CHAPTER II

TAXONOMIC STUDIES AND DISTRIBUTION OF FRESHWATER ROTIFERS

INTRODUCTION
MATERIALS AND METHODS
RESULTS
DESCRIPTION
FIGURES
PLATES
INTRODUCTION

The most admirable animal having attractive features and interesting mode of life with sufficient nutrients for the fish and crustacean hatchlings in all the aquatic environments is 'Rotifers or Rotatoria or Wheel animalcules' in general. As Josef Donner, a rotiferologist says these minute microscopic life forms are the "Wonderful jewels of nature". These harmless microorganism exist in different forms with specific locomotion and play a key role in the aquatic environments. Their wider distribution, frequent occurrence in abundance and their striking beauty attracted all the microscopists (Hudson and Gosse, 1886).
Chart. 1. Life cycle of Rotifers

Amictic female (2n)

↓

Eggs (2n)

Dormant egg (2n)

Fertilized egg (2n)

Sexual reproduction

Fertilization

Mictic male (n)

Unfertilized egg (2n)

Eggs (n)

Amictic female (2n)

Asexual reproduction

Amictic female (2n)

Mictic female (2n)
**General Characteristics**

Rotifers are microscopic, pseudocoelomate, free floating microzooplanktons. The size of the rotifers ranged form 0.05 - 5 mm in length. They are easily recognised by their corona with cilia which resembles a 'rotating wheel'. The mastax or trophi used for mastigation is another salient species specific feature which helps in the classification of rotifers. The body wall is formed of cuticle. Muscular system, nervous system, digestive system, excretory system and reproductive system are well developed in all female rotifers. No such separate systems are seen for the tiny males which appear rarely with a short life span. In rotifers, there is no notable respiratory system instead they respire by their body surface. Depending on their feeding habits they are classified as current producers, grasping rotifers and trapping carnivores. Bacteria, small algae, flagellates and detritus filtered from the water are the most common food. In general rotifers possess 2 types of life cycles namely a sexual (Amictic) and sexual (Mictic) (Chart. 1). They are dioecious a remarkable sexual dimorphism exists. Some rotifers are oviparous (eg. *Brachionus, Epiphanes, Hexarthra, Conochilus* ...) and some are viviparous (eg. *Asplanchna, Rhinoglena*... ). Among the Ploimite rotifers, some species vary in their morphology just as a different species which is considered as cyclomorphism.
Ecological Distribution

Rotifer distribution is usually regarded as potentially cosmopolitan due to their dispersal through water and air with a worldwide distribution. Over 2500 species belonging to 200 genera are known from different countries (Dhanapathi, 2000). Occurrence in particular locality seems to be controlled by environmental features. In regard to their abundant occurrence, they are classified as Polycyclic, Monocyclic and Acyclic. They are adapted to wide range of ecological conditions such as Benthic, Pelagic, Terrestrial, Epizoic and Parasitic members. They mainly live among aquatic vegetation in the littoral zone of lakes, artificial reservoirs, fish ponds, rivers, canals, pools and even in the roadside ditches (Vladimir Sladecek, 1983). It is common that the number of species are greater in acid lakes than in alkaline lakes (Edmondson, 1959). Some species show distinctly limited geographical range. The pelagic or limnetic rotifers encounters about 1000 indls/lit. (Ahlstrom, 1933). Th terrestrial rotifers mainly Bdelloids inhabit mosses and lichen adjacent to streams, lakes and glaciers. The moss dwelling rotifers has been discussed in detail by Hernis (1910) and Dobers (1915). Number of rotifers leading epizoic and parasitic existence are considered in the account of orders and a review has been made by Budde (1925). Segers (1996) defined 4 major distributional groups of planktonic rotifers.
a. **Cosmopolitan**

Occur both in the Eastern and Western hemispheres under tropical as well as temperate climates.

b. **Arctic temperate**

Occur in regions with Arctic or temperate climate not necessarily restricted by latitudes.

c. **Tropicopolitan**

Occur in tropical and sub-tropical latitudes but can occasionally be found in suitable habitats in temperate regions.

d. **Pantropical**

Chiefly restricted to the tropical belt as delimited by the tropic of cancer and tropic of capricorn.

**Classification**

Rotifers were classified by several workers based on morphology, trophic structure, male morphology, presence of cilia... ever since Leeuwenhoek (1703) first studied these fascinating creatures. The description of new species of Rotifera and their organisation into genera and higher categories is based on morphological features in one aspect. In loricate taxa eg. *Keratella* & *Brachionus*, lorica facetellation, number and placement of anterior lorical spines appears to be characteristics for each species and species specific. For the illoricate taxa, size and shape varies with
overlap between congener. Morphology of appendages, bristles (Filinia), fins or paddles (Polyarthra), location of lateral antennae (Testudinella) have been used though there may be inter and intra population variation. Trophi structure also plays a key role to separate congener Guiset, (1977); Stemberger (1979), Koste (1980), Koste and Shiel (1989), Markovichi Koreneva (1981), Koste and Tobias (1989). Filinia hoffmani and F. australiensis were distinguished by Hoze (1980) using trophi structure which is species specific and a valuable taxonomic discriminate (Koste and Shell, 1989). Classification of rotifers were done by several workers so far such as Ehrenberg (1838), Dujardin (1841), Ledig (1854), Bartsch (1870), Hudson (1884), Hudson and Goose (1889), Wesenberg and Lund (1899), Harring (1973, 1933), Remane (1929, 1933), Hyman (1951), Pennak (1953), Donner (1956), Gallaher (1957), Edmondson (1959), Sudzuki (1964), Koste (1978) and Segers (1993, 1995).


Indian Rotifera

The rotifer fauna of India seems to be cosmopolitan. A large number of cosmopolitan species exists in India. 310 species

**Objective of the Study**

Anderson (1889) initiated the systematic studies on Indian rotifera but still taxonomical studies are comparatively scanty and comprehensive regional investigation from many states are still for from complete (Sharma and Michael, 1980). The present work is an initial attempt to study the distribution of freshwater rotifer fauna of
MATERIALS AND METHODS

1. Collection and Isolation

Water samples were collected separately from one natural pond (PC) and three experimental fish ponds (P1, PII and PIII) at random using plankton net made of nylon bolt mesh. The natural pond Ilanthaikulam is located behind St. Xavier's College, Palayamkottai and three experimental fish ponds are located inside the College Campus (79.9°N; 77.3°E latitude). The collected samples were filtered separately using different mesh sizes of 65μ, 105μ, 160μ for isolating the rotifer species from the other plankton.

2. Observation

The filtered and isolated samples were made up to 10 ml. From the 10 ml subsample 1 ml was taken for observation. The organisms were observed lively under the microscope. Size of the animals were measured using micrometer. Glycerin or 70% alcohol was used to slow down the activity of organisms for observation.

3. Identification and Classification

Rotifers were identified using the keys and classification of W. T. Edmondson (1959) (Chart. 2).

4. Photomicrography

Live rotifers were kept in clean glass slides and covered with coverslip for photomicrography. Photomicrographs were taken in the
Chart. 2. CLASSIFICATION OF ROTIFER

By W. T. Edmondson (1959)

ROTIFER

MONOGONONTA

PLOIMA

FLOSCULARIAE

COLLOTHECACEAE

BDELLOIDEA

SEISONIDEA

1. BRACHIONIDAE
2. LECANIDAE
3. PROALIDAE
4. NOTAMMATIDAE
5. LINDIDAE
6. BIRGEIDAE
7. TRICHOCECIDA
8. GASTROPIDAE
9. DICRANOPHORIDAE
10. TYLOTROCHIDAE
11. TETRASIPHONIDAE
12. ASPLANCHNIDAE
13. SYNCHAETIDAE
14. MICROCODONIDAE

1. TESTUDINELLIDAE
2. HEXARHIDAE
3. FLOSCULARIIDAE
4. CONOCHILIDAE

COLLOTHECIDAE

1. HABROTROCHIDAE
2. PHILODINIDAE
3. ADINETIDAE
4. PHILODINAVIDAE

1. SEISONIDAE
NIKON - VII (MODEL ECLIPSE E 400) microscope attached with camera (NIKON FDX - 35) in different magnifications (4x, 10x).

5. Preservation

The collected rotifers were preserved in 70% alcohol for further observation.

6. Degree of similarity

Degree of similarity between the planktonic rotifers of different localities were calculated using Sorenson’s index (Dharapathi, 2000).

\[
S = \frac{2c}{a + b} \times 100
\]

- \( a \) = No. of species in the first sample
- \( b \) = No. of species in the second sample
- \( c \) = No. of species common to both.
RESULTS

A total number of 93 species were observed from all the four different ponds i.e. three experimental fish ponds and one natural pond viz., PI, PII, PIII and PC respectively (Plate. II. 1). The identified species belong to 2 classes, 4 orders, 16 families and 41 genus. The number of genus and species belonging to separate Classes, Orders and Families are represented in the Table. 2. 1. More than 90% of the species belong to class Monogononta with a highest number of 46 species in the family Brachionidae including a highest encounter of 21 species in the genus Brachionus followed by 11 species in the family Lecanidae. Class Bdelloidea is represented by 6 species. Among the rotifers observed, both free living, sessile, loricate and illoricate forms are present. The identified rotifers were classified taxonomically by the classification of Edmondson (1959) Fig. 2. 2; Table. 2. 1.

Different forms and varieties of selective species of rotifers were noticed as B. calyciflorus exhibits 3 forms and 1 variety; B. quadridentatus exists in 2 forms and 1 variety, B. caudatus with 2 subspecies and Epiphantes brachionus with 1 subspecies (Plate. II. 1). The habitat specific nature of rotifers is clearly shown in the Table. 2. 2. i.e., B. quadridentatus var. brevispinus and f. cluniorbicularis, B. bidentatus, E. macroura, E. clavulata, keratella ticinensis, Macrochaetus, Lepadella cristata, Lecane ohioensis, Lecane obtusa,
Monostyla, quadridentata, Polyarthra multiappendiculata, Polyarthara sp. Horaella brehmi, Lacinularia, Conochilus, Conochiloides are present only in the natural pond Ilanthaikulam. The distribution of B. calyciflorus, B. angularis, B. caudatus, K. cochlearis, K. procurva, K. valga, Euchlanis, Dipleuchlanis, Tripleuchlanis, Diplois davisiae, Anuraeopsis, Lecane inopinata, L. luna, Monostyla bulla, M. decipiens, M. closteroerca, Cephalodella gibba, Asplanchna priodonta, A. intermedia, Polyarthra (apterous form), Filinia, Testudinella, Hexarthra, Philodina roseola, P. citrina and Rotatia rotatoria is cosmopolitan.

**Size and Morphology**

Size and morphology of some rotifers belonging to same genus and species varied with respect to different localities. Lenth of the occipital spines and posterior spines of B. calyciflorus varied in between to PI, PII, PIII and PC ponds (Plate. II. 1). Significantly the spine length was much longer in the individuals of Ilanthaikulam for some species such as B. calyciflorus, f. amphiceros, B. caudatus, B. fulcatus (Plate. II. 1 & 2). Remarkable difference in the total length, width and morphology of Hexarthra and Epiphanes brachionus was noticed between the experimental fish pond and natural pond (Plate. II. 2 & 5). Among the species of experimental pond genus Brachionus exhibits variation in the size noticeably. The lorica of Asplanchna of Ilanthaikulam pond was so flexible comparing other ponds.
Of the observed species, 83 species were encountered in the natural pond (PC) 55 species in PI, 56 species in PII and 43 species in PIII experimental ponds.

**Degree of similarity**

Degree of similarity was calculated using Sorenson’s index.

Degree of similarity between PC & PI = 68.11

Degree of similarity between PC & PII = 71.94

Degree of similarity between PC & PIII = 60.31

Degree of similarity between PI & PII = 66.66

Degree of similarity between PI & PIII = 67.34

Degree of similarity between PII & PIII = 66.66
Table. 2. 1. Total number of genus and species recorded from 4 different localities of Palayamkottai

<table>
<thead>
<tr>
<th>S. No.</th>
<th>A. CLASS : Monogononta</th>
<th>No. of Genus</th>
<th>No. of Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I. ORDER : Ploima</td>
<td>28</td>
<td>74</td>
</tr>
</tbody>
</table>

**FAMILIES**

1. *Brachionidae* | 15 | 46 |
2. *Lecanidae* | 2 | 11 |
3. *Proalidae* | 1 | 1 |
4. *Notommatidae* | 2 | 4 |
5. *Trichocercidae* | 1 | 1 |
6. *Gastropodae* | 1 | 1 |
7. *Dicranophoridae* | 1 | 1 |
8. *Asplanchnidae* | 1 | 4 |
9. *Synchaetidae* | 3 | 5 |

II. ORDER : Flosculariaceae | 7 | 11 |

**FAMILIES**

10. *Tesudinellidae* | 3 | 6 |
11. *Hexarthridae* | 1 | 2 |
12. *Floscularidae* | 1 | 1 |
13. *Conochilidae* | 2 | 2 |

III. ORDER : Collothecaceae | 2 | 2 |

**FAMILIES**

14. *Collothecidae* | 2 | 2 |

B. CLASS : Bdelloidea | 4 | 6 |

IV. ORDER : Bdelloidea | 4 | 6 |

**FAMILIES**

15. *Habrortochidae* | 1 | 1 |
16. *Philodinidae* | 3 | 5 |

Total No. of Classes = 2 Total No. of Orders = 4
Total No. of Families = 16 Total No. of Genus = 41
Total No. of Species = 93
LIST OF VARIOUS SPECIES OF ROTIFER FAUNA OF PALAYAMKOTTAI

I. CLASS: MONOGONONTA
   ORDER: PLOIMA
1. FAMILY: Brachionidae
   SUB FAMILY: Brachioninae
1. Genus: Brachionus
   1. *Brachionus calyciflorus*
   2. *B. calyciflorus var. hymani*
   3. *B. calyciflorus f. amphiceros*
   4. *B. calyciflorus f. borgerti*
   5. *B. calyciflorus f. dorcas*
   6. *B. calyciflorus f. anuraeiformis*
   7. *B. quadridentatus*
   8. *B. quadridentatus var. brevispinus*
   9. *B. quadridentatus f. cluniorbicularis*
  10. *B. quadridentatus f. rhenanus*
  11. *B. angularis*
  12. *B. angularis angularis*
  13. *B. angularis bidens*
  14. *B. caudatus*
  15. *B. caudatus apsteini*
  16. *B. bidentatus*
  17. *B. fulcatus*
  18. *B. patulus*
19.  *B. urceolaris*
20.  *B. leydigii*
21.  *B. budapestinensis*

**2. Genus: Epiphanes**
22.  *Epiphanes brachionus spinosus*
23.  *E. senta*
24.  *E. macroura*
25.  *E. clavulata*

**3. Genus: Keratella**
26.  *Keratella cochlearis*
27.  *K. procurva*
28.  *K. tropica*
29.  *K. valga*
30.  *K. ticinensis*

**4. Genus:**
31.  *Euchlanis* sp.
32.  *Pseudoeuchlanis*
33.  *Dipleuchlanis* sp.
34.  *Tripleuchlanis* sp.
35.  *Diplois davisiae*
36.  *Lophocharis*
37.  *Macrochaetus*
38.  *Wolga spinifera*
39.  *Anuraeopsis* sp.
**SUB FAMILY : Colurinae**

13. **Genus : Colurella**
   40. Colurella obtusa
   41. C. bicuspidata
   42. C. adriatica

14. **Genus : Lepadella**
   43. Lepadella ovalis
   44. L. patella
   45. L. cristata

15. **Genus :**
   46. Squatinella

2. **FAMILY : Lecanidae**

16. **Genus : Lecane**
   47. Lecane inopinata
   48. L. luna
   49. L. ploensis
   50. L. elasma
   51. L. obtusa
   52. L. brauhmi
   53. L. depressa

17. **Genus : Monostyla**
   54. Monostyla bulla
   55. M. decipiens
   56. M. closterocerca
   57. M. quadridentata
3. FAMILY : Proalidae
18. Genus : Wulfertia
   58. Wulfertia ornata

4. FAMILY : Notommatidae
19. Genus : Cephalodella
   59. Cephalodella gibba

20. Genus : Eosphora
   60. Eosphora najas
   61. E. anthadis

21. Genus : Itura
   62. Itura aurita

5. FAMILY : Trichocercidae
22. GENUS :
   63. Trichocerca

6. FAMILY : Gastropidae
23. Genus : Gastropus
   64. Gastropus hyptopus

7. FAMILY : Dicranophoridae
24. Genus : Wierzejskiella
   65. Wierzejskiella racinae

8. FAMILY : Asplanchnidae
25. Genus : Asplanchna
   66. Asplanchna priodonta
   67. A. intermedia
   68. A. brightwelli
   69. A. herricki
9. FAMILY: Synchaetidae

26. Genus: Harringia
   70. Harringia rousseleti

27. Genus: Ploesoma
   71. Ploesoma

28. Genus: Polyarthra
   72. Polyarthra (apterous form)
   73. Polyarthra multiappendiculata
   74. Polyarthra sp.

II. ORDER: FLOSCULARIACEAE

10. FAMILY: Testudinellidae

29. Genus: Filinia
   75. Filina longiseta
   76. F. pejleri
   77. F. opoliensis
   78. F. terminalis

30. Genus: Horaella
   79. Horaella brehmi

31. Genus: Testudinella
   80. Testudinella patina

11. FAMILY: Hexarthridae

32. Genus: Hexarthra
   81. Hexarthra mira
   82. H. intermedia
12. FAMILY: *Floscularidae*

33. Genus:
   83. *Lacinularia*

13. FAMILY: *Conochilidae*

34. Genus:
   84. *Conochilus*

35. Genus:
   85. *Conochiloides*

III. ORDER: **COLLOTHECACEAE**

14. FAMILY: *Collothecidae*

36. Genus: *Collotheca*
   86. *Collotheca ornata*

37. Genus:
   87. *Cupelopagis*

CLASS: **BDELLOIDEA**

IV. ORDER: **BDELLOIDA**

15. Family: *Habrotrachidae*

38. Genus:
   88. *Habrotracha*

16. FAMILY: *Philodinidae*

39. Genus:
   89. *Macrotrachela*

40. Genus: *Philodina*
   90. *Philodina roseola*
   91. *Philodina citrina*

41. Genus: *Rotaria*
   92. *Rotaria rotatoria*
   93. *R. citrinus*
DESCRIPTION

Description of the observed rotifer fauna of Palayamkottai.

Abbreviation used

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>TL</td>
<td>Total Lenth</td>
</tr>
<tr>
<td>MW</td>
<td>Maximum Width</td>
</tr>
<tr>
<td>AMSL</td>
<td>Anteromedian spine length</td>
</tr>
<tr>
<td>AIMSL</td>
<td>Anterointermedian spine length</td>
</tr>
<tr>
<td>ALSL</td>
<td>Anterolateral spine length</td>
</tr>
<tr>
<td>PSL</td>
<td>Posterior spine length</td>
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<tr>
<td>PLSL</td>
<td>Posterolateral spine length</td>
</tr>
<tr>
<td>FL</td>
<td>Foot Length</td>
</tr>
</tbody>
</table>

CLASS: MONOGONONTA

ORDER: Ploima

1. FAMILY: Brachionidae

SUB-FAMILY: Brachioninae

1. Genus: Brachionus

1. Brachionus calyciflorus (Pallas, 1776) (Fig. 1. 1; Plate II. 1)

Broad, oval, dorsoventrally flattened lorica with separate lorical plates; Anterior lorica is narrower than the posterior region; eye spot present; 4 occipital spines; anteromedian spines unequal in length and larger than the anterolateral spines; no posterolateral spines; foot opening with spinal projection, long, slender, contractile...
annulated foot with toes. Normally carries 1 - 12 eggs. Both large and small strains have been observed.

**Measurements**

**Large strain**

TL - 420 - 450μ; MW - 300 - 360μ; AMSL - 22.5 - 30μ; ALSL - 22μ; PSL - 22μ; FL - 375μ.

**Small strain**

TL - 270 - 300μ; MW - 225 - 255μ; AMSL - 15 - 22.5μ; ALSL - 15μ; PSL - 15μ; FL - 255μ


**Distribution**: Cosmopolitan.

2. **B. calyciflorus v. hymani** (Dhanapathi, 1974)  
(Fig. 1. 2; Plate II. 1)

Broad, sub-rectangular lorica with separate dorsal and ventral plates; 4 occipital spines equal in length; Antero median spines join together to form a 'V' shaped notch at the centre; eye spot present; 2 posterior spines of equal length and 2 posterolateral spines facing outwards; posterior spines gives way to the foot; long annulated
retractible foot with toes; normally bearing 1 - 12 eggs. Both large and small strains have been observed.

**Large strain**

TL - 420 - 450µ; MW - 300 - 360µ; AMSL - 60 - 75µ; ALSL - 60 - 75µ; PSL - 30µ; PLSL - 30µ; FL - 375µ.

**Small strain**

TL - 270 - 300µ; MW - 225 - 255µ; AMSL - 22.5µ; ALSL - 22.5µ; PSL - 15µ; PLSL - 22.5µ; FL - 255µ.

**ER:** Edmondson and Hutchinson (1934); George (1961); Arora (1964); Nayar (1965, 1968); Nair (1969); Vashist and Gupta (1967), Nasar (1973); Dhanapathi (1974, 1977); Sharma (1979); Jyoti and Sehgal (1980); Sharma and Saksena (1981); Nayar *et al.* (1982), Rao and Mohan (1983); Saksena and Kulharni (1986).

**Distribution:** India.

3. **B. calyciflorus f. amphiceros** (Ehrenberg, 1838) *(Fig. 1. 3; Plate II. 1)*

Smaller in size, sub rectangular lorica; 4 occipital spines; antero median spines longer than anterolateral spines of equal length; anteromedian spines form a 'V' shaped notch at the centre; Eye spot present; Broad, pointed 2 posterior spines; 2 long posterolateral spines (longer than the occipital spines and 2/3 of the total length) seen as lorical extensions posterolaterally. Long, annulated, retractible foot with toes.
**Large strain**

Sub rectangular, dorsoventrally flattened, broad based body with distinct dorsal and ventral plates; 4 occipital spines; very prominent longer anteromedian spines; very long, broad, pointed, movable, non-retractible posterolateral spines which start from the mid of the lorica; long slender retractible foot with toes.

TL - 420μ; MW - 240μ; AMSL - 135μ; ALSL - 90μ; PSL - 30μ; PLSL - 240μ; FL - 300μ.

**Small Strain**

TL - 195 - 210μ; MW - 105 - 135μ; ALSL - 60 - 75μ; AMSL - 75 - 90μ; PSL - 30 - 45μ; PLSL - 105 - 120μ; FL - 210μ.

**ER:** Nayar (1965), Dhanapathi (1977)

**Distribution:** Cosmopolitan

4. **B. calyciflorus f. borgerti** (Apstein, 1907)
   **(Fig. 1. 4; Plate II. 1)**

Broad, oval dorsoventrally flattened lorica with separate dorsal and ventral plates; eye spot present; 4 occipital spines with longer anteromediains; Posterior spines rudimentary; long retractible annulated foot. Normally bears 1 - 10 eggs.

TL - 210μ; MW - 120μ; AMSL - 75μ; ALSL - 60μ; TL - 195μ.

**ER:** Dhanapathi (1977), Sharma (1979).
5. *B. calyciflorus v. dorcas* (Gosse, 1851)  
(Fig. 1. 5; Plate II. 1)

Dorsoventrally flattened broad based loricate body with separate lorical plates; 4 occipital spines; anteromedian spines are longer than anterolateral spines; eye spot present; No posterior or posterolateral spines. Foot starts from the basal plate. Normally carries 1 - 4 eggs.

TL - 285µ; MW - 240µ; AMSL - 30µ; ALSL - 22.5µ; FL - 255µ.

**ER:** Dhanapathi (1977), Sharma (1979).

**Distribution:** India, China and Japan

6. *B. calyciflorus f. anuraeiformis* (Brehm, 1909)  
(Fig. 1. 6; Plate II. 1)

4 occipital spines of equal length, 2 posterior spines and 2 posterolateral lateral spines; round posterior region; long retractible annulated foot.

TL - 300 µ; MW - 255 µ; AMSL - 22.5 µ; PSL - 15 µ; PLSL - 15 µ; FL - 15 µ.

**ER:** Sharma *et al.* (1992), Sharma and George Michael (1980), Sharma (1983).

**Distribution:** India.
7. **B. quadridentatus** (Herman, 1783) (Fig. 1. 7)

Dorsoventrally flattened, firm lorica; slightly convex at the dorsal base; Eye spot present; 6 occipital spines; 2 long anteromedian spines which bent outwards laterally; 2 intermedian spines smaller than the marginal spines; 2 Long curved or bent (inwards) posterior spines; foot starts from the prominent foot sheath.

TL - 135 μ; MW - 120 μ; AMSL - 22.5 μ; ALMSL - 15 μ; ALSL - 15 μ; PSL - 45 μ; FL - 120 μ


**Distribution**: Cosmopolitan

8. **B. quadridentatus var. brevispinus**  
(Fig. 1. 8; Plate II. 1)

Dorsonventrally compressed, broad firm lorica, slightly convex at the base dorsally; Eye spot present 6 occipital spines 2 longer median spines bent outwards with a 'V' shaped notch; 2 intermedian spines smaller than the marginal spines; 2 anteromarginal spines smaller than the median spines. 2 long posterolateral spines; 2 small posterior spine; it gives way to the foot in between the long, retractable annulated foot.

TL - 135 μ; MW - 120 μ; AMSL - 22.5 μ; ALMSL - 15 μ; ALSL - 15 μ; PSL - 45 μ.
Distribution: Europe, India, Japan

9. *B. quadridentatus f. cluniorbicularis* (Skorikov, 1897) (Fig. 1. 9; Plate II. 1)

6 occipital spines; 2 long anteromedian spines forms a deep 'V' shaped notch; 2 intermedian spines smaller than the median and lateral spines; 2 anterolateral spines smaller than the median spines; No posterior or posterolateral spines.

TL - 135 μ; MW - 180 μ; AMSL - 30 μ; ALMSL - 15 μ; ALSL - 15 μ; PLSL - 15 μ.

Distribution: India

10. *B. quadridentatus f. rhenanus* (Lauterborn) (Fig. 1. 10; Plate II. 1)

6 occipital spines; 2 long median spines with a free 'V' shaped notch; 2 smaller intermedian spines and 2 small anterolateral spines; No posterior spine; 2 distinctive posterolateral spines on the dorsal side; long retractible foot.

TL - 105 μ; MW - 105 μ; AMSL - 22.5 μ; ALMSL - 15 μ; ALSL - 15 μ; AIMSL - > 15 μ; PLSL - 15 μ.

Distribution: India

ER: Dhanapathi (1997)

ER: Sharma and Michael (1980), Sharma (1983)

ER: Sharma (1983)
**Distribution**: India

11. **B. angularis (Gosse, 1851)** *(Fig. 1. 11; Plate II. 1)*

Small, stippled, broad bodied, loricate animal with the dorsal plate broader than the ventral plate. No occipital spines except a 'U' shaped invagination on the mid part of the elevated anterior dorsal margin. Posterior spines absent instead of small lorical extensions for the foot opening posteriorly. Long slender annulated foot rotate itself very often; Normally carries 1 - 3 eggs; size of the egg is half the size of the whole body length.

TL - 105μ; MW - 75μ; FL - 60μ


**Distribution**: Cosmopolitan

12. **B. angularis angularis (Gosse, 1851)** *(Fig. 1. 13; Plate II. 1)*

Small, broad dorsoventally compressed, anterior margin, occipital spines absent; eye spot present; long annulated foot longer than the entire body length, normally carries 1 - 3 eggs.

TL - 105μ; MW - 75μ; FL - 60μ

**Distribution**: India, Czechoslovakia,

13. *B. angularis bidens* (Gosse, 1851)  
(Fig. 1. 12; Plate II. 1)  
Smaller in size, broad, dorsoventrally flattened lorica, broad dorsal plate convex at the base; no occipital spines; elevated anterior margins. Eye spot present; Long slender annulated foot; normally carries 1 - 3 eggs.

\[ \text{TL} - 105\mu; \text{MW} - 75\mu; \text{FL} - 60\mu \]

**ER**: Arora (1963)

**Distribution**: Cosmopolitan

14. *B. caudatus* (Barrois and Dadday, 1894)  
(Fig. 1. 14; Plate II. 2)  
Broad, dorsoventrally flattened body with separate lorical plates; Dorsal plate slightly larger than the ventral plate; eye spot present; 4 occipital spines of equal length; anteromedian spines form a 'U' shaped notch; 2 posterior flexible spines bent inwards; long annulated foot with toes; Normally carries 1 - 3 eggs.

\[ \text{TL} - 225\mu; \text{MW} - 105\mu; \text{OSL} - 22.5\mu; \text{PSL} - 45\mu. \]

**ER**: Arora (1963), Nayar (1968) and Dhanapath (1974)

**Distribution**: Cosmopolitan
15. *B. caudatus apsteini* (Fadeev, 1925)  
(Fig. 1. 15; Plate II. 2)  

Broad and flexible lorica with distinct dorsal ventral plates; dorsal plate slightly convex, ventral plate concave at the base; eye spot present; 4 occipital spines of length unequal; 2 anteromedian spines join together forming deep 'V' shaped notch; 2 posterior spines seen as long lorical projections slightly curved or bent inwards; foot annulated with tocs. Normally carries 1 - 4 eggs.  

TL - 210 - 240μ; MW - 120 - 135μ; AMSL - 22.5 - 30μ; ALSL - 15μ - 22.5μ; PSL - 22.5 - 30μ.  

ER: Sharma (1981), Vashist and Battish (1971)  

Distribution: Cosmopolitan

16. *B. bidentatus* (Anderson, 1889) (Fig. 1. 16)  

Broad, stippled lorica with distinct lorical plates; 6 occipital spines of unequal length; 2 anteromedian spines forms a 'V' shaped notch; the anterointermedian and anterolateral spines are more or less equal in length; posterior spines located astride facing downwards. Foot starts from prominent foot sheath opening upon mid half of the posterior end on a separate lorical plate.  

TL - 150μ; MW - 165μ; AMSL - 30μ; AIMSL - 15μ; ALSL - 30μ;  
FL - 150μ.

Distribution: America, Europe, Africa, China, Japan and India.

17. B. fulcatus (Zacharias, 1898) (Fig. 1. 17; Plate II. 2)

Dorsoventrally compressed, broad oval shaped body; 6 occipital spines; 2 antero intermedian spines are longer than the anteromedian and anterolateral spines. Broad longer and movable, posterolateral spines starts in the mid half of the ventral plate posteriorly. Long retractible foot starts from the opening on the ventral plate at the base.

TL - 420; MW - 240; AMSL - 30; AIMSL - 90; ALSL - ; PLSL - 285.


Distribution : Cosmopolitan

18. B. patulus (Muller, 1786) (Fig. 1. 18)

Asymmetric, broad, rectangular areolated or ridged lorica with 10 occipital spines; 2 median spines bent outwards forming a 'U' shaped notch, 6 intermedian spines having the length unequal. Eye spot present; broader posterior laterally projected lorica with unequal length forms the posterolateral spines which differ in shape, size; 2
small posterior spines at the foot opening; Non-retractible jointed foot with toes.

TL - 135µ; MW - 75µ; AMSL - 30µ; AIMSL - 22.5µ; PSL - 22.5 - 37.5µ; PLSL - 37.5µ; FL - 60µ.


Distribution: Cosmopolitan

19. *B. urceolaris* (Muller, 1773) (Fig. 1. 19; Plate II. 2)

Short, oval, broad lorica, maximum width is higher than the total length 6 occipital spines, intermediate spines slightly smaller than anteromedian and marginal spines; the median spines flanked upwards by a deep 'V' or 'U' shaped sinus; eye spot present; no posterior spines; foot starts from the foot sheath ventrally and opens halfway between the mid and posterior end.

TL - 135µ; MW - 180µ; AMSL - 30µ; ALSL - 15µ; AIMSL - 15µ.


Distribution: Cosmopolitan
20. *B. leydigii* (Cohn, 1862) (Fig. 1. 20; Plate II. 2)

Broad, dorsally convex, loricate body; corona with 2 discs; 8 occipital spines arranged distinctly in 2 rows with unequal length; 4 each in dorsal and ventral side; dorsal spines are smaller than the ventral spines; long slender foot with 2 toes; foot starts from the foot sheath; no posterior or posterolateral spines.

TL - 150μ; MW - 120μ; AMSL - 30μ; ALSL - 15μ; AIMSL - 15μ.

**ER:** Sharma (1983), Sharma and Michael (1980)

**Distribution:** Cosmopolitan

21. *B. budapestinensis* (Daday, 1885) (Fig. 2. 1; Plate II. 2)

Broad ornamental lorica at the base with distinct anterior region; 4 occipital spines of equal length but very in shape; look like 2 anteromedian spines with blunt ends facing laterally, flanked upwards by a 'U' shaped notch; 2 sharp antero lateral spines; long slender foot; normally carries 1 - 2 eggs. ML - 195μ; MW - 120μ; AMSL - 45μ and ALSL - 45μ.


**Distribution:** Cosmopolitan
2. Genus: *Epiphanes*

22. *Epiphanes brachionus var. spinosus* (Rousselet, 1901)  
(Fig. 2. 2a; Plate II. 2)

Broad, more or less sub-rectangular lorica resembling the genus *Brachionus*; no occipital spines instead the entire head with the corona is retractible; wreath like corona with ciliary bands around the large mouth opening; eye spot present; 2 posterolateral spines resembling *B. calyciflorus*; non-retractible long foot with toes resembling *B. patulus*; no spines in the ventral plate, fingerlike projection rotates when at rest.

TL - 300µ; MW - 225; MO - 75µ; PLSL - 22.5µ; FL - 180µ.

**ER:** Nogrady (1983), Harring (1913)

**Distribution:** India, West Indies.

23. *E. senta* (Muller, 1773) (Fig. 2. 3)

Broad cylindric elongated body; retractible head with wreath like corona; eye spot present; anterior lorica broader than the narrowed posterior part ending with toes on the rudimentary foot.

TL - 240µ; MW - 105µ; MO - 60µ; HL - 45µ; FL - 45µ.

**ER:** Sharma and Michael (1983)

**Distribution:** Cosmopolitan
24. *E. macroura* (Barrois and Daday, 1894)  
(Fig. 2. 4; Plate II. 2)

Broad, sacciform body with bulged ventral bases; 3 sheaths of coronal bands; eye spot present; antenna with fur at the anterior part ventrally; long foot arises from the prominent foot opening on the ventral plate towards the left side just seen as lateral extension; ventral lorical plate flexible.

TL - 210μ; MW - 120μ; AL - 30μ; HW - 60μ; FL - 90μ; FSL - 45μ.

ER: Sarma (1988), Sharma et al. (1992)

**Distribution**: America, Australia, Europe, China and India

25. *E. clavulata* (Ehrenberg, 1832) (Fig. 2. 5; Plate II. 2)

Broad, cylindric, lorica; retractible head with round corona without spines; long retractible foot arises from the lateral lorical extension on the left side posteriorly.

TL - 270μ; MW - 120μ; HW - 90; FL - 105μ.


**Distribution**: America, China and India

3. **Genus: Keratella**

26. *Keratella cochlearis* (Gosse, 1851)  
(Fig. 2. 6; Plate II. 2)

Sculptured lorica with separate pieces of dorsal and ventral plate; dorsal side slightly convex; 4 occipital spines more or less equal
in length; anteromedian spines narrower than the anterolateral spines.

TL - 135μ; MW - 60μ; AMSL - 22.5μ.

**ER:** Edmondson and Hutchinson (1934), Brehm (1965), Dhanapathi (1974), Sharma (1979).

**Distribution:** Cosmopolitan

27. *K. procurva* (Thorpe, 1891) (Fig. 2. 7; Plate II. 3)

Broad, stippled, multifaceted lorica; 6 occipital spines; 2 hook like anteromedian spines longer than the laterals and anterointermedian spine; 2 unequal posterolateral spines; deep concave ventral posterior region where the egg is kept; peculiar locomotion.

TL - 120μ; MW - 75μ; AMSL - 15μ; ALSL - 15μ; PLSL - 22.5μ; PLSL - 15μ.

**ER:** Edmondson and Hutchinson (1934), Nayar (1968), Nair and Nayar (1969) Vashist and Battish (1971), Sharma (1979, 1980)

**Distribution:** Tropicopolitan

28. *K. tropica* (Apstein, 1907) (Fig. 2. 7, 8; Plate II. 3)

Long, flat, sculptured lorica with separate dorsal and ventral plates; 4 anterior spines; 2 outwardly facing long anteromedian
spines, flanked by a 'U' shaped notch; 2 marginal broad, pointed spines; 2 posterolateral spines unequal in length.

TL - 105μ; MW - 60μ; AMSL - 30μ; ALSL - 15μ; PLSL - 45μ; PLSL - 15μ.

ER: Sharma & Michael (1980)

Distribution: Cosmotropical

29. K. valga (Ehrenberg, 1834) (Fig. 2. 9; Plate II. 3)
Smaller in size; Broad multifaceted lorica with separate dorsal and ventral plates; 4 occipital spines; 2 outwardly facing long hook like anteromedians; the distance between the median and marginal spines is longer; 2 posterolateral spines of unequal length.

TL - 90μ; MW - 75μ; AMSL - 30μ; ALSL - 22.5μ; PLSL - 30μ; PLSL - 52.5.


Distribution: Cosmopolitan.

30. K. ticinensis (Carlin, 1939) (Fig. 2. 10; Plate II. 3)
Broad stippled multifaceted lorica; 4 occipital spines more or less unequal in length; median spines blunt and flanked by 'V' shaped notch; 2 sharp anterolaterals; No posterior or posterolateral spines; long annulated foot; Normally carries 1 - 3 eggs.
4. Genus:

31. *Euchlanis* sp. (Voronkov, 1912) (Fig. 2. 11)

Broad, firm, lorica with the arched dorsal plate; anterior margin has a deep notch; body divided by a crest or keel; jointed foot with equal toes.

TL - 135 µ; MW - 90 µ; Toe L - 60 µ.

ER: Edmondson and Hutchinson (1934), Myers (1930).

Distribution: America, Europe, India.

32. *Pseudoeuchlanis* (Dhanapathi, 1978) (Fig. 2. 12)

Broad, dorsoventrally flattened oval lorica with separate dorsal and ventral plates; wider round corona; anterior margin is slightly elevated at the centre; jointed foot with 2 toes.

TL - 105; MW - 75µ.

ER: Dhanapathi (1978)

Distribution: India
33. *Dipleuchlanis sp.* (Gosse, 1886) (Fig. 2. 13; Plate II. 3)

Broad, firm, ovate lorica formed of separate dorsal and ventral plates; wider corona with longer cilia on the lateral margin; eye spot present; jointed, segmented foot with 2 equal toes.

TL - 300 μ; MW - 210 μ; Toe L - 92 μ.

**ER:** Dhanapathi (1978), Sharma (1979)

**Distribution:** Cosmopolitan

34. *Tripleuchlanis sp.* (Levander, 1894) (Fig. 2. 14)

Cylindrical, firm lorica, head with a wider corona is clearly differentiated from the abdominal region; eye spot present; jointed segmented, non-retractible foot with long toes of equal length.

TL - 180 μ; MW - 75 μ; Toe L - 105 μ.

**ER:** Dhanapathi (1927), Sharma (1979).

**Distribution:** America, Africa, India, Srilanka.

35. *Diplois davisiae* (Gosse, 1886) (Fig. 2. 15; Plate II. 3)

Symmetric broad firm, vase like body with a central septum dividing the body into equal halves vertically; no anterior or posterior spines; bulky stout posterior base with jointed foot at the centre; short foot ends with long equal toes.

TL - 220 μ; MW - 135 μ; AW - 60 μ; Toe L - 90 μ.
ER: Dhanapathi and Rama sarma (2000).

Distribution: Europe and India

36. *Lophocharis* (Gosse, 1851) (Fig. 2. 16; Plate II. 3)

Small, stiff, laterally compressed asymmetric, cuticular body with separate dorsal and ventral plates; no occipital spines; prominent anterior region with one lateral elevation and also the posterior region tapers at one side asymmetrically; long stout, jointed, segmented foot starts from the mid half in between the centre ending with toes.

TL - 90 μ; MW - 60 μ; Toe L - 45 μ.

ER: Sharma and Michael (1980).

Distribution: Cosmopolitan.

37. *Macrochaet us* (Thorpe, 1893) (Fig. 5. 7)

Small, symmetric lorica provided with long, equal, 4 pairs of movable spines arranged in order. Flexible head with corona; jointed foot with 2 toes equal in length.

TL - 135 μ; MW - 135 μ; TL - 30 μ; FL - 60 μ.


Distribution: Europe, India, China and Japan
38. *Wolga spinifera* (Skorikov) (Fig. 5. 4; Plate II. 3)

Sessile form broad, rigid, faceted body; broad wider corona distinctive in the head; eye spot present; bulky abdominal region; illustrious segmented foot with 2 equal pointed toes.

**Distribution**: Cosmopolitan

39. *Anuraeopsis fissa* (Gosse, 1851)  
(Fig. 5. 10; Plate II. 3)

Small, lobed, asymmetric, slightly curved body with separate dorsal and ventral plates; wider corona; eye spot present, blunt posterior region without foot.


**Distribution**: Cosmopolitan

**SUB FAMILY**: Colurinae

5. **Genus**: *Colurella*

40. *Colurella obtusa* (Gosse, 1886) (Fig. 2. 17; Plate II. 3)

Smaller firm, oval, laterally compressed body with separate dorsal and ventral plates; jointed foot with 2 toes.

**TL** - 105μm; **MW** - 90μm; **FL** - 45μm.

**Distribution**: Tropicopolitan.
41. *C. bicuspidata* (Ehrenberg, 1832) (Fig. 2. 17)

Smaller, laterally compressed body of stout more or less sub-rectangular lorica, shield like covering in the anterior head region; tapered posterior end; scraps the leaves of weeds; jointed foot with pointed distal end.

TL - 105 μ; MW - Shield; L - 90 μ; Toe L - 45 μ.

**ER**: Hutchinson (1934), Sharma (1979)

**Distribution**: Cosmopolitan

42. *C. adriatica* (Ehrenberg, 1837) (Fig. 2.19)

Smaller, firm, broad, oval, laterally compressed lorica with separate dorsal and ventral plates; jointed foot with toes.

TL - 105 μ; Shield; L - 90 μ; TL - 45 μ.

**ER**: Anderson (1889), Murray (1906)

**Distribution**: Europe, America, Canada, India, China, Japan

6. Genus: *Lepadella*

43. *Lepadella ovalis* (Muller, 1786) (Fig. 2. 20; Plate II. 3)

Broad circular dorsoventrally flattened firm lorica; no anterior or posterior spines; a deep notch at the centre anteriorly; jointed foot starts form the distinct separate groove located in the mid half of the posterior region at the centre; foot ends with 2 free toes.
TL & width - 270µ; Notch length - 60µ; Foot groove length - 105µ; Toe length - 45µ.

**ER:** Edmondson and Hutchinson (1934), Vasisht and Battish (1971), Sharma (1976), Sharma and Sumita Sharma (1987).

**Distribution:** Cosmopolitan.

### 44. *L. patella* (Muller, 1773) (Fig. 3. 1; Plate II. 3)

Oval firm lorica broader at the centre. Both interior and posterior notches equal in length not in width; broad wider notch anteriorly and narrowed inverted deep 'U' shaped notch posteriorly; spines absent; foot arises out from the posterior notch; jointed single foot with 2 toes having pointed ends.

TL - 240µ; A. notch L - 60µ; P. notch L - 60µ; FL - 45; TL - 45µ.

**ER:** Edmonson and Hutchinson (1934), Wulfert (1966), Vashist and Battish (1971), Sharma (1976), Sharma and Sumita Sharma (1987).

**Distribution:** America, Canada, India.

### 45. *L. cristata* (Rousselet, 1893) (Fig. 3. 2; Plate II. 3)

Crested, oval firm lorica formed of separate pieces of lorica the crest splits the dorsal plate into equal halves vertically throughout the length; convex ventral plate; jointed segmented foot with 2 toes equal in length.
TL - 180µ; MW - 90µ; FL - 37.5µ; TL - 37.5µ.

ER: Sharma and Sharma (1987)

Distribution: Cosmopolitan

7. Genus:

46. **Squatinella** (Ehrenberg, 1832) (Fig. 4.9)

Very small, loricate organism; distinctive head, abdomen and foot; head covered by a prominent, non-retractible, semi-circular hood or shield-like structure; corona is seen inside this hood, retractible neck, eye spot present; jointed segmented foot with long equal pointed toes start from the mid half of the posterior part. Foot longer than the body length.

TL - 90 µm; Neck W - 30 µm; MW - 37.5 µm; TL - 105 µm.

ER: Edmondson and Hutchinson (1934)

Distribution: Europe, America, India

2. FAMILY: **Lecanidae**

8. Genus: **Lecane**

47. **Lecane inopinata** (Harring and Myers, 1926) (Fig. 3. 3; Plate II. 4)

Broad ovate lorica; triangular cusps are seen at the anterolateral side; broad corona; eye spot present; posterior region with transverse ridges; 2 long, jointed, fused toes with claws.
TL - 135μ; MW - 105μ; TL - 45μ.

**ER:** Wulfert (1966), Dhanapathi (1976), Sharma (1978), Sharma and Sharma (1997).

**Distribution:** Cosmopolitan

48. *L. luna* (Muller, 1776) (Fig. 3. 4; Plate II. 4)

Broad sub-circular lorica of posterior region broader than the anterior region, wider round shaped corona; broad invaginated anterior opening depending on coronal movement; 2 long, slender toes with claws.

TL - 150μ; MW - 120μ; TL - 45μ.


**Distribution:** Cosmopolitan

49. *L. ohioensis* (Voigt, 1902) (Fig. 3. 5)

Broad ovate elongated lorica; straight and plain anterior margin with 2 tiny cusp like projections in the lateral side; 2 long separated toes with claws; ridged posterior end.

TL - 165 μm; MW - 105 μm; Toe L - 45 - 60 μm.

**ER:** Edmondson and Hutchinson (1934), Sharma (1979)
**Distribution**: Cosmopolitan

50. *L. elasma* (harring & Myers, 1926) (Fig. 3. 6)

Broad ovate lorica; no occipital spines; anterior end more or less straight or slightly invaginated; long joined, fused toes with claws.

TL - 120 μm; MW - 90 μm; Toe L - 52.5 μm.

**Distribution**: Tropicopolitan

51. *L. obtusa* (Murray, 1913) (Fig. 3. 7)

Dorsally convex, elongated, ovate body formed of separate lorical pieces, with broad corona; anterior margin is straight almost with cusps laterally; long, single, jointed toe with 2 claws.

TL - 165 μm; MW - 105 μm; Toe L - 75 μm.


**Distribution**: Cosmopolitan

52. *L. brauhmi* (Koste, 1988) (Fig. 3. 8)

Double layered, broad ovate, lorica with broader corona; shape of the anterior end depends on the coronal movement; eyespot present; 2 long toes without claws.

TL - 180 μ; MW - 150 μ; Toe L - 60 μ.
**Genus**: Monostyla

**ER**: Sharma and Sharma (1997)

**Distribution**: Tropicopolitan

53. *L. depressa* (Bryce) (Fig. 3. 9; Plate II. 4)

Elongated sub-rectangular lorica with double layered outer wall; anterior margin straight with small lorical projections laterally as spines; eye spot present; transverse ridges seen posteriorly 2 jointed, separated toes with claws.

TL - 150 μ; MW - 105 μ; Toe L - 60 μ.

**Distribution**: Cosmopolitan

9. **Genus**: Monostyla

54. *Monostyla bulla* (Gosse, 1851) (Fig. 3. 10; Plate II. 4)

Stiff, elongated ovate lorica, narrow anterior margin deeply invaginated with 'V' shaped notch; absence of spines in both anterior and posterior ends. Long foot with pointed ends.

TL - 165 μ; MW - 105 μ; Toe L - 90 μ.

**ER**: Several workers from India

**Distribution**: Cosmopolitan
55. *Monostyla decipiens* (Murray, 1913)  
(Fig. 3. 11; Plate II. 4)

Firm, oval elongated lorica tapered at both anterior and posterior ends with small 'V' shaped notch anteriorly having 2 triangular cusps in the anterolateral margin; semicircular invaginations in the posterior region gives way to the toes; single, jointed, long toes end in jointed claws.

TL - 135 μ; MW - 90 μ; Toe L - 45 μ.

**ER:** Vasisht and Battish (1971), Sharma (1978)

**Distribution:** Tropicopolitan

56. *M. closterocerca* (Schmarda, 1898)  
(Fig. 3. 12; Plate II. 4)

Sub circular, stout, firm lorica of approximately equal length and width; anterior margin almost straight and broad; single, jointed toe with pointed distal end.

TL - 120 μ; MW - 90 μ; Toe L - 45 μ.


**Distribution:** Cosmopolitan
57. *M. quadridentata* (Ehrenberg, 1832)  
(Fig. 3. 13; Plate II. 4)  
Elongated, oval, firm lorica, tapered at both extremes; antero-median spines forms a pyriform sinus, slender long foot with pointed claw.  

TL - 135 µm; MW - 105 µm; AMSL - 30 µm.  

ER: Anderson (1889), Edmondson and Hutchinson (1934), Arora (1965), Nayar (1968), Dhanapathi (1976).  

Distribution: Cosmopolitan  

3. FAMILY: Proalidae  
10. Genus: Wulfertia  
58. *Wulfertia ornata* (Fig. 4. 14; Plate II. 4)  
Flexible, thin, striated, body, wider corona; illustrious, distinct segmented head; eye spot present; bulky posterior mid half; very short ruminental foot with 2 toes.  

TL - 195 µ; MW - 90 µ.  

4. FAMILY: Notommatidae  
11. Genus: Cephalodella  
59. *Cephalodella gibba* (Ehrenberg, 1832) (Fig. 5. 5)  
Asymmetric, slender, body; wider corona; well differentiated head and abdominal region; eye spot present; unequal dorsal and ventral plates; jointed foot with 2 spiny long equal toes.
Edmondson and Hutchinson (1934), Wulfert (1966), Sharma (1979)

Distribution: America, Canada, Europe, India, China

12. Genus: *Eosphora*

60. *Eosphora najas* (Ehrenberg, 1830)
(Fig. 5. 11; Plate II. 4)

Elongated cylindrical broad and attenuated body; Transparent wider corona; well differentiated head abdomen and tail region; bulky abdomen; eye spot present; foot with 3 segment and toes.

TL - 330 μ; MW - 105 μ; Toe L - 15 μ.

ER: Edmondson and Hutchinson (1934), Dhanapathi (1975)

Distribution: America, Europe, India

61. *E. anthadis* (Harring and Myers, 1921)
(Fig. 5. 12; Plate II. 4)

Thin, broad, transparent body with head, abdomen and distinctive foot; broad, wider, round corona; eye spot present; attenuated foot with pointed toes.

TL - 330 μ; MW - 135 μ; Toe L - 15 μ.

ER: Dhanapathi (1975)

Distribution: America, Australia, Europe, India, China

Genus: *Itura*
62. *Itura aurita* (Ehrenberg, 1830) (Fig. 5. 8)

Elongated, thin, flexible lorica, wider corona with a tuft of cilia in the anterolateral margins; more than 2 eyes; illustrious head, abdomen and foot region; posterior part of the body broader than the anterior region; jointed segmented foot with slender pointed toes.

TL - 165 μ; MW - 90 μ; foot L - 30 μ.

**ER**: Edmondson and Hutchinson (1934)

**Distribution**: America, Europe, India, China

5. **FAMILY**: *Trichocercidae*

13. **Genus**: *Trichocerca*

63. *Trichocerca porcellus* (Gosse, 1886) (Fig. 5. 6)

Smaller in size; asymmetric curved body; distinct head and abdominal region; 2 spiny projections seen on the anterior region laterally; illustrious foot with unequal spiny toes.

**ER**: Dhanapathi (2000)

**Distribution**: Cosmopolitan
6. FAMILY : *Gastropidae*

14. Genus : *Gastropus*

64. *Gastropus hyptopus* (Ehrenberg, 1838)  
(Fig. 4. 7; Plate II. 4)  
Large, transparent, compressed, sacciform body; wider mouth opening, corona with tufts of cilia; antennae like projection arise from the anterior opening; laterally short retractible foot with toes open, laterally; a caudal antenna like projection near the foot joint; Mucilagenous sheath like covering surrounds the whole body.

ER : Edmondson and Hutchinson (1934)

Distribution : Cosmopolitan

7. FAMILY : *Dicranophoridae*

15. Genus : *Wierzejskiella*

65. *Wierzejeskiella racinae* (Wiszniewski, 1929)  
(Fig. 4. 17; Plate II. 4)  
Thin, curved body; wider corona; distinctive head, abdomen and foot; long, chain like foot joints about half the length of entire body ends with small toes.

TL - 105 μ; MW - 45 μ; Toe L - 60 μ.
8. FAMILY : *Asplanchnidae*

16. Genus : *Asplanchna*

66. *Asplanchna priodonta* (Gosse, 1850)  
(Fig. 4. 1; Plate II. 5)

Large, sacciform, flexible, very transparent organism, opening only at the anterior region where a broader corona with thin ciliary filaments seen; large body cavity; stomach just away from the body wall in the posterior region; viviparous animals with embryocyst inside; no foot or other extensions.

TL - 540 - 750 μm; Corona W - 105 - 135 μm.

ER : Sharma and Sharma (1992)

Distribution : Cosmopolitan

67. *A. intermedia* (Hudson, 1886) (Fig. 4. 2; Plate IV. 1)

Large, sacciform, flexible, transparent body; broader corona with ciliary band lack of foot; oviparous animals; predatory behaviour.

TL - 540 - 750 μm; Corona W - 105 - 135 μm.

ER : Arora (1962), Dhanapathi (1975)

Distribution : Tropicopolitan

68. *A. brightwelli* (Gosse, 1850) (Fig. 4. 3; Plate II. 5)

Sacciform large, flexible body; anterior margin smaller than the posterior region; retractible wider corona with small ciliary band;
differs from other species by changing its shape and movement of internal organs predatory organism.

TL - 540 - 750 μ; Corona W - 105 - 135 μ.

ER : Edmondson and Hutchinson (1934), Dhanapathi (1975), Sharma (1979)

**Distribution** : Cosmopolitan

69. *A. herricki* (Fig. 4. 4; Plate II. 5)

Large, sacciform, flexible transparent animal with large body cavity with no specialized intestine, stomach except glandular structure at the posterior end. Wider retractible corona with ciliary band.

TL - 540 - 750 μ; Corona W - 105 - 135 μ.

**Distribution** : Cosmopolitan

9. **FAMILY** : *Synchaetidae*

17. Genus : *Harringia*

70. *Harringia rousseleti* (Fig. 4. 8)

Broad, bulky, flexible body with retractible head having corona; anterior region is very narrower than the posterior region head and neck are much constricted whereas the abdominal region suddenly broadens from the neck; short retractible, clawed foot.
18. Genus: *Ploesoma*

71. *Ploesoma* (Fig. 5. 2)

Flexible body with corona bearing antenna anteriorly; segmented foot with 2 toes.

TL - 300 μ; MW - 225 μ.

ER: Kannan and Govindasamy (1991)

19. Genus: *Polyarthra*

72. *Polyarthra* (apterous form) (Fig. 3. 20; Plate II. 5)

Rectangular, transparent thin body; paddles arise from the neck region laterally, with length equal to the body length; 2 antennae present in anterior occipital region eye spot present.

73. *P. multiappendiculata* (Arora, 1962) (Fig. 3. 21; Plate II. 5)

Sacciform body with long paddles of equal length from 3 locations on the neck region. Paddle length equal.

Distribution: Tropicopolitan

74. *Polyarthra* sp. (Fig. 3. 22; Plate II. 5)

Broad rectangular body, paddles arise from the neck region. Paddle length shorter than the body length.
II. ORDER: *FLOSCULARIACEAE*

10. FAMILY: *Testudinellidae*

20. Genus: *Filinia*

75. Filinia longiseta (Ehrenberg, 1834)  
(Fig. 3. 16; Plate II. 5)

Thin firm, lorica, smaller in size; fast moving; corona with ciliary band; setiform extensions from the cuticle more than twice the length of the body; foot absent; narrowed posterior region.

TL - 150 μ; MW - 105 μ; Toe L - 330 μ.

**ER**: Several workers from India

**Distribution**: Cosmopolitan

76. *F. pejleri* (Hutchinson, 1964) (Fig. 3. 17; Plate II. 5)

Smaller, firm, broad, oval, laterally compressed lorica with separate dorsal and ventral plates; jointed foot with toes.

TL - 105 μ; Shield L - 90 μ; FL - 45 μ.

**ER**: Nayar (1978), Sharma (1979), Dhanapathi and Rama Sarma (2000)

**Distribution**: America, South Africa, India, Sri Lanka
77. *F. opoliensis* (Zacharias, 1898) (Fig. 3. 19)

Thin, firm, fusiform, lorica, 4 spines of which 2 anterior and posterior of unequal length, length of the spine twice the length of the entire body length.

TL - 135 μ; ASL - 315 μ; PSL - 270 μ.


**Distribution**: Europe, China, Sri Lanka, India

78. *F. terminalis* (Plate, 1886) (Fig. 3. 18; Plate II. 5)

Thin, firm, lorica, fast moving, 3 long, movable setiform extensions; 2 anterior spine and 1 posterior spine smaller than the 2 anterior spines.

TL - 105 μ; MW - 60 μ; ASL - 225 μ; PSL - 225 μ.

**ER**: Sharma *et al.* (1992)

**Distribution**: Tropicopolitan

21. Genus: *Horaella*

79. *Horaella brehmi* (Donner, 1949) (Fig. 5. 9)

Transparent, circular, flexible lorica; corona with circular ciliary band; distinctive head and body; no foot.
ER : Donner (1949), Sharma (1979), Dhanapathi and Rama Sarma (2000)

TL - 270 μ; MW - 240 μ.

Distribution : Srilanka, India.

22. Genus : Testudinella

80. Testudinella patina (Hermann, 1783) (Fig. 4. 5; Plate II. 5)

Circular, stippled, thin, very transparent, dorsoventrally flattened body; retractible corona with ciliary band arise from the anteromedian notch, the invagination; eye spot present; long retractible annulated foot arises on the ventral side away from the posterior region.

TL (diameter) - 195 μ; FL - 120 μ.

ER : Anderson (1889), Edmonson and Hutchinson (1934), Wulfert (1966), Naidu (1967), Sharma (1979), Dhanapathi and Rama Sarma (2000), Sharma et al. (1992)

Distribution : Cosmopolitan
11. FAMILY: *Hexarthridae*

23. Genus: *Hexarthra*

81. *Hexarthra mira* (Hudson, 1871)  
(Fig. 3. 15, 15a; Plate II. 5)  
Specialized appendages arise from the body; skipping movement; broader anterior region with corona and narrowed posterior region; arms with filaments both on ventral and dorsal side.

TL - 354; MW - 225.


Distribution: Europe, Australia, India, Sri Lanka and China

82. *H. intermedia* (Wizneiwskei, 1929)  
(Fig. 14, 14a; Plate II. 6)  
Smaller is size; looks alike Hexarthra mira; in the narrowed posterior region 2 sac-like structures occur inside the body; produces resting eggs; serrated arms with long filaments both on ventral and dorsal side.


Distribution: Cosmopolitan
12. FAMILY: Floscularidae

24. Genus:

83. Lacinularia (Muller, 1773)
(Fig. 4.11, 4.12; Plate II. 6)
Colonial forms with large number of animals (20 - 500) in a single colony attached to aquatic weeds; longs lender transparent body with abdomen and foot well differentiated; heart shaped corona; foots joined by gelatinous sheath matrix.

ER: Arora (1963), Nayar (1968), Dhanapathi and Rama Sarma (2000)

Distribution: America, India

13. FAMILY: Conochilidae

25. Genus:

84. Conochilus (Rajendran, 1971)
(Fig. 4.10; Plate II. 6)
Free swimming colonial forms having 10 - 200 animals in a single colony; round corona with small cilia; antenna seen above the corona; the foots of individuals always attached together at the posterior end in the mucilagenous sheath; produces both resting and normal eggs whirling movement.

26. Genus:

85. Conochiloides (Hudson, 1885) (Fig. 4.13; Plate II. 6)
Small, transparent free swimming animal resembling conochilus; round corona; 2 long dorsal antenna arise from stalk on one side laterally; long blunt foot used for attachment.

Distribution: Cosmopolitan

III. ORDER: COLLOTHECACEAE

9. FAMILY: Collothecidae

17. Genus: Collotheca

86. *Collotheca ornata* (Ehrenberg, 1832)
   (Fig. 4. 15, 4.16; Plate II. 6)
   Long slender, transparent body with bulky abdomen and slender long foot; peculiar corona with 5 lobes having tuft of cilia when retracted; only one long ciliary tuft equal to the anterior length of the body; whole body surrounded by a mucilagenous sheath; foot ends with peduncle for attachment.

ER: Sarma (1988)

Distribution: America, Australia, Canada, India

28. Genus:

87. *Cupelopagis vorax* (Leidy, 1957) (Fig. 4. 6; Plate II. 6)
   Large, circular, firm body with wider mouth opening holding a retractible a bowl like covering eye spot present; viviparous.

   TL & TW - 750µ diameter.

ER: Edmondson and Hutchinson (1934), Vasisht and Dawar (1968), Dhanapathi and Rama Sarma (2000).

Distribution: Cosmopolitan
II. CLASS: BDELLOIDEA

IV. ORDER: BDELLOIDA

15. FAMILY: Habrotrachidae

29. Genus:

88. Habrotracha (Bryce) (Fig. 5. 1)

Illoricate bulb like body; illustrious 2 coronal discs; dorsal antennae with spur; bulky abdomen with vacuoles, lack of distinct foot.

TL - 165 μ; MW - 75 μ.

Distribution: Cosmopolitan

16. FAMILY: Philodinidae

30. Genus:

89. Macrotrachela quadricornifera (Milne, 1886) (Fig. 5. 3)

Broad, thin, transparent body; 2 coronal discs; retractible foot with toes.

TL - 180 μ; MW - 90 μ.

ER: Murray (1906)

Distribution: Europe, India.

31. Genus: Philodina

90. Philodina roseola (Ehrenberg, 1832) (Fig. 5. 15)

Orangish is colour; long elongated, transparent body; 2 illustrious ciliary discs in the corona; retractible head. A finger like
projection is seen in the anterior end of the head, when at rest/contracted state; segmented lateral antenna, stretchable abdomen and foot; foot with a spur; pedal glands are clearly seen;

**Distribution**: Cosmopolitan

91. *Philodina citrina* (Ehrenberg, 1832)
(Fig. 5. 16; Plate II. 7)

Long, elongated, transparent body with 2 distinct ciliary discs of corona; retractible head, eye spot clearly seen; abdomen is striated in stretched state; short foot with spurs for attachment;

32. **Genus**: *Rotaria*

92. *Rotaria rotatoria* (Pallas, 1766)
(Fig. 5. 13; Plate II. 7)

Specific example for rotifers. Illoricate, segmented, transparent body with 2 distinctive trochal discs; eye spot present; lateral antenna present in the neck region; body stretchable to twice the length of the whole body length; retractible 5 segmented foot with spur; found among weeds.

**ER**: Anderson (1889), Murray (1906), Arora (1962)

**Distribution**: Cosmopolitan
93. *R. citrina* (Fig. 5. 14; Plate II. 7)

Illoricate, segmented transparent body. Body stretchable twice the normal length; corona with 2 trochal disc., antennae on the cervical region; retractible very long foot with spurs.

**Distribution**: Cosmopolitan.
## Table 2.2. Local occurrence of freshwater rotifers in selected sites at Palayamkottai

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Species Name</th>
<th>PC</th>
<th>P-I</th>
<th>P-II</th>
<th>P-III</th>
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<tbody>
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<td>1.</td>
<td><em>Brachionus calyciflorus</em></td>
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<td>2.</td>
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<td><em>B. calyciflorus f. anuræiformis</em></td>
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<td>8.</td>
<td><em>B. quadridentatus var. brevispinus</em></td>
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<td><em>Polyarthra (apterous form)</em></td>
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<tr>
<td>78</td>
<td><em>F. terminalis</em></td>
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<td>82</td>
<td><em>H.intermedia</em></td>
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<tr>
<td>83</td>
<td><em>Lacinularia</em></td>
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<td>84</td>
<td><em>Conochilus</em></td>
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<td>85.</td>
<td><em>Conochiloides</em></td>
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<td>86.</td>
<td><em>Collotheca ornata</em></td>
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<td>87.</td>
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<td><em>Habrotracha</em></td>
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<td><em>Macrotrachela</em></td>
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<td>+</td>
<td>+</td>
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<td>90.</td>
<td><em>Philodina roseola</em></td>
<td>+</td>
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<td>92.</td>
<td><em>Rotaria rotatoria</em></td>
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<td>+</td>
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<td>91.</td>
<td><em>Philodina citrina</em></td>
<td>+</td>
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<tr>
<td>93.</td>
<td><em>R. citrinus</em></td>
<td>+</td>
<td>+</td>
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<td></td>
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<tr>
<td>Total</td>
<td></td>
<td>83</td>
<td>55</td>
<td>56</td>
<td>43</td>
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+ = Present  
- = Absent
PLATE II. 1.

Brachionus calyciflorus
B. calyciflorus var. hymani
B. calyciflorus f. amphiceros

B. calyciflorus f. borgerti
B. calyciflorus f. dorcas
B. calyciflorus f. anuraeiformis

B. quadridentatus f. brevispinus
B. quadridentatus f. duniobicularis
B. quadridentatus f. rhenanus

B. angularis
B. angularis angularis
B. angularis bidens
PLATE II. 2.

- B. caudatus
- B. caudatus apsteini
- B. fulcatus
- B. leydigii
- B. urceolaris
- B. budapestinensis
- Epiphanes brachionus spinosus
- E. macroura
- E. clavulata
- Keratella cochlearis
PLATE II. 3.

K. procurva  

K. tropica  

K. valga  

K. ticinensis  

Dipleuchlanis  

Diplois davisiae  

Lophocharis  

Wolga spinifera  

Anuraeopsis  

Colurella obtusa  

Lepadella ovalis  

L. patella  

L. cristata
PLATE II. 4.

Lecane inopinata

L. Luna

L. depressa

Monostyla bulla

M. decipiens

M. closterocerca

M. quadridentata

Wulftia ornata

Eosphora najas

E. anthadis

Gastropus hytopus

Wierzejskiella racinae
PLATE II. 7.

Rotaria rotatoria

R. citrinus

Philodina citrina