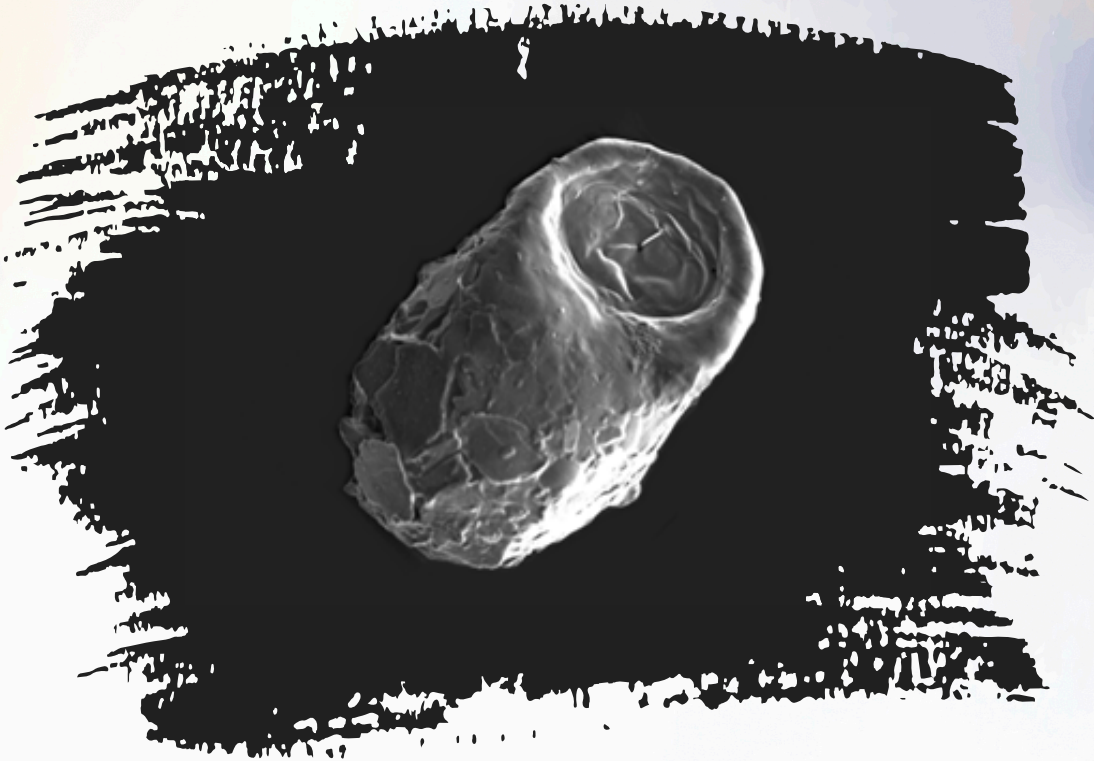


# FAUNA OF INDIA CHECKLIST

JULY, 2024

ONLINE VERSION 1.0



## TESTATE AMOEBIA (Protozoa: Tubulinea; Cercozoa; Stramenopiles)

L. Bindu<sup>1</sup>, J. Purushothaman<sup>2</sup>, A. Ambili<sup>2,3</sup> & A. Chaudhary<sup>2,3</sup>

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DOI : <https://doi.org/10.26515/Fauna/1/2023/Protista:Tubulinea; Cercozoa; Stramenopiles>

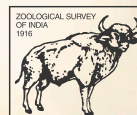
**Keywords:** Protozoa, Testate Amoeba, India, Checklist, Lower Invertebrate biodiversity.

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**Comments on the checklist:**

E-mail your comments and suggestions to improve the checklist to

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and [jasbose@gmail.com](mailto:jasbose@gmail.com)



**ZOOLOGICAL SURVEY OF INDIA**  
Ministry of Environment, Forest & Climate Change

# TESTATE AMOEBEA (Protozoa: Tubulinea; Cercozoa; Stramenopiles)

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**Introduction:** Testate amoebae are unicellular eukaryotic free-living protozoans in which the amoeboid cells are covered by an extracellular shell (test), mostly with a single main opening which extrude pseudopodia. They are divided into two main groups based on the morphology of pseudopodia- Arcellinida (with lobose pseudopodia) and Euglyphida (with filose pseudopodia). Testate amoebae are distributed worldwide from the tropics to the polar region and occur in most terrestrial, freshwater, brackish and marine habitats, but are very abundant and diverse in the sphagnum mosses. They are a good model for taxonomy and evolutionary studies because of their abundance, diversity and presence of a shell which is a reliable taxonomic feature for the diagnosis of species. Testate amoebae are very sensitive and quickly respond to environmental changes which makes them valuable biomonitors. Presently testate amoebae are a polyphyletic assemblage of at least three major unrelated taxonomic groups of unicellular eukaryotes: Amoebozoa, Stramenopiles and Cercozoa.

**Global diversity:** The global distribution of testate amoebae is more than 675 species under 104 genera and 22 families which include records from polar regions also.

**Diversity in India:** In India 209 species belong to 37 genera under two classes and two orders were recorded.

## Diversity in States

| Sl.No. | State/Union Territory | No. Species | No. Endemic Species |
|--------|-----------------------|-------------|---------------------|
| 1      | Andhra Pradesh        | 34          | -                   |
| 2      | Arunachal Pradesh     | 41          | -                   |
| 3      | Assam                 | 40          | -                   |
| 4      | Bihar                 | 0           | -                   |
| 5      | Chhattisgarh          | 0           | -                   |
| 6      | Gujarat               | 0           | -                   |
| 7      | Goa                   | 0           | -                   |
| 8      | Haryana               | 0           | -                   |
| 9      | Himachal Pradesh      | 107         | -                   |
| 10     | Jharkhand             | 0           | -                   |
| 11     | Karnataka             | 1           | -                   |
| 12     | Kerala                | 62          | -                   |
| 13     | Madhya Pradesh        | 0           | -                   |
| 14     | Maharashtra           | 17          | -                   |
| 15     | Manipur               | 22          | -                   |
| 16     | Meghalaya             | 31          | -                   |
| 17     | Mizoram               | 21          | -                   |

| Sl.No. | State/Union Territory           | No. Species | No. Endemic Species |
|--------|---------------------------------|-------------|---------------------|
| 18     | Nagaland                        | 21          | -                   |
| 19     | Odisha                          | 38          | -                   |
| 20     | Punjab                          | 1           | -                   |
| 21     | Rajasthan                       | 6           | -                   |
| 22     | Sikkim                          | 40          | -                   |
| 23     | Tamil Nadu                      | 48          | -                   |
| 24     | Telangana                       | 21          | -                   |
| 25     | Tripura                         | 27          | -                   |
| 26     | Uttar Pradesh                   | 43          | -                   |
| 27     | Uttarakhand                     | 64          | -                   |
| 28     | West Bengal                     | 62          | -                   |
| 29     | Andaman & Nicobar               | 0           | -                   |
| 30     | Chandigarh                      | 8           | -                   |
| 31     | Dadra Nagar Haveli, Daman & Diu | 0           | -                   |
| 32     | Delhi                           | 1           | -                   |
| 33     | Jammu & Kashmir                 | 3           | -                   |
| 34     | Ladakh                          | 0           | -                   |
| 35     | Lakshadweep                     | 0           | -                   |
| 36     | Puducherry                      | 0           | -                   |
|        | <b>INDIA TOTAL</b>              | <b>209</b>  | <b>-</b>            |

**Endemism:** No testate amoebae species has so far been demarcated as endemic to India.

**Habitat:** Testate amoebae are found in most of the moist habitats like ponds, rivers, streams, estuaries, marine habitats, leaf litter, sphagnum mosses and soil.

**Ecological significance:** They are valuable bioindicators for ecological and environmental monitoring studies and as proxies for hydrological changes and the shells remain well preserved in peat and sediment for a quite long time makes them excellent microfossils and widely used in micro paleontological studies.

**Human significance:** Testate amoebae are widely used in biomonitoring of various ecosystems and also used in sewage treatment plants. Soil protozoa play an important role in mineralizing nutrients and making them available for plants.

**Threatened species:** Testate amoebae species are not assessed for IUCN threat categories.

**Protected Species as per WPA (2022):** Testate amoebae are not listed under any schedules of Wildlife Protection Act (2022).

**Species under CITES:** Testate amoebae are not listed under any appendices of CITES.

**Invasive alien species:** No testate amoebae species is reported as invasive.

**Gap areas:** Testate amoebae are not documented from many states such as Bihar, Chhattisgarh, Gujarat, Goa, Haryana, Jharkhand, Madhya Pradesh, Andaman & Nicobar, Dadra Nagar Haveli, Daman & Diu, Ladakh, Lakshadweep and Puducherry and only meagre reports from many other states.

**Systematic list:**

Domain **Amorphea** Adl *et al.*, 2012

Supergroup **Amoebozoa** Lhe, 1913, *sensu* Cavalier-Smith, 1998

Phylum **Tubulinea** Smirnov *et al.*, 2005

Class **Corycida** Kang *et al.*, 2017

Genus **Amphizonella** Greeff, 1866

1. *Amphizonella violacea* Greeff, 1848

Genus **Diplochlamys** Greeff, 1888

2. *Diplochlamys leidy* Greeff, 1883

3. *Diplochlamys timida* Penard, 1909

Class **Elardia** Kang *et al.*, 2017

Order **Arcellinida** Kent, 1880

Suborder **Glutinoconcha** Lahr *et al.*, 2019

Infraorder **Sphaerothecina** Kosakyan *et al.*, 2016

Family **Arcellidae** Ehrenberg, 1843

Genus **Arcella** Ehrenberg, 1830

4. *Arcella arenaria* Greeff, 1866

5. *Arcella conica* Playfair, 1918

6. *Arcella crenulata* Deflandre, 1928

7. *Arcella excavata* Cunnungham, 1919

8. *Arcella geosphaira* Ogden, 1991

9. *Arcella gibbosa* Penard, 1890

10. *Arcella gibbosa* var. *mitriformis*

11. *Arcella hemisphaerica* Perty, 1852

12. *Arcella indica* Chattopadhyay and Das, 2003

13. *Arcella manipurensis* Chattopadhyay and Das, 2003

14. *Arcella mitrata* Leidy, 1876

15. *Arcella papyracea* Playfair

16. *Arcella papyracea* Playfair, 1914

17. *Arcella polypora* Penard

18. *Arcella rotundata* var. *scorbiculata* Playfair

19. *Arcella vulgaris* Ehrenberg, 1832

20. *Arcella vulgaris* var. *angulosa* Perty, 1852

21. *Arcella vulgaris* var. *undulatum* Deflandre, 1852

Genus **Galeripora** Gonzlez-Miguns, Soler-Zamora, Villar-dePablo, Todorov & Lara, 2021

22. *Galeripora artocrea* (Leidy, 1876) Gonzalez-Miguens *et al.*, 2021

23. *Galeripora catinus* (Penard, 1890) Gonzalez-Miguens *et al.*, 2021

24. *Galeripora dentata* (Ehrenberg, 1830) Gonzalez-Miguens *et al.*, 2021

25. *Galeripora discoides* (Ehrenberg, 1871) Gonzalez-Miguens *et al.*, 2021

26. *Galeripora megastoma* (Penard, 1902) Gonzalez-Miguens *et al.*, 2021

27. *Galeripora megastoma* var. *arcuta* Deflandre, 1928

Family **Netzeiliidae** Kosakyan *et al.*, 2016

Genus **Cyclopyxis** Deflandre, 1929

28. *Cyclopyxis arcelloides* (Penard, 1902) Deflandre, 1929

29. *Cyclopyxis arenata* (Cushman, 1930) Boltovskoy, 1956

30. *Cyclopyxis bharateii* Bindu, 2012

31. *Cyclopyxis eurystoma* Deflandre, 1929

32. *Cyclopyxis gramen* Penard, 1902

33. *Cyclopyxis kahli* Deflandre, 1929

34. *Cyclopyxis leidy* Couteaux and Chardez, 1981

35. *Cyclopyxis lismorensis* playfair, 1921

36. *Cyclopyxis lithophila* Penard, 1902



37. *Cyclopyxis tronconica* Godeanu, 1972  
Genus *Netzelia* Ogden, 1979
38. *Netzelia achlora* (Penard, 1902) Gomma *et al.*, 2017
39. *Netzelia oviformis* Ogden, 1979
- Incertae sedis Sphaerothecina**
- Genus *Cucurbitella* Penard, 1902
40. *Cucurbitella mespiliformis* Penard, 1902
- Genus *Trigonopyxis* Penard, 1912
41. *Trigonopyxis arcula* Penard, 1912
42. *Trigonopyxis complanatum* Penard, 1912
- Infraorder **Longithecina** Lahr *et al.*, 2019
- Family **Diffugiidae** Wallich, 1864
- Genus *Diffugia* Lecrec, 1815
43. *Diffugia acuminata* Ehrenberg, 1838
44. *Diffugia acuminata* var. *brevicaulis* Thomas & Mabilie
45. *Diffugia acuminata* var. *inflata* Penard, 1899
46. *Diffugia acutissima* Deflandre, 1931
47. *Diffugia amphora* Leidy, 1874
48. *Diffugia amphoralis* Hopkinson, 1958
49. *Diffugia ampla* Rampi, 1950
50. *Diffugia ampullula* Playfair, 1918
51. *Diffugia arcula* Leidy, 1879
52. *Diffugia avellana* Penard, 1890
53. *Diffugia bacillarum* Perty, 1958
54. *Diffugia bacillifera* Penard, 1890
55. *Diffugia bidens* Penard, 1902
56. *Diffugia binucleata* Penard, 1902
57. *Diffugia brevicolla* Cash, 1909
58. *Diffugia bryophila* (Penard, 1902) Jung, 1942
59. *Diffugia capreolata* Penard, 1902
60. *Diffugia carinata* Van Oye, 1956
61. *Diffugia corona* Wallich, 1864
62. *Diffugia curvicaulis* Penard, 1899
63. *Diffugia difficilis* Thomas, 1954
64. *Diffugia dragana* Ogden and Zivkovic, 1983
65. *Diffugia echinulata* Penard, 1911
66. *Diffugia elegans* Penard, 1890
67. *Diffugia geosphaira* Ogden, 1991
68. *Diffugia globularis* (Wallich, 1864) Chardez, 1956
69. *Diffugia globulosa* (Dujardin, 1837) Penard, 1902
70. *Diffugia globulus* Ehrenberg, 1990
71. *Diffugia gramen* Penard, 1902
72. *Diffugia kabylica* Gauthier-Lievre and Thomas, 1958
73. *Diffugia lacustris* Penard, 1890
74. *Diffugia lanceolata* Penard, 1890
75. *Diffugia lebes* Penard, 1890
76. *Diffugia leidyi* Wailes, 1913
77. *Diffugia limnetica* (Levander, 1900) Penard, 1902
78. *Diffugia lismorensis* Playfair, 1890
79. *Diffugia lithophila* Penard, 1902
80. *Diffugia lithoplites* Penard, 1902
81. *Diffugia lobostoma* Leidy, 1879
82. *Diffugia lucida* Penard, 1890

83. *Diffflugia muriformis* Gauthier-lievre and Thomas, 1958  
 84. *Diffflugia oblonga* Ehrenberg, 1831  
 85. *Diffflugia oblonga* var. *microclaviformis* Kourov, 1925  
 86. *Diffflugia oblonga* var. *musculicola* Chattopadhyay and Das, 2003  
 87. *Diffflugia penardi* Hopkinson, 1909  
 88. *Diffflugia pyriformis* Perty, 1849  
 89. *Diffflugia rubescens* Penard, 1891  
 90. *Diffflugia tuberculata* Wallich, 1864  
 91. *Diffflugia urceolata* Carter, 1864  
 92. *Diffflugia ventricosa* Deflandre, 1926  
 93. *Diffflugia viscidula* Penard, 1902  
 Family **Lesquereusiidae** Jung, 1942  
 Genus **Lesquereusia** Schlumberger, 1845  
 94. *Lesquereusia minor* Walton, 1930  
 95. *Lesquereusia modesta* Rhumbler, 1895  
 96. *Lesquereusia spiralis* Ehrenberg, 1840  
 97. *Lesquereusia spiralis* var. *penardi* Thomas & Gauthier-Lievre, 1959  
 Genus **Paraquadrula** Deflandre, 1932  
 98. *Paraquadrula irregularis* Wallich, 1863  
 Infraorder **Excentrostoma** Lahr *et al.*, 2019  
 Family **Centropyxidae** Jung, 1942  
 Genus **Centropyxis** Stein, 1857  
 99. *Centropyxis aculeata* (Ehrenberg, 1838)  
 100. *Centropyxis aculeata minima* Van Oye, 1956  
 101. *Centropyxis aculeata* var. *oblonga* Deflandre *f. minima* Kufferath  
 102. *Centropyxis aculeata* var. *tropics* Deflandre  
 103. *Centropyxis aerophila* Deflandre, 1929  
 104. *Centropyxis aerophila* var. *sphagnicola* Deflandre, 1929  
 105. *Centropyxis arunachalensis* Chattopadhyay and Das, 2003  
 106. *Centropyxis cassis* (Wallich, 1864) Deflandre, 1929  
 107. *Centropyxis constricta* (Ehrenberg, 1907) Penard, 1902  
 108. *Centropyxis delicatula* Penard, 1902  
 109. *Centropyxis discoides* Penard, 1902  
 110. *Centropyxis ecornis* (Ehrenberg, 1843) Leidy, 1879  
 111. *Centropyxis elongata* (Penard, 1890) Thomas, 1959  
 112. *Centropyxis faizabadensis* Bindu, 2012  
 113. *Centropyxis hemisphaerica* (Barnard, 1875) Deflandre, 1929  
 114. *Centropyxis himachalensis* Bindu, 2012  
 115. *Centropyxis laevigata* Penard, 1890  
 116. *Centropyxis minuta* Deflandre, 1929  
 117. *Centropyxis mizoramensis* Chattopadhyay and Das, 2002  
 118. *Centropyxis oblonga* Deflandre, 1929  
 119. *Centropyxis orbicularis* Deflandre, 1929  
 120. *Centropyxis plagiostoma* Bonnet and Thomas, 1955  
 121. *Centropyxis platystoma* (Penard, 1890) Deflandre, 1929  
 122. *Centropyxis purthiensis* Bindu, 2012  
 123. *Centropyxis spinosa* (Cash and Hopkinson, 1905) Deflandre, 1929  
 124. *Centropyxis stellata* Wailes, 1927  
 125. *Centropyxis sylvatica* (Deflandre, 1929) Bonnet and Thomas, 1955  
 Family **Plagiopyxidae** Bonnet *et* Thomas, 1960  
 Genus **Bullinularia** (Penard, 1907) Deflandre, 1953  
 126. *Bullinularia indica* (Penard, 1907)  
 Genus **Plagiopyxis** Penard, 1910

127. *Plagiopyxis callida* Penard, 1919  
 128. *Plagiopyxis declivis* Bonnet and Thomas, 1955  
 129. *Plagiopyxis minuta* Bonnet, 1959  
 Infraorder **Hyalospheniformes** Lahr et al., 2019  
 Family **Hyalospheniidae** Schultze, 1977, emend. Kosakyan and Lara, 2012  
 Genus **Certesella** Loeblich and Tappan, 1961  
 130. *Certesella martiali* Certes, 1889  
 Genus **Gibbocarina** Kosakyan et al., 2016  
 131. *Gibbocarina galeata* Penard, 1890  
 Genus **Hyalosphenia** Stein, 1859  
 132. *Hyalosphenia elegans* Leidy, 1874  
 133. *Hyalosphenia nobilis* Cash and Hopkinson, 1905  
 134. *Hyalosphenia papilio* Leidy, 1874  
 Genus **Nebela** Leidy, 1874  
 135. *Nebela bohémica* Taranek, 1882  
 136. *Nebelacaudata* Leidy, 1876  
 137. *Nebela collaris* (Ehrenberg, 1848) Leidy, 1879  
 138. *Nebela denticulata* Chattopadhyay and Das, 2003  
 139. *Nebela dentistoma* Penard, 1890  
 140. *Nebela galeata* Penard, 1890  
 141. *Nebela himalayana* Chattopadhyay and Das, 2003  
 142. *Nebela lageniformis* Penard, 1890  
 143. *Nebela longitubulata* Gauthier-Lievre, 1953  
 144. *Nebela penardiana* Deflandre, 1936  
 145. *Nebela tinctoria* (Leidy, 1879) Awerintzew, 1906  
 146. *Nebela wailesi* Deflandre, 1936  
 147. *Nebela flabellalum* Leidy, 1974  
 Genus **Padaungiella** Lara and Todorov, 2012  
 148. *Padaungiella tubulata* (Brown, 1910) Lara and Todorov, 2012  
 Genus **Porosia** Jung, 1942  
 149. *Porosia paracarinata* Bobrov and Kosakyan, 2015  
 Genus **Quadrulella** Cockerell, 1909  
 150. *Quadrulella elegans* Gauthier-lievre, 1958  
 151. *Quadrulella madibai* Kosakyan et al., 2016  
 152. *Quadrulella quadrigera* Deflandre, 1936  
 153. *Quadrulella symmetrica* (Wallich, 1863) Kosakyan et al., 2016  
 154. *Quadrulella tropica* Wailes, 1912  
 155. *Quadrulella variabilis* Kosakyan, 2016  
 Infraorder **Volnustoma** Lahe et al., 2019  
 Family **Heleoperidae** Jung, 1942  
 Genus **Heleopera** Leidy, 1879  
 156. *Heleopera papilio* Leidy, 1879  
 157. *Heleopera petricola* Leidy 1879  
 158. *Heleopera petricola* var. *amethystea*  
 159. *Heleopera rosea* Penard, 1890  
 160. *Heleopera sphagni* Leidy, 1874  
 161. *Heleopera sylvatica* Penard, 1890  
 Suborder **Organoconcha** Lahr et al., 2019  
 Family **Microchlamyidae** Ogden, 1985  
 Genus **Microchlamys** Cockerell, 1911  
 162. *Microchlamys patella* Cockerell, 1911  
 Genus **Pyxidicula** Ehrenberg, 1838  
 163. *Pyxidicula invisitata* Awerintzew, 1906

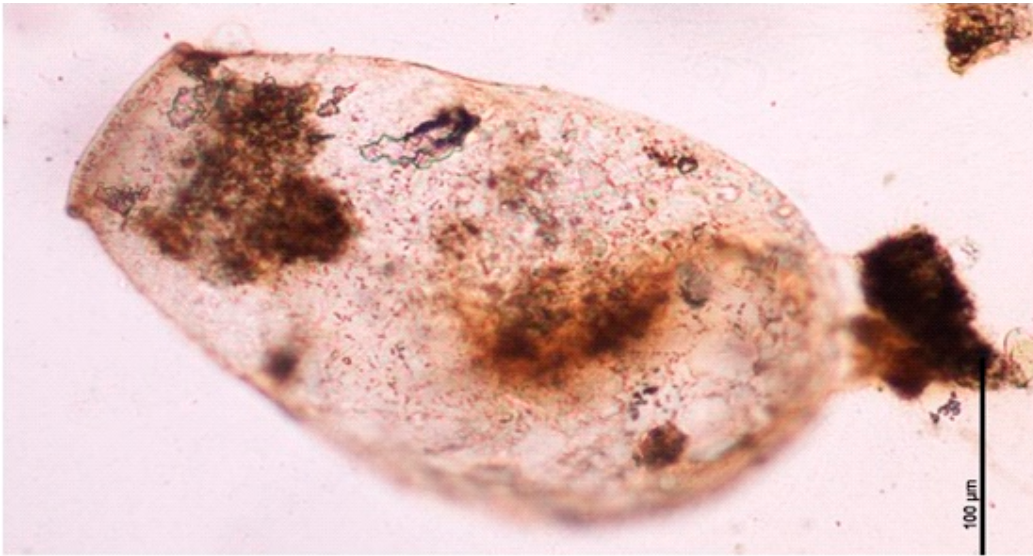
164. *Pyxidicula operculata* (Agardh, 1827) Ehrenberg, 1838  
 Suborder **Phryganellina** Bovee, 1985  
 Family **Phryganellidae** Jung, 1942  
 Genus **Phryganella** Penard, 1902  
 165. *Phryganella acropodia* Hopkinson, 1909  
 166. *Phryganella hemisphaerica* Penard, 1902  
 167. *Phryganella paradoxa* Penard, 1902  
 Family **Cryptodiffugiidae** Jung, 1942  
 Genus **Cryptodiffugia** Penard, 1890  
 168. *Cryptodiffugia oviformis* Penard, 1902  
**Incertae sedis Arcellinida**  
 Genus **Awerintzewia** Schouteden, 1906  
 169. *Awerintzewia cyclostoma* Schouteden, 1906  
 170. *Awerintzewia schoutedeni* Chattopadhyay & Das, 2003  
 Genus **Leptochlamys** West, 1901  
 171. *Leptochlamys ampullacea* West, 1901  
 Genus **Schwabia** Jung, 1942  
 172. *Schwabia robustus* Chardez, 1964  
 Domain **Diaphoretickes** Adl *et al.*, 2012  
 Supergroup **Rhizaria** Cavalier-Smith, 2002  
 Phylum **Cercozoa** Cavalier-Smith, 1988, *emend.* Adl *et al.*, 2005., *emend.* Cavalier-Smith, 2018  
 Class **Silicofilosea** Adl *et al.*, 2005, *emend.* Adl *et al.*, 2012  
 Order **Euglyphida** Copeland, 1956, *emend.* Cavalier-Smith, 1997  
 Family **Assulinidae** Lara *et al.*, 2007  
 Genus **Assulina** Ehrenberg, 1872  
 173. *Assulina discoides* Bobrov *et al.*, 2012  
 174. *Assulina muscorum* Greeff, 1888  
 175. *Assulina quadratum* Van Oye, 1958  
 176. *Assulina seminulum* Ehrenberg, 1848  
 Genus **Placocista** Leidy, 1879  
 177. *Placocista lens* Penard, 1902  
 Family **Euglyphidae** Wallich, 1864, *emend.* Lara *et al.*, 2007  
 Genus **Euglypha** Dujardin, 1841  
 178. *Euglypha acanthophora* (Ehrenberg, 1842) Perty, 1849  
 179. *Euglypha acanthophora* var. *flexusa* Penard, 1890  
 180. *Euglypha capsiosa* Couteaux, 1978  
 181. *Euglypha ciliataforma.glabra* Cash, Wailes and Hopkinson, 1915  
 182. *Euglypha ciliata* Leidy, 1878  
 183. *Euglypha compressa* Carter, 1864  
 184. *Euglypha cristata* Leidy, 1874  
 185. *Euglypha denticulata* Brown, 1912  
 186. *Euglypha filifera cylindracea* Playfair, 1918  
 187. *Euglypha filifera* Penard, 1890  
 188. *Euglypha hyalina* Couteaux, 1978  
 189. *Euglypha laevis* Perty, 1849  
 190. *Euglypha rotunda* Wailes and Penard, 1911  
 191. *Euglypha scutigera* Penard, 1890  
 192. *Euglypha simplex* Decloitre, 1965  
 193. *Euglypha strigosa* Leidy, 1878  
 194. *Euglypha tuberculata* Dujardin, 1841  
 Family **Trinematidae** Hoogenraad and De Groot, 1940, *emend.* Adl *et al.*, 2012  
 Genus **Corythion** Taranek 1881



195. *Corythion asperulum* Schonborn, 1988  
 196. *Corythion constricta* Jung, 1942  
 197. *Corythion dubium* Taranek, 1881  
 198. *Corythion pulchellum* Penard, 1890  
 Genus ***Trinema*** Dujardin, 1841  
 199. *Trinema chardezi* Decloitre, 1981  
 200. *Trinema complanatum* Penard, 1890  
 201. *Trinema enchelys* Ehrenberg, 1838  
 202. *Trinema galeata* Jung, 1942  
 203. *Trinema grandis* Chardez, 1960  
 204. *Trinema lineare* Penard, 1902  
 205. *Trinema penardi* Thomas & Chardez, 1958  
 Family **Cyphoderiidae** de Saedeleer, 1934  
 Genus ***Cyphoderia*** Schlumberger, 1845  
 206. *Cyphoderia ampulla* Ehrenberg, 1840  
**Incertae sedisEuglyphida**  
 Genus ***Pareuglypha*** Penard, 1902  
 207. *Pareuglypha indica* Nair and Mukherjee, 1968  
 208. *Pareuglypha reticulata* Penard, 1902  
 Genus ***Tracheleuglypha*** Deflandre, 1928  
 209. *Tracheleuglypha dentata* (Moniez, 1888) Deflandre, 1928

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