma, 1996, 1998). This generalization also holds true to the rotifer fauna of Orissa; the earlier contributions from this state are so far restricted to the works of Sharma (1977, 1980, 1987). The present study is, therefore, an attempt to fill up the stated lacuna and it deals with 104 species (114 taxa). Various interesting species are briefly diagnosed and illustrated. Remarks are made on the general nature and composition of Orissa Rotifera and on the distribution of different taxa.

MATERIALS AND METHODS

The present observations are based on the material collected by the authors from the following localities (Fig. 1) of Eastern Orissa :

Gopalpur-on-sea	(Lat. : 19°16' N; Long. : 84°57' E)
Berhampur	(Lat. : 19°18' N; Long. : 84°51' E)
Ganjam	(Lat. : 19°22' N; Long. : 85°06' E)
Puri	(Lat. : 19°48' N; Long. : 85°32' E)
Bhubaneshwar	(Lat. : 20°15' N; Long. : 85°52' E)
Khurda	(Lat. : 20°11' N; Long. : 85°40' E)

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Cuttack	(Lat. : 20°28' N; Long. : 85°54' E)
Kendrapara	(Lat. : 20°30' N; Long. : 86°28' E)
Dhenkanal	(Lat. : 20°40' N; Long. : 85°38' E)

Qualitative plankton samples were collected from various ephemeral and perennial aquatic biotopes of the mentioned major localities and their adjacent areas by towing a nylobolt plankton net (No. 25) and were preserved in 5% formalin. In all, about 118 samples were examined for this study. Various rotifer taxa were screened, isolated, mounted in Polyvinyl alcohol-lactophenol mixture and identified following the works of Kutikova (1970), Koste (1978), Sharma (1983) and Segers (1995). All the drawings are made with a Leitz-Dialux phase contrast stereoscopic microscope with a drawing-tube attachment and the measurements are given in micrometers (µm). The system of classification followed in this account is after Sharma (2001). The reference collections are deposited in Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong.

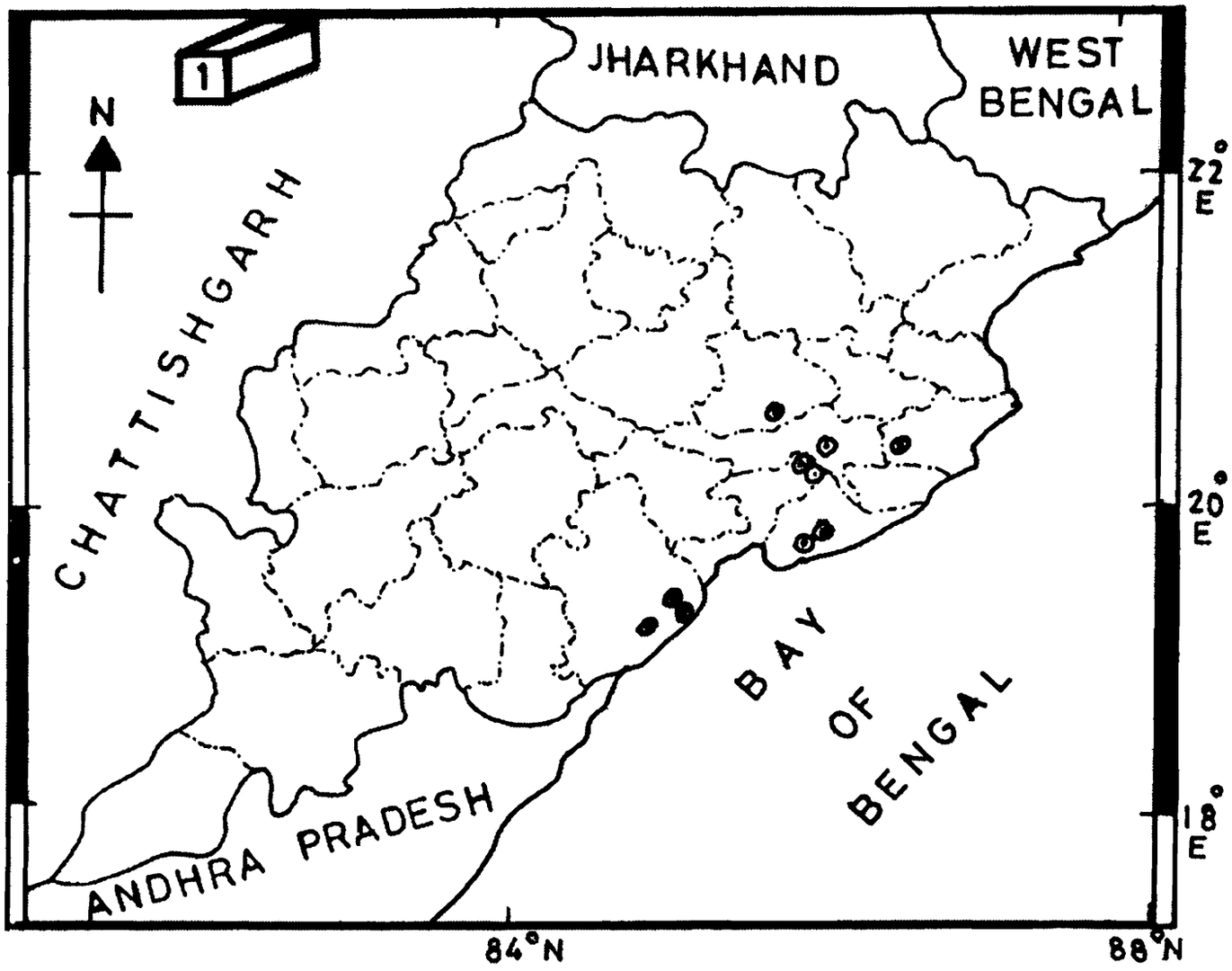

Fig. 1. : Map of Orissa showing the sampling sites.

LIST OF THE EXAMINED TAXA

Phylum ROTIFERA

Super-class EUROTATORIA

Class MONOGONONTA

Order PLOIMIDA

Family BRACHIONIDAE

1. *Anuraeopsis coelata* (De Beauchamp, 1932)
2. *A. fissa* (Gosse, 1851)
3. *Brachionus angularis* Gosse, 1851
4. *B. bidentatus bidentatus* Anderson, 1889
   B. bidentatus testudinarius (Jakubski, 1912)*
5. *B. budapestinensis* Daday, 1885
6. *B. calyciflorus f. anuraeiformis* (Brehm, 1909)
   B. calyciflorus f. amphiceros (Brehm, 1909)
   B. calyciflorus f. dorcas (Gosse, 1851)
7. *B. caudatus aculeatus* (Hauer, 1937)
   B. caudatus personatus (Ahlstrom, 1940)
   B. caudatus vulgatus Ahlstrom, 1940
8. *B. diversicornis* (Daday, 1883)
9. *B. durgae* Dhanapathi, 1974*
10. *B. falcatus* Zacharias, 1898
11. *B. forficula* Wierzejski, 1891
    B. forficula minor (Voronkov, 1913)
12. *B. mirabilis* Daday, 1897*
13. *B. plicatilis* (O. F. Müller, 1786)
14. *B. quadridentatus* (Hermann, 1783)
    B. quadridentatus brevispinus (Ehrenberg, 1832)
    B. quadridentatus cluniorbicularis (Skorikov, 1894)
    B. quadridentatus rhenanus (Lauterborn, 1893)
15. *B. rubens* Ehrenberg, 1838
16. *Keratella edmondsoni* (Ahlstrom, 1943)**
17. *K. lenzi* Hauer, 1953
18. *K. procurva* (Thorpe, 1891)
19. *K. quadrata* (O. F. Müller, 1786)*
20. *K. tropica* (Apstein, 1907)
21. *Platyias quadricornis* (Ehrenberg, 1832)
22. *Platinous patulus* (O. F. Müller, 1786)
    P. patulus macracanthus (Daday, 1905)

Family EUCHLANIDAE

23. *Euchlanis dilatata* Ehrenberg, 1832
24. *E. triquetra* Ehrenberg, 1838
25. *Dipleuchlanis propatula* (Gosse, 1886)
26. *Tripleuchlanis plicata* (Levander, 1894)
27. *Beauchampiella eudactylota* (Gosse, 1886)*

Family MYTILINIDAE

28. *Mytilina acanthophora* Hauer, 1938
29. *M. bisulcata* (Lucks, 1912)*
30. *M. ventralis* (Ehrenberg, 1832)

Family TRICHOTRIDAE

31. *Macrochaetus sericus* (Thorpe, 1893)
32. *Trichotria tetractis* (Ehrenberg, 1830)

Family COLURELLIDAE

33. *Colurella obtusa* (Gosse, 1886)*
34. *C. sulcata* (Stenroos, 1898)
35. *C. uncinata* (O. F. Müller, 1773)
36. *Lepadella acuminata* (Ehrenberg, 1834)
37. *L. apsida* Harring, 1916*
38. *L. costatoides* Segers, 1992**
39. *L. cristata* (Rousselet, 1893)*
40. *L. ovalis* (O. F. Müller, 1786)
41. *L. patella* (O. F. Müller, 1773)
42. *L. rhomboides* (Gosse, 1886)
43. *L. rhomboidula* (Bryee, 1890)*
44. *L. triptera* Ehrenberg, 1830
45. *L. (Heterolepadella) apsicora* Myers, 1934*
46. *L. ehrenbergi* (Perty, 1850)
47. *L. heterostyla* (Murray, 1913)

Family LECANIDAE

48. *Lecane aculeata* (Jakubski, 1912)
49. *L. arcula* Harring, 1914*
50. *L. curvicornis* (Murray, 1913)
51. *L. crepida* Harring, 1914
52. *L. flexilis* (Gosse, 1886)
53. *L. hornemanni* (Ehrenberg, 1834)*

54. *L. inermis* (Bryce, 1892)
55. *L. lateralis* Sharma, 1978
56. *L. leontina* (Turner, 1892)
57. *L. ludwigii* (Eckstein, 1883)
58. *L. luna* (O. F. Müller, 1776)
59. *L. nana* (Murray, 1913)*
60. *L. ohioensis* (Herrick, 1885)*
61. *L. papuana* (Murray, 1913)*
62. *L. signifera* (Jennings, 1896)*
63. *L. sola* Hauer, 1936**
64. *L. ungulata* (Gosse, 1887)
65. *L. (Hemimonostyla) inopinata* Harring & Myers, 1926
66. *L. (Monostyla) acanthinula* (Hauer, 1938)
67. *L. (M.) bulla* (Gosse, 1851)
68. *L. (M.) closterocerca* (Schmarda, 1898)
69. *L. (M.) bifurca* (Bryce, 1892)*
70. *L. (M.) decipiens* (Murray, 1913)
71. *L. (M.) furcata* (Murray, 1913)
72. *L. (M.) hamata* (Stokes, 1896)
73. *L. (M.) lunaris* (Ehrenberg, 1982)*
74. *L. (M.) obtusa* (Murray, 1913)*
75. *L. (M.) pyriformis* (Daday, 1905)
76. *L. (M.) quadridentata* (Ehrenberg, 1832)
77. *L. (M.) stenroosi* (Meissner, 1908)
78. *L. (M.) thienemanni* (Hauer, 1938)*
79. *L. (M.) unguitata* (Fadeev, 1925)

Family NOTOMMATIDAE

80. *Cephalodella forficula* (Ehrenberg, 1832)*
81. *C. mucronata* Harring & Myers, 1921
82. *Scaridium longicaudum* (O. F. Müller, 1786)

Family GASTROPODIDAE

83. *Ascomorpha ovalis* (Bergendal, 1892)*

Family TRICHOCERCIDAE

84. *Trichocerca bicristata* (Gosse, 1887)*
85. *T. cylindrica* (Imhof, 1891)
86. *T. flagellata* Hauer, 1938
87. *T. longiseta* (Schrank, 1802)*

88. *T. rattus* (O. F. Müller, 1786)
89. *T. similis* (Wierzejski, 1893)

Family ASPLANCHNIDAE

90. *Asplanchna brightwelli* Gosse, 1850

Family SYNCHAETIDAE

91. *Polyarthra vulgaris* Carlin, 1943

Order FLOSCULARIACEA

Family CONOCHILIDAE

92. *Conochilus unicornis* Rousselet, 1892*

Family HEXARTHRIDAE

93. *Hexarthra mira* (Hudson, 1871)*

Family FILINIIDAE

94. *Filinia longiseta* (Ehrenberg, 1834)
95. *F. opoliensis* (Zacharias, 1898)
96. *F. pejleri* Hutchinson, 1964
97. *F. saltator* (Gosse, 1886)*

Family TESTUDINELLIDAE

98. *Testudinella emarginula* (Stenroos, 1898)*
99. *T. parva* (Ternetz, 1892)**
100. *T. patina* (Hermann, 1783)
101. *Pompholyx sulcata* Hudson, 1885

Family TROCHOSPHAERIDAE

102. *Horaella brehmi* Donner, 1949

Super-class DIGONONTA

Class BDELLOIDEA

Order PHILODINIDA

Family PHILODINIDAE

103. *Rotaria neptunia* (Ehrenberg, 1832)*
104. *R. rotatoria* (Pallas, 1766)*

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* New record from Orissa.

** New record from Eastern India; the term 'form' has been used in 'non-taxonomic' sense to indicate cyclomorphic variations in *B. calyciflorus*.

SYSTEMATIC NOTES

Thirty-six species (37 taxa) are new to Orissa; the following systematic notes, however, deal only with some interesting species reported presently :

Brachionus durgae Dhanapathi, 1974
(Fig. 2)

Diagnosis : Characterised by large lorica, distinct occipital margin and thread-like processes for egg attachment with lorica. Rare in the present study; examined specimens agree with those described from Andhra Pradesh (Dhanapathi, 1974).

Distribution : INDIA – Andhra Pradesh. *Elsewhere* – Cosmo(sub)tropical.

Brachionus mirabilis Daday, 1897
(Fig. 3)

Diagnosis : Ventral plate of lorica produced into two posterior spines extending backwards at an angle of 45° Foot-opening situated between the bases of ventral spines and surrounded by a sheath.

Distribution : INDIA – Meghalaya, Assam, Tripura, West Bengal. *Elsewhere* – Tropics and subtropics.

Keratella edmondsoni (Ahlstrom, 1943)
(Fig. 4)

Diagnosis : Lorica granulated, with characteristic pattern of carinal plaques on dorsum and divergent posterior spines. Specimens from Orissa identical with those reported by Sanoamuang *et al.* (1995).

Distribution : INDIA – Rajasthan, Assam. *Elsewhere* – Oriental region.

Mytilina bisulcata (Lucks, 1912)
(Fig. 5)

Diagnosis : Lorica thin, transparent and without anterior spines; dorsal sulcus indistinct. Toes long, slender and ending into slender, curved spines.

Distribution : INDIA – Meghalaya, West Bengal, Tripura, Orissa. *Elsewhere* – Cosmopolitan.

Lepadella apsida Harring, 1916
(Fig. 6 & 7)

Diagnosis : Lorica small, nearly circular; without dorsal sinus, ventral sinus circular and dorsal plate arched. Foot-groove rounded U-shaped; toes short and pointed.

Distribution : INDIA – West Bengal, Punjab, Meghalaya. *Elsewhere* – Pantropics, reported from China, America, Central and Eastern Asia, India.

Lepadella costatoides Segers, 1992
(Fig. 8)

Diagnosis : Dorsum with three pairs of longitudinal ridges. Lorica with symmetrical postero-lateral projections.

Distribution : INDIA – Kerala. *Elsewhere* – Tropics and subtropics.

Lepadella cristata (Rousselet, 1893)
(Fig. 9 & 10)

Diagnosis : Lorica with a dorsal median keel and a distinct posteriorly directed dorsal crest. Toes long and pointed.

Distribution : INDIA – Meghalaya, West Bengal. *Elsewhere* – Cosmopolitan.

Lepadella rhomboidula (Bryce, 1890)
(Fig. 11 & 12)

Diagnosis : Lorica rhomboidal; median dorsal keel moderately high and with concave sides. Dorsal sinus lacking, ventral sinus semicircular. Foot-groove inverted U-shaped; toes long and pointed.

Distribution : INDIA – West Bengal. *Elsewhere* – Cosmopolitan.

Lepadella (Heterolepadella) apsicora Myers, 1934
(Fig. 13)

Diagnosis : Lorica oval, with shallow dorsal and V-shaped ventral sinus. Toes unequal; right toe longer than the left and often twisted.

Distribution : INDIA – West Bengal, Meghalaya. *Elsewhere* – Tropics and subtropics.

Lecane sola (Hauer, 1936)
(Fig. 14)

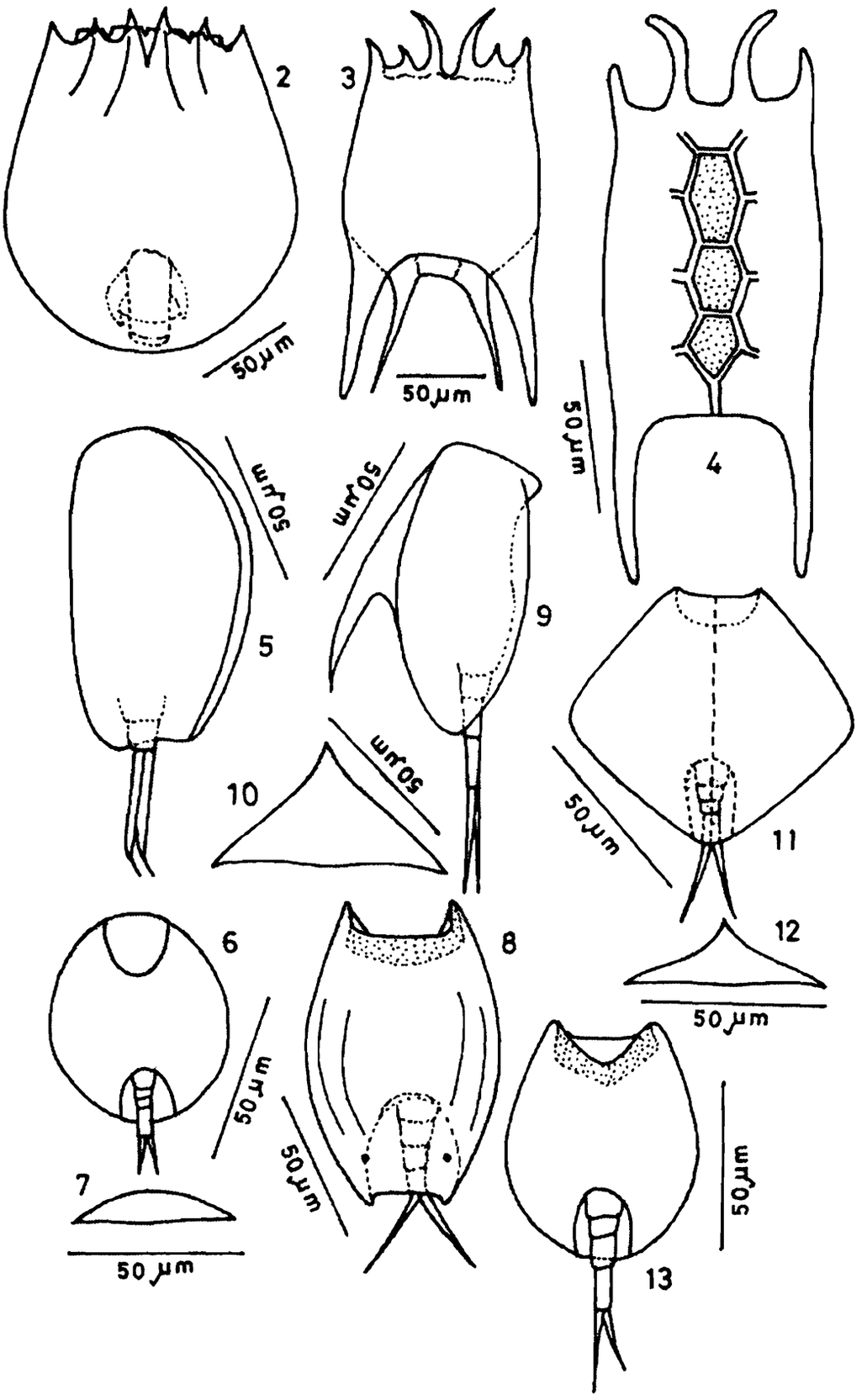
Diagnosis : Lorica small, oval, with straight and coincident anterior margins. Dorsal plate with distinct pattern. Ventral plate smaller than dorsal plate and with small spines at its external angles. Second foot-segment elongated, projecting beyond posterior end of lorica. Toes parallel-sided for about half of their length and then tapering to pointed tips.

Distribution : INDIA – Tamil Nadu, Tripura. *Elsewhere* – Pantropical.

Lecane (Monostyla) acanthinula (Hauer, 1938)
(Fig. 15)

Diagnosis : Lorica oval and with straight anterior margins. Dorsal plate ovate, ventral plate narrower than dorsal plate and with small spines at external angles. Toe parallel-sided for half of its length, then slightly narrowing and with two claws; each claw with a small basal spine.

Distribution : INDIA – Kerala and Tripura. *Elsewhere* – Oriental region.



Figs. 2-13. : 2. *Brachionus durgae* Dhanapathi, dorsal view; 3. *B. mirabilis* Daday, dorsal view; 4. *Keratella edmondsoni* (Ahlstrom), dorsal view; 5. *Mytilina bisulcata* (Lucks), lateral view; 6 & 7. *Lepadella apsida* Harring, ventral view and cross-section; 8. *L. costatoides* Segers, dorsal view; 9 & 10. *L. cristata* (Rousselet), lateral view and cross-section; 11 & 12. *L. rhomboidula* (Bryce), dorsal view and cross-section; 13. *L. apsicora* Myers, ventral view.

Lecane (Monostyla) bifurca (Bryce, 1892)
(Fig. 16)

Diagnosis : Lorica small, oval and without any markings. Ventral plate slightly narrower than dorsal plate and with small posterior projections. Toe small, claws divergent.

Distribution : INDIA – Delhi. *Elsewhere* – Cosmopolitan.

Lecane (Monostyla) obtusa (Murray, 1913)
(Fig. 17)

Diagnosis : Lorica oval, without surface makings; anterior margins straight, coincident and with minute spines at external angles. Ventral plate narrow than dorsal plate. Toe cylindrical, slightly swollen in its middle region; claw pointed, with basal spicules.

Distribution : INDIA – Tripura, West Bengal, Andhra Pradesh. *Elsewhere* – Tropics and subtropics.

Lecane (Monostyla) thienemanni (Hauer, 1938)
(Fig. 18)

Diagnosis : Lorica elongate-oval, anterior dorsal margin straight, anterior ventral margin with a shallow sinus and its external angles produced into two stout triangular spines. Dorsal plate broader than ventral plate. Toe parallel-sided for about half of its length and then tapering to an acute point.

Distribution : INDIA – Meghalaya, Tripura, West Bengal and Gujarat. *Elsewhere* – S. E. Asia.

Trichocerca bicristata (Gosse, 1887)
(Fig. 19)

Diagnosis : Lorica with two characteristic distinct keels extending upto 2/3 the length of dorsum. Left toe longer than body, right toe reduced; substyles present.

Distribution : INDIA – Bihar. *Elsewhere* – Cosmopolitan.

Filinia saltator (Gosse, 1886)
(Fig. 20)

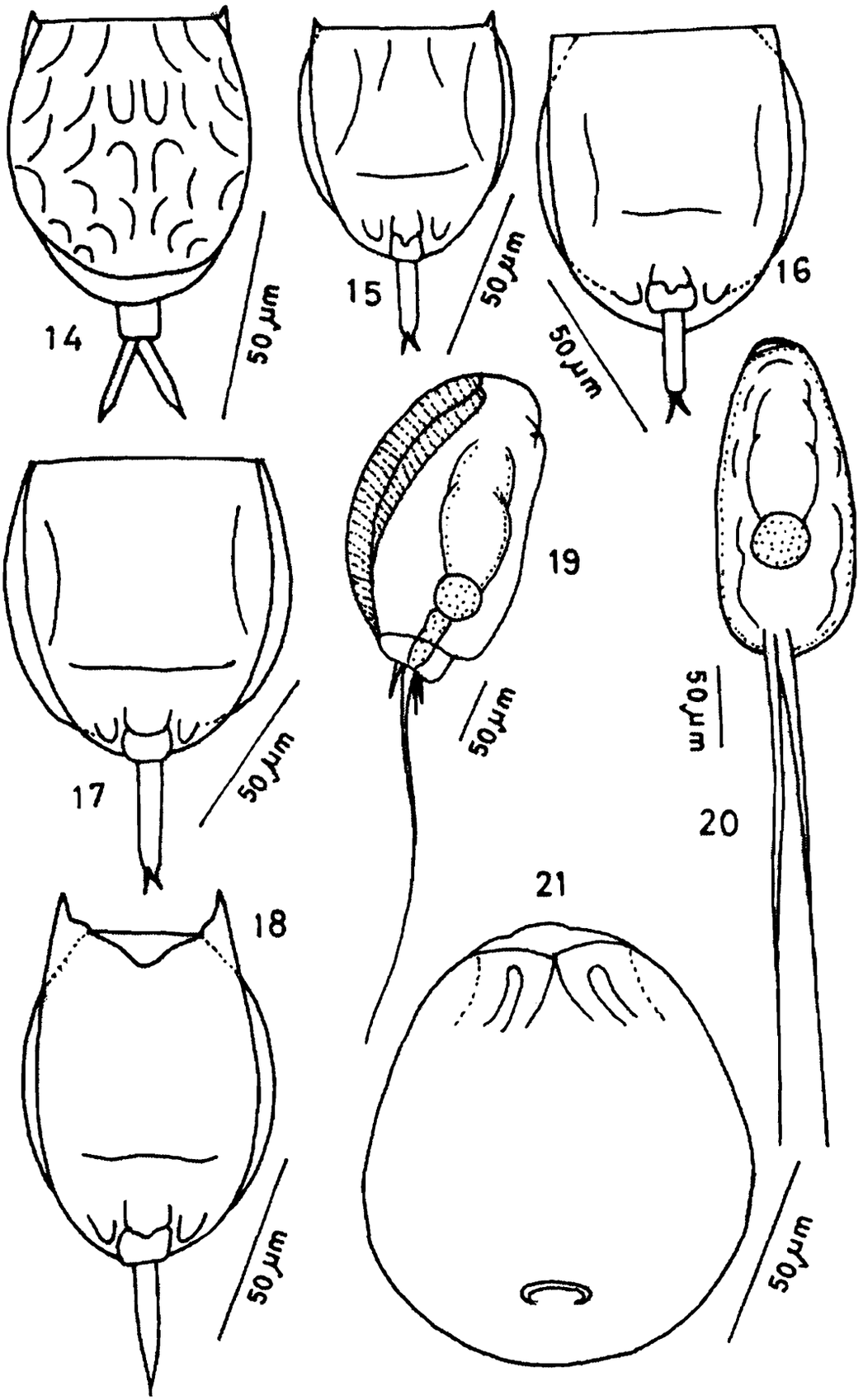
Diagnosis : Body cylindrical, with two long movable antero-lateral setae; caudal seta lacking.

Distribution : INDIA – Tripura and Bihar. *Elsewhere* – Tropicopolitan.

Testudinella parva (Temetz, 1892)
(Fig. 21)

Diagnosis : Lorica pear-shaped and with maximum width in the posterior region; convex in cross-section. Anterior dorsal margin slightly elevated and with a shallow depression; anterior ventral margin with median notch. Lateral antennae located behind the middle region of lorica. Foot-opening elliptical and located at a short distance from posterior margin of lorica.

Distribution : INDIA – Meghalaya, Assam, Tripura. *Elsewhere* – Cosmopolitan.



Figs. 14-21. : 14. *Lecane sola* (Hauer), dorsal view; 15. *L. (Monostyla) acanthinula* (Hauer), ventral view; 16. *L. (M.) bifurca* (Bryce), ventral view; 17. *L. (M.) obtusa* (Murray), ventral view; 18. *L. (M.) thienemanni* (Hauer), ventral view; 19. *Trichocerca bicristata* (Gosse), lateral view; 20. *Filinia saltator* (Gosse), ventral view; 21. *Testudinella parva* (Ternetz), ventral view.

REMARKS

The rotifer fauna of Orissa has so far been inadequately studied and an earlier report (Sharma, 1987) documented only 69 species from freshwater environs of this state. The present study dealing with 104 species (114 taxa) has, hence, reasonably enriched overall species richness of Rotifera of Orissa which, in turn, now follows the faunas of West Bengal (148 species) > Tripura (112 species) > Meghalaya (111 species). In general, the examined taxocoenosis is fairly rich and diversified and the reported species comprise about 30.1% of the Indian Rotifera. Of the 25 families and 63 genera of Eurotatoria known from India (Sharma, 1998), 17 families and 28 genera recorded in this account exhibit fairly good diversity of the higher categories of phylum Rotifera. *Keratella edmondsoni, Lepadella costatoides, Lecane sola, Lecane (Monostyla) acanthinula* and *Testudinella parva* are new records from Eastern India and 37 taxa (36 species) represent new reports from Orissa. In addition, some rare and interesting species (including new species) are awaiting examination of more specimens and will be dealt with separately.

The monogononts comprise bulk of the reported species (98%) while the bdelloids include only two species. The stated pattern agrees with the composition of rotifer taxocoenosis of the Oriental region (Sudzuki, 1989) and India (Sharma, 1996, 1998) in general and that of relatively well explored faunas of the states of West Bengal (Sharma, 1995), Meghalaya (Sharma and Sharma, 1999) and Tripura (Sharma and Sharma, 2000) in particular. Such a generalization again highlights general paucity of information on the bdelloid rotifers. The monogonont rotifers are, however, predominated by members of order Ploimida (91 species, 87.5%) and the examined collections include only 11 species (10.6%) belonging to order Flosculariacea.

Cosmopolitan (52.5%) > Cosmotropical and Pantropical (28.5%) elements comprise significant fraction of the recorded species. On the contrary, biogeographically interesting taxa constitute only 6.7%; these include three Oriental species namely *Keratella edmondsoni, Lecane acanthinula* and *Trichocerca flagellata*; South-East Asian *Mytilina acanthophora* and *Lecane thienemanni*; plaeo(sub)tropical *Lecane lateralis* and *L. ungulata* and cosmo(sub)tropical *Brachionus durgae*. However, the paucity of the taxa of this category in the examined material presents a misleading picture but is apparently attributed to the fact that a number of eurotatorien families containing periphytic, littoral, sessile and colonial taxa are not yet adequately represented in the sampled collections. In addition, various species of regional or local distributional interest are represented by *Lepadella costatoides, L. rhomboidula, Lecane bifurca, L. sola, Horaella brehmi, Testudinella parva* and *Filinia saltator.*

Lecanidae (32 species) > Brachionidae (22 species) > Colurellidae (15 species) altogether comprise important component (66.3%) of the documented species; the observed trend of dominance of these monogonont families corresponds with the composition of the rotifer faunas of India

(Sharma, 1998) and the Oriental region (Sudzuki, 1989) in general and those of West Bengal (Sharma, 1995), Meghalaya (Sharma and Sharma, 1999) and Tripura (Sharma and Sharma, 2000) in particular. Besides, other qualitatively important rotifer families include Trichocercidae (6 species) > Euchlanidae (5 species) > Filiniidae (4 species) = Testudinellidae (4 species). Higher species richness of two 'tropic-centred' genera namely *Lecane* (32 species) and *Brachionus* (13 species) imparts general 'tropical character' to the rotifer taxocoenosis of Orissa. The stated aspect is further supported by fewer number of species of 'temperate-centred' *Keratella* (5 species). Besides, these generalizations corroborate with salient features of many tropical rotifer faunas from different parts of the globe (Green, 1972; Pejler, 1977; Fernando, 1980; Fernando and Zankai, 1981; Dumont, 1983; Dussart *et al.* 1984; Sanoamuang *et al.* 1995; Segers, 1995, 1996; Sharma, 1996, 1998; Sanoarnuang, 1998; Sharma and Sharma, 1997, 2001).

Among various recorded species of regional/local distributional importance, *Keratella edmondsoni* is so far known in India from Rajasthan and N. E. region; *Lepadella costatoides* from Kerala; *Lecane acanthinula* from Tripura; *L. sola* from Tamil Nadu and Tripura; and *Testudinella parva* from N. E. region. The present report of these species from Orissa, therefore, extends their distributional ranges to Eastern India. Other interesting elements include three species believed earlier to be the Indian endemics *i.e.*, cosmo(sub)tropical *B. durgae*, palaeo(sub)tropical *Lecane lateralis* and pantropical *Horaella brehmi* which were originally described from Andhra Pradesh (Dhanapathi, 1974), West Bengal (Sharma, 1978) and Bihar (Donner, 1949), respectively. Besides, cosmopolitan *Lepadella rhomboides, Lecane bifurca, Trichocerca bicristata* and *F. saltator* exhibit restricted occurrence in India; the first two species are examined so far from Bihar and Delhi respectively while the last two species are recorded exclusively from Bihar.

To sum up, the rotifer fauna of Orissa reflects fairly rich species, generic and family diversity. Planktonic taxa are well documented in the studied taxocoenosis which, in turn, also depicts reasonably good number of littoral or periphytic species but shows distinct lack of sessile, colonial and bdelloid taxa. This fauna, therefore, still provides scope for updating with special emphasis on sampling of the members of specified communities and on their general composition and richness of Rotifera in different freshwater ecosystems of this state.

ACKNOWLEDGMENTS

Thanks are due to the Head, Department of Zoology, North-Eastern Hill University, Shillong, the Director, Zoological Survey of India, Kolkata and the Officer-in-Charge, Eastern Regional Station, Zoological Survey of India, Shillong for necessary facilities for the study.

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