FAUNA OF WEST BENGAL

Part 12

[PROTOZOA]

ZOOLOGICAL SURVEY OF INDIA
1993
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Director, Zoological Survey of India

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INTRODUCTION

The protozoa are unicellular eukaryotic organisms. They are not a natural group, but have been placed together as a matter of convenience (Levina et al., 1980). According to newly revised classification (Levine et al., op. cit.) the protozoa have been considered as subkingdom under the kingdom Protista. Under the subkingdom Protozoa seven phyla have been included in the above stated classification, of which the freeliving protozoa of West Bengal, the subject matter of the present communication, represent only two phyla, namely, Sarcomastigophora and Ciliophora.

The first report of freeliving protozoa from West Bengal dates back to 1842 when Cantor referred about the occurrence of six species of freshwater protozoa from Calcutta based on an unpublished observation of G.W. Grant. Incidentally this is also the first report of freshwater protozoa from India. Subsequently Wallich (1864) recorded four species of Diffugia from Gangetic Sundarbans of Lower Bengal without citing any specific locality. Simmons (1889, 1891 a) reported the occurrence of 12 genera of freeliving ciliates from Calcutta without mentioning any specific identification of those forms. He (1891 b,c) also referred about a reticulated amoeba, Biomyxa vagans from Calcutta. In 1907 Annandale recorded two species of ciliates from the fresh and brackish water ponds of Port Canning, South 24-Parganas. Subsequently Ghosh (1918-1929) published a series of papers reporting 29 species of freeliving ciliates and one species of testacid rhizopod from Calcutta and its nearby localities. Out of the said 29 species of ciliates 18 are from pond water and the rest are either from sewer water or from ‘vegetable infusion’ Nair (1960, 1966, 1971) reported the occurrence of one heterotrichious, one hymenostomatous and two peritrichious ciliates from Calcutta including a new species, Disematostoma bengalensis. Mahajan and Nair (1965) published the occurrence of 19 species of freeliving ciliates from Calcutta and its vicinity. Nair and Mukherjee (1968 a,b) and Nair, Das and Mukherjee (1971) also reported 12 species of rhizopods and 20 species of rhizopods and heliozoans respectively from Calcutta and its environs. In 1971 Das described a new species, Leptopharynx chlorophagus from West Bengal. Subsequently Nair and Das (1974) published the description of another new species, Drepanomonas hooghlyensis and two rare species of freshwater ciliates, Pseudomicrothorax agilis and P. dubius from the state.

Freeliving flagellates of West Bengal are least studied. Whatever published information is available on this group is intermingled with the algal or planktonic study. During his studies on the Myxophyceae of Lower Bengal, Banerjee (1936) reported the occurrence of Euglena viridis from various parts of the district 24-Parganas (West Bengal) as well as from the districts Jessore, Faridpur,
In the course of qualitative and quantitative studies of phytoplankton in the Hugli river around Falta (Dist. Haora) Roy (1949, 1955) recorded a chrysomonadid flagellate belonging to *Monas* sp. along with a testacean rhizopod, *Diffugia* sp. and a tintinnid ciliate, *Codonella* sp. While studying the distribution and fluctuation of plankton throughout the 290 km tidal stretch of the Hugli-Rupnarayan estuary and upper part of the Matla estuary Shetty, Saha and Ghosh (1961) collected 17 species of protozoa of which 8 are flagellates, 6 rhizopods and 3 ciliates. Excepting three species, namely, *Ceratium hirundinella*, *C. tripos* and *Noctiluca miliaris* specific identification of the rest 14 species could not be made by them. Mandal (1985) observed *Ceratium* sp. and *Noctiluca* sp. as the common component of the planktonic samples of the Hugli-Maltal estuary and collected a chrysomonadid flagellate *Mallomonas* sp. from the Bidyadhari river near Kulti (South 24-Parganas).

Recently Ghosh and Choudhury (1989, 1987) isolated two species of *Acanthamoeba* from the soils of Sagar island (Dist. South 24-Parganas) and Basu *et al.* (1987 and *in press*) have reported the occurrence of 14 species of aerobic amoebae from several districts of West Bengal. These are also been dealt with in this paper.

In the course of the faunal surveys of West Bengal undertaken by ZSI scientists during the years 1984-87 freeliving protozoa belonging to diversified groups have been collected from 17 districts of the state. These collections as well as those already present in the National Collections of the Zoological Survey of India including the reports of the earlier workers are being dealt with in the present communication. Altogether 248 species comprising 24 species of flagellates, 85 species of rhizopods and 139 species of ciliates have been reported from West Bengal, the majority of which have been collected by different survey parties of the Zoological Survey of India during 1964-70 and 1983-88. A complete systematic list is presented in the paper in order to indicate their placement in the newly revised classification by Levine *et al.* (1980). Further, key to the families, genera and species is also incorporated in this paper for the aid in identification of protozoan species occurring in West Bengal.

**MATERIAL AND METHODS**

Water samples collected from various ponds, puddles and water bodies along with some algae, water weeds, flocculent matter and bottom oozes were kept in the laboratory for some days for considerable increase in protozoa population in them. Those samples were then thoroughly examined under the microscope from time to time. The freeliving flagellates, rhizopods, heliozoans and ciliates occurring in them were isolated and examined in living condition by keeping them in a drop of natural medium. 'Methocyl' was used for slowing down the fast moving ciliates and Lugol's solution was used as a killing agent and also for detecting peripheral organellae. For making permanent slides of freeliving protozoa (excepting testacean rhizpods) Schaudinn's fixative, Carnoy's fluid and Buin's fluid were used. The first one is very effective particularly for keeping the exact shape of the specimen. For staining Heidenhain's iron haematoxylin, Delafield's haematoxyling and sometimes Borax Carmine
were used. Dry silver impregnation method was employed in some cases for studying the ciliates. Slides were mounted in DPX.

For making permanent slides of testacean rhizopods empty tests which are frequently found in abundance in the bottom ooze were isolated. These were then air dried after two or three washings in absolute alcohol and mounted in DPX.

Large number of samples of ground moss, wall moss and tree mosses were collected from different places and brought to the laboratory. These were kept in pretty dishes and sprinkled regularly with sufficient water. After a day or two aqueous drops drawn from the moss by means of micropipette were kept on slides and examined thoroughly. Any protozoa observed therein was fixed, stained and mounted in the same manner as stated earlier for freeliving protozoa.

MORPHOLOGY AND TERMINOLOGY

The present paper deals with large number of higher taxa of protozoa, comprising 2 phyla, 2 subphyla, 7 classes, 29 orders, 76 families and 124 genera. It is, therefore, not possible to give any generalised morphology which could cover basic diagnostic features of all the said groups of protozoa. However, some diagramatic illustrations (Pls. I-V) are included and widely used terminologies with explanations are listed below so that the beginners of the subject may conveniently use the key to the families, genera and the species given in the present paper for identification of diversified groups of freeliving protozoa.

Adoral Zone of Membranellae : Three or more serially arranged membranellae along the left side of the oral area; found in peritrichous and in many spirotrichous ciliates.

Annulus : Girdles, ring-like structures or markings on the pellicle of the dinoflagellates or on that of the zooids of some peritrichous ciliates.

Arboroid colony : Colony of zooids formed in a tree-like manner members of which are interconnected by either stalks or loricae.

Atrium : Shallow depression found in close proximity to or around the cytostome of certain hypostomatous ciliates.

Buccal cavity : Depression or pouch located usually at or near apical end of the body and/or on the ventral surface, leading ultimately to cyto-pharyngeal complex; found in many oligohymenophoran ciliates.

Buccal overture : Distal or outer aperture or opening of the buccal cavity, though unrecognisable when buccal cavity is everted or flattened out; found in many hymenostomes.
Caudal cilium: A distinctly longer cilium (sometimes more than one) present near the posterior end of the body.

Ciliary girdle: Encircling band of somatic ciliature found in peritrichous ciliates and some Didinium like gymnostomatous ciliates.

Cirrus: A thick conical locomotor organellae occurs in lines or in groups in definite patterns on the ventral surface of the hypotrichous ciliates; classified and named by their location e.g. buccal, frontal, fronto-ventral, midventral, anal, caudal, marginal.

Contractile vacuole pore: Minute permanent opening(s) in the pellicle through which contents of contractile vacuole are to be thrown outside the body; these are characteristically stable in number and location.

Cyrtos or Cytopharyngeal basket: Tubular cytopharyngeal apparatus, the walls of which are arranged by longitudinally arranged nematodesmata derived from apically located kinetosomes and lined with extensions of postciliary microtubules; typical in hypostomatous ciliates.

Cytopharynx: Nonciliated tubular passage, long or short, leading from the cytostome proper into the inner cytoplasm of the unicellular animal.

Cytostome: An aperture, usually permanently open (when present) through which food material of the organism passes into its inner cytoplasm via cytopharynx.

Epicone or epitheca: Part of the shell (of dinoflagellates) anterior to the annulus.

Haptocyst: Minute extrusive organellae found in the suctorial tentacles of suctorians.

Hypotheca or hypocone: Part of the shell (of dinoflagellates) posterior to the annulus.

Infraciliature: Whole of somatic and orally located kinetosomes together with associated subpellicularly located microfibrillar and microtubular structures; argentohpilic in nature.

Infundibulum: Posterior, inner or lower part of the buccal cavity usually funnel-shaped or long tubular, found particularly in peritrichous ciliates.

Kinetosome: Tubular cylinder of nine longitudinally oriented peripheral structures, each composed of three microtubules; structures are subpellicularly located, equally spaced and skewe.

Kinety: A single row of single or paired kinetosomes together with cilia and other associated cortical organelles and structures.

Lorica: Envelope or test secreted and/or assembled by many ciliates; commonly found in tintinnids, folliculinids and peritrichs.

Nematodesmata: Kinetosome - associated birefringent bundle of parallel microtubules; it strengthens the walls of cytopharyngeal apparatus of gymnostomes and hypostomes.
Oral apparatus: General term to denote mouth *sensu lato*.

Paroral membrane: Membrane lying along the right side or border of the buccal cavity in oligo and polyhymenophoran ciliates.

Pectinelle: One of a circumferential band of cilia which are closely appeared and oriented at an oblique angle to the long axis of the body.

Pedicel: Very short attachment stalk as found in chonotrichous ciliates.

Peduncle: Stalk but usually refers to long and distinctly visible stalks as found in peritrichous ciliates and suctorians.

Pellicle: Outer living covering of the ciliate.

Peniculus: Compound buccal ciliary organellae in the form of a long band of usually short and apparently fused cilia.

Peristome: Entire oral area of those ciliates in which buccal ciliature encircles the major portion of the anterior end of the organism; found in peritrichous and many spirotrichous ciliates.

Prebuccal area: Oral groove lined with somatic or slightly modified somatic ciliature and leading to buccal cavity.

Rhabdos: Tubular cytopharyngeal apparatus, the walls of which are strengthened on the outside by bundles of nematodesmata, often lined longitudinally by transverse microtubules - derived from circumoral kinetosome.

Stigma: Usually a reddish or brownish red dot or short rod (also colourless in exceptional cases) usually found in chromatophore bearing flagellates.

Sulcus: A furrow run from end to end or from one end of the body to the annulus; found in dinoflagellates.

Thigmotactic ciliature: A zone of more or less specialised cilia functionally modified to serve tactile or adhering function.

Trichite: Hollow rod-like skeletal structures radially arranged beneath the pellicle; found in large number in certain oligotrichous ciliates; in older sense cytopharyngeal rod.

Trichocyst: Spindle-shaped, non-toxic explosive organellae located in the subpellicle of some ciliates (e.g. *Paramecium*).

Vestibulum: Depression located at either pole and leading directly to cytostome-cytopharyngeal complex covered with more or less complex somatic ciliature, exclusively found in the members of the subclass Vestibulifera.
Plate 1. Showing general structures of flagellates

Fig. 1. *Chilomonas paramecium* Ehrenberg; Fig. 2. *Euglena oxyuris* Schmadra; Fig. 3. *Phacus longicauda* (Ehrenberg); Fig. 4. *Euglena* sp (diagrammatic); Fig. 5. *Chilomonas* sp (diagrammatic); Fig. 6. *Trachelomonas armata* Salinario; Fig. 7. *Trachelomonas richmondiae* (Playfair); Fig. 8. A typical naked dinoflagellate.

Plate 2. Showing structure and sculpture of tests of different testacoid rhizopods

Fig. 1. Lesquereusia spiralis (Ehrenberg); Fig. 2. Lesquereusia modesta Rhumbler; Fig. 3. Diffugia lobostoma Leidy; Fig. 4. Diffugia urceolate Carter; Fig. 5. Diffugia corona Wallich; Fig. 6. Diffugia acuminata Ehrenberg; Fig. 7. Diffugia pyriformis Perty; Fig. 8. Euglypha acanthophora (Ehrenberg); Fig. 9. Centropyxis spinosa (Cash & Hopkinson); Fig. 10. Centropyxis aculeata (Ehrenberg); Fig. 11. Euglypha tuberculata Dujardin; Fig. 12. Trinema enchelys (Ehrenberg); Fig. 13. Arcella discoides Ehrenberg.
Plate 3. Showing general structures of gymnamoeba and granuloreticulosea particularly their pseudopodial types

Fig. 1. *Pelomyxa palustris* Greet; Fig. 2. *Vannella* sp; Fig. 3. *Biomyxa vagans* Leidy; Fig. 4. *Acanthamoeba* sp (diagrammatic); Fig. 5. *Mayorella* sp (diagrammatic); Fig. 6. *Thecamoeba soli* (Sing & Hanumaiah); Fig. 7. *Amoeba* sp (diagrammatic).

(cv - contractile vacuole; n - nucleus; ps - pseudopodia; ur - uroid).
Plate 4. Figs. 1–5, 7 : Showing pseudopodial types (diagrammatic) of gymnamoeba

1. Cylindroid type (in Amoebidae); 2. Hemispheroid granular ‘eruptive’ type (in Pelomyxidae); 3. Hemispheroid clear ‘eruptive’ type of (in Hartmannellidae); 4. Short, conical, clear pseudopodium of some Paramoebidae; 5. Pseudopodial bulges of Thecamoebidae; 6. Actinophrys sol Ehrenberg showing axopodia; 7. Long, conical clear pseudopodium of Paramoebidae; Figs. 8–12 : Common external ciliary structures: 8, 10. Euplotes sp (hypotrich); 9. Epistylis sp (peritrich); 11. Cylidium sp (Scuticociliate); 12. Didinium sp (gymnostome).

(acg – anterior ciliary girdle; acs – adoral ciliary spiral; ad – adoral zone of membranelles; adc – adoral cirri; anc – anal cirri; ax – axopodia; cc – caudal cilia; cdc – caudal cirri; col – collar; fc – frontal cirri; mc – marginal cirri; n – nucleus; pcg – posterior ciliary girdle; pdc – peduncle; pel – pellicle; pels – pellicular striae; ps – pseudopodia; um – undulating membrane; va – vacuole; vc – ventral cirri).
Plate 5. Figs. 1–8. Showing diversified shape of nucleus in freeliving ciliates
(at – atrium; bc – buccal cavity; bo – buccal overture; ci – cirrus; cp – cytopharynx; ct – cytostome; cvp – contractile vacuole pore; ma – macronucleus; mi – micronucleus; pm – paroral membrane; prb – prebuccal area; sb – sensory bristle; ve – vestibulum).
Plate 6. *Vannella bengalensis* sp. nov.
1–2. Locomotive form; 3. dividing form
### Systematic List of Freely Living Protozoa Hitherto Reported from West Bengal

**Subkingdom**: PROTOZOA

**Phylum**: SARCOMASTIGOPHORA

**Subphylum**: MASTIGOPHORA

**Class**: PHYTOMASTIGOPHOREA

**Order**: CRYPTOMONADIDAE

**Family**: CRYPTOMONADIDAE

1. *Chilomonas paramecium* Ehrenberg
2. *Noctiluca miliaris* Suriray
3. *Ceratium hirundinella* Muller
4. *Ceratium tripos* Nitzsch
5. *Peridinium tabulatum* Claparede & Lachmann

**Order**: DINOFLAGELLIDA

**Family**: NOCTILUCIDAE

2. *Noctiluca miliaris* Suriray

**Family**: PERIDINIIDAE

3. *Ceratium hirundinella* Muller
4. *Ceratium tripos* Nitzsch
5. *Peridinium tabulatum* Claparede & Lachmann

**Order**: EUGLENIDA

**Suborder**: EUGLENINAE

**Family**: EUGLENIDAE

7. *Euglena acus* Ehrenberg
8. *Euglena oxyuris* Schmadra
9. *Euglena viridis* Ehrenberg
10. *Euglena* sp.
11. *Phacus acuminata* Stokes
12. *Phacus longicauda* (Ehrenberg)
13. *Phacus pleuronectes* (Muller)
14. *Phacus* sp.
15. *Trachelomonas armata* var. *ovata* Swirenko
16. *Trachelomonas hispida* (Perty)
17. *Trachelomonas richmondiæ* (Paltyfair)
18. *Trachelomonas* sp.

**Family**: ANISONEMIDAE

19. *Entosiphon ovatum* Stokes
20. *Entosiphon sulcatum* (Dujardin)
21. *Peranema trichophorum* (Ehrenberg)

**Phylum**: SARCOMASTIGOPHORA

**Subphylum**: MASTIGOPHORA

**Class**: PHYTOMASTIGOPHOREA

**Order**: CRYPTOMONADIDAE

**Family**: CRYPTOMONADIDAE

22. *Mallomonas* sp.
23. *Monas* sp.
24. *Dinobryon* sp.

**Subphylum**: SARCODINA

**Class**: LOBOSEA

**Subclass**: GYMNAMOEBA

**Order**: AMOEBA

**Suborder**: TUBULINA

**Family**: AMOEBAE

25. *Amoeba discoides* Schaeffer

**Family**: HARTMANNELLIDAE

27. *Hartmannella crumpeae* Singh & Hanumaiah
28. *Hartmannella vermiformis* Page

**Suborder**: THECINA

**Family**: THECAMOEBAE

29. *Thecamoeba soli* (Singh and Hanumaiah)
30. *Thecamoeba striata* (Penard) (= *Amoeba striata* Penard)
31. *Vannella bengalensis* sp.nov.
32. *Vannella cutleri* Singh & Hanumaiah
33. *Vannella* sp.

**Suborder**: CONOPODINA

**Family**: PARAMOEBAE

34. *Mayorella vespertilio* (Penard) (= *Amoeba vespertilio* Penard)
35. *Mayorella* sp.

Suborder ACANTHOPODINA

Family ACANTHAMOEIDAE

36. *Acanthamoeba astronyxis* (Ray & Hayes)
37. *Acanthamoeba culbertsonii* (Singh & Das)
38. *Acanthamoeba glebae* (Dobell)
39. *Acanthamoeba palestinensis* (Reich)
40. *Acanthamoeba rhyssodes* (Singh)

Family ECHINAMOEIDAE

41. *Echinamoeba exundans* (Page)

Order SCHIZOPYRENIDA

Family VAHLKAMPIIDAE

42. *Vahlkampfia russelli* (Singh)

(= *Schizopyrenus russelli* Singh)
43. *Naegleria gruberi* (Schar ding er)
44. *Naegleria thortonii* (Singh)

(= *Didascalus thortonii* Singh)
45. *Tetramitus rostratus* (Perty)

Order PELOBIONTIDA

Family PELOMYXIDAE

46. *Pelomyxa palustris* Greeff

Subclass TESTACEALOBOSIA

Order ARCELLINIDA

Family ARCELLIDAE

47. *Arcella conica* (Playfair)
48. *Arcella discoides* Ehrenberg
49. *Arcella gibbosa* Penard
50. *Arcella hemispherica* Perty

51a. *Arcella vulgaris* var. angulosa (Perty)

51b. *Arcella vulgaris* forma undulatum Deflandre

52. *Diplochlamys leidyi* Greeff
53. *Lesquereusia modesta* Rhum bler
54. *Lesquereusia spiralis* (Ehrenberg)
55. *Pseudochlamys patella*

Claparede & Lachmann
56. *Pyxidicola operculata* (Agardh)

Family COCHLIOPODIIDAE

57. *Cochliopodium bilimbosum* (Auerbach)

Family DIFFLUGIIDAE

58. *Centropyxis aculeata* (Ehrenberg)
59. *Centropyxis aerophila* Deflandre
60. *Centropyxis arcelloides* Penard
61. *Centropyxis cassis* (Wallich)
62. *Centropyxis ecornis* (Ehrenberg)
63. *Centropyxis minuta* Deflandre
64. *Centropyxis penardi* Deflandre
65. *Centropyxis spinosa* (Cash & Hopkinson)
66. *Cucurbitella mesophiliformis* Penard
67. *Diffugia acuminata* Ehrenberg
68. *Diffugia acutissima* Deflandres
69. *Diffugia amphoralis* Hopkinson
70. *Diffugia arcula* Leidy
71. *Diffugia bacilliarum* Perty
72. *Diffugia brevicolla* Cash
73. *Diffugis capreolata* Penard
74. *Diffugia corona* Wallich
75. *Diffugia curvicaulis* Penard
76. *Diffugia difficilis* Thomas
77. *Diffugia elegans* Penard
78. *Diffugia globularis* (Wallich)
79. *Diffugia globulosa* Dujardin
80. *Diffugia globulus* (Ehrenberg)
81. *Diffugia gramen* Penard
82. *Diffugia lismoensis* Playfair
83. *Diffugia lithophila* (Penard)
84. *Diffugia lobostoma* Leidy
85. *Diffugia muriculata* Gauthier-Lievre & Thomas
86. *Diffugia muriformis* Gauthier-Lievre & Thomas
87. *Diffugia oblonga* Ehrenberg
88. *diffugia pyrifomis* Perty
89. **Diffugia tuberculata** (Wallich)
90. **Diffugia urceolata** Carter
91. **Heliopera sylvatica** Penard
92. **Phryganella hemispherica** Penard
93. **Plagiopyxis callida** Penard

**Class FILOSEA**
**Order GROMIIDA**
**Family EUGLYPHIDAE**
94. **Euglypha acanthophora** (Ehrenberg)
94a. **Euglypha acanthophora** var. *flexusa* Penard
95. **Euglypha denticulata** Brown
96. **Euglypha loevis** (Ehrenberg)
97. **Euglypha rotunda** Wailes
98. **Euglypha scutigera** Penard
99. **Euglypha tuberculata** Dujardin

100. **Paraeuglypha indica** Nair & Mukherjee
101. **Placocysta lens** Penard
102. **Trecheleuglypha dentata** (Vejdowsky)
(= Euglypha dentata Vejdowsky)
103. **Trinema enchelys** (Ehrenberg)
104. **Trinema lineare** Penard

**Class GRANULORETICULOSEA**
**Order ATHALAMIDA**
**Family BIOMYXIDAE**
105. **Biomyxa vagans** Leidy

**Order MONOTHALAMIDA**
**Family LIEBERKUHNIIDAE**
106. **Lieberkuhnia paludosa** (Cienkowski)

**Superclass ACTINOPODA**
**Class HELIOZOA**
**Order DESMOTHORACIDA**
**Family CLATHRULINIDAE**
107. **Clathrulina elegans** Cienkowski

**Order ACTINOPHYRIDA**
**Family ACTINOPHYRIDA**
108. **Actinophrys sol** Ehrenberg

**Order CENTROHELIDA**
**Family ACANTHOCYSTIDAE**
109. **Acanthocystis spinifera** Grøn

**Phylum CILIOPHORA**
**Class KINETOFRAGMINOPHOREA**
**Subclass GYMNOSTOMATIA**
**Order PROSTOMATIDA**
**Suborder PROSTOMATINA**
**Family HOLOPHYRIDA**
110. **Holophrya annandalei** Ghosh
111. **Holophrya bengalensis** Ghosh

**Suborder PRORODONITINA**
**Family PRORODONTIDAE**
112. **Prorodon discolor** (Ehrenberg)
113. **Prorodon edentatus** Claparede & Lachmann
114. **Prorodon stewarti** Ghosh
115. **Prorodon teres** Ehrenberg
116. **Pseudoprorodon lieberkuhni** Butschli
117. **Urotricha** sp.

**Family COLEPIDAE**
118. **Cloeps hirtus** (Muller)

**Suborder HAPTORINA**
**Family ENCHELYIDAE**
119. **Lacrymaria minima** Kahl
120. **Lacrymaria olor** (Muller)
121. **Lacrymeria pupula** (Muller)
122. **Enchelys** sp.

**Family SPATHIDIIDAE**
123. **Bryophyllum spathidiodes** V. Gelei
124. **Spathidium moniliforme** Bhatia
125. **Spathidium muscicola** Kahl

**Family TRACHELIIDAE**
126. **Dileptus anser** (Muller)
127. **Dileptus monilatus** (Stokes)
128. **Trachelius gutta** (Cohn)
129. **Trachelius ovum** Ehrenberg
Family  DIDINIIDAE
130. Didinium nasutum (Muller)
Family  ACTINOBOLINIDAE
131. Actinobolina radians Stein
Order  PLEUROSTOMATIDA
Family  AMPHILEPTIDAE
132. Amphileptus sp.
133. Loxophyllum levigatum Sauerby
134. Loxophyllum nimeccense (Stein)
135. Loxophyllum undulatum Sauerbrey
136. Litonotus fasciola (Ehrenberg)
137. Litonotus infusionus Ghosh
138. Litonotus procera Penard
(= Hemiophrys procera Penard)
139. Litonotus similis Ghosh
Order  KARYORELICTIDA
Family  TRACHELOCERCIDAE
140. Trachelocerca sp.
Family  LOXODIDAE
141. Loxodes magnus Stokes
142. Loxodes striatus (Engelmann)
143. Loxodes vorax Stokes
144. Loxodes sp.
Subclass  VESTIBULIFERIA
Order  TRICHOSTOMATIDA
Suborder  TRICHOSTOMATINA
Family  PLAGIOPYLIDAE
145. Plagiopyla nasuta Stein
Order  COLPODIDA
Family  COLPODIDAE
146. Colpoda aspera Kahl
147. Colpoda cucullus Muller
148. Colpoda maupasi Enriques
149. Colpoda sp.
Family  CYRTOLOPHOSIDIDAE
150. Cyrtolophosis (= Balantiophorus)
elongatus (Schewiakoff)
151. Cyrtolophosis (= Balantiophorus)
minutus (Schewiakoff)
152. Opisthostomatella (= Opisthostomum)
bengalensis (Ghosh)
Subclass  HYPOSTOMATIA
Superorder  NASSULIDEA
Order  SYNHYMENIIDA
Family  ORTHODONELLIDAE
153. Orthodonella banerjeei (Ghosh)
Family  SCAPHIDIODONTIDAE
154. Chilodontopsis bengalensis (Ghosh)
Order  NASSULIDA
Suborder  NASSULINA
Family  NASSULIDAE
155. Nassula ornata Ehrenberg
Suborder  MICROTHORACINA
Family  LEPTOPHARYNGIDAE
156. Leptopharynx chlorophagus Das
157. Leptopharynx sphagnetorum (Levander)
158. Leptopharynx torpens (Kahl)
159. Pseudomicrothorax agilis Mermod
160. Pseudomicrothorax dubius (Maupas)
Family  MICROTHORACIDAE
161. Microthorax pusillus Engelman
162. Drepanomonas dentata Fresenius
163. Drepanomonas hooghlyensis Nair & Das
164. Drepanomonas revoluta Penard
Superorder  PHYLLOPHARYNGIDEA
Order  CYRTOPHORIA
Suborder  CHLAMYDODONTINA
Family  CHILODONELLIDAE
165. Chilodonella cucullulus (Muller)
166. Chilodonella spiralidentis (Bhatia & Mallik)
167. Chilodonella uncineta (Ehrenberg)
168. Chilodonella sp.
Subclass  SUCTORIA
Order SUCTORIDA
Suborder  EXOGENINA
Family   PODOPHYRIDAE
169. Podophrya bengalensis Ghosh
170. Podophrya sandi Collin
Suborder  ENDOGENINA
Family   DENDROSOMATIDAE
171. Tokophrya bengalensis Ghosh
172. Tokophrya cyclopum (Claparede & Lachmann)
173. Tokophrya infusorium (Stein)
Class   OLIGOHYMENOPHOREA
Subclass  HYMENOSTOMATIA
Order HYMENOSTOMATIDA
Suborder  TETRAHYMENINA
Family   TETRAHYMENIDAE
174. Stegochilum ovale Ghosh
175. Tetrahymena pyriformis (Ehrenberg)
Family   GLAUCOMIDAE
176. Glaucoma pyriformis (Ehrenberg)
Suborder  OPHRYOGLENINA
Family   OPHRYOGLENIDAE
177. Ophryoglena flava (Ehrenberg)
Suborder  PENICULINA
Family   PARAMECIIDAE
178. Paramecium caudatum Ehrenberg
179. Paramecium sp.
Family   FRONTONIIDAE
180. Disematostoma bengalensis Nair
181. Frontonia depressa (Stokes)
182. Frontonia leucas (Ehrenberg)
Family   UROCENTRIDAE
183. Urocentrum turbo (Muller)
Family   NEOBURSARIDIIDAE
184. Neobursaridium gigas (tech)
Order  SCUTICOCALCITRI
Suborder PHILASTERINA
Family   LOXOCEPHALIDAE
185. Loxocephalus plagius (Stokes)
Family   CINETOCHILIDAE
186. Cinetochilum margaritaceum Perty
187. Sathrophilus (= Saprophilus) chlorophagus (Kahl)
Suborder  PLEURONEMATINA
Family   PLEURONEMATIDAE
188. Pleuronema crassum Dujardin
Family   CYCLIDIIDAE
189. Ctedoctema acanthocrypta Stokes
190. Cyclidium glaucoma Muller
Subclass  PERITRICHA
Order PERITRICHIDA
Suborder  SESSILINA
Family   VORTICELLIDAE
191. Carchesium polypinum (Linnaeus)
192. Carchesium sp.
193. Vorticella campanula Ehrenberg
194. Vorticella globosa Ghosh
195. Vorticella patellina Ehrenberg
196. Vorticella subcylindrica Ghosh
197. Vorticella submicrostoma Ghosh
198. Vorticella subprocubens Ghosh
199. Vorticella subsinuata Ghosh
200. Vorticella sp.
201. Zoothamnium horai Khajuria and Pillai
Family   EPISTYLIDIDAE
202. Epistylis anastatica (Linnaeus)
203. Epistylis sp.
Family   VAGINICOLIDAE
204. Cothurinia sp.
205. *Platycola decumbens* (Ehrenberg)

206. *Platycola striata* (Fromental)

207. *Platycola* sp.

208. *Pyxicola affinis* Kent

209. *Vaginicola crystallina* Ehrenberg

210. *Vaginicola* sp.

Family **LAGENOPHYRIDEAE**

211. *Lagenophrys labiata* Stokes

Class **POLYHYMENOPHOREA**

Subclass **SPIROTICHIAS**

Order **HETEROTRICHIIDA**

Suborder **HETEROTRICHIINA**

Family **SPIROSTOMIDAE**

212. *Blepharisma intermedium* Bhandary

213. *Blepharisma undulans* Stein

214. *Spirostomum ambiguum* Ehrenberg

215. *Spirostomum teres*

Claparede and Lachmann

Family **METOPIDAE**

216. *Bothrostoma extenta* (Kahl)

217. *Bothrostoma nasuta* (Da Cunha)

218. *Bothrostoma mirabilis* (Kahl)

219. *Brachonella campanula* (Kahl)

220. *Brachonella spiralis* (Smith)

221. *Metopus daphnides* Jankowski

222. *Metopus es* Muller

223. *Metopus fuscus* Kahl

224. *Metopus ovalis* Kahl

225. *Metopus rostratus* Kahl

226. *Metopus striatus* McMurrich

Family **CONDYLOSTOMATIDAE**

227. *Bryometopus pseudochilodon* Kahl

Family **STENTORIDAE**

228. *Stentor (= Stentorella ) polymorphus* (Muller)

229. *Stentor (= Stentorella ) viridis* (Ghosh)

Family **BURSARIIDAE**

230. *Bursaria truncatella* Muller

Suborder **ARMOPHORINA**

Family **CAENOMORPHIDAE**

231. *Caenomorpha lata* Kahl

232. *Caenomorpha medusula* Perty

Suborder **COLIPHORINA**

Family **FOLLICULINIDAE**

233. *Folliculina ampula* (Muller)

Order **ODONTOSTOMATIDAE**

Family **EPALXELLIDAE**

234. *Sapodinium dentatum* Lauterborn

Order **OLIGOTRICHIDA**

Suborder **OLIGOTRICHINA**

Family **HALTERIIDAE**

235. *Halteria grandinella* (Muller)

Family **STROBILIDIIDAE**

236. *Strobilidium gyrans* (Stokes)

Order **HYPOTRICHIDA**

Suborder **STICHOTRICHINA**

Family **SPIROFILIDAE**

237. *Hypotrichidium conicum* Ilowaisky

238. *Stichotricha socialis* Gruber

Family **?**

239. *Balladinopsis nuda* Ghosh

Suborder **SPORADOTRICHINA**

Family **OXYTRICHIDAE**

240. *Oxytricha falax* Stein

241. *Pleurotricha grandis* Stein

242. *Stylonichia mytilus* (Ehrenberg)

Family **ASPIDISCIDAE**

243. *Aspidisca bengalensis* (Ghosh)

244. *Aspidisca costata* (Dujardin)

Family **EUPLOTIDAE**

245. *Euplotes lecioniensis* Bovee

246. *Euplotes gracilis* Kahl

247. *Euplotes patella* (Muller)

248. *Euplotes plumipes* Stokes
SYSTEMATIC ACCOUNT

Subkingdom PROTOZOA
Phylum SARCOMASTIGOPHORA
Class CRYPTOMONADIDAE
Order CRYPTOMONADIDAE

Body truncate anteriorly with a distinct oblique vestibulum near anterior region.

Genus Chilomonas Ehrenberg

Body colourless, elliptical, truncate anteriorly and covered with a firm pellicle, flagella two and subequal, an oblique furrow near anterior region, 'cytopharynx' deep.

1. Chilomonas paramecium Ehrenberg


Diagnosis: Body elliptical, posteriorly narrowed and slightly bent dorsally; vestibulum deep; chloroplast absent; dimensions 15-21 µm x 6-8 µm.

Distribution: India : West Bengal (Calcutta district), Rajasthan, first record from the state.

Remarks: This species is universal in stagnant water with putrid vegetation infusion.

Order DINOFLAGELLIDA

Two families under this order have so far been reported/collected from this state.

Key to the families

1(2) Naked or covered by a single piece of cellulose membrane with sulcus and annulus, contractile tentacle arising from sulcus area and extending posteriorly.................................NOCTILUCIDAE

2(1) Covered by shell consisting of numerous plates; shell composed of epitheca, annulus and hypotheca, plates variously sculptured and finely perforated, annulus usually at equator and covered by a plate, contractile tentacle absent........................................PERIDINIIDAE

Family NOCTILUCIDAE
Genus Noctiluca Suriray

Body spherical and bilaterally symmetrical, cytostome with a well developed tentacle and short flagellum, cytoplasm vacuolated and cytoplasmic strands connect the central mass with periphery.

2. Noctiluca miliaris Suriray

**Diagnosis**: Body almost spherical, without girdle, with deep sulcus; posterior portion drawn out into a tentacle; transverse flagellum attached to pellicle forming a tooth like process; diameter 400 to 1000 μm.

**Distribution**: India: West Bengal (Hugli, Medinipur, Nadia and South 24-Parganas districts); in seas and ocean.

**Remarks**: Gopalkrishnan (1971) reported this species from the Zones I (Nabadwip to Konnagar), III (Diamond Harbour to the mouth of Hugli river), IV (Rupnarayan tributary) and V (Matla, Gosaba and Raimangal) of the Hugli-Rupnarayan-Matla estuary. During the present investigation the authors have also observed this species in considerable number in the near shore water of Digha beach (Mednipur district).

This species is universal in seas and ocean.

**Family PERIDINIIIDAE**

Under this family two genera, namely, *Peridinium* and *Ceratium* have been recorded in this state.

**Key to the genera**

1(2) Body spherical to ovoid, annulus slightly spiral with projecting rims, horn-like protrusion absent .......................................................... *Peridinium*

2(1) Body flattened with horn-like protrusions .......................... *Ceratium*

**Genus Ceratium Schrank.**

**Key to the species**

1(2) Epicone with one and hypocone with 2 or 3 horns, the horn of the epicone being longest ...... .......................................................... *C. hirundinella*

2(1) Epicone with two and hypocone with one long horn of almost same length............ *C. tripos*

3. **Ceratium hirundinella** Muller


**Diagnosis**: Shell with 3 or more horns of unequal length; hypocone with one considerably long horn and epicone with 2 or 3 shorter horns.

**Distribution**: India: West Bengal (Hugli-Rupnarayan-Matla estuary covering Hugli, Nadia and North and South 24-Parganas districts).

**Remarks**: This is mainly a freshwater form. Gopalkrishnan (1971) reported this species from Zone I to Zone V of the Hugli-Rupnarayan - Matla estuary, the Zone V of which is mostly estuarine or marine.

4. **Ceratium tripos** Nitzsch


**Diagnosis**: Shell with 3 long horns of almost equal length; epicone with two and hypocone with one horn.
**Distribution**: India: West Bengal (Hugli-Matla estuary covering the districts Hugli, North and South 24-Parganas districts).

**Remarks**: This is a salt water species reported from Zones II, III and V of the Hugli-Malta estuary by Gopalkrishnan (1971).

**Genus** *Peridinium* Ehrenberg

5. *Peridinium tabulatum* Claparede and Lachmann


**Material examined**: 3 exs., Diamond Harbour, South 24-Parganas, 11.i.1966, K. N. Nair.

**Distribution**: India: West Bengal (South 24-Parganas district). First record from the state.

**Remarks**: This species is universal in freshwater ponds and lakes.


**Distribution**: India: West Bengal (Hugli-Matla estuary covering the districts Hugli, Nadia, North and South 24-Parganas districts).

**Remarks**: Gopalkrishnan (1971) recorded several species of *Peridinium* (without ascertaining specific names of the forms) in different parts of the Hugli estuary starting from Nabadwip to the mouth of the river Hugli as well as well as Malta estuary.

**Order** EUGLENIDA

**Key to the families**

1(2) One flagellum emerging from the 'cytostome' and directed anteriorly, stigma usually present...

.................................................................................................................. EUGLENIDAE

2(1) Two flagella emerging from the cytostome, one directed anteriorly and the other usually posteriorly, chromatophore and stigma absent................................. ANISONEMIDAE

**Family** EUGLENIDAE

Three genera under this family have been reported so far from this state.

**Key to the genera**

1(4) Baby naked

2(3) Body spindle-shaped, chromatophores discoid, fusiform or band-shaped, pyrenoids present......

.................................................................................................................. *Euglena*

3(2) Body highly flattened, chromatophores discoid and green and without pyrenoid.......... *Phacus*

4(1) Body overed with lorica, (often with numerous spines, a single long flagellum protruding from anterior aperture, the rim of which frequently thickened to form a collar, chromatophores either two curved plates or numerous discs) ........................................ *Trachelomonas*
Genus *Euglena* Ehrenberg

Key to the species

1(2) Body spindle-shaped, flagellum long, paramylon bodies rod-shaped, 8-10 in number... *E. acus*

2(1) Body cylindrical, flagellum short, paramylon bodies irregular or ring-shaped

3(4) Larger species (200-270 \( \mu m \) long), with clear spike like projection at the posterior end, paramylon bodies ring-shaped ................................................................. *E. oxyuris*

4(3) Species of medium size (70-110 \( \mu m \) long), with a minute tail, paramylon bodies irregular .... ................................................................. *E. viridis*

7. *Euglena acus* Ehrenberg


*Diagnosis*: Body elongate, spindle-shaped, posterior end pointed, flagellum long; paramylon bodies 8 to 10 in number, rod-shaped and arranged in two groups in either half of the body; dimensions 60-98 \( \mu m \) x 9-14 \( \mu m \).

*Distribution*: India: West Bengal (Calcutta district); in fresh water pond. New record from the state; Andhra, Rajasthan.

8. *Euglena oxyuris* Schmadra

1913. *Euglena oxyuris* Schmadra; Lammermann, *Eugleninae*, p.130, fig. 207.


*Diagnosis*: Body cylindrical, long, somewhat flattened, almost always twisted, with clear spike-like projection at the posterior end; flagellum short; two oval ring-shaped paramylon bodies, one on either side of the nucleus; dimension 200-270 \( \mu m \) x 30 - 35 \( \mu m \).

*Distribution*: India: West Bengal (Sough 24-Parganas district), in freshwater pond. New record from West Bengal; Andhra.

9. *Euglena viridis* Ehrenberg


*Diagnosis*: Body more less cylindrical, blunt in front and rapidly attenuated behind to from a minute tail, flagellum very short, paramylon bodies irregular; dimensions 70-110 \( \mu m \) x 14-16 \( \mu m \).

*Material examined*: India: West Bengal (24-Parganas district).

*Remarks*: Banerjee (1936) reported this species from ‘various parts of 24-Parganas district’ without mentioning any locality.

10. *Euglena* sp

*Distribution*: India: West Bengal (in Hugli-Malta estuary in Hugli, Nadia and North and South 24-Parganas districts).
Remarks: Gopalkrishnan (1971) recorded *Euglena* sp from the plankton samples collected from the zones I, II and III of the Hugli-Malta estuary (i.e., the zones extending from Nabadwip, Dist. Nadia to the mouth of the Hugli river). Ray and Mitra (1980) have also recorded *Euglena* sp as the prominent protozoan species in the plankton samples at the outfall, from 1.5 to 0.7 km above the outfall and from 1.5 to 2.5 km below the outfall of Tribeni Tissue and Pulp Mill at Hazinagar (Dist. Hugli).

Genus *Phacus* Dujardin

Key to the species

1(2) A prominent ridge present on the convex side of the body extending up to posterior end

11. *Phacus acuminata* Stokes


*Diagnosis*: Nearly circular in outline, longitudinally striated; caudal projection short; flagellum as long as body; one small paramylum body; dimensions 40 - 52 μm x 20 - 25 μm.

*Distribution*: India: West Bengal (North 24-Parganas district); common in fresh water pond, New record from West Bengal; Andhra.

12. *Phacus longicauda* (Ehrenberg)


*Diagnosis*: Body sometime slightly twisted, longitudinally striated with a long caudal projection; flagellum about one-half the body length; paramylum body single, discoid and central; dimensions 150-180 μm x 50-72 μm.

*Distribution*: India: West Bengal (Hugli district), in fresh water pond. First report from West Bengal.

13. *Phacus pleuronectes* (Muller)

1773. *Cercaria pleuronectes* Muller, Vermium hist., p.36.

Diagnosis: A prominent ridge on the convex side, extending to posterior end; longitudinally striated; short posterior prolongation slightly curved; paramylum body single, circular and located near centre; dimensions 70-80 μm × 40-60 μm.

Distribution: India: West Bengal (North and South 24-Parganas districts); in freshwater pond. First report from West Bengal; Andhra.

14. Phacus sp.

Distribution: India: West Bengal (in Hugli-Matla estuary).

Remarks: Gopalkrishnan (1971) observed Phacus sp in the plankton samples collected from all the zones of the Hugli-Matla estuary. He, however, could not determine the specific identity of this species.

Genus Trachelomonas Ehrenberg

Key to the species

1(2) Shell ovate, aperture for flagella covered with spines, spines at lower part robust and slightly curved .............................................................. T armata

2(1) Shell oval or long elliptical, aperture for flagella not covered with spine, entire shell covered with sharp pointed spines

3(4) Shell oval with rounded ends, aperture for flagella wide ........................................... T hispida

4(3) Shell long elliptical, slightly rounded at upper part and abruptly cuneate at lower part, aperture for flagella narrow ................................................................. T. richmondiae

15. Trachelomonas armata var. ovata Swireno

1925. Trachelomonas armata (Ehrenberg) Stein var. ovata Swireno; Skvortzov, New Phytol, p.4, pl.3, fig. 48.


Diagnosis: Shell ovate, broadly rounded at ends, brown to dark brown; aperture for flagella covered with spines; spines at lower part robust and slightly curved; chromatophores numerous.

Distribution: India: West Bengal (Hugli district); in fresh water among plankton sample. First report from West Bengal.

16. Trachelomonas hispida (Perty)

1925. Trachelomonas hispida (Perty) Stein; Skvortzov, New Phytol, p.300.


Diagnosis: Shell brown, oval with rounded ends; covered with distinct sharp pointed spines; aperture for flagella wide and not covered with spine.

Distribution: India: West Bengal (Hugli district); in fresh water among plankton sample. First report from West Bengal.
17. Trachelomonas richmondiae (Playfair)

1926. Trachelomonas richmondiae (Playfair); Deflandre, Monographie du genre Trachelomonas Ehrenberg, p.55.


Diagnosis: Shell brown, long elliptical, slightly attenuate and rounded at upper part and abruptly cuneate at lower part, aperture for flagella narrow and not covered with spine; shell covered with sharp pointed spines; chromatophores numerous.

Distribution: India: West Bengal (Nadia district), in fresh water among plankton sample. First report from West Bengal.

18. Trachelomonas sp.

Distribution: India: West Bengal (in Hugli-Matla estuary)

Remarks: Gopalkrishnan (1971) observed this species in the plankton samples collected from Zone I extending from Nabadwip, Dist. Nadia to Konnagar, Dist. Hugli and Zone IV (Rupnarayan tributary, Dist. Mednipur) of the Hugli-Matla estuary.

Family ANISONEMIDAE

Under this family the following two genera have been found in this state.

Key to the genera

1(2) Elongate, with a broad or truncate posterior end during locomotion, cytostome with a thickened ridge and two oral rods at anterior end; cytopharynx not visible, one free flagellum and the second flagellum adhered to the pellicle ............................................ Peranema

2(1) Oval, flattened, more or less rigid body, cytostome not visible, oral rods absent, cytopharynx a long conicle tubule almost reaching posterior end, one free flagellum and the second one trailing flagellum ................................................................. Entosiphon

Genus Entosiphon Stein

Key to the species

1(2) Anterior end rounded with 10-12 longitudinal striae..............................................E. ovatum

2(1) Anterior end with prominent depression of cytopharynx, body ridged longitudinally ............

.................................................................E. sulcatum

19. Entosiphon ovatum Stokes


Diagnosis: Anterior end rounded; 10-12 longitudinal striae; dimensions 20-25 μm long.

Distribution: India: West Bengal (Calcutta); among fresh water plankton. First report from West Bengal.
20. *Entosiphon sulcatum* (Dujardin)


*Diagnosis*: Body ridged longitudinally, posterior end rounded; cytopharynx prominent; dimensions 15-20 µm long.

*Distribution*: India: West Bengal (Calcutta, Barddhaman and Haora districts); among freshwater plankton. First report from West Bengal, Rajasthan.

**Genus Peranema** Dujardin

21. *Peranema trichophorum* (Ehrenberg)


*Material examined*: 1 ex., Kalyani, Nadia district, 9.xi.1964, K.N. Nair.

*Diagnosis*: Body cylindrical, posterior end usually truncate; small and numerous paramylum bodies present; dimensions 20-55 µm long.

*Distribution*: India: West Bengal (Nadia district); among freshwater plankton. First report from West Bengal.

**Order** CHRYSMONADIDA

**Key to the families**

1(2) With a single dominant emergent flagellum; naked or with sculptured shell..........................

............................CHROMULINIDAE

2(1) With two unequal emergent flagella; with or without delicate test........OCHROMONADIDAE

**Family** CHROMULINIDAE

**Genus** Mallomonas Perty

Body elongated, siliceous thorns originate at the cell envelop, two chromatophores rod-shaped.

22. *Mallomonas* sp.

*Distribution*: India: West Bengal (South 24-Parganas district).

*Remarks*: Mandal (1985) observed *Mallomonas* sp from the Bidyadhari river (a tributary of the Hugli river) near Kulti (South 24-Parganas). This species is enlarged with siliceous thorns originating at the cell envelop. Its average dimension is 20 - 25 µm x 6 - 8 µm.

**Family** OCHROMONADIDAE

Under this family two genera have been reported so far from this state.
Key to the genera

1(2) Solitary or colonial, body surface delicate, posterior surface often drawn out for attachment, chromatophores lacking................................................................. *Monas*

2(1) Solitary or colonial, individuals with vase-like hyaline and sometimes yellow cellulose test drawn out at the base, one or two lateral chromatophores present.......................... *Dinobryon*

**Genus Monas Muller**

23. *Monas* sp.

*Distribution*: India: West Bengal (in Hugli-Matla estuary); Universal in fresh and salt water.

*Remarks*: In the course of qualitative and quantitative studies of phytoplankton in the Hugli river Roy (1949, 1955) reported the occurrence of *Monas* sp around Falta (South 24-Parganas district). He, however, could not confirm the specific identity of this form.

**Genus Dinobryon Ehrenberg**

24. *Dinobryon* sp.

*Distribution*: India: West Bengal (in Hugli-Matla estuary); universal in freshwater bodies.

*Remarks*: Gopalkrishnan (1971) reported the occurrence of this species from the planktonic samples collected from Zone I and Zone II of the Hugli-Matla estuary (extending from Nabadwip, Dist. Nadia to Diamond Harbour, Dist. South 24-Parganas).

Subphylum SARCODINA
Superclass RHIZOPODA
Class LOBOSEA
Order AMOEБIDA

Under this order six families have been dealt with in the paper.

Key to the families

1(8) Locomotive form not producing subpseudopodia

2(5) Body a branched or unbranched cylinder, with or without hyaline cap, no rolling movement, body without pellicle

3(4) Usually polypodial, body in locomotion tubulate or cylindroid with rounded lobose pseudopodia, pseudopodia of radiate floating form granular in most length with clear hemispherical tips, if monopodial in locomotion then commonly with villous-bulb uroid......

.............................................................................................................................................. AMOEБIDAE

4(3) Monopodial, body in locomotion more or less tubular, limaciform, pseudopodia granular, more or less hemispherical, locomotion generally by steady flow, sometimes with gently anterolateral bulging, but never with hyaloplasm infected back along side, villous-bulb uroid lacking................................................................. HARTMANNELLIDAE
5(2) Body flattened, oval, oblong, discoid or flabellate, pellicle like layer usually with longitudinal or irregular folds, with rolling movement, without any posterior granular mass...............................THECAMOEBIDAE

6(7) Body usually oval, oblong or flabellate, longer than broad, symmetrical, pellicle-like layer with longitudinal or irregular folds, without any posterior or central granular mass or conical pseudopodia..........................................................THECAMOEBIDAE

7(6) Body discoid or fan-shaped, usually broader than long, without pellicle-like layer, with posterior or central granular mass, sometimes with conical hyaline pseudopodia.........................HYALODISCIDAE

8(1) Locomotive form producing subpseudopodia

9(10) Subpseudopodia hyaline, conical but not filose, cysts seldom formed ........PARAMOEBIDAE

10(9) Subpseudopodia hyaline, more or less finely tipped, sometimes filose, often furcate, cysts usually formed

11(12) Subpseudopodia numerous, short and spiny, sometimes furcate, cysts with inner wall often polygonal or stellate, outer wall often rippled or wrinkled, with operculum..........................ACANTHAMOEBIDAE

12(11) Subpseudopodia few to many, filose or microspines produced from a distinct hyaline zone, cysts round, smooth and without operculum..............................ECHINAMOEBIDAE

Family AMOEBIDAE

Under this family two genera are dealt with in this paper.

Key to the genera

1(2) Commonly polypodial but one pseudopodium dominant at one time, with somewhat shorter pseudopodia originating from the main stem, villous-bulb uroid not reported........Amoeba

2(1) Almost always monopodial, with villous-bulb uroid..............................Trichamoeba

Genus Amoeba Bory

25. Amoeba discoides Schaeffer

1916. Amoeba discoides Schaeffer, Arch. Protistenk., Jena, 37, p.218, fig. 5a,b.

Material examined: 1 ex., Kalyani, Nadia district, 5.xi.1962, K.N. Nair; 1 ex., Paikpara (Sahid colony), Calcutta, 27.xii.1962, K.N. Nair.

Diagnosis: Locomotive form large (264-338 μm long), with few blunt, smooth pseudopodia; crystals abundant; coarse granules distributed all over the cytoplasm.

Distribution: India: West Bengal (Calcutta and Nadia districts); in freshwater.

Remarks: Nair, Das and Mukherjee (1971) reported this species for the first time from India, that too, from West Bengal.
Genus *Trichamoeba* Fromentel

26. *Trichamoeba villosa* (Wallich)


*Diagnosis*: Large (upto 400 μm long), limax amoeba with prominent villous-bulb uroid; length-breadth ratio usually three, nucleus granular.

*Distribution*: India: West Bengal (South 24-Parganas district) in still freshwater. First report from India.

Family HARTMANNELLIDAE

A single genus, *Hartmannella* under this family has been collected so far from this state.

Genus *Hartmannella* Alexieff

Limax amoebae with hyaline cap practically always present in continuing locomotion, villous-bulb uroid or extensive filamentous adhesion uroid absent.

Key to the species

1(2) Cysts single walled with an outer gelatinous layer ............................................. *H. crumpae*

2(1) Cysts double walled, outer one being irregular ............................................. *H. vermiformis*

27. *Hartmannella crumpae* Singh and Hanumaiah


*Diagnosis*: Cysts rounded or spherical, single-layered with an outer gelatinous layer, 6.3 - 9.8 μm in diameter; during excystation amoeba detaches itself from the cyst wall; preformed pore lacking.

*Distribution*: India: West Bengal (Bankura district); in soil, mud and sewage sludge; Gujarat, Maharashtra, Uttar Pradesh.

*Remarks*: Basu *et al* (*in press*) recorded this species from the soil of Pratappur, Dist Bankura, West Bengal.

28. *Hartmannella vermiformis* Page


*Diagnosis*: Cysts spherical or slightly ovoid, with ectocyst somewhat separated in majority; cysts 5.6 - 9.8 μm in diameter; during excystation inner cyst wall dissolves and amoeba moving inside the outer wall; no pore reported.

*Distribution*: India: West Bengal (Medinipur district); Gujarat, and Uttar Pradesh; in soil, mud, sewage sludge, freshwater and leaf litter.

*Remarks*: Basu *et al* (*in press*) reported this species from the saline soil collected from the 'Jhau forest' area of Digha, Medinipur district, West Bengal. Earlier, this species has been reported to inhabit freshwater and leaf litter in England, Sweden and U.S.A. (*see* Page, 1976).
Family THECAMOEBIDAE

Two genera under this family are dealt with in this paper.

Key to the genera

1(2) Pellicle-like surface with conspicuous folds or wrinkles, hyaloplasm as crescent at anterior end, extending posteriorly along sides, but with granuloplasm not set off as thicker separate mass, outline more or less oval.................................................. *Thecamoeba*

2(1) Surface wrinkles absent, flattened hyaloplasm occupying approximately anterior quarter to half, usually extending around sides of thicker granuloplasmic mass, outline flabellate, spatulate, occasionally oval........................................................................ *Vannella*

Genus *Thecamoeba* Fromentel

Key to the species

1(2) Body oval with several parallel folds, nucleus with 2-4 nucleoli ............................ *T. striata*

2(1) Body oval, elliptical or sometimes semicircular, several parallel folds present, nucleus with many nucleoli........................................................................ *T. soli*

29. *Thecamoeba soli* (Singh and Hanumaiah)


*Diagnosis*: Body oval, elliptical or sometimes semicircular in shape with several distinct parallel folds, nucleus spherical containing many nucleoli filling the whole space of nucleus.

*Distribution*: India: West Bengal (South 24-Parganas District); in soil and leaf litter; Uttar Pradesh.

*Remarks*: Singh and Hanumaiah (1979) erected the genus *Greeffia* and accommodated one of their newly described species *G. soli* under that genus. The characteristic features of the genus *Greeffia* as mentioned by the authors are: i) flattened amoebae whose outline during locomotion nearly fan-shaped, oval, oblong or somewhat elongated; ii) possess thickened pellicle and iii) resting nucleus with Feulgen-negative nucleolus which during mitosis forms 'polar masses'. All these features are also found in an earlier described genus *Thecamoeba* Fromentel. The only difference between the two genera as pointed out by Singh and Hanumaiah (1979) is that the resting nucleus of *Greeffia* 'contains several Feulgen-negative nucleoli' whereas resting nucleus of the genus *Thecamoeba* possesses 'single Feulgen-negative nucleolus'. This difference can not be considered as sound taxonomic character for establishment of a separate genus (see Bovee *et al.* 1973 for more clarification). Hence, the genus *Greeffia* is treated as the synonym of the genus *Thecamoeba* and *G. soli* as that of *T. soli*.

Basu *et al.* (1987) have reported this species under the name *Greeffia soli* from a sewage ditch at Harinavi, South 24-Parganas, West Bengal.

30. *Thecamoeba striata* (Penard)


**Diagnosis**: Outline oval; with several parallel dorsal folds extending far anteriorly; nucleus round with fragmented endosome.

**Distribution**: India: West Bengal (Calcutta and Hugli districts); in soil and freshwater. First record from India.

**Genus** *Vannella* Bovee

**Key to the species**

1(2) Cyst spherical, single-walled with an outer gelatinous layer, maximum dimension 196 μm; reported from soil ................................................................. *V. cutleri*

2(1) Cyst not known, maximum dimension of locomotive form 60 μm, reported from leaf litter in freshwater ................................................................. *V. bengalensis* sp. nov.

31. *Vannella bengalensis* sp. nov.

(Pl. VI)

**Diagnosis**: Locomotive form flattened, somewhat reniform and at times spatulate, usually broader than long; dimensions of larger forms 50-60 μm; endoplasmic hump distinct, vacuolated, occupying the posterior portion of the body, surrounded anteriorly or laterally by fan-shaped hyaline ectoplasmic veil; nucleus vesicular, more or less oval, 3.5 - 5 μm in dimension; floating from usually with central granular mass and several radiate pseudopodia with pointed end.

**Type material**: Holoype 1 ex., on slide (Reg no. pt. 1360) Barasat, North 24-Parganas, West Bengal, India, 6.xii.1965, A.K. Das, collected from leaf litter in a small fresh water pond with sparse aquatic vegetation. **Paratypes**: 3 exs., on slide (Reg. No. pt 1359), other data as for the holotype.

**Remarks**: The present species resembles *V. platypoda* only to some extent in general appearance and in the characteristic feature that it attaches well to glass substratum. Both the species have also been found to occur in fresh water and grow out from leaf litter. *V. bengalensis*, however, differs from *V. platypoda* in larger dimension (50-60 μm vs 10-25 μm) and that its locomotive form is broader than long (vs. longer than broad).

32. *Vannella cutleri* Singh and Hanumaiah


**Diagnosis**: Outline flabellate with broad flattened hyaline ectoplasmic veil preceeding raised endoplasmic hump; breadth usually greater than length; cysts single walled, spherical with an outer gelatinous layer; dimension 8.4-196 μm.

**Distribution**: India: West Bengal (Puruliya); in soil; Gujarat, Maharashtra.

**Remarks**: Basu et al (in press) have collected this species from the grassy soil of Puruliya district, West Bengal. *V. cutleri* has been found to produce cysts in culture (Basu et al, op. cit.). But such behaviour has not been found in any other species of *Vannella*. 
33. *Vanella* sp.


*Distribution*: India: West Bengal (Calcutta).

*Remarks*: This species was earlier identified and reported from West Bengal by Nair, Das and Mukherjee (1971) under the name *Amoeba radiosa*. But *A. radiosa* is no longer a valid species (Bovee and Jahn, 1973) because radiate state of amoebae (the character on which this species was erected) is almost universal, if naked lobose amoebae are disturbed (*see* Bovee and Jahn, *op. cit.*). *A. radiosa* is thus nothing but a conglomerate of various species of floating or disturbed amoebae.

In light of above findings the slides bearing Registration Nos. pt.849, pt. 912-914 identified and reported earlier as *Amoeba radiosa* (Nair, Das and Mukherjee, 1971) have been critically re-examined and found to be the floating forms of *Vanella* sp. These forms possess rounded central mass with slender, hyaline, radiate and thickly helical pseudopodia. However, from the floating from its specific identification could not be made.

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A few digitiform or mamilliform conical, blunt, hyaline, nonfurcate subpseudopodia of similar lengths, usually produced from a hyaline lobe; amoebae long and rather flattened.

34. *Mayorella vespertilio* (Penard)


*Diagnosis*: Small amoeba (52 - 62 μm in diameter), often with short and conical pseudopodia on sides, producing hyaline web between the pseudopodia during active locomoting, number of pseudopodia four to six.

*Distribution*: India, West Bengal (Calcutta, Haora and North 24-Parganas districts), Rajasthan.

*Remarks*: This species was reported from Rajasthan by Mahajan (1965) and West Bengal by Nair, Das and Mukherjee (1971) under the name *Amoeba vespertilio* Penard.

35. *Mayorella* sp.


*Distribution*: India: West Bengal (North 24-parganas district).

*Remarks*: A floating form of this species was identified and reported by Nair, Das and Mukherjee (1971) from West Bengal under the name *Amoeba radiosa* as has been done for *Vanella* sp referred earlier in this paper.
The slide (Reg.No. Pt.848) has been critically examined and reidentified as a floating form of *Mayorella* sp because it possesses hyaline tapering pseudopodia of more or less similar length on a cell mass which is not a regular sphere. From the floating from, however, its specific identification was not possible.

**Family ACANTHAMOEIDAE**

This family possesses a single genus, *Acanthamoeba* whose characteristic features are the same as those of its family.

**Genus *Acanthamoeba* Volkonsky**

Key to the species

1(2) Cysts rounded or spherical and appearing to be single walled, operculum lacking......*A. glebae*

2(1) Cysts double walled and both the walls clearly visible, operculum present

3(6) Endocysts stellate or polygonal

4(5) Ectocysts circular, gently rippled or smooth, endocyst stellate, with tips of rays approximately at general level of ectocyst ..............................................*A. astronyxis*

5(4) Ectocysts wrinkled, endocyst markedly polygonal or stellate, with tips of rays usually in depression of wrinkled ectocyst ..........................................................*A. rhysodes*

6(3) Endocyst more or less rounded or with only slight angles

7(8) Ectocyst slightly wrinkled and closely apposed to endocysts .......................*A. palestinensis*

8(7) Ectocyst noticeably wrinkled and pathogenic to mice by nasal installation........*A. culbertsoni*

### 36. *Acanthamoeba astronyxis* (Ray and Hayes)


**Diagnosis**: Cysts biconvex, ectocysts more or less circular, endocysts stellate with tips of rays contacting ectocysts approximately in the same plane.

**Distribution**: India: West Bengal (Hugli, Maldah, Murshidabad and South 24-Parganas districts) in soil and sewage sludge; Gujarat and Uttar Pradesh.

**Remarks**: Ghosh and Choudhury (1987) isolated *A. astronyxis* strains from the soils of intertidal belts of Sagar Island (South 24-Parganas, West Bengal) facing Bay of Bengal. Basu *et al.* (1987 and *in press*) also reported this species from a sewage ditch at Harinavi, South 24-Parganas and subsequently from the soils of Mayapur (Hugli district), Khagra (Murshidabad district) and English Bazar (Maldah District).

### 37. *Acanthamoeba culbertsoni* (Singh and Das)


**Diagnosis**: Cysts rounded or oval, ectocyst considerably wrinkled or sometimes circular; endocyst rounded or with slight angles; endocyst in contact with the ectocyst only at the point of operculum.
**Distribution**: India: West Bengal (South 24-Parganas district); in soil and sewage sludge. Gujarat, Maharashtra, Uttar Pradesh.

**Remarks**: Singh and Das (1970) isolated strains of *A. culbertsoni* from the soil collected from four stations of Baroda (Gujarat) - three from different gardens and one from a cultivated field. So far as its occurrence in West Bengal this is to mention that Ghosh and Choudhury (1986) isolated the strains of this species from the soil samples of 3-5 cm depth of sand silt beds of the 'lowest littoral zone' of the beach of Sagar island (South 24-Parganas) facing the Bay of Bengal. Subsequently Basu *et al* (*in press*) reported this species from Kakdwip (South 24-Parganas) from the soil of a paddy field. This species is pathogenic to mice by nasal installation.


**Diagnosis**: Cysts rounded or spherical and appearing to be single walled; cyst wall smooth; operculum absent.

**Distribution**: India: West Bengal (North 24-Parganas district); in soil and freshwater.

**Remarks**: Basu *et al* (*in press*) reported this species from the soil of a manured jute field. Mention is to be made here that except the character that *A. glebae* produces acanthopodia (one of the important characteristic features of the genus *Acanthamoeba* as defined by Page, 1967b) it considerably differs from all other congeneric species in the cyst character (another important character of the genus) and mode of excystment.


**Diagnosis**: Ectocyst fairly thick, very irregular and wrinkled and closely apposed to endocyst; endocyst similar to that of *A. culbertsoni* and sometimes retaining contact with ectocyst at the points of operculum.

**Distribution**: India: West Bengal (South 24-Parganas district); in soil and freshwater.

**Remarks**: Basu *et al* (1987 and *in press*) recorded this species from a sewage ditch at Harinavi and from the soil of Sagar island (South 24-Parganas), West Bengal respectively.


**Diagnosis**: Endocyst stellate or irregularly polyhedral; ectocyst rippled or wrinkled and loosely applied to endocyst.

**Distribution**: India: West Bengal (South 24-Parganas and West Dinajpur districts); in soil, mud and sewage sludge; Gujarat, Maharashtra, Uttar Pradesh.

**Remarks**: Singh and Das (1970) isolated *A. rhysodes* strains from the soils of flower gardens and Gomti river bank, Lucknow (U.P.) and cultivated fields of Baroda (Gujarat). Ghosh, Choudhury and Bhattacharjya (1987) isolated the strains of this species from the soils of intertidal belt of Sagar
island (South 24-Parganas) facing the Bay of Bengal. Subsequently Basu et al (1987 and in press) reported this species from a sewage ditch at Harinavi (South 24-Parganas) from the soil of a Mango garden in West Dinajpur, West Bengal respectively.

Singh and Das (1970) found this species pathogenic to mice but its pathogenicity is less than that of A. culbertsoni.

Family ECHINAMOEBIDAE
Genus Echinamoeba Page

Short spine-like projections (microspines) usually produced from extensive anterior hyaline zone, but sometimes temporarily absent in rapid locomotion, no eruptive hemispherical pseudopodia.

41. Echinamoeba exundans (Page)

Diagnosis: Flattened, triangular to elongate and limax-like, with irregular anterior edge; cysts smooth, spherical or ovoid, ectocyst closely apposed to endocyst, occasionally raised at some points.

Distribution: India: West Bengal (South 24-Parganas, Medinipur and Koch Behar districts); in soil, mud and sewage sludge; Gujarat, Maharashtra, Uttar Pradesh.

Remarks: Basu et al (1987 and in press) reported this species from a sewage ditch at Harinavi and from soils of Digha (Medinipur district) and Brahmanpara (Koch Behar district), West Bengal respectively.

Order SCHIZOPYRENIDA

A single family, Vahlkampfiidae under this order is reprented from this state.

Family VAHLKAMPFIIDAE

Limax amoebae with locomotion by successive eruptive, hyaline, hemispherical waves, often alternating to either side at anterior end, with hyaloplasm sometimes spilling rearward along side, nuclear division promitotic.

Three genera under this family have been reported from West Bengal.

Key to the genera

1(2) Pseudopods eruptive and explosive, locomotion rapid, flagellate stage absent

Vahlkampfia

2(1) Pseudopods similar to Vahlkampfia but flagellate stage present

3(4) Normally biflagellate; flagellate stage without cytostome like opening

Naegleria

4(3) Quadriflagellate, flagellate stage with cytostome like opening

Tetramitus

Two species of Naegleria and one species each of Vahlkampfia and Tetramitus have been reported from West Bengal.
Genus *Vahlkampfia* Chatton & Lalung-Bonnaire

42. *Vahlkampfia russelli* (Singh)


*Diagnosis*: Monopodial during active locomotion; cytoplasm with circular and cylindrical refractive granules; nucleus vesicular with central nucleolus; cysts usually spherical or ovoid and double walled; ectocyst widely separated from endocyst except at some points of contact; in some specimens ectocyst wavy.

*Distribution*: India: West Bengal (Medinipur district); in soil, mud and sewage sludge; Gujarat, Maharashtra, Uttar Pradesh.

*Remarks*: Singh (1952) described *Schizopyrenus russelli* and erected the genus *Schizopyrenus* under the family Schizopyrenidae to accommodate this species. Amoebae possessing polar masses during nuclear division but not having any flagellate stage were included in the above said genus. But, earlier Calkins (1913) suggested the said characteristic features for the genus *Vahlkampfia*. Page (1967 a, 1976), therefore, rightly included *Schizopyrenus* under *Vahlkampfia*. Mention is to be made here that subsequently Singh and Hanumaiah (1979) have retained the genus *Schizopyrenus* and described a species *S. horticola* without commenting on Page's revision (1976).

Basu *et al* (*in press*) have reported this species from the soils of ‘Jhau forest’ at Digha (Medinipur district), West Bengal under the name *Schizopyrenus russelli*.

Key to the species of *Naegleria*

1(2) Cysts usually smooth walled, but with thin outer wall separated in strains, several pores containing plugs discernable with light microscope, usually a perinuclear layer of coarse granules present ................................................................. *N. gruberi*

2(1) Cysts smooth-walled, with fairly thick gelatinous layer, distinct plugs not discernible in unstained cysts with light microscope; no perinuclear layer of granules reported .... *N. thortoni*

Genus *Naegleria* Alexeieff

43. *Naegleria gruberi* (Schardinger)


*Diagnosis*: Cysts round or slightly oval and smooth-walled; sometimes outer wall with irregular architecture can be separated; several pores with plugs; flagellate stage easily produced.

*Distribution*: India: West Bengal (Haora district); in soil, mud and sewage sludge: Gujarat, Maharashtra, Uttar Pradesh.

*Remarks*: Basu *et al* (*in press*) reported this species from the soils of a seed farm at Uluberia (Haora district), West Bengal.
44. *Naegleria thortoni* (Singh)


**Diagnosis** : Cysts round, smooth, covered with thick gelatinous outer layer; no distinct plugs visible; flagellate transformation rare.

**Distribution** : India: West Bengal (South 24-Parganas district); in soil and mud; Uttar Pradesh.

**Remarks** : Singh (1952) erected the genus *Didascalus* to accommodate his species *D. thortoni*. He separated *Didascalus* from *Naegleria* on the basis of absence of interzonal bodies during mitosis. But this genus has been synonymised by Page (1967a, 1976) under *Naegleria*. Basu *et al* (in press), however, reported this species from the soils of some grassy field of Sagar island (South 24-Parganas), West Bengal under the name *Didascalus thortoni*. Singh and Hanumaiah (1979) have also retained the name *D. thortoni* without any comment on Page's revision. In light of discussion made by Bovee and Jahn (1973) Page's revision (1967a, 1976) seems to be justified.

45. *Tetramitus rostratus* (Perty)


**Material examined** : 2 exs., Barrackpur, North 24-Parganas, 31.v.66, K.N. Nair.

**Diagnosis** : Amoebae sometimes spreading anteriorly, with a distinct rostrum; flagellate with an anteriorly broad cytostomal groove, a distinct rostrum and four equal flagella; cysts spherical or ovoid, with outer wall often slightly raised in one or two places and inner wall smooth.

**Distribution** : India: West Bengal (Darjiling and North 24-Parganas district); universal in soil, freshwater and sewage sludge; Uttar Pradesh.

**Remarks** : This species has been collected from a stagnant fresh water body in Barrackpore (North 24-Parganas district). In this connection it is worth mentioning that Bunting (1926) found this species in the cultures of the coecal contents of rats. Recently Basu *et al* (*in press*) recorded this species from the soils of tea plantation in Darjiling district West Bengal.

**Order** **PELOBIONTIDA**

Only a single family, Pelomyxidae under this order is known from this state.

**Family** **PELOMYXIDAE**

Amoebae with thick limax-like form, usually without hyaline cap and with a villous uroid; usually multinucleate.

A single genus with a single species, *Pelomyxa palustris* under this family has been collected so far from this state.

**Genus** **Pelomyxa** Greeff

Large to very large amoebae, moving slowly by fountain streaming or hemispherical eruption of cytoplasm, usually multinucleate, rarely bi- or mono-nucleate.
46. *Pelomyxa palustris* Greeff


Material examined: 5 exs., Garia, South 24-Parganas, 8.ii.1965, K.N. Nair.

**Diagnosis**: Amoeba with usually hundreds of nuclei; cytoplasm opaque possessing a lot of assorted type of crystals; no contractile vacuole.

**Distribution**: India: West Bengal (North 24-Parganas district); in freshwater.

**Remarks**: Nair, Das and Mukherjee (1971) reported this species from West Bengal for the first time. Specimens encountered in this state are very large and range from 150 μm to 560 μm in length during locomotion.

Order **ARCELLINIDA**

Three families are dealt with under this order.

Key to the families

1(2) Test thin flexible, expansible and contractile..........................COCHLIOPODIIDAE
2(1) Test thin or thick, flexible or rigid but not expansible or contractile

3(4) Test simple and without foreign bodies.................................ARCELLIDAE
4(3) Test with foreign bodies ..................................................DIFFLUGIIDAE

Family **ARCELLIDAE**

Five genera have been dealt with under this family.

Key to the genera

1(6) Test rigid
2(3) Test semispiral in appearance, with curved or vermiform pellets (or with sand grains in single species) ..............................................................Lesquereusia
3(2) Test hemispherical, oval, circular or patelliform but not semispiral and without any pellet or sand grain as stated above
4(5) Test hemispherical, oval or circular with hexagonal markings, aperture circular, central and not covering the entire diameter of the test..........................Arcella
5(4) Test patelliform, punctate, without any hexagonal markings, aperture circular and covering the entire diameter of the test..................................................Pyxidicola
6(1) Test flexible
7(8) Test discoid, flexible when young, pseudopodia finger like, nucleus single and central............Pseudochlamys
8(7) Test hemispherical or cup-shaped, with a double envelop, pseudopodia few, short, digitate or pointed, nuclei many (upto 100)..................Diplochlamys
Genus *Arcella* Ehrenburg

Five species of *Arcella* have so far been found in this state.

Key to the species

1(6) Test hemispherical  
2(3) Surface with more or less deep fine 'areoles' .......................... *A. hemispherica*  
3(2) Surface with large 'areoles'  
4(5) 'Areoles' serrated on the oral surface while approaching mouth .......................... *A. gibbosa*  
5(4) 'Areoles' not serrated .............................................. *A. vulgaris*  
6(1) Test spherical or pyramidal  
7(8) Test spherical, planoconvex in profile .................................................. *A. discoides*  
8(7) Test pyramidal and sometimes angular in front view .......................... *A. conica*

47. *Arcella conica* (Playfair)


*Diagnosis*: Test pyramidal, sometimes angular in front view, with holes of 4-8 faces; mouth circular, proportionately small and without buccal tube.

*Distribution*: India: West Bengal (Bankura and Calcutta districts); in freshwater amongst bottom ooze. First record from West Bengal; Andhara.

48. *Arcella discoides* Ehrenberg


 Diagnosis: Test spherical, planoconvex in profile and circular in front view; height of the dome about one-fourth to one-third of the diameter of the test.

 Distribution: India: West Bengal (Bankura, Birbhum, Barddhaman, Koch Behar, Hugli, Haora, Jalpaiguri, Maldah, Medinipur, Murshidabad, Nadia, Puruliya, South 24-Parganas and West Dinajpur districts); in freshwater amongst bottom ooze.

 Remarks: Nair, Das and Mukherjee (1971) recorded this species for the first time from West Bengal. This species is very common in West Bengal waters.

49. **Arcella gibbosa** Penard


 Diagnosis: Test almost hemispherical; oral face with a characteristic s-shaped curvature, surface with a large regular 'areoles' being smaller and serrated on the oral surface while approaching mouth.

 Distribution: India: West Bengal (South 24-Parganas West Dinajpur); in freshwater amongst submerged vegetation; Andhra.

 Remarks: Nair, Das and Mukherjee (1971) reported this species from West Bengal for the first time.

50. **Arcella hemispherica** Perty


 Diagnosis: Test distinctly hemispherical and circular in front view; surface with more or less fine 'arcolas': mouth without or with short buccal tube.

 Distribution: India: West Bengal (Bankura, Koch Bihar and South 24-Parganas districts); in freshwater amongst submerged vegetation and bottom ooze; Andhra, Orissa.

51. **Arcella vulgaris** Ehrenberg


**Diagnosis**: Test hemispherical, evenly convex and its height about 1/2 of its diameter; surface with very large ‘areoles’, mouth circular, central and often without buccal tube.

**Distribution**: India: West Bengal (Birbhum, Barddhaman, Hugli, Koch Bihar, Maldah, Medinipur, Murshidabad, South 24-Parganas and West Dinajpur districts); in freshwater amongst bottom ooze and submerged vegetation.

**Remarks**: Nair, Das and Mukherjee (1971) reported the occurrence of some specimens, the tests of which were similar to those of var. *angulosa* and forma *undulatum* of the species *A. vulgaris*. This species is common in West Bengal waters.

**Genus Dipochochlamys** Greef

52. *Diplochlamys leidyi* Greef


**Diagnosis**: Test hemispherical, covered by double membrane, outer one rigid and brown while inner one delicate, gray and inverted funnel-shaped in distented condition; aperture of outer membrane circular and that of inner membrane oviform with a neck like constriction below and a slightly expanded collar above.

**Distribution**: India: West Bengal (Calcutta and South 24-Parganas districts).

**Remarks**: Nair and Mukherjee (1968) have reported this species for the first time from West Bengal. They collected the specimens from the mosses intermixed with lichens on banyan tree at Calcutta. This species has also been collected from freshwater amongst bottom ooze from the localities shown in the *Material examined* column.

**Genus Lesquereusia** Schlumberger

Key to the species

1(2) Test encrusted with quartz crystals .......................................................... *L. modesta*

2(1) Test composed of vermiform pellets arranged very closely .................................. *L. spiralis*

53. *Lesquereusia modesta* Rhumbler


**Diagnosis**: Test opaque, hemispherical in appearance and encrusted with quartz crystals.
**Distribution**: India: West Bengal (Jalpaiguri, Medinipur, Nadia, North and South 24-Parganas districts); in freshwater amongst bottom ooze.

**Remarks**: Nair, Das and Mukherjee (1971) reported this species for the first time from West Bengal.


**Diagnosis**: Test transparent, hemispherical and composed of closely arranged vermiform pellets.

**Distribution**: India: West Bengal (Jalpaiguri, Medinipur, Nadia, North 24-Parganas and South 24-Parganas districts); in freshwater amongst bottom ooze; Andhra.

**Remarks**: This species has already been reported from West Bengal by Nair, Das and Mukherjee (1971).

Genus *Pseudochlamys* Claparede and Lachmann

55. *Pseudochlamys patella* Claparede and Lachmann 1966. *Pseudochlamys patella* Claparede and Lachman; Kudo, *Protozoology*, p.572, Fig. 204c.

**Material examined**: 5 exs., Champahati, South 24-parganas, 11.vii.1967, K.N. Nair.

**Diagnosis**: Test hyaline when young but rigid and brown when old; a short finger like pseudopodium between folds.

**Distribution**: India: West Bengal (South 24-Parganas); in freshwater amongst vegetation.

Genus *Pyxidicola* Ehrenberg

56. *Pyxidicola operculata* (Agardh) 1966. *Pyxidicola operculata* (Agardh); Kudo, *Protozoology*, pp.571-572, Fig. 204, a-b.


**Diagnosis**: Test smooth, colourless to brown; nucleus single and vesicular; pseudopodia short, lobose or digitate.

**Distribution**: India: West Bengal (Hugli and South 24-Parganas districts); in freshwater amongst vegetation.

Family COCHLIOPODIDAE

Under this family a single genus, *Cochliopodium* is known so far from this state.
Genus *Cochliopodium* Hertwig and Lesser

Central or post central granular mass surrounded by a thin hyaloplasmic veil when in locomotion; spherical or bell shaped when inactive; flexible closely adherent tectum on dorsal surface often appearing as double lined layer when seen on the hump in side view.

57. *Cochliopodium bilimbosum* (Auerbach)


*Diagnosis*: Distinct tubular configuration of tectum around pseudopodial bases of floating form; scales clearly visible in light microscope; pseudopodia sometimes furcate and often produced from anterior margin.

*Distribution*: India: West Bengal (Nadia and South 24-Parganas districts); in freshwater and sewage sludge.

Family *DIFFLUGIIDAE*

Under this family six genera are reported/collected so far from West Bengal.

Key to the genera

1(2) Test composed of cemented quartz sand, diatoms and other foreign bodies, aperture terminal, pseudopodia cylindrical, simple or branching ................................................... *Difflugia*

2(1) Test usually with sand grains and sometimes with diatoms and occasionally with quartz crystals, pseudopodia digitate or sharply pointed

3(4) Aperture eccentric .................................................................................. *Centropyxis*

4(3) Aperture terminal

5(6) Aperture surrounded by a four-lobed annular collar ........................................ *Cucurbitella*

6(5) Aperture not surrounded by any annular collar

7(8) Pseudopodia sharply pointed and radiating .................................................. *Phryganella*

8(7) Pseudopodia digitate or branching

9(10) Test oval, compressed, surface covered with scales of various size and shape, aperture truncate . ................................................................................................. *Heliopera*

10(9) Test broadly hemispherical to ovoid, not covered by any scale, aperture linear or lunate .......... ................................................................................................. *Plagiopyxis*

Genus *Centropyxis* Stein

Key to the species

1(12) Test swollen at posterior part, oral aperture not exactly centrally located

2(5) Test beset with spines
3(4) Oral aperture usually circular, spines few and resembling scrap or strap .......... *C. aculeata*

4(3) Oral aperture irregularly circular with invaginated borders, spines many and frequently curved ................................................................. *C. spinosa*

5(2) Test without spines

6(9) Oral aperture circular or round

7(8) Test more or less elliptical, discoid or oval in ventral view, mature shell large, with dimensions 195-267 μm x 85-102 μm ................................................................. *C. ecornis*

8(7) Test circular in ventral view, mature shell small, 65-70 μm .............. *C. minuta*

9(6) Oral aperture semicircular

10(11) Test elliptical in ventral view, with widely rounded posterior part .......... *C. cassis*

11(10) Test oval in ventral view, with spheroidal or little elliptical posterior part ...... *C. aerophila*

12(1) Test regularly arched, oral aperture centrally located

13(14) Test hemispherical, brown, covered with small flat scales, 100-110 μm in diameter................................................................. *C. arcelloides*

14(13) Test nearly hemispherical formed of flat sandy particles, clothed in a chitinoid colourless marix, 300-400 μm in diameter ................................................................. *C. penardi*

58. *Centropyxis aculeata* (Ehrenberg)


*Diagnosis*: Test usually with quartz crystals and sometimes with admixture of diatomes, fistules and sand particles; spines few and usually resembling a scrap; oral aperture usually circular.

*Distribution*: India: West Bengal (Bankura, Barddhaman, Birbhum, Hugli, Koch Bihar, Maldah, Medinipur, Murshidabad, North and South 24-Parganas and West Dinajpur districts); in freshwater pond amongst vegetation. Andhra, Rajasthan, Sikkim, Himalayas.
Remarks: Nair, Das and Mukherjee (1971) reported this species for the first time from West Bengal.

59. **Centropyxis aerophila** Deflandre


Diagnosis: Test with spheroidal posterior portion and its dorsal face very much flattened towards mouth; in ventral view test ovoidal; oral aperture semicircular.

Distribution: India: West Bengal (Bankura, North and South 24-Parganas districts); very common in wall and tree mosses.

Remarks: In many occasions tests of *C. aerophila* have been found to be adhered with vegetable fragments and transparent crystals.

60. **Centropyxis arcelloides** Penard

1902. *Centropyxis arcelloides* Penard, *Faune Rhiz. du bass. du Leman*, p. 309, Fig. 1-4.


Diagnosis: Test hemispherical, brown, chitinous, covered with flat scales; oral aperture very wide, centrally located, diameter of which about half of that of the test.

Distribution: India: West Bengal (Puruliya district); from the bottom ooze of a freshwater pond. First report from India.

61. **Centropyxis cassis** (Wallich)


Diagnosis: In general form test quite analogous to that of *C. aerophila*; in ventral view test elliptical and widely rounded at the posterior part; oral aperture semicircular; oral margin usually provided with well oriented thicker pebbles.

Distribution: India: West Bengal (Calcutta and Nadia districts); in moss, soil and freshwater; Andhra, Orissa.

62. **Centropyxis ecornis** (Ehrenberg)

1843. *Arcella ecornis* Ehrenberg, *Abh. preuss. Akad. Wiss.*, Berlin, p. 368, pl. 1, fig. 9, pl. 3, fig. 46.


**Diagnosis** : Nature and texture of the test analogous to *C. minuta* but spine lacking; oral aperture circular.

**Distribution** : India: West Bengal (Bankura, Birbhum, Hugli, Koch Bihar, Jalpaiguri, Maldah, Medinipur, Murshidabad, Puruliya, South 24-Parganas and West Dinajpur districts); in freshwater amongst vegetation and in bottom ooze; Sikkim Himalayas.

63. *Centropyxis minuta* Deflandre


**Diagnosis** : Test circular in ventral view and subspherical in lateral view; size minute (local specimens 65-70 µm in diameter), oral aperture circular.

**Distribution** : India: West Bengal (Bankura, Calcutta, Nadia, North 24-Parganas districts); in ground and wall moss and also in freshwater.

**Remarks** : Nair and Mukherjee (1968) collected this species from ground moss of Nadia district, West Bengal. Subsequently Guru and Das (1983) reported this species from the soils of Orissa. The present authors could collect this species from the ground and wall moss in Calcutta, North 24-Parganas and Bankura districts of West Bengal.

This species closely resembles the immature form of *C. ecornis*. But careful observation would reveal that it considerably differs in ventral view as mentioned in the key to the species and usual habitat of *C. minuta* is ground moss or soil whereas that of *C. ecornis* is freshwater.

64. *Centropyxis penardi* Deflandre


**Diagnosis** : Test nearly hemispherical formed of small flat sandy particles covered with colourless chitinoid matrix; oral aperture centrally located, occupying more than half of the diameter of the shell.
Distribution : India : West Bengal (Bankura district); in the bottom ooze of freshwater ponds. First report from India.

65. **Centropyxis spinosa** (Cash and Hopkinson)

1905. *Centropyxis aculeata* var. *spinosa* Cash and Hopkinson, *The British Freshwater Rhiz. & Heliozoa*, 1, p.135, pl.16, Fig.15 & Text. fig.28.


**Diagnosis** : Test chitinous with few quartz crystals or diatom fistules; spines six to eight in number and frequently curved; oral aperture irregularly circular with invaginated borders.

**Distribution** : India : West Bengal (Bankura, Barddhaman, Hugli, Koch Bihar, Jalpaiguri, Medinipur, North 24-Parganas, Puruliya, South 24-Parganas and West Dinajpur districts); in freshwater among vegetation and in bottom ooze.

**Remarks** : This species is very common in the bottom ooze of freshwater bodies of West Bengal and closely resembles *C. aculeata* which is also common in the same habitat. These two species, however, differs from each other in the shape of oral aperture and nature of spines; it is sometimes very difficult to isolate them particularly when the specimens are collected from the water samples kept for long in the laboratory.

**Genus Cucurbitella** Penard

66. **Cucurbitella mespiliformis** Penard


**Material examined** : 2 exs., Chandkhali (Talodi), South 24-Parganas, 5.xi.1968, K.N. Nair.

**Diagnosis** : Test ovoid with sand grains, not compressed; oral aperture terminal, circular and surrounded by a four-lobed annular collar.

**Distribution** : India : West Bengal (South 24-Parganas district); in freshwater in the bottom ooze. First report from India.

**Genus Diffugia** Leclerc

Key to the species

1(22) Test without collar

2(9) Test terminated by one or more 'horn' like extension

3(4) Test adhered with diatom fistules..........................*D. bacilliarum*
4(3) Test not adhered with diatom fistules
5(8) Test cylindrical with a single pointed tubular extension at the base
6(7) Pointed extension of the base usually straight, quartz crystals of the test big and some of them projecting out of the margin of the test. ............................................ D. acuminata
7(6) Pointed extension of the base curved and test more or less transparent .......... D. cuvicaulis
8(5) Test pear-shaped with usually one but occasionally three pointed tubular extensions near the base ............................................................................................... D. elegans
9(2) Test not terminated by any spinous structure or ‘horn’
10(13) Pseudostome normally quadrilobed in the form of a cross but very often trilobed
11(12) Test hemispherical with a slightly concave base and covered with sandy and muddy particles.
.................................................................................................................................................. D. arcula
12(11) Test ovoidal, without any concave base and covered with angular quartz particles............ D. lobostoma
13(10) Pseudostome circular
14(19) Test hemispherical, ovoidal or ovoid globular
15(16) Test hemispherical .............................................................................................................. D. globulus
16(15) Test not hemispherical
17(18) Test ovoidal ..................................................................................................................... D. globularis
18(17) Test ovoid-globular ......................................................................................................... D. globulosa
19(14) Test pyriform or oblong
20(21) Test typically pyriform with smooth margins and small angular quartz crystals.............. ............................................................................................................................. D. pyriformis
21(20) Test characteristically oblong with smooth margins and big angular quartz crystals........ ............................................................................................................................. D. oblonga
22(1) Test with collar
23(28) Test bearing many disc-shaped protruberances or tubercals
24(25) Pseudostome hexagonal, test ovoidal ................................................................................ D. tuberculata
25(24) Pseudostome usually 3-lobed, occasionally 4-lobed
26(27) Test spherical with protruberances of feeble amplitude................................................. D. muriformes
27(26) Test subcylindrical with prominent protruberances....................................................... D. muriculata
28(23) Test without bearing any protruberances
29(32) Margin of collar around pseudostome recurved or rolled towards exterior
30(31) Test ovoidal, base of the test sometimes provided with 2 or 3 ‘horn’ like projection ...........
.................................................................................................................................................. D. amphoralis
31(30) Test spherical or ovoid-spherical and never provided with any 'horn' like projection .............. ........................ D. urceolata

32(29) Margin of collar never recurved towards exterior or interior

33(46) Test with short collar or straight pad

34(41) Pseudostome circular or oval

35(36) Test fusiform with base gradually terminating to horn-like structure ............... D. acutissima

36(35) Test spherical, subspherical, ovoid or subglobose without any 'horn' like extension at the base

37(38) Test elongate to ovoidal with a 'ogivale' base................................. D. difficilis

38(37) Test spherical to subglobose with rounded base

39(40) Test spherical or subspherical and covered with irregular mineral scales or diatome .............. ........................................ D. brevicolla

40(39) Test spherical to subglobose and covered with well arranged stony particles..... D. lithophila

41(34) Pseudostome lobed or crenulated

42(43) Pseudostome crenulated, crenulation varying from 10-12 in number............... D. corona

43(42) Pseudostome lobed but not crenulated

44(45) Pseudostome trilobed................................................................. D. gramen

45(44) Pseudostome characteristically 5 - lobed ........................................ D. lismorensis

46(33) Test with long collar formed by flanks which initially converging and then becoming parallel................................................................. D. capreolata

67. Diffugia acuminata Ehrenberg

1838. Diffugia acuminata Ehrenberg, Infusiothierchen, p.131, pl.9, fig.3.


Diagnosis : Test cylindrical, without any collar and with pointed 'horn' like extension at the base; spine straight and differentiated from the base; quartz crystals of the test big and some of them projecting out of the margin of the test giving an irregular appearance of test margins.

Distribution : India: West Bengal (Birbhum, Calcutta, Hugli, Maldah, Medinipur, Murshidabad, Nadia, South 24-Parganas and West Dinajpur districts); in bottom ooze of freshwater ponds; Andhra.
68. **Difflugia acutissima** Deflandre

1931. *Difflugia acutissima* Deflandre, Ann. Protistologie, 3, p.84, pl.12, 1-3, fig. 40a-d.


*Diagnosis*: Test fusiform with slight indication of collar; base gradually terminating to a 'horn' like structure, 'horn' not differentiated from the base; pseudostome circular; quartz crystals of the test small.

*Distribution*: India: West Bengal (Puruliya district); in bottom ooze of a freshwater pond. First report from India.

69. **Difflugia amphoralis** Hopkinson

1958. *Difflugia amphoralis* Hopkinson; Gauthier-Lievre & Thomas, Arch. Protistenk., Jena, 103, p.303, Fig. 29.


*Diagnosis*: Test ovoidal, pseudostome wide, collar rolled towards exterior; base of the test provided with two or three spines.

*Distribution*: India: West Bengal (Koch Bihar and West Dinajpur districts); in freshwater among vegetation and in bottom ooze. First record from India.

*Remarks*: The local specimens are quite similar to *D. amphoralis* var. *cornuta* described by Gauthier-Lievre and Thomas (1958) from Ivory Coast, Africa.

70. **Difflugia arcuia** Leidy


*Diagnosis*: Test hemispherical, with slightly concave base and regularly arched crown; mouth irregularly trilobed, roughly quadrangular or even triangular; test encrusted with fine sandy and muddy particles.

*Distribution*: India: West Bengal (Haora districts); in freshwater amongst bottom ooze; Sikkim Himalayas.

71. **Difflugia bacilliarium** Perty

1958. *Difflugia bacilliarium* Perty; Gauthier-Lievre & Thomas, Arch. Protistenk., Jena, 103, p.327, Fig. 45 b,c.

*Material examined*: 6 exs., Makalpur (Belmuri), Hugli, 10.x.1968, K.N. Nair.

*Diagnosis*: Test top-shaped, ovoid globular; its base provided with an elongated axial spine; both test and spine thickly encrusted with frustules of diatomcs, some of which may extend beyond the margin; pseudostome circular.

*Distribution*: India: West Bengal (Hugli district); in freshwater among vegetation and bottom ooze. First record from India.
72. **Difflugia brevicolla** Cash


*Diagnosis*: Test spherical or subspherical, with short but distinct collar; pseudostome circular, test chitinoid and covered by irregular mineral scales or diatomes.

*Distribution*: India: West Bengal (Hugli and Medinipur districts); in freshwater from the bottom ooze. First report from India.

73. **Difflugia capreolata** Penard

1902. *Difflugia capreolata* Penard, *Fauna rhizopodique du bassin du Leman.*, Geneve, p.222, Fig. 1 & 4, p.228.


*Diagnosis*: Test resembling a flower vase, with broad and short collar; submedian region preceding collar constricted; collar first swelling up and then constricted near pseudostome; pseudostome circular; its diameter almost equal to that of the constricted part below the collar; chitinoid test covered by a row of small regular stones.

*Distribution*: India: West Bengal (Bankura, Hugli and Nadia districts); in freshwater amongst bottom ooze. First report from India.

74. **Difflugia corona** Wallich


*Diagnosis*: Test more or less spherical, slightly narrow near pseudostome but widened at the base with the presence of 5 - 10 spines; surfaces of test spines smooth formed by quartz crystals; pseudostome wide, about half the diameter of the test, crenulated; crenulations varying from 8 to 12, sometimes more.
**Distribution**: India: West Bengal (Birbhum, Barddhaman, Calcutta, Koch Bihar, Murshidabad, Nadia, North and South 24-Parganas, West Dinajpur districts); in freshwater amongst vegetation and in bottom ooze.

75. **Difflugia curvicaulis** Penard


*Diagnosis*: Shape and texture of the test similar with those of *D. acuminata*; but spine not exactly terminal, one of its side convex and in continuity of the curvature of one side of the flank, while other side concave; test transparent, having very few crystals; pseudostome circular.

*Distribution*: India: West Bengal (Birbhum, North and South 24-Parganas districts); in freshwater in bottom ooze.

76. **Difflugia difficilis** Thomas


*Diagnosis*: Test elongate to ovoidal with ‘ogivale’ base; flanks converge imperceptibly towards the pseudostome forming less elevated but distinct collar; pseudostome circular, about half or two-third the diameter of the test.

*Distribution*: India: West Bengal (Puruliya district); in freshwater amongst bottom ooze; Andhra.

77. **Difflugia elegans** Penard


*Diagnosis*: Test elongate to ovoidal, its base simply acuminate, most often elongated forming a narrow tube of variable length, straight or curved with leathery point; pseudostome circular, flanks towards the pseudostome widened without forming any collar; test covered with angular quartz particles which often surpass the margin.

*Distribution*: India: West Bengal (Hugli and Medinipur districts); in freshwater amongst bottom ooze; First report from India.

78. **Difflugia globularis** (Wallich)


Diagnosis : Test generally ovoid-globular and more elongated than that of D. globulosa; pseudostome circular and bordered with minute particles; its diameter about two-thirds of that of the test; test composed of angular stony particles making it gray.

Distribution : India : West Bengal (Koch Bihor and North 24-Parganas districts); in freshwater amongst bottom ooze. First report from India.

79. Diffugia globulosa Dujardin


Diagnosis : Test slightly ovoidal and less elongated than that of D. globularis; pseudostome circular; its diameter about half of that of the test; diversified material like clay, mineral platelets, vegetable fragments etc, embedded in brownish chitinous membrane.

Distribution : India : West Bengal (Koch Bihor district); in freshwater bottom ooze; Andhra, Rajasthan.

80. Diffugia globulus (Ehrenberg)
1990. Diffugia globulus (Ehrenberg); Cash, The British Freshwater Rhizopods and Heliozoa, 2, pp.33,37, pl.21, Figs. 5-9.


Diagnosis : Test hemispherical, gray to pale yellow with few brown particles; pseudostome circular.

Distribution : India : West Bengal (Calcutta, Nadia and North 24-Parganas districts); in freshwater in bottom ooze; also in moss.

81. Diffugia gramen Penard


Diagnosis : Test ovoid, rarely spherical with a collar; pseudostome trilobed, with rounded or angular lobes; test hyaline covered with stones; nucleus spherical with a unique central karyosome.

Distribution : India : West Bengal (Bankura and Nadia districts); in freshwater bottom ooze; Andhra.

82. Diffugia lismorensis Playfair

**Diagnosis**: Test globular or slightly ovoid, formed of quartz particles; pseudostome very small and characteristically pentalobular; lobe constituting a less prominent collar.

**Distribution**: India: West Bengal (Nadia district); in freshwater amongst vegetation and in bottom ooze; First report from India.

83. *Difflugia lithophila* (Penard)

1902. *Difflugia hydrostatica* var. *lithophila* Penard, *Fauna rhizopodique du bassin du Leman*, Geneve, p.274, Fig.1.


**Diagnosis**: Test ovoid-globular or sub-globular drawn out to the pseudostome in the form of short collar; pseudostome circular, test covered with well arranged stony particles.

**Distribution**: India: West Bengal (Bankura, Bardhaman, Jalpaiguri, Medinipur, South 24-Parganas and West Dinajpur districts); in freshwater in bottom ooze.

84. *Difflugia lobostoma* Leidy


**Diagnosis**: Test ovoidal, pseudostome usually quadrilobed but very often trilobed; not enclosed by collar; test covered with angular quartz particles.

**Distribution**: India: West Bengal (Bankura, Barddhaman, Birbhum, Darjiling, Haora, Hugli, Jalpaiguri, Koch Bihar, Maldah, Medinipur, Murshidabad, North and South 24-Parganas and West Dinajpur districts); in freshwater amongst vegetation and in bottom ooze.

**Remarks**: *D. lobostoma*, particularly its juvenile form resembles *D. gramen* to a great extent. Former differs from the latter by lacking collar around the pseudostome and that it possesses a nucleus with many karyosomes while *D. gramen* possesses a collar around the pseudostome and a nucleus with a unique central karyosome.

85. *Difflugia muriculata* Gauthier-Lievre and Thomas


**Diagnosis**: Test elongate, subcylindrical with a short collar around pseudostome; pseudostome with 3-4 well developed rounded (rarely angular) lobes; test bearing many prominent disc-shaped or mammae-shaped protruberances; test hyaline and covered by stony particles.

**Distribution**: India: West Bengal (Nadia and South 24-Parganas districts); in freshwater amongst bottom ooze.

86. *Difflugia muriformis* Gauthier-Lievre and Thomas


**Diagnosis**: Test spherical with a short collar around pseudostome; pseudostome usually trilobed (sometimes 4 or 5 lobed); test covered with disc-shaped protruberances of feeble amplitude; test with a brownish or yellowish tinge.

**Distribution**: India: West Bengal (Hugli and Nadia districts); in the bottom ooze of freshwater ponds.

**Remarks**: At a causal look *D. muriformis* very much resembles *D. muriculata* because both the species possess mammae-like protruberances from the test. But the former differs from the latter by the presence of spherical test with brownish or yellowish tinge and feebly developed protruberances.

87. *Difflugia oblonga* Ehrenberg

1838. *Difflugia oblonga* Ehrenberg, *Infusionsthierchen*, p.131, pl.2, figs. 3 a-d.

Diagnosis: Test typically oblong with rounded base and composed of big angular quartz crystals; pseudostome circular.

Distribution: India: West Bengal (Hugli and Nadia districts); Andhra; in freshwater amongst vegetation and in bottom ooze.

88. *Difflugia pyriformis* Perty


Diagnosis: Test pyriform or flask-shaped; small angular quartz crystals and mud particles encrusted on the chitinous membran of the test; pseudostome circular.

Distribution: India: West Bengal (Bankura, Barddhaman, Medinipur, Nadia, South 24-Parganas and West Dinajpur districts); Rajashthan; in the bottom ooze of freshwater bodies.

89. *Difflugia tuberculata* (Wallich)


Diagnosis: Test ovoidal with wide base; pseudostome hexagonal in outline with obtuse angles surrounded by a short collar; test yellowish or chocolate brown, covered with tubercles or disc-shaped protruberances and composed of small platelets perfectly uniting the tubercles.

Distribution: India: West Bengal (North and South 24-Parganas districts); in the bottom ooze of freshwater bodies.

Remarks: Although *D. tuberculata* resembles *D. muriformis* to some extent in its external appearance still it can conveniently be differentiated from the latter by the presence of hexagonal pseudostome and tubercles which are more or less united with one another by endogenous platelets of the test (while in *D. muriformis* tubercles are almost discrete bodies).

90. *Difflugia urceolata* Carter


Diagnosis: Test spherical or ovoido-spherical; pseudostome circular; margin of the collar around pseudostome recurved or rolled towards exterior; test composed of angular quartz crystals and also diatomes; quartz crystals on the rim smaller than those of the spherical part of the test.

Distribution: India: West Bengal (Bankura, Hugli, Koch Bihar, Maldah, Nadia, Puruliya and South 24-Parganas districts); in freshwater amongst vegetation and in bottom ooze.

Genus *Heliopera* Leidy

91. *Heliopera sylvatica* Penard


Diagnosis: Test oval in broad view, compressed with smooth crown and sides; test membrane transparent with small scales on its surface having varied shapes and sizes; mouth convex with a narrow border devoid of any scale.

Distribution: India: West Bengal (Calcutta and South 24-Parganas districts); Kerala; in mosses.

Remarks: Nair and Mukherjee (1968) reported this species from the tree mosses mixed with lichens which were collected from South 24-Parganas, West Bengal. Subsequently Nair (1984) recorded this species from the mosses grown on the tree trunks of Calcutta as well as on wall tops at Calicut (Kerala) and studied its morphological variations.

Genus *Phryganella* Penard

92. *Phryganella hemispherica* Penard


Diagnosis: Test hemispherical, yellowish or brownish, covered with amorphous scales and sometimes sparsely with sand grains; mouth concentric, occupying two-third the oral side of the test; pseudopodia sharply pointed and radiating.

Distribution: India: West Bengal (South 24-Parganas district); in freshwater amongst bottom ooze; first report from India.

Genus *Plagiopyxis* Penard

93. *Plagiopyxis callida* Penard


Diagnosis: Test broadly hemispherical to ovoid in shape with a shallow depression on ventral side; aperture long, narrow with a concave upper lip and a more or less straight lower lip.
**Distribution**: India: West Bengal (Calcutta and Nadia districts); among ground mosses; Orissa.

**Remarks**: Nair and Mukherjee (1968) reported the occurrence of this species from the ground moss of Calcutta and Simurali (Dist. Nadia). Subsequently Guru and Das (1983) recorded this species from the soil of Orissa.

Class **FILOSEA**

Order **GROMIIDA**

Family **EUGLYPHIDAE**

Test composed of siliceous scales or plates cemented together. Five genera under this family have been collected/reported from this state.

**Key to the genera**

1(2) Test hyaline, aperture rugged or slightly expanded outwards ....................... *Paraeuglypha*

2(1) Test hyaline, aperture neither rugged nor expanded outwards

3(4) Aperture circular, oblique, invaginate, test compressed only anteriorly ............... *Trinema*

4(3) Aperture of various shape, not oblique or invaginate, test compressed in general

5(6) Aperture wide, linear, with flexible undulate borders, test with oval subcircular silicious scales........................................................................................................ *Placocista*

6(5) Aperture linear, bordered with denticulated scales or transparent membrane, test with circular, oval or scutiform silicious scales

7(8) Scales circular, overlapping, overlapping edges of scales very prominent, aperture bordered with transparent chitinous membrane drawn out into finger-shaped process ......................

........................................................................................................ *Tracheleuglypha*

8(7) Scales of various shape, imbricated and arranged in longitudinal rows, aperture bordered with regularly arranged denticulate scales .................................................................................. *Euglypha*

**Genus Euglypha** Dujardin

**Key to the species**

1(6) Pseudostome bordered with one or two rows of finely dentate scales

2(3) Base of test with 3-8 scales prolonged into spines, body scales elliptical ...... *E. acanthophora*

3(2) Test spineless, body scales oval or scutiform

4(5) Scales of the test oval, rarely circular, pseudostome usually bordered with one and occasionally with two rows of finely dentate scales ........................................ *E. tuberculata*

5(4) Scales of the test scutiform, pseudostome bordered with two rows of finely dentate scales ......

........................................................................................................ *E. scutigera*
6(1) Pseudostome not bordered with dentate scales
7(8) Scales bordering pseudostome terminated by a single semicircular projection \(\ldots\) \(E. \text{rotunda}\)
8(7) Scales bordering pseudostome without any semicircular projection
9(10) Scales of the test less visible, pseudostomal scales pointed and always shiny at their margin \(\ldots\) \(E. \text{loewis}\)
10(9) Scales of the test clearly visible, pseudostomal scales unevenly denticulated and not shiny at their margin \(\ldots\) \(E. \text{denticulata}\)

94. **Euglypha acanthophora** (Ehrenberg)


*Diagnosis*: Test ovoidal, pseudostome bordered with one or occasionally two rows of finely dentate scales; scales of the test elliptical or rarely circular; some scales at the base of the test and at posterior half prolonged into spines.

*Distribution*: India: West Bengal (Bankura, Haora, Hugli, Medinipur, North 24-Parganas, Puruliya and West Dinajpur districts); in freshwater bodies amongst vegetation and in bottom ooze; Andhra.

*Remarks*: The specimens collected from West Bengal mostly resemble *E. acanthophora* var. *flexuosa* Penard by the presence of flexuous spines. Some specimens with two to three tiers of flexuous spines at varying intervals are observed and reported earlier by Nair, Das and Mukherjee (1971).

95. **Euglypha denticulata** Brown


*Diagnosis*: Test glabrous, oval, aperture small, scales bordering aperture unevenly denticulated.

*Distribution*: India: West Bengal (Calcutta); in ground moss; First report from India.

*Remarks*: This species could so far be collected from the ground moss grown within the Indian Museum campus, Calcutta.
96. *Euglypha loevis* (Ehrenberg)


*Diagnosis*: Test oviform; scales bordering pseudostome pointed terminally always shiny at their margin and having wider gap in between their free ends.

*Distribution*: India: West Bengal (Calcutta); in ground moss; Andhra.

*Remarks*: This species was reported from West Bengal for the first time by Nair and Mukherjee (1968).

97. *Euglypha rotunda* Wailes


*Diagnosis*: Test oval, eight scales bordering pseudostome having a semicircular denticulate projections in each; imbrication of test scales displaying a hexagonal or rectangular pattern on the surface.

*Distribution*: India: West Bengal (Calcutta); in ground moss.

*Remarks*: Nair and Mukherjee (1968) reported this species from West Bengal for the first time.

98. *Euglypha scutigera* Penard


*Diagnosis*: Test oviform, without spine; scales of the test scutiform, disposed in alternate longitudinal rows; two rows of finely dentate scales on the margin of the pseudostome numbering 8-10 in each row.

*Distribution*: India, West Bengal (Bankura district); in freshwater ponds amongst bottom ooze; First report from India.

99. *Euglypha tuberculata* Dujardin


*Diagnosis*: Closely resembles *E. acanthophora* in shape, nature of pseudostomal scales and test scales but spines absent.
**Distribution**: India: West Bengal (Bankura, Darjiling, Hugli, Nadia, North 24-Parganas and West Dinajpur districts); in freshwater amongst vegetation and in bottom ooze.

**Genus Paraeuglypha Penard**

100. *Paraeuglypha indica* Nair and Mukherjee


**Material examined**: 5 exs., Gopalnagar (Lakshmikantapur), South 24-Parganas, 2.xi.1966, K.N. Nair.

**Diagnosis**: Test hyaline, small, delicate, roughly spindle-shaped, with horn like projection at the posterior end; pseudostome with a slightly expanded rim, test composed of small hexagonal plates, having a reticulated appearance.

**Distribution**: India: West Bengal (South 24-Parganas district); in freshwater.

**Remarks**: Nair and Mukherjee (1968) described this species from the bottom ooze of a freshwater pond in the locality mentioned in the column material examined.

**Genus Placocista Leidy**

101. *Placocista lens* Penard


**Material examined**: 3 exs., Gopalnagar, Lakshmikantapur, South 24-Parganas, 2.xi.1966, K.N. Nair.

**Diagnosis**: Test very much compressed, broadly oval, covered with small oval shaped silicious scales; pseudostome bordered by a delicate membrane.

**Distribution**: India: West Bengal (South 24-Parganas district); in the bottom ooze of freshwater ponds.

**Genus Tracheleuglypha Deflandre**

102. *Tracheleuglypha dentata* (Vejdowsky)

1953. *Tracheleuglypha dentata* (Vejdowsky); Deflandre, *Traite de Zoologie*, 1(2), p.133, fig. 94 G.


**Diagnosis**: Test oval, hyaline, test scales circular, overlapping edges of test scales very prominent due to extra thickness of cement; pseudostome bordered by transparent chitinous membrane drawn out into finger like process.

**Distribution**: India: West Bengal (Calcutta, Haora and Hugli districts); in ground moss and in freshwater; Andhra.

**Remarks**: This species is commonly found in ground moss. Only in one occasion it has been collected among vegetation in a freshwater pond at Kamarkundu, Hugli district.
Genus **Trinema** Dujardin

103. *Trinema enchelys* (Ehrenberg)

1838. *Difflugia enchelys* Ehrenberg, *Infusionsthiere*, p.132, pl.9, fig. 4 a,b.


*Diagnosis*: Test small, ovoid, anteriorly compressed, scales circular and imbricated; pseudostome circular bordered by small incurved silicious plates.

*Distribution*: India: West Bengal (Bankura, Calcutta, Koch Bihar, Haora, Hugli, Medinipur, North 24-Parganas, Puruliya, South 24-Parganas districts); in freshwater amongst vegetation and in bottom ooze as well as on ground moss; Sikkim Himalayas.

104. *Trinema lineare* Penard


*Diagnosis*: Shape of the test closely resembles that of *T. enchelys*, but scales of test not distinct.

*Distribution*: India: West Bengal (North 24-Parganas district); in freshwater amongst vegetation and bottom ooze.

*Remarks*: Nair, Das and Mukherjee, (1971) reported this species from West Bengal for the first time. Since then no further collection of this species from the state could be made.

Class **GRANULORETICULOSEA**
Order **ATHALAMIDA**

Under this order a single family Biomyxidae is represented from this state.

Family **BIOMYXIDAE**

Body shape inconstant; initial form spherical, cytoplasm colourless, finely granulated, capable of expanding and extending in any direction forming numerous freely branching reticulopodia. Monogereric family with the genus *Biomyxa* which exhibits all the characters of the family.

Genus **Biomyxa** Leidy

105. *Biomyxa vagans* Leidy


Diagnosis: Shape of the main part of the body greatly variable, numerous small contractile vacuoles in body and pseudopodia.

Distribution: India: West Bengal (Calcutta, North 24-Parganas and Nadia districts); in sphagnous swamps and bog water.

Remarks: Simmons (1891 b, c) was the first to report this species from Calcutta. Subsequently B. vagans has been collected from 24-Parganas and Nadia districts during the local surveys.

Order MONOTHALAMIDA

Under this order also a single and monogeneric family Lieberkuhniidae with the genus Lieberkuhnia is known so far from the state.

Family LIEBERKUHNIIDAE

Test ovoidal or spherical, aperture usually single, lateral or subterminal, pseudopodia formed from a long peduncle, reticulate and often enveloping test.

Genus Lieberkuhnia Clapere de and Lachmann

Exhibits all the characters of the family.

106. Lieberkuhnia paludosa (Cienkowski)


Diagnosis: Test ovoidal with an uniform test membrane, aperture subterminal, oblique, pseudopodia originating from a peduncle, reticulate and anastomosing; primary contractile vacuole located at the base of peduncle followed by three small accessory vacuoles arranged close to each other.

Distribution: India: West Bengal (Calcutta); in freshwater amongst vegetation and sometimes in ground moss.

Remarks: Nair and Mukherjee (1968) reported this species from the ground moss of Calcutta.

Superclass ACTINOPODA
Class HELIOZOE A
Order DESMOTHORACIDA
Family CLATHRULINIDAE

Body enclosed in usually spherical, latticed organic capsule stalked in most species, microtubular stiffening elements not discernable as axonemes.

Genus Clathrulina Cienkowski

Envelope spherical, homogeneous, with numerous regularly arranged openings, with stalk, protoplasm central, not filling the capsule.
107. *Clathrulina elegans* Cienkowsky


*Diagnosis*: Envelope colourless to brown, perforated by many large circular or polygonal openings; solitary or colonial.

*Distribution*: India: West Bengal (Hugli, Koch Bihar, North 24-Parganas districts); in submerged vegetation of freshwater bodies.

*Remarks*: This species was first reported by Nair, Das and Mukherjee (1971) from West Bengal. During the recent survey colonies with 6-7 individuals were observed and collected from Koch Bihar district.

**Order** ACTINOPHRYIDA

**Family** ACTINOPHRYIDAE

Axopods radiating, cytoplasm highly vacuolated, skeletal structure lacking. A single genus, *Actinophrys* is dealt with in the paper.

Genus *Actinophrys* Ehrenberg

Axopodia straight, numerous, axial filaments terminating at surface of nucleus, nucleus central.

108. *Actinophrys sol* Ehrenberg


*Diagnosis*: Spherical, ectoplasm vacuolated, endoplasm granulated and with many small vacuoles.

*Distribution*: India: West Bengal (Calcutta, Haora and Hugli districts); in longstanding still water amongst vegetation.

**Order** CENTROHELIDA

Under this order also a single family Acanthocystidae with the single genus *Acanthocystis* has so far been recorded from this state.

**Family** Acanthocystidae

Frequently with skeletal structure of siliceous plates and/or spines or of organic spicules.

Genus *Acanthocystis* Carter

A distinct central granule in which axial filaments terminate, siliceous scales arranged tangentially, radiating siliceous spines with pointed or bifurcated ends.
109. *Acanthocystis spinifera* Greef


*Diagnosis:* Body spherical with numerous slightly curved radiating spines of unequal length; nucleus eccentric; contractile vacuole single.

*Distribution:* India: West Bengal (Hugli district); in standing still freshwater bodies amongst vegetation.

- Phylum: CILIOPHORA
- Class: KINETOFRAKMINOPHOREA
- Subclass: GYMNOSTOMATIA
- Order: PROSTOMATIDA
- Suborder: PROSTOMATINA

Under this suborder a single family Holophryidae with single genus *Holophrya* is represented from West Bengal.

- Family: HOLOPHRYIDAE

Body radially symmetrical, ciliation uniform, cytopharyngeal apparatus simple rhabdos type.

- Genus: *Holophrya* Ehrenberg

Cytostome round, simple and without any ciliary ring around it, cytopharynx absent or a short simple tube with or without trichites.

**Key to the species**

1(2) Macronucleus single, spindle-shaped; contractile vacuole single, subterminal close to one side

...............................................................*H. bengalensis*

2(1) Macronuclei two, spherical, contractile vacuole single, lateral and located at anterior half .......

...............................................................*H. annandalei*

110. *Holophrya annandalei* Ghosh


*Diagnosis:* Body cylindrical with rounded ends; cytostome subapical and circular; cytopharynx a slight depression; macronuclei two, spherical; contractile vacuole single, lateral and located at anterior half.

*Distribution:* India: West Bengal (Calcutta); in freshwater.

*Remarks:* This species is not reported since its first description by Ghosh (1919). Bhatia (1936) pointed out that position of macronuclei is very unusual for a species of this genus.
111. *Holophrya bengalensis* Ghosh


**Diagnosis**: Body cylindrical, rounded at both ends; cytostome apical and circular; cytopharynx absent; macronucleus single, spindle-shaped; contractile vacuole single, subterminal and close to one side.

**Distribution**: India: West Bengal (Calcutta); in freshwater, Rajasthan.

**Remarks**: Based on the examination of a single specimen Ghosh (1919) described this species (see Bhatia 1936). Subsequently Mahajan (1965) recorded this species from Rajasthan and created a subspecies *minor* on the size difference (75 μm x 37 μm in *bengalensis* verses 34.2 - 48.9 μm x 16-19.5 μm in *bengalensis minor*).

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**Suborder** PRORODONTINA

**Key to the families**

1(2) Body barrel-shaped bearing armoured plates in longitudinal rows, cytostome round, without any prominent ciliation near anterior end.........................................................COLEPIDAE

2(1) Body oval to elongate, without bearing any armoured plate, cytostome and ciliation as above...

.................................................................PRORODONTIDAE

Family PRORODONTIDAE

Under this family three genera are dealt with.

**Key to the genera**

1(4) Body oval to cylindrical, symmetrical, contractile vacuole near posterior end, large terminal vacuole absent, macronucleus spherical or oval (in one species horse-shoe shaped)

2(3) Uniform ciliation throughout the body, oral basket made up of double trichites, cytostome not surrounded by ring of heavier cilia ..........................................................*Prorodon*

3(2) Ciliation uniform but posterior region may be without cilia; cytostome surrounded by a ring of heavier cilia, oral basket not visible or made up of double tichites.................*Urotricha*

4(1) Body ovoidal to vermiform, asymmetrical, contractile vacuoles with several pores, large terminal vacuole may be present, macronucleus usually long and attenuate.................................

.................................................................*Pseudoprorodon*

**Genus** *Prorodon* Ehrenberg

**Key to the species**

1(6) Pharyngeal tube with trichites, extending usually upto one-fourth and sometimes upto one-third of the body

2(3) Macronucleus horse-shoe shaped.................................................................*P. stewarti*
3(2) Macronucleus spherical
4(5) Body oval, narrowed posteriorly ................................., P. discolor
5(4) Body ovoid with truncated anterior end and rounded posterior end ................. P. teres
6(1) Pharyngeal tube without trichites, extending up to middle of the body............. P. endentatus

112. Prorodon discolor (Ehrenberg)


Diagnosis : Body oval, narrower posteriorly, mouth terminocentral, pharyngeal tube with trichites extending above one-fourth of the body; macronucleus single, rounded; contractile vacuole single and situated near posterior end.

Distribution : West Bengal (Calcutta); in freshwater.

Remarks : The only specimen was collected and reported from West Bengal by Mahajan and Nair (1971).

113. Prorodon edentatus Claparede and Lachmann


Diagnosis : Body ovoid or ellipsoidal; mouth terminal and eccentric; pharyngeal tube without trichites, extending diagonally up to middle of the body; macronucleus single, oval and elongate, contractile vacuoles single and located at posterior end.

Distribution : India: West Bengal (Calcutta); in freshwater.

Remarks : Mahajan and Nair (1971) reported the occurrence of this species from West Bengal and India for the first time.

114. Prorodon stewarti Ghosh


Diagnosis : Body elongately oval, rounded at both ends; mouth terminal and slightly lateral, pharyngeal tubes with trichites, extending one-fourth to one-third the length of the body; macronucleus horse-shoe shaped, contractile vacuoles two in number and located at the posterior half of the body.

Distribution : India: West Bengal (Calcutta); in freshwater.

Remarks : This species has never been reported since its first description by Ghosh (1928). Its horse-shoe shaped nucleus and position of contractile vacuole make it unique from its other congeneric species. Kahl (1930) and Bhatia (1936), however, doubt its placement under the genus Prorodon.
115. *Prorodon teres* Ehrenberg  


*Diagnosis*: Body ovoid, anterior end slightly narrowed and posterior end considerably rounded; mouth terminal, pharyngeal tube slightly conical and with trichites, extending about one-fourth of the body length; contractile vacuole single and terminal, macronucleus spherical.  

*Distribution*: India: West Bengal (Calcutta); in freshwater bodies.  

*Remarks*: This species was reported from West Bengal by Mahajan and Nair (1971).  

Genus *Pseudoprorodon* Blochmann  

116. *Pseudoprorodon lieberkuhni* Butschli  

*Material examined*: 1 ex., Gopal Nagar (Lakshmikantapur), South 24-Parganas, 2.xi.1966, K.N. Nair; 1 ex., Falta, South 24-Parganas, 20.viii.1965, K.N. Nair.  

*Diagnosis*: Body slender vermiform, 600-800 μm in length, anterior end distinctly flattened and posterior end rounded; contractile vacuole in 4 to 5 series.  

*Distribution*: India: West Bengal (South 24-Parganas); first record from India.  

*Remarks*: This species has been collected from Gopalnagar (Lakshmikantapur, South 24-Parganas) from a medium sized freshwater pond. The specimen collected from Falta (South 24-Parganas) and identified as *Pseudoprorodon gigas* da Cunha (ZSI Reg. No. pt. 1564) also belongs to *P. lieberkuhni* (see Kahl, 1930).  

Genus *Urotricha* Claparede & Lachmann  

117. *Urotricha* sp.  

*Distribution*: India: West Bengal (Calcutta).  

*Remarks*: Chaudhuri (1929) recorded *Urotricha* sp from soils of Calcutta, without mentioning any specific identify.  

Family COLEPIDAE  

Under this family a single genus *Coleps* is known from West Bengal.  

Genus *Coleps* Nitzsch  

Body barrel-shaped, with regularly arranged ectoplasmic plates, anterior end truncate, posterior end rounded often with spinous projections, cytostome apical and terminal, surrounded with slightly larger cilia.
118. *Coeps hirtus* (Muller)


*Diagnosis*: Ectoplasmic plates 18-20; anterior margin denticulate, posterior end with three spinous projections.

*Distribution*: India: West Bengal (in all 17 districts); Rajasthan; Jammu & Kashmir.

**Suborder** HAPTORINA

Under this suborder five families are dealt with

1(8) Cytostome apical

2(3) Retractile non-suctorial tentacles widely distributed over the body in addition to uniform holotrichous body ciliature

3(2) Holotrichous body ciliature present but tentacles absent

4(5) Ciliation reduced to one or more circumferential bands on the body

5(4) Ciliation uniform

6(7) Body usually flask-shaped and flattened, with truncate anterior end, cycostome on apical non-ciliated ridge

7(6) Body of variable shape, but anterior end not truncate, cycostome in many species located at distal end of long flexible neck

8(1) Cytostome at the base of the proboscis, located at considerable distance from anterior end of the body

**Family** ENCHELYIDAE

Key to the genera

1(2) Body, cylindrical, spindle or flask-shaped with a long contractile proboscis, cycostome round and located on the summit of the proboscis

*Lacrymaria*
2(1) Body flask-shaped, anterior end truncate, without any contractile proboscis; cytostome slit like, rarely round and apically located .........................................................*Enchelys*

Genus *Lacrymaria* Ehrenberg

Key to the species

1(2) Body elongate, neck very long and highly contractile with well developed oral cone ..... *L. olor*

2(1) Body cylindrical, neck ill developed and almost non contractile

3(4) Body cylindrical with rounded posterior end, cytoplasm with characteristic dumble-shaped granules.........................................................*L. pupula*

4(3) Body more or less cylindrical with abruptly pointed posterior end, cytoplasm colourless, hyaline with out any characteristic granule .........................................................*L. minima*

119. *Lacrymaria minima* Kahl


*Material examined*: 1 ex., Adisaptagram, Hugli, 5.i.1967, K.N. Nair,

*Diagnosis*: Body cylindrical, slender, with abruptly pointed posterior end; neck small, non-contractile, cytoplasm colourless, hyaline, contractile vacuole single, located near posterior end, macronucleus single, oval.

*Distribution*: India: West Bengal (Hugli district); in freshwater; new record from India.

120. *Lacrymaria olor* (Muller)


*Diagnosis*: Body elongate, posterior portion cylindrical with pointed posterior end; neck long, highly contractile, oral cone well developed, contractile vacuoles two in number and located on either end of cylindrical body portion; macronucleus with two rounded parts united together.

*Distribution*: India: West Bengal (Bankura, Barddhaman, Calcutta, Hugli, Koch Bihar, South 24-Parganas districts); in freshwater. Orissa, Rajasthan.

121. *Lacrymaria pupula* (Muller)

1786. *Enchelys pupula* Muller, Animalc. fluviat et. marina. etc., Havniae et Lipsiae, p.75.

*Material examined*: 2 exs., Mohanpukur (Belmuri), Hugli, 10.x.1986, K.N. Nair.

*Diagnosis*: Body cylindrical with rounded posterior end, neck ill developed and non contractile and seen in stretched forms only; cytoplasm with characteristic dumble-shaped granules; longitudinally
arranged fine granules in the alveolar layer; contractile vacuole single and terminal; macronucleus single and ellipsoidal.

**Distribution**: India: West Bengal (Hugli district); in freshwater; new record from India.

**Genus** *Enchelys* O.F. Muller

122. *Enchelys* sp.

**Distribution**: India: West Bengal (Haora district); in soil.

**Remarks**: Choudhuri (1929) reported this form from the soils of cultivated fields of Sibpur (Haora).

**Family** Spathidiidae

**Key to the genera**

1(2) Cytostome slit-like, located anteriorly but not at the anterior tip, ventral ridge with closely arranged trichocysts .................................................. *Bryophyllum*

2(1) Cytostome slit-like and occupy anterior end almost completely, ventral ridge lacking ..........

............................ *Spathidium*

**Genus** *Bryophyllum* Kahl

123. *Bryophyllum* spathidioides V. Gelei


**Material examined**: 4 exs., Mohanpukur (Belmuri), Hugli, 10.x.1968, K.N. Nair.

**Diagnosis**: Body flask-shaped, flattened, hyaline with feeble dorsal elevation; ventral ridge with closely set trichocyst continuing upto to the opposite side to some distance; 15-16 ciliary rows, big elongated nucleus.

**Distribution**: India: West Bengal (Hugli district). New record from India.

**Remarks**: Majority of the species under the genus *Bryophyllum* are moss-inhabiting. But the present species has been collected from a freshwater pond of Belmuri (Hugli district) on the surface scum with full bacterial growth as well as from decaying pistea leaf.

**Genus** *Spathidium* Dujardin

Under this genus two species have been collected from West Bengal.

**Key to the Species**

1(2) Macronucleus resembling a long chain of small beads, beads of which sometimes disjointed, inhabit freshwater .......................................................... *S. moniliforme*

2(1) Macronucleus long, band form, posterior portion often recurved; moss inhabiting ..........

............................ *S. muscicola*

124. *Spathidium moniliforme* Bhatia


Diagnosis: Body elongated, flask-shaped, anterior end obliquely truncate; cytostome narrow slit-like occupying anterior end almost completely; macronucleus moniliform, beads of which sometimes disjointed; contractile vacuole single and located at posterior end.

Distribution: India: West Bengal (Birbhum, Hugli and Maldah districts); in freshwater. New record from India.

125. Spathidium muscicola Kahl


Diagnosis: Body flask-shaped with truncated anterior end; cytostome, resembling those of S. moniliforme; macronucleus long, bandform, posterior portion of which often recurved.

Distribution: India: West Bengal (Calcutta and Darjiling districts); from ground and rock moss. New record from India.

Family TRACHELIIIDAE

Key to the genera

1(2) Body elongate, anterior end with very conspicuous neck-like prolongation, posterior end sharply pointed or drawn out into a tail-like process (occasionally cuspidate). .......... Dileptus

2(1) Body oval to spherical, anterior end with a short finger-like process, posterior end rounded ....

.......................... .......................................................... Trachelius

Genus Dileptus Dujardin

Key to the species

1(2) Macronucleus divided into 100 or more discoid bodies ............................................ D. anser

2(1) Macronucleus moniliform .......................................................... D. monilatus

126. Dileptus anser (Muller)

1773. Vibrio anser O. F. Muller, Animalc. Infusoria fluviat. et. marina, etc. Havniae et Lipsiae. pp. 73, 74, pl. 10, figs. 7-11.

**Diagnosis**: Body elongate with a tail-like projection at the posterior end, neck elongated, contractile and one-half to as long as total length of the trunk; cytostome funnel-shaped and located at the base of the neck; macronuclei many, discoid in shape and scattered, contractile vacuoles also many and arranged in a row.

**Distribution**: India: West Bengal (Bankura, Calcutta, Hugli, Jalpaiguri, Koch Bihar, North and South 24-Parganas and West Dinajpur districts); Rajasthan.


**Diagnosis**: Body elongated, posterior end uniformly cuspidate, neck elongated contractile and about one-fourth to one-half the length of the trunk; cytostome resembling previous species; macronucleus ovoid, contractile vacuole many.

**Distribution**: India: West Bengal (Hugli district); in freshwater; new record from India.

**Genus** *Trachelius* Schrank

**Key to the species**

1(2) Spheroidal to ellipsoid in shape, anterior end with distinct finger-like proboscis, macronucleus sausage-shaped .............................................................................................. *T. ovum*

2(1) Elongated-pyriform, anterior extremity pointed but without any proboscis, macronucleus numerous and scattered .................................................................................... *T. gutta*


**Diagnosis**: Elongated-pyriform in shape with rounded posterior end; anterior extremity pointed and curved dorsally without any proboscis, macronucleus numerous and scattered, contractile vacuole single and posterterminal.

**Distribution**: India: West Bengal (Calcutta).

**Remarks**: Ghosh (1920a, 1921a) recorded this species from putrefying vegetable infusions in Calcutta. Bhatia (1936), however, doubted the correctness of this identification.

129. *Trachelius ovum* Ehrenberg


**Diagnosis**: Body spheroidal to ellipsoid, anterior end with finger like proboscis curved dorsally and posterior end broadly rounded; cytostome located at the base of the proboscis, macronucleus sausage shaped; contractile vacuole many.

**Distribution**: India: West Bengal (Calcutta and Hugli districts); in freshwater. Rajasthan.
Family DIDINIIDAE
Genus *Dudinium* Stein

Barrel-shaped body with rounded posterior end; girdles of cilia one to several; cytostome expansible and located at the tip of the proboscis, macronucleus horse-shoe shaped.

130. *Didinium nasutum* (Muller)


*Diagnosis*: Body barrel-shaped, two girdles of cilia - one near the base of the proboscis, the other below posterior half; macronucleus horse-shoe shaped, contractile vacuole single and located at posterior end.

*Distribution*: India: West Bengal (Calcutta and Maldah districts); in freshwater. Rajasthan.

Family ACTINOBOLINIDAE
Genus *Actinobolina* Strand

Ovate or spherical in shape, macronucleus band like and curved, contractile vacuole single and terminal.

131. *Actinobolina radians* Stein


*Diagnosis*: Ovoid, posterior end broadly rounded, cytostome subapical, prominent; cytopharynx with distinct trichites; cilia at lower spiral rib dense, long and very delicate, retractile tentacles distinctly visible, macronucleus sausage shaped with several micronuclei.

*Distribution*: India: West Bengal (Calcutta). New record from India.

Order PLEUROSTOMATIDA

Under this order single family Amphileptidae is represented from this state.

Family AMPHILEPTIDAE

Body lanceolate and laterally compressed; slit-like cytostome located at the convex ventral border of the anterior part of the of the body. Under this family three genera as follows are represented from this state.

Key to the genera

1(3) Ciliation uniform and complete

2. Body lanceolate, contracile, cytostome slit-like, located on the convex border of the body, without trichocyst, contractile vacuole many, macronucleus two or more. *Amphileptus*
3(1) Ciliation only on right side

4(5) Body elongated, often curved in 'S'-shaped manner, with a neck at anterior part and without trichocyst borders, cytostome similar to that of *Amphileptus* but with trichocysts, contractile vacuole one to many, macronucleus bipartite........................................... *Litonotus*

5(4) Body leaf-like, flattened, contractile and pointed at both ends, presence of a hyaline border on ventral side, reaching posterior end bearing trichoysts, cytostome as in previous genus; contractile vacuole one to many, macronucleus single or moniliform........... *Loxophyllum*

**Genus *Amphileptus* Ehrenberg**

132. *Amphileptus* sp.

*Distribution* : India : West Bengal (Calcutta).

*Remarks* : Simmons (1891) reported this species from a freshwater pond of Calcutta without mentioning its specific identity.

**Genus *Loxophyllum* Dujardin**

1(2) Macronuclei two in number, usually asymmetrical in shape ...................... *L. niemeccense*

2(1) Macronuclei many, symmetrical in shape

3(4) Body leaf-like with smooth border, macronuclei 7-15 in number, globular and scattered.............. ........................................................................................................... *L. levigatum*

4(3) Body leaf-like with undulating border, macronuclei many, elliptical and arranged along ventral line................................................................................................. *L. undulatum*

133. *Loxophyllum levigatum* Sauerbey


*Material examined* : 3 exs., Gopalganj (Lakshmikantapur), South 24-Parganas, 2.xi.1966, K. N. Nair.

*Diagnosis* : Body leaf-like, anterior end with distinct beak, posterior end rounded; body margin smooth; macronuclei 7-15 in number, globular and scattered; contractile vacuole single and located at posterior end on dorsal side.

*Distribution* : India : West Bengal (South 24-Parganas district); in freshwater. New record from India.

134. *Loxophyllum niemeccense* (Stein)

1859. *Opisthodon niemeccense* Stein, Der organismus der Infusionsthier, Leipzig, I.


*Diagnosis* : Body flat, leaf-like, asymmetrical, anterior end acuminate, posterior end somewhat blunt; macronuclei two in number; contractile vacuole single and located at the middle of the body on dorsal side.
Distribution: India: West Bengal (Birbhum, Hugli and Murshidabad districts); in freshwater. New record from India.

135. *Loxophyllum undulatum* Sauerbrey


*Diagnosis:* Body flat, leaf-like, distinct beak at anterior end, posterior end very broadly rounded, body margin undulating; macronuclei many, elliptical and arranged along ventral line; contractile vacuole single, its location same as in *L. levigatum*.

*Distribution:* India: West Bengal (Haora district); in freshwater. New record from India.

Genus *Litonotus* Wrzesniowski

Under this genus following four species are reported from West Bengal.

Key to the species

1(4) Macronucleus single

2(3) Macronucleus reniform, contractile vacuole single ........................................... *L. infusionus*

3(2) Macronucleus bilobed, contractile vacuole 5-6, arranged in two rows ..................... *L. similis*

4(1) Macronucleus consisting of two discrete lobes

5(6) Two lobes of macronucleus spherical and united to one another by a thread, contractile vacuole single ................................................................. *L. fasciola*

6(5) Two lobes of macronucleus elliptical united together by a thread or discrete, contractile vacuole several and arranged in two rows ........................................... *L. procera*

136. *Litonotus fasciola* (Ehrenberg)


*Diagnosis:* Body lanceolate, non contractile, neck not always sharply distinguished from body; macronucleus subcentral, consisting of two spherical lobes united to one another by a thread; contractile vacuole single and located near the posterior end of the body.

*Distribution:* India: West Bengal (Calcutta), Maharastra, Rajasthan, Jammu & Kashmir.

*Remarks:* Ghosh (1921 a) reported this species from dirty water of Calcutta.

137. *Litonotus infusionus* Ghosh


*Diagnosis:* Body lanceolate, with widest mid portion and rounded posterior end; macronucleus single and reniform located at the anterior end of body; contractile vacuole single and located near the posterior and of the body.
Distribution: India: West Bengal (Calcutta).

Remarks: Ghosh (1920a) described this species from hay infusion and pond water from Calcutta. This species could not be collected since its original description.

138. Litonotus procera Penard

1922. Litonotus procera Penard, Etudes Sur les Infusories eau douce, Geneve, p. 69, fig. 75.


Diagnosis: Flask-shaped, elongated, posterior end tail-like, anterior end with a distinct neck; macronucleus consisting of two elliptical lobes which may be discrete or united by a fine thread; contractile vacuole many and arranged in two lateral rows.

Distribution: West Bengal (Hugli and Maldah districts); in freshwater. Rajasthan.

Remarks: Mahajan (1971) was the first to report this species from India (Rajasthan) under the name, Heimiophrys procera (Penard). Specimens collected from West Bengal quite resemble Rajasthan form excepting that lobes of macronucleus are elliptial in the present material (vs spherical lobes in Rajasthan form). The basic characteristic feature of ciliation and shape of macronucleus fit well with the generic characters of Litonotus. This observation is quite in conformity with Kudo (1966). Corliss (1979), however, indicated a probability of placement of the genus Heimiophrys under the genus Amphileptus. But characteristic features of H. procera do not support this proposition. Therefore, this the present species is placed under the genus Litonotus for the reasons as stated above.

139. Litonotus similis Ghosh


Diagnosis: Body lanceolate, widest behind middle, with bluntly rounded posterior end; macronucleus bilobed, contractile vacuole 5-6 in number and arranged in two rows.

Distribution: Ghosh (1921 a) described this species from vegetable infusions of Calcutta. This species has not been collected since its description.

Order KARYORELICTIDA

Under this order two families are dealt with.

Key to the families

1(2) Body fragile, usually extremely elongate, thigmotactic cilia primarily on ventral side, cytostome apical ............................................................... TRACHELOCERCIDAE

2(1) Body elongate or lancet-like, laterally compressed, ciliation on right side only, cytostome when present slit-like located on concave body surface.......................... LOXODIDAE
Family TRACHELOCERCIDAE
Genus *Trachelocerca* Ehrenberg

Elongated, vermiform or flask-shaped with drawn out anterior end, cytostome apical surrounded by a circket of cilia, no neck or any constriction marking off the anterior portion, no spiral striation when constricted.

140. *Trachelocerca* sp.

*Distribution*: India: West Bengal (Calcutta).

*Remarks*: Simmons (1891) reported this form from 'pond water' of Calcutta without giving any specific identification. This generic identification seems to be doubtful as all the species of *Trachelocerca* reported so far are known from marine waters only.

Family LOXODIDAE

Under this family single genus *Loxodes* has been reported so far from this state.

Genus *Loxodes* Ehrenberg

Leaf-like, flattened, anterior end with beak curved ventrally, right surface slightly convex, uniform ciliation on several longitudinal rows, macronuclei two or more, 2-25 strongly refractile Muller’s vesicles in dorsal region.

Key to the species

1(4) Macronuclei two in number

2(3) Body leaf-like with rounded posterior end; both the macronuclei lying close to each other........

3(2) Body leaf-like with pointed posterior end, both macronuclei 35-50 \( \mu m \) apart from each other...

4(1) Macronuclei many and scattered in endoplasm................................................. *L. magnus*

141. *Loxodes magnus* Stokes


*Diagnosis*: Large in size (400 \( \mu m \) - 750 \( \mu m \)) leaf-like, flattened, anterior end beak-like and curved ventrally, posterior end rounded; macronuclei many and scattered in endoplasm; 10-20 Muller’s vesicles visible.

*Distribution*: India: West Bengal (Calcutta, Koch Bihar, Puruliya, North & South 24-Parganas and West Dinajpur districts); in freshwater.
Remarks: Mahajan and Nair (1965) were the first to report this species from India, that too, from Calcutta.

142. *Loxodes striatus* (Engelmann)


Diagnosis: General shape as in *L. magnus* but smaller in dimension (120 μm x 47 μm), posterior end pointed; macronuclei two in number and lying about 35-50 μm apart from each other; few (4 to 7) Muller's vesicles observed.

Distribution: India: West Bengal (Bankura, Calcutta and North 24-Parganas and Puruliya districts); in freshwater. Jammu & Kashmir, Rajasthan.

Remarks: This species was earlier reported from West Bengal by Mahajan and Nair (1965).

143. *Loxodes vorax* Stokes


Diagnosis: General body shape and size as in *L. striatus* but posterior end rounded; macronuclei two in number and lying vary close to each other; Muller's vesicles not observed.

Distribution: India: West Bengal (North 24-Parganas district); in freshwater. New record from India.

144. *Loxodes* sp.

Distribution: India: West Bengal (Calcutta).

Remarks: Simmons (1891) reported this form from pond water, of Calcutta without mentioning its specific identity.

Subclass VESTIBULIFERIA
Order TRICHOSTOMATIDA
Suborder TRICHOSTOMATINA
Family PLAGIOPYLIDAE

Body dorsoventrally flattened with uniform ciliation, cytostome and vestibulum anteriorly located.

Genus *Plagiopyla* Stein

Vestibulum a broad ventrally opened groove from which body ciliation begins, vestibular cilia short excepting at the anterior end where a tuft of longer cilia present.
145. *Plagiopyla nasuta* Stein


*Diagnosis*: Body reniform or ovoid, narrower anteriorly; cytostome situated near median line at the end of peristome; cytopharynx long; single and terminal contractile vacuole; macronucleus round.

*Distribution*: India: West Bengal (Calcutta, Hugli and South 24-Parganas districts); in fresh and brackish water. Orissa.

*Remarks*: Nair and Mahajan (1965) reported this species for the first time from India, that too from Calcutta. Subsequently Das and Nair (1987) recorded this species from the Chilka Lagoon, Orissa. *P. nasuta* has been collected from freshwater bodies of different districts of West Bengal (Nair and Mahajan, 1965 and present report) as well as from brackishwater of Chilka Lagoon, Orissa (Das and Nair, *op. cit.*).

**Order COLPODIDA**

**Key to the families**

1(2) Body typically reniform, with distorted ciliary rows, no conspicuous ciliary tuft at anterior end ............................................................................................................ COLPODIDEA

2(1) Body narrow-ovoid, ciliation uniform but sparse, with conspicuous anterior ciliary tuft ........

**Family COLPODIDAE**

Under this family single genus *Colpoda* has been reported/collected from this state.

**Genus Colpoda** Muller

Body kidney-shaped, cytostome present in the ventral depression, leading into peristomeal cavity and giving rise to a diagonal groove at dorsal side, a ciliated area present in the right edge of the cytostome.

**Key to the species**

1(2) Cytostome located at about middle of the flattened ventral side, 8-10 frontal dentations and 29-34 meridians present ................................................................. *C. cucullus*

2(1) Cytostome located at about one-third to one-fourth from the anterior end; 6-7 frontal dentations and 14-18 meridians present

3(4) Cytostome at about one-third from the anterior end, 6-7 frontal dentations and 14-16 meridians present ................................................................. *C. aspera*

4(3) Cytostome at about one-fourth from the anterior end, 6-7 frontal dentations but 16-18 meridians present ................................................................. *C. maupasi*
146. *Colpoda aspera* Kahl


*Diagnosis*: Body somewhat bean shaped; cytostome at about one-third from the anterior end; frontal dentations 6-7 and meridians 14-16, macronucleus spherical, contractile vacuole single and posterior.

*Distribution*: India: West Bengal (Calcutta, and Murshidabad districts); in freshwater.

*Remarks*: Mahajan and Nair (1965) were the first to report this species from West Bengal.

147. *Colpoda cucullus* Muller

1773. *Colpoda cucullus* O.F. Muller, Verminum terrest et. fluviatil S. animal infusor. etc. historia., IIafniae et Lipsiae, I & II.


*Diagnosis*: Body typically kidney-shaped, cytostome located about middle of the body, frontal dentations 8-10 and meridians 29-34; macronucleus oval; contractile vacuole as in *C. aspera*.

*Distribution*: India: West Bengal (Calcutta). Andhra Pradesh, Assam, Karnataka, Jammu & Kashmir, Maharashtra, Madhya Pradesh, Orissa, Punjab, Tamil Nadu, Uttar Pradesh.

*Remarks*: This species has earlier been reported from soil, vegetable infusion and freshwater with hay infusions from different states of India as stated above. The present material has been collected from the ground moss grown within the Indian Museum campus, Calcutta.

148. *Colpoda maupasi* Enriques


*Diagnosis*: Body oval and cylindrical, cytostome located at about one-fourth of the body from the anterior end, frontal dentations 6-7 and meridians 16-18, macronucleus spherical.

*Distribution*: India: ‘Bengal’ (exact locality not cited) (see Sandon, 1927).

149. *Colpoda* sp.

*Distribution*: India: West Bengal (Calcutta).

*Remarks*: Knowles(1927) observed this form in cultures of *Paramecium* and reported as *Colpoda* sp. without mentioning its specific identity.

Family CYROTOLOPHOSIDIDAE

Under this family two genera have been reported from this state.

**Key to the genera**

1(2) Peristome short, located at the anterior margin of the ventral surface, left posterior and right margins of the peristome with a bag-like undulating membrane, which may be withdrawn into the peristome.................................................................*Cryptolophosis*
2(1) Peristome narrow, posteroterminal surrounded by ventral, left dorso-lateral and a right dorso-lateral lobe and, with a row of well developed membranelles.............Opisthostomatella

Genus Cytolophosis Stokes

Key to the species

1(2) Body elongate and narrow, cilia long, sparsely scattered and not arranged in longitudinal rows.................................C. elongatus

2(1) Body ovoid with broadly rounded posterior end, cilia short, uniform and arranged in distinct longitudinal rows.................................C. minutus

150. Cytolophosis elongatus (Schewiakoff)


Diagnosis: Body elongate and narrow with long sparsely scattered cilia not arranged in longitudinal rows; macronucleus oval and centrally located; contractile vacuole single and posterior.

Distribution: West Bengal (Calcutta and Haora districts). Assam, Bihar, Karnataka, Jammu & Kashmir, Maharashtra, Madhya Pradesh, Orissa, Punjab, Tamil Nadu, Uttar Pradesh.

Remarks: This is a very small ciliate (28-30 μm × 10 μm) reported by Chaudhuri (1929) from soils of Calcutta and Sibpur (Haora) under the name Balantiophorus elongatus.

151. Cytolophosis minutus (Schewiakoff)


Diagnosis: Body ovoid with narrow anterior and broadly rounded posterior end; short and uniform cilia arranged in distinct longitudinal rows; macronucleus spherical and central, contractile vacuole single and postcrolateral.

Distribution: India: West Bengal (Calcutta and Haora districts). Bihar, Maharashtra, Punjab, Tamilnadu, Uttar Pradesh.

Remarks: This is also a soil inhabiting ciliate reported by Chaudhury (1929) from West Bengal under the name Balantiophorus minutus.

Genus Opisthostomatella Corliss

152. Opisthostomatella bengalensis (Ghosh)


Diagnosis: Body elongately or irregularly oval, uniformly ciliated, cilia on the left side longer; macronucleus large, oval and located at the posterior half of the body.

Distribution: India: West Bengal (Calcutta).

Remarks: Ghosh described this species from sewer water of Calcutta under the name Opisthostomum bengalensis, and created a genus Opisthostomum to accommodate this species. But,
Corliss (1960) proposed new name *Opisthostomatella* for this monotypic genus with the remarks that this is 'perhaps bonafide genus in the trichostomatid family Marylandia' (Corliss, 1979). This view is quite in conformity with Kahl (1931). Further study of this species is essential for ascertaining its exact systematic position.

Subclass HYPOSTOMATIA
Order SYNHYMENIIDA

Under this order two families have been reported from this state.

Key to the families

1(2) Body more or less ovoid with asymmetrical lobe or beak to the left, hypostomial frange with single lengthy “membrane” ......................................................... ORTHODONELLIDAE

2(1) Body with broad anterior and gently tapered posterior end, hypostomial frange as above but simpler and less conspicuous .................................................... SCAPHIDIODONTIDAE

Family ORTHODONELLIDAE
Genus *Orthodonella* Bhatia

Body lanceolate or elongate oval, dorsoventrally flattened with a more or less prominent beak on the anterior end, opening of trichites directed to the right.

153. *Orthodonella banerjeei* (Ghosh)

*Diagnosis*: Body oval, anterior end narrowed with a blunt beak and posterior end broadly rounded; cytostome located at one-fourth of body length from anterior end; cytopharynx elongated, conical and bent forward posteriorly; macronucleus oval.

*Distribution*: India: West Bengal (Calcutta).

*Remarks*: Ghosh (1921a) described this species from ‘tank water’ of Calcutta. This species is of doubtful taxonomic status (See Kahl, 1931 and Bhatia, 1936).

Family SCAPHIDIODONTIDAE
Genus *Chilodontopsis* Blochmann

Body elongate, ventrally flattened and dorsally slightly bulging, with weakly developed beak-like structure at the anterior end, opening of trichites median.

154. *Chilodontopsis bengalensis* (Ghosh)

*Diagnosis*: Body elongated oval, with slightly narrower anterior end terminating with a weakly developed beak; posterior end broadly rounded; cytopharynx short, trichite rod opening median.

*Distribution*: India: West Bengal (Calcutta).
Remarks: Ghosh (1921a) described this species under the name *Chlamydodonopsis bengalensis* from 'vegetable infusion' in Calcutta. From the general shape and structure of this species, it appears that it belongs to the genus *Chilodonella* as opined by Kahl (1931).

Order NASSULIDA
Suborder NASSULINA

Under this suborder single family, single genus and single species are dealt with.

Family NASSULIDAE

Body ciliated all over the body, ciliation usually denser on ventral side than on dorsal one, hypostomial frange short but multiple, cytopharyngeal apparatus prominent.

Genus *Nassula* Ehrenberg

Body oval to elongate with flat ventral surface and convex dorsal surface; cytostome provided with well developed trichites and located at about one-third to one-fourth from the anterior end, macronucleus spherical or oval and centrally located.

155. *Nassula ornata* Ehrenberg


*Diagnosis:* Body broadly oval, both end broadly rounded, macronucleus round or slightly elliptical, contractile vacuole single, located little below the middle of the body.

*Distribution:* India: West Bengal (Calcutta, Darjiling and Murshidabad districts); in freshwater. Rajasthan.

Suborder MICROTHORACINA

Under this suborder two families are dealt with.

Key to the families

1(2) Hypostomial frange bears three 'pseudomembranelles' on left side of oral area, cytopharynx usually tubular..........................................................LEPTOPHARYNGIDAE

2(1) Hypostomial frange bears few 'pseudomembranelles' and sometimes set in a shallow atrium, cytopharynx simple or lacking..................................................MICROTHERACIDAE

Family LEPTOPHARYNGIDAE

Under this family two genera have been reported from this state.
Key to the genera

1(2) Body more or less compressed, body surface marked with a broad longitudinal ridge with cross striation, furrows canal like ................................................................. *Pseudomicrothorax*

2(1) Body compressed, body surface with longitudinal furrows but without cross striations, canal like furrow absent .................................................................................. *Leptopharynx*

Genus *Leptopharynx* Mermod

Key to the species

1(2) Pharyngeal basket tubular, ventral ridges not joining to form any anterior beak, moss-inhabiting .................................................................................. *L. sphagnetorum*

2(1) Pharyngeal basket lacking, ventral ridges join together to form an anterior beak, inhabiting freshwater

3(4) Cytoplasm heavily laden with characteristic green ingested food material, no spine near the cytostome .......................................................................................... *L. chlorophagus*

4(3) Spines present at the beginning of the cytostome, cytoplasm without green ingested food material as stated above .................................................................................. *L. torpens*

156. *Leptopharynx chlorophagus* Das


*Diagnosis*: Small, ovoid, right margin convex, left margin straight, ventral ridges join to form a short beak at the anterior end; pharyngeal basket lacking; macronucleus single, round or slightly ovoid, located below the middle of the body; contractile vacuoles two, both of which located below the middle; cytoplasm heavily laden with green ingested food material.

*Distribution*: India: West Bengal (Hugli district); in freshwater.

157. *Leptopharynx sphagnetorum* (Levander)


*Diagnosis*: Body more or less ovoid and considerably flattened, right margin slightly convex, left margin slightly concave, ventral ridges join near preoral slope, but without forming any beak; pharyngeal basket tubular, macronucleus and contractile vacuole as in *L. chlorophagus*; cytoplasm colourless and transparent.

*Distribution*: India: West Bengal (Calcutta). New record from India.

*Remarks*: This is a moss inhabiting form collected from the ground moss of Indian Museum campus, Calcutta.
158. *Leptopharynx torpens* (Kahl)


*Diagnosis*: Ovoid in shape, with convex right margin and more or less straight ventral margin; ventral ridges unite to form a distinct beak near anterior end, pharyngeal basket lacking, presence of spines at the beginning of the cytosome; macronucleus oval; contractile vacuole two and located below middle of the body; cytoplasm without green ingested food matter.

*Distribution*: India: West Bengal (Hugli district).

*Remarks*: Das (1971) was the first to report its occurrence from India, that too from Kamarkundu, (Dist. Hugli, West Bengal) as one of the associate species of *L. chlorophagus*.

Genus *Pseudomicrothorax* Mermod

Key to the species

1(2) Oval, comparatively large in dimension, 56-73 μm x 35-44 μm, number of ciliary meridian 13, macronucleus rod-shaped

2(1) Oval, small (25-31 μm x 16-20 μm), ciliary meridian 12 in number, macronucleus spherical

159. *Pseudomicrothorax agilis* Mermod


*Diagnosis*: Oval, smaller in dimension, ciliary meridian 12 in number (8 ventral and 4 dorsal), macronucleus spherical and located at the posterior half.

*Distribution*: India: West Bengal (Calcutta and North 24-Parganas districts); in freshwater.

*Remarks*: Nair and Das (1974) were the first to report this species from West Bengal and also from India.

160. *Pseudomicrothorax dubius* (Maupas)


*Diagnosis*: Oval, comparatively large in dimension, ciliary meridian 13 in number (9 ventral and 4 dorsal), macronucleus rod-shaped and located in the middle.

*Distribution*: India: West Bengal (Nadia and South 24-Parganas district); in freshwater.

*Remarks*: Nair and Das (1974) reported this species for the first time from West Bengal and also from Asia.
Family MICROTHORACIDAE

Under this family two genera have been dealt with.

Key to the genera

1(2) Body more or less oval with delicate keeled armour, oral depression posterior - ventral, with a stiff ectoplasmic lip on right side and a small tooth on left margin, cytopharynx lacking

..............................................................Microthorax

2(1) Body semilunar or sickle-shaped with longitudinal furrow, oral field groove-like located little above the middle of the body, cytopharynx tubular

..............................................................Drepanomonas

Genus Microthorax Engelmann

161. Microthorax pusillus Engelmann


Diagnosis: Body small, ovoid, with left border slightly sigmoid and right border more or less straight; oral depression on the dorsal side at the vicinity of ventral border; macronucleus spherical; contractile vacuole two in number and located below the middle half of the body.

Distribution: India: West Bengal (Calcutta, Barddhaman and Hugli districts); in freshwater. New record from India.

Genus Drepanomonas Fresenius

Key to the species

1(2) Body semilunar and sharply pointed at either end; two longitudinal ciliated grooves present on the dorsal side

..............................................................D. dentata

2(1) Body broadly semilunar with broad posterior end, one longitudinal furrow present on the dorsal side

3(4) Macronucleus oviform and situated very close to peristomal angle; body colourless without any zoochlorellae

D. hooghlyensis

4(3) Macronucleus spherical and situated considerably far from peristomal angle, body with zoochlorellae

D. revoluta

162. Drepanomonas dentata Fresenius


Diagnosis: Body semilunar, dorsal margin convex, ventral margin concave and both anterior and posterior ends sharply pointed; two longitudinal ciliated grooves present on the dorsal side; macronucleus spherical and situated a little behind or above the peristome.
DAS: et al.: Freeliving Protozoa

Distribution: India: West Bengal (Calcutta).

Remarks: Ghosh (1920a) reported this species from ‘vegetable infusions’ in Calcutta.

163. Drepanomonas hooghlyensis Nair and Das

1974. *Drepanomonas hooghlyensis* Nair and Das, Proc. Zool. Soc., Calcutta, 27, pp. 36-37, Text-Fig. 1 a,b.


Diagnosis: Body colourless, broadly semilunar in shape, with convex dorsal margin and slightly concave or attenuate ventral margin, posterior end broadly rounded; single broad longitudinal ciliated groove, macronucleus single, oviform, situated very close and dorsal to peristomal angle, zoochlorellae absent.

Distribution: India: West Bengal (Hugli district); in freshwater.

164. Drepanomonas revoluta Panard


Diagnosis: Shape of the body, number and position of longitudinal ciliated groove resemble *D. hooghlyensis*; macronucleus single, spherical and situated considerably far from peristomal angle; cytoplasm with zoochlorellae.

Distribution: India: West Bengal (Hugli district); in freshwater. New record from India.

Order CRYPTOPHORIDA
Suborder CHLAMYDODONTINA
Family CHILODONELLIDAE

Body with a distinct beak to the left, thigmotactic zone broad.

Genus *Chilodonella* Strand

Ovoid, dorsal surface convex, ventral surface flat and with ciliary rows, a cross-row of bristles on anteriorly flattened dorsal surface.

Key to the species

1(2) Cytopharynx straight, contractile vacuole several and scattered ....................... *C. cucullulus*

2(1) Cytopharynx curved at posterior end, contractile vacuole one to three

3(4) Macronucleus somewhat oval surrounded by a clear space, contractile vacuole three in number

.............................................. *C. spiralidentis*

4(3) Macronucleus oval but not surrounded by any clear space, contractile vacuole single and terminally located .............................................. *C. uncinata*


*Diagnosis*: Body dorso-ventrally flattened, cytopharynx long and straight, macronucleus oval, contractile vacuole many and scattered.

*Distribution*: India: West Bengal (Bankura, Barddhaman, Calcutta, Darjiling, Hugli, Jalpaiguri and Maldah districts); Jammu & Kashmir, Maharashtra, Rajasthan.


*Diagnosis*: Body flattened and oval, cytopharynx wider in front, narrow behind and spirally curved; macronucleus somewhat oval and surrounded by a clear space, contractile vacuole three, terminal vacuole largest.


*Diagnosis*: Body dorsoventrally flattened, cytopharynx as in *C. spiralidentis*, macronucleus oval and not surrounded by any clear space, contractile vacuole single and terminal.

*Distribution*: India: West Bengal (Calcutta, Haora and South 24-Parganas districts); in freshwater.

168. *Chilodonella sp.*

*Distribution*: India: West Bengal (Calcutta, Haora).

*Remarks*: Simmons (1889) and Chaudhuri (1929) reported *Chilodonella sp.* from freshwater pond of Calcutta and soils of Sibpur (Haora district) respectively without mentioning their specific identity.
Subclass SUCTORIA
Order SUCTORIDA
Suborder EXOGENINA
Family PODOPHYIDAE

Adults small, pyriform or spherical, tentacles apical or evenly distributed, usually with stalk or lorica.

Genus Podophrya Ehrenberg

Usually with rigid stalk, suctorial tentacles evenly distributed or arranged in fascicles.

Key to the species

1(2) Body spherical, pedicle dilated at its proximal end, no contractile vacuole...........P. bengalensis
2(1) Body pyriform, pedicle straight, contractile vacuole single and eccentric................P. sandi

169. Podophrya bengelensis Ghosh


Diagnosis: Body spherical with pedicle slightly dilated at its proximal end; tentacles many, straight, knobbed and unequal in length, and arranged radially; macronucleus spherical and subcentral; contractile vacuole absent.

Distribution: India: West Bengal (Calcutta).

Remarks: Ghosh (1929c) described this species from sewer water of Calcutta. The present authors, however, could not collect this species.

170. Podophrya sandi Collin

1912. Podophrya sandi Collin, Arch. zool. exp. gen., 51, pp. 398-401, fig. 105.

Diagnosis: Body pyriform with straight pedicle; tentacles numerous, knobbed and unequal in length distributed uniformly of in one to three bundles; macronucleus spherical or oval and central, contractile vacuole single and concentric.

Distribution: India: West Bengal (Calcutta).

Remarks: Simmons (1889) collected this species from pond water of Calcutta (for details see Bhatia, 1936).

Suborder ENDOGENINA
Family DENDROSOMATIDAE

Body shape pyriform to truncate to branching, suctorial tentacles arranged in clusters, with or without stalk, aloricate.

Genus Tokophrya Butchli

Pyriform or pyramidal, tentacles arranged in one to four sometimes five clusters on anterior surfaces, stalk delicate and of uniform thickness.
Key to the species

1(2) Macronucleus pyramidal, stalk long.............................. *T. bengalensis*
2(1) Macronucleus oval or spherical, stalk comparatively short
3(4) Pyramidal in shape, tentacles arranged in 2 clusters, macronucleus oval .............. *T. infusorium*
4(3) Oval to spherical in shape, tentacles arranged in 2-5 clusters, macronucleus spherical ..................*T. cyclopum*

171. *Tokophrya bengalensis* Ghosh


*Diagnosis*: Body more or less pyramidal, with a cuplike depression at narrow fixed end; stalk long, tentacles arranged in two clusters; macronucleus pyramidal; contractile vacuole single located at the anterior end.

*Distribution*: India: West Bengal (Calcutta).

*Remarks*: Ghosh (1929c) described this species from sewer water of Calcutta.

172. *Tokophrya cyclopum* (Claparede and Lachmann)


*Diagnosis*: Body oval to spherical; stalk short, suctorial tentacles arranged in 2-5 clusters; macronucleus spherical, contractile vacuoles one to two.

*Distribution*: India: West Bengal (Calcutta). New record from India.

*Remarks*: This species has been collected from a freshwater pool in the locality stated above and found to be attached on the antenna of *Cyclops sp*.

173. *Tokophrya infusorium* (Stein)


*Diagnosis*: Body pyramidal, stalk of moderate length, suctorial tentacles arranged in 2 clusters, macronucleus oval, contractile vacuole two.

*Distribution*: India: West Bengal (Calcutta); in freshwater. New record from India.

Class OLIGOHYMENOPHOREA
Subclass HYMENOSTOMATIA
Order HYMENOSTOMATIDA
Suborder TETRAHYMENINA

Key to the families

1(2) Body pyriform, elongate-ovoid or cylindrical, buccal cavity small, membranellar bases with uniform width, 1-3 post oral kinetics ........................................... tetrahymenidae
2(1) Body ovoid or ellipsoidal, buccal cavity large, infraciliary bases of second or third membranellae much wider, 5-10 post roal Kineties ........................................ GLAUCOMIDAE

Family TETRAHYMNIDAE

Key to the genera

1(2) Pyriform in shape, cytostome close to anterior end, inconspicuous ectoplasmic ridge or flange on the left margin...............................................................Tetrahymena

2(1) Body elongately-oval, cytostome in the anterior half of the body without any ectoplasmic ridge, outer membrane inserted in the left and enclosed the mouth in a cap-like manner.......... ...................................................... Stegochilum

Genus Stegochilum Schewiakoff

174. Stegochilum ovale Ghosh


Diagnosis : Body elongately oval, rounded at both ends; undulating membrane attached to the left, anterior or right margin of the cytostome; macronucleus oval and centrally located, contractile vacuole single.

Distribution : India : West Bengal (Calcutta).

Remarks : Ghosh (1921a) described this species from 'vegetable infusions' in Calcutta.

Genus Tetrahymena Furgason

175. Tetrahymena pyriformis (Ehrenberg)

1966. Tetrahymena pyriformis (Ehrenberg); Kudo, Protozoology, p. 895, figs. 325 a,d.

Material examined : 1 ex., Calcutta, 18.xii.1962, K. N. Nair.

Diagnosis : Pyriform in shape, cytostome pyriform and about one-tenth of the body-length; ciliary meridian 17-23; macronucleus ovoid, contractile vacuole single.

Distribution : India : West Bengal (Calcutta). New record from the India.

Remarks : This species with a single representative has been collected from hay infusion.

Family GLAUCOMIDAE

Genus Glaucoma Ehrenberg

Ellipsoid in shape, cytostome near the anterior end, extending about one-fourth of the length of the body and with conspicuous undulating membrane on right and three membranellae on left.

176. Glaucoma pyriformis (Ehrenberg)

1838. Leucophrys pyriformis Ehrenberg, Die Infusionsthiere als Vollkommene organismen, Veipzig., pp.312-313, pl.32, fig. 4.

Diagnosis: Body ellipsoid, cytostome located at anterior one-third of the body and placed little obliquely; macronucleus more or less round and centrally located; contractile vacuole single and lying in posterior one-fourth of the body.

Distribution: India: West Bengal (Calcutta), Jammu & Kashmir.

Suborder OPHRYOGLENINA
Family OPHRYOGLENIDAE

Body uniformly ciliated, peristome runs as a sickle-shaped ciliated cleft, perpendicular to surface of the body.

Genus Ophryoglena Ehrenberg

Body ellipsoidal with both ends rounded or attenuated, preoral depression in the form of '6' due to an ectoplasmic membrane extending from the left edge.

177. Ophryoglena flava (Ehrenberg)


Diagnosis: Body ellipsoidal, cytostome on ventral side and situated at about one-third of body length from anterior end; macronucleus elliptical, contractile vacuole two, with long radiating canals.

Distribution: India: West Bengal (Bankura, Birbhum, Hugli, Maldah, Murshidabad, North 24-Parganas, Puruliya, South 24-Parganas and West Dinajpur districts); in freshwater. Maharastra, Rajasthan.

Suborder PENICULINA

Key to the families

1(2) Body short with girdless of cilia and an eccentric posterior ciliary tuft........UROCENTRIDAE
2(1) Body large, neither ciliary girdles nor posterior ciliary tuft present
3(4) Buccal area large, with an extensive false adoral zone of membranellae covering much of apical and ventral surface of the body ..............................................................NEOBURSARIDIIIDAE
4(3) Buccal area not large or with any adoral zone of membranellae
5(6) Prebuccal cavity conspicuous leading to equatorially located buccal cavity, two peniculi in buccal cavity, cytostome not expansible, contractile vacuole two.............PARAMECIIDAE
6(5) Prebuccal area shallow or absent, three peniculi in buccal cavity, cytostome expansible, contractile vacuole single.................................................................FRONTONIIDAE

Family PARAMECIIDAE
Genus Paramecium Hill

Cigar-shaped, peristome long, broad and slightly oblique, cytopharynx moderately long, with a row of very fine cilia attached to its dorsal wall.

178. Paramecium caudatum Ehrenberg


Diagnosis: Cigar-shaped, anterior end broader and rounded and posterior end gradually tapering; micronuclei single and compact, lying close to massive and egg-shaped macronucleus; contractile vacuoles two.

Distribution: India: West Bengal (in all 17 districts); in freshwater as well as hay infusion. Orissa, Rajasthan, Uttar Pradesh, Jammu & Kashmir.

179. Paramecium sp.

Distribution: India: West Bengal (Calcutta).

Remarks: Simmons (1891) reported this species from pond water of Calcutta without mentioning its species-status.
Family FRONTONIIDAE

Key to the genera

1(2) Ovoid to ellipsoid with both the ends rounded, no dorsal ridge in the posterior region of the body, macronucleus oval......................................................Frontonia

2(1) Body pyriform with broadly rounded anterior end and bluntly pointed posterior end, a dorsal ridge present in the posterior region of the body, macronucleus sausage-shaped..............................Disematostoma

Genus Disematostoma Lauterborn

180. Disematostoma bengalensis Nair


Material examined : 5 exs., Samchi vill. (Deula), South 24-Parganas; 3.i.1969, K. N. Nair.

Diagnosis : Body roughly pyriform, broadly elliptical; peristome measuring one-fourth of its body-length located in the middle of anterior third on the ventral side; macronucleus horse-shoe shaped located around the peristome; contractile vacuole single located towards the middle of the body and having 8-10 radiating channels.

Distribution : India: West Bengal (South 24-Parganas districts); in freshwater.

Genus Frontonia Ehrenberg

Key to the species

1(2) Body elongated or ovoid, rounded at both ends, macronucleus ellipsoid, with several micronucleus, inhabiting freshwater......................................................F. leucas

2(1) Body oval, flattened, macronucleus short, sausage shaped with single micronucleus, inhabiting moss......................................................F. depressa

181. Frontonia depressa (Stokes)


Diagnosis : Body ovoid, flattened, body size small, 50-65 μm × 30-40 μm in dimension; contractile vacuole single with strong radiating canals and located below the middle, macronucleus short, sausage-shaped with single micronucleus, inhabiting moss.

Distribution : India: West Bengal (Calcutta); in ground moss. New record from India.

182. Frontonia leucas (Ehrenberg)


**Diagnosis:** Body elongated or ovoid, rounded at both ends, body size larger, 250-300 μm × 140-150 μm in dimension; contractile vacuole single with long radiating canals and located at the middle of the body; macronucleus ellipsoidal with several micronuclei.

**Distribution:** India: West Bengal (Bankura, Birbhum, Calcutta, Haora, Koch Bihar, Maldah, Murshidabad, North 24-Parganas, Puruliya and West Dinajpur districts); in freshwater. Jammu & Kashmir, Rajasthan, Maharashtra.

### Family UROCENTRIDAE

### Genus *Urocentrum* Nitzsch

183. *Urocentrum turbo* (Muller)


**Diagnosis:** Body resembling two spheres, closely oppressed, each encircles with a broad ciliary girdle, caudal tuft of cilia very conspicuous, no depressed prebuccal area, buccal cavity subequatorial in position; contractile vacuole single, with multiple collecting canals and posteriorly located; macronucleus horse-shoe-shaped.

**Distribution:** West Bengal (Calcutta, Hugli, Maldah, Murshidabad, Nadia, North 24-Parganas, Puruliya, South 24-Parganas and West Dinajpur district); in freshwater. Rajasthan, Maharashtra, Jammu & Kashmir.

### Family NEOBURSARIDAE

### Genus *Neobursaridium* Balech

184. *Neobursaridium gigas* Balech


Diagnosis: Body broadly ovate and purse-shaped, anterior end truncated; peristome large and conspicuous ending in a conical cytopharynx, false adoral zone of membranellae short and situated on left side of the peristome; macronucleus long, dumbell-shaped and located in the middle of the body; contractile vacuole two, each with several long radiating canals.

Distribution: India: West Bengal (Calcutta); in freshwater.

Remarks: Mahajan and Nair (1971) recorded this species for the first time from Asia that too from Calcutta. Since then no further report on this species from India is published.

Order SCUTICOCILIATIDA
Suborder PHILASTERINA

Key to the families

1(2) Body elongated oval, generally uniformly ciliated, buccal cavity small, anteroventral in position .......................................................... LOXOCEPHALIDAE

2(1) Body small, flattened, ovoid to ellipsoidal, with sparse ciliature limited to ventral surface; oral area sometimes disproportionately large, midventral in position ........... CINETOCHILIDAE

Family LOXOCEPHALIDAE
Genus Loxocephalus Eberhard

Body ovoid to cylindrical, cytostome crescentic located at a slightly flattened area near anterior end, with zone of cilia around the body and with one or more long caudal cilia.

185. Loxocephalus plaguis (Stokes)


Diagnosis: Body slender, nearly cylindrical, 15-16 ciliary rows, single long caudal cilium, contractile vacuole just behind middle of the body, endoplasm usually dark coloured.

Distribution: India: West Bengal (Nadia and South 24-Parganas districts); in freshwater. Orissa.

Family CINETOCHILIDAE

Key to the genera

1(2) Body oval to ellipsoid, highly flattened, cilia on flat ventral surface only, cytostome right of median line of posterior half, with a membrane on both edges, forming a packet, with 3-4 caudal cilia .............................................................. Cinetochilum

2(1) Body oval to pyriform, compressed, ciliation uniform, tetrahymenal cytostome located at anterior one-third to one-fourth of the body, caudal cilia may or may not present .............................................................. Sathrophilus
Genus *Cinetochilum* Petry

186. *Cinetochilum margaritaceum* Petry


*Diagnosis*: Body small, oval and highly flattened cytostome as described in the genus; macronucleus spherical and central, caudal cilia long, contractile vacuole terminal.

*Distribution*: India: West Bengal (Bankura, Calcutta, Hugli, Maldah, Nadia and North 24-Parganas districts); in freshwater. Rajasthan.

Genus *Sathrophilus* Corliss

187. *Sathrophilus chlorophagus* (Kahl)


*Diagnosis*: Body slender, oval, cilia long, cytostome located at anterior one-third of the body; cytoplasm heavily laden with irregular green food material; contractile vacuole terminal.

*Distribution*: India: West Bengal (Hugli district); in freshwater. New record from India.

**Suborder** PLEURONEMATINA

**Key to the families**

1(2) Paroral membrane very prominent, sometimes present as stiff velum and distinctly curling around subequatorial cytostome; body ciliation comparatively dense... PLEURONEMATIDAE

2(1) Buccal ciliatures less prominent; paroral membrane without any velum, body ciliation spares; ........................................................................................................................................... CYCLIDIIDAE

**Family** PLEURONEMATIDAE

**Genus** *Pleuronema* Dujardin

Ovoid to ellipsoid; peristome extending from anterior end to two third of the body; conspicuous membrane at both edges, a semicircular swelling to left near oral area.

188. *Pleuronema crassum* Dujardin


Diagnosis: Body irregularly ovoid, peristome prominent, undulating membrane very distinct and narrow anteriorly, and rapidly widening posteriorly; macronucleus round with adjacent micronucleus, located at the anterior half of the body; contractile vacuole single and posterodorsal.

Distribution: India: West Bengal (Calcutta).

Remarks: Ghosh (1921 a) collected Pleuronema chrysalis from hay infusions of Calcutta. But, Kahl (1931) considered this species as Paramecium chrysalis. If the species collected by Ghosh (op. cit) belong to the genus Pleuronema, from his description (see Bhatia, 1936) it appears that it belongs to P. crassum. Subsequently, P. crassum has been collected from a freshwater pool of Calcutta by the Zoological Survey of India party.

Family CYCLIDIIDAE

Key to the genera

1(2) Body long, ovoid, with a caudal cilium, peristome near right side, a membrane occurs on its right edge, forming a pocket around cytostomal groove ........................................... Cyclidium

2(1) Body similar as above, peristome nearer median line, diagonally right to left; right peristomal ridge with a sail-like membrane which surrounds cytostome at its posterior end .......................................................... Ctedoctema

Genus Ctedoctema Stokes


Diagnosis: Body long, ovoid with a frontal plate, body cilia long, dense and well spread; peristome occupying about three-fourth of body-length, macronucleus round lying in the anterior half of the body, contractile vacuole single, located at the posterior half of the body.

Distribution: India: West Bengal (Calcutta). New record from India.

Remarks: This species has been collected from ground moss from the locality as stated above.

Genus Cyclidium Muller

190. Cyclidium glaucoma Muller

1786. Cyclidium glaucoma Muller, O. F., Animalc. infusoria fluviat, et. marinae, etc., Hafniae et Lipsiae, p.80, pl.11, figs.6-8.

Diagnosis: Body ovoid with posterior end broadly rounded; a long caudal cilium conspicuous; undulating membrane prominent; macronucleus round and lying at the middle of the body; contractile vacuole single and postero-terminal.

Distribution: India: West Bengal (Haora district). Rajasthan.

Remarks: Choudhury (1929) reported this species from the soils of Sibpur (Haora), West Bengal.
Subclass PERITRICHIA
Order PERITRICHIDA
Suborder SESSILINA

Key to the families

1(4) Usually stalked and without any lorica

2(3) With contractile stalk, colonial (except in two genera), in colonial forms zooids not independently contractile (except in one species)..........................VORTICELLIDAE

3(2) Usually stalked, with stalk often noncontractile (but body may be highly contractile)..........

..................................................................................................................................................EPISTYLIDIDAE

4(1) With or without stalk, loricate

5(6) Solitary, with or without stalk, attachment not at the opening..................VAGINICOLIDAE

6(5) Solitary, stalkless, attachment is only at opening..........................LAGENOPHYRIDAE

Family VORTICELLIDAE

Key to the genera

1(2) Inverted bell form, solitary, may be in clusters but not in colonies ...............Vorticella

2(1) Shape similar to above, but colonial

3(4) Each branch contractile as an independent unit..........................................Carchesium

4(3) The whole colony contracts at the same time..............................................Zoothamnium

Genus Carchesium Ehrenberg

191. Carchesium polypinum (Linnaeus)


Diagnosis : Body campanulate, broadly expanded in front; peristomial border everted and recurved; macronucleus form an arc in the longitudinal plane, colony comprising large number of individuals.

Distribution : India: West Bengal (South 24-Parganas). Karnataka.

Remarks : Annandale (1907) collected this species from backish and freshwater ponds of Port Canning (South 24-Parganas).


Distribution : India: West Bengal (Calcutta).

Remarks : Simmons (1891) collected this form from pond water of Calcutta.
Genus *Vorticella* Linnaeus

Key to the species

1(10) Cuticular surface of the body smooth

2(5) Body conical or elongate, stalk comparatively short in length ranging from 1 to 2 times the length of the body

3(4) Body elongated and cylindrical, length-breadth ratio 3 : 1, stalk as long as body

.............................................................V. subcylindrica

4(3) Body more or less vase-shaped, length-breadth ratio 2 : 3, stalk twice as long as body

.............................................................V. subsinuata

5(2) Body not elongate and cylindrical, stalk longer, about 3 to 7 times the length of the body

6(9) Body more or less campanulate

7(8) Body broadly campanulate, peristomial margin widely dilated, stalks vary long, sometimes 6 to 7 times longer than the body

.............................................................V. campanula

8(7) Body conical-campanulate, widest at the anterior border and then tapering in a straight line to form a cone, stalk 3 to 4 times the length of the body

.............................................................V. patellina

9(6) Body spheroidal, with posterior end tapering abruptly to a point, peristomial margin half the greatest diameter of the body, stalk 4-5 times the length of the body

.............................................................V. globosa

10(1) Cuticular surface of the body transversely annulated

11(12) Body subpyriform, peristomial margin widely everted and slightly less than greatest body diameter in the middle, stalk less than twice the body length

.............................................................V. submicrostoma

12(11) Body curved, obliquely conical-campanulate; peristomial margin placed obliquely and slightly everted; stalk 4 to 5 times the body length

.............................................................V. subprocubens

193. *Vorticella campanula* Ehrenberg


*Diagnosis*: Body usually broadly campanulate, but shape considerably variable; peristomial margin thick and much dilated, cuticular surface smooth and highly elastic; macronucleus band from; stalk thick and about 4 to 7 times the length of the body.

194. Vorticella globosa Ghosh

Diagnosis: Body spherical, with posterior end tapering considerably to join with the stalk; peristomial margin half the greatest diameter of the body and raised vertically like a collar; cuticular surface smooth, macronucleus horse-shoe shaped; stalk 4-5 times the length of the body.

Distribution: India: West Bengal (Calcutta).

Remarks: Ghosh (1922) described this species from 'pond water' of Calcutta.

195. Vorticella patellina O. F. Muller

Diagnosis: Body conical-campanulate, widest at the anterior border, peristomial margin thin, cuticular surface smooth, macronucleus resembling an arc, stalk thin 3 to 4 times the length of the body.

Distribution: India: West Bengal (Calcutta).

Remarks: Grant (see Cantor, 1842) observed this species in pond water of Calcutta.

196. Vorticella subcylindrica Ghosh

Diagnosis: Body elongated, cylindrical, length-breadth ratio 3 : 1, tapering at aboral end to join with the stalk; peristomial margin slightly everted and raised; cuticular surface smooth; macronucleus band form; stalk thin and about as long as the body.

Distribution: India: West Bengal (Calcutta).

Remarks: Ghosh (1922) described this species from pond water of Calcutta.

197. Vorticella submicrostoma Ghosh

Diagnosis: Body subpyriform tapering towards aboral end, body constricted behind peristome, peristomial margin considerably everted, cuticular surface transversely annulated; macronucleus horse-shoe shaped; stalk stout less than twice the length of the body.

Distribution: India: West Bengal (Calcutta).

Remarks: This species has also been described by Ghosh (1922) from pond water of Calcutta. Kahl (1935) regarded this species as the larger variety of V. octava Stokes.

198. Vorticella subprocubens Ghosh
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**Diagnosis**: Body conical-campanulate and curved obliquely, peristomial margin placed obliquely and slightly everted, cuticular surface transversely annulated, stalk 4 to 5 times the body length.

**Distribution**: India: West Bengal (Calcutta).

**Remarks**: Ghosh (1922) described this species from pond water of Calcutta. Kahl (1935) considered it as a doubtful species.

199. *Vorticeda subsinuata* Ghosh


**Diagnosis**: Body resembling a vase, length-breadth ratio 2:3, peristomial margin slightly everted; cuticular margin smooth, stalk about 2 times the body length.

**Distribution**: India: West Bengal (Calcutta).

**Remarks**: This species has also been described by Ghosh (1922) from pond water of Calcutta.

200. *Vorticella* sp.

**Distribution**: India: West Bengal (Calcutta).

**Remarks**: Simmons (1891) reported this form from 'pond water' of Calcutta.

Genus *Zoothamnium* Bory de St. Vincent

201. *Zoothamnium horai* Khajuria and Pillai


**Diagnosis**: Zooids colonial, homomorphic, strongly marked with transverse ridges and furrows; zooids globular, peristome narrow, nucleus longer.

**Distribution**: India: West Bengal (Medinipur district).

**Remarks**: Khajuria and Pillai (1951) described this species after collecting the specimens from a freshwater tank at Contai (Dist. Medinipur), West Bengal. The specimens were found attached to the scales on the latero-ventral surface of one specimen of fish *Mugil tade*.

Family EPISTYLIDIDAE

Key to the genus

Individuals on non-contractila branched stalk, forming large colonies.............*Epistylis*

Genus *Epistylis* Ehrenberg

202. *Epistylis anastatica* (Linnaeus)


**Material examined**: 2 exs., Wellington Square, Calcutta, 6.ii.1961, K.N. Nair.

**Diagnosis**: Body conical-campanulate, length-breadth ratio 3:1, cuticular surface smooth or finely and transversely striated; stalk moderately thick and entirely smooth.

**Distribution**: India: West Bengal (Calcutta). New record from India.
Remarks: This species was collected from freshwater around a fountain in Wellington Square, Calcutta during 1961. The specimens were found attached to some aquatic vegetation.

203. *Epistylis* sp.

*Distribution*: India: West Bengal (Calcutta).

*Remarks*: Simmons (1891) recorded this form from pond water of Calcutta, without giving any specific identify.

Family *VIGINICOLIDAE*

Key to the genera

1(4) Lorica without any stalk
2(3) Lorica attached to a submerged substratum, object directly with its posterior end ..................

................................................................. *Vaginicola*

3(2) Lorica usually with neck-like constriction anteriorly and attached to the submerged substratum by its lateral side............................................................... *Platycola*

4(1) Lorica with stalk
5(6) Lorica without any operculum and remaining open during contraction ............... *Cothurnia*

6(5) Lorica with operculum beneath the border of peristome and remaining closed with lorica during contraction............................................................... *Pyxicola*

Genus *Cothurnia* Ehrenberg

204. *Cothurnia* sp.

*Distribution*: India: West Bengal (Calcutta).

*Remarks*: Simmons (1891) reported this form from pond water of Calcutta.

Genus *Platycola* Kent

Key to the species

1(2) Lorica without distinct collar and without any transverse striations ............... *P. decumbens*
2(1) Lorica with short collar and usually with eight transverse striations ............... *P. striata*

205. *Platycola decumbens* (Ehrenberg)


*Material examined*: 1 ex., Indian Museum tank, Calcutta, 8.x.1963, K.N. Nair.

*Diagnosis*: Lorica broadly oval, without any distinct collar or any transverse striation, colourless to yellow in colour.

*Distribution*: India: West Bengal (Calcutta).

*Remarks*: Mahajan and Nair (1965) recorded this species from a freshwater pond of Calcutta.
206. \textit{Platycola striata} (Fromentel)


\textit{Material examined}: 2 exs., Indian Museum tank, Calcutta, 30.i.1962, K.N. Nair; 1 ex., Falta, South 24-Parganas, 2.viii.1965, K.N. Nair.

\textit{Diagnosis}: Lorica elliptical with very short collar and usually with eight transverse striations in a regular distance, yellowish to brown in colour.

\textit{Distribution}: India: West Bengal (Calcutta).

\textit{Remarks}: Nair (1966) recorded this species for the first time from India, that too, from West Bengal and found this species to be attached on the zoecium of a bryozoan encrustation on \textit{Valisnaria} leaves.

207. \textit{Platycola} sp.

\textit{Distribution}: India: West Bengal (Calcutta).

\textit{Remarks}: Simmons (1891) reported this species from `pond water' of Calcutta.

Genus \textit{Pyxicola} Kent

208. \textit{Pyxicola affinis} Kent


\textit{Material examined}: 3 exs., Indian Museum tank, Calcutta, 8.x.1963, K.N. Nair.

\textit{Diagnosis}: Lorica urceolate, slightly curved at anterior end and little narrowed beneath aperture end, colourless or deep brown; animalcule when fully extended an operculum clearly visible on anterolateral surface of a conical protruberance.

\textit{Distribution}: India: West Bengal (Calcutta).

\textit{Remarks}: This species has already been reported by Mahajan and Nair (1965) from West Bengal.

Genus \textit{Vaginicola} Lamarck

209. \textit{Vaginicola crystallina} Ehrenberg


\textit{Material examined}: 1 ex., Indian Museum tank, Calcutta, 8.x.1963, K.N. Nair.

\textit{Diagnosis}: Lorica transparent, vase-like, usually with two individuals, one of them being invariably shorter.

\textit{Distribution}: India: West Bengal (Calcutta).

\textit{Remarks}: Mahajan and Nair (1965) were the first to report this species from West Bengal.

210. \textit{Vaginicola} sp.

\textit{Distribution}: India: West Bengal (Calcutta).

\textit{Remarks}: Simmons (1891) reported this species from pond water of Calcutta.
Family LAGENOPHYRIDAE

Key to the genus

Lorica with short neck and flattened adhering surface............................................Lagenophrys

Genus Lagenophrys Stein

211. Lagenophrys labiata Stokes


Diagnosis: Lorica oval in side profile, orifice of lorica with two labial flaps through which peristome bearing portion protrudes.

Distribution: India: West Bengal (Calcutta).

Remarks: Nair (1966) reported this species from the freshwater pond of Calcutta and found it to be attached on the branchial vesicles of Gammarus sp.

Class POLYHYMENOPHOREA
Subclass SPIROTRICHA
Order HETEROTRICHIDA
Suborder HETEROTRICHINA

Key to the families

1(2) Anterior part of the body uniquely twisted to left and posterior part sometimes tailed and/or bearing tuft of longer cilia.................................................................METOPIDAE
2(1) Anterior part of the body not twisted as above

3(4) Oral ciliature spiralling clock wise about 360° around flared out anterior end, body highly contractile, trumpet-shaped and elongate..................................................STENTORIDAE
4(3) Oral ciliature not spiralling as above and body not trumpet-shaped

5(6) Body large, elongate and cylindrical or pyriform, highly contractile, peristomial field long and narrow..............................................................................SPIROSTOMIDAE
6(5) Body large, elongate but not highly contractile, peristomial field funnel-like and prominent

7(8) Body large elongate or nearly ellipsoidal, macronucleus usually long and moniliform.................CONDYLOSTOMATIDAE
8(7) Body large, broad with round posterior end, macronucleus elongate and rod-like..................

.................................................................BURSARIIDAE

Family SPIROSTOMIDAE

Key to the genera

1(2) Elongated cylindrical, peristome without any twist or undulating membrane; contractile vacuole very large, terminal and extending forward as straight canal............Spirostomum
2(1) Body usually pyriform or ellipsoidal somewhat narrowed anteriorly, peristome twisted to right at posterior end and connected with oral funnel without membrane, contractile vacuole terminal and without any straight canal

**Blepharisma** Perty

Key to the species

1(2) Cytoplasm pink coloured, peristome extending about one-third the length of the body, macronucleus elongated

**B. intermedium**

2(1) Cytoplasm colourless, peristome extending about half the length of the body, macronucleus consisting of two to six nodes connected by a thin strand

**B. undulans**

2(2) Very large in size (500-3000 μm or more), cytostome usually extending beyond the middle of the body, macronucleus moniliform

**Spirostomum** Ehrenberg

Key to the species


Distribution: India: West Bengal (Calcutta and South 24-Parganas districts); in freshwater. Karnataka.

Remarks: Mahajan and Nair (1971) were the first to report this species from West Bengal.

213. **Blepharisma undulans** Stein


Diagnosis: Body flattened, cylindrical, cytoplasm colourless, undulating membrane prominent, extending about half the length of the body; macronucleus consisting of macronuclei two to six nodes, connected by a thin strand.

Distribution: India: West Bengal (Bankura, Calcutta and West Dinajpur districts); in freshwater. Rajasthan.
214. *Spirostomum ambiguum* Ehrenberg


*Diagnosis*: Body elongate and cylindrical, length more than ten times the width, peristome extending up to or even beyond the middle of the body; macronucleus elongated and moniliform; contractile vacuole very large and terminal with a straight canal.

*Distribution*: India: West Bengal (Barddhaman, Calcutta, Maldah, North 24-Parganas and West Dinajpur districts); in freshwater. Jammu & Kashmir.

215. *Spirostomum teres* Claparede & Lachmann


*Diagnosis*: Body elongated, posterior end truncated; cytostome not usually extending up to the middle of the body; macronucleus oval or spindle shaped and located at the middle; contractile vacuole as in the preceding species.

*Distribution*: India: West Bengal (Bankura and Jalpaiguri districts); in freshwater. Jammu & Kashmir.

**Family METOPIDAE**

**Key to the genera**

1(2) Body elongated, flattened dorsoventrally and narrow anteriorly, body torsion very slight at left side of the anterior end, undulating membrane prominent, peristome not spiraling ................................................................. *Bothrostoma*

2(1) Body elongated, ovoid or pyriform, body torsion very strong at left side of the anterior end, undulating membrane not very prominent, peristome may or may not spiraling

3(4) Anterior body part shorter than or equal to posterior body part, buccal cavity not very large, peristome never spiraling, cytostome subanterior or subequatorial .......................... *Metopus*

4(3) Anterior body part greatly enlarged and posterior body part reduced in length, peristome spiraling, buccal cavity extremely developed shifting the cytostome to posterior extremity...... .............................................................................. *Brachonella*
Genus *Bothrostoma* Stokes

Key to the species

1(2) Anterior end of the body with a large rostrum-like continuation, macronucleus crescent-shaped  

.................................................................................................................. *B. nasuta*

2(1) Body without any rostrum-like continuation at anterior end, macronucleus sausage-shaped or ellipsoid

3(4) Anterior and posterior end of the body slightly attenuated, undulating membrane short...........

.................................................................................................................. *B. extenta*

4(3) Anterior end often with a short beak, posterior end retracted, undulating membrane very much developed.......................................................................................... *B. mirabilis*

216. *Bothrostoma extenta* (Kahl)


*Diagnosis*: Body elongated, slightly flattened, anterior and posterior ends slightly attenuated; buccal cavity well developed; cytostome reaching about two-third of the ventral body surface; macronucleus ellipsoid or sausage-shaped; contractile vacuole occupying the posterior end.

*Distribution*: India: West Bengal (Calcutta); in freshwater. First record from India.

*Remarks*: Jankowski (1963) has placed *Metopus extensus* Kahl under the genus *Bothrostoma* Stokes.

217. *Bothrostoma nasuta* (Da Cunha)


*Material examined*: 1 ex., Sahid colony (Paikpara), Calcutta, 5.x.1962, K. N. Nair.

*Diagnosis*: Body elongated, slightly flattened, anterior end with a rostrum-like prolongation, posterior end retracted; buccal cavity well developed, undulating membrane very large, cytostome extending slightly below the equatorial line; macronucleus crescent-shaped; contractile vacuole located at the posterior end.

*Distribution*: India: West Bengal (Calcutta); in freshwater.

*Remarks*: Mahajan and Nair (1965) reported this species from West Bengal under the name *Metopus nasutus*.

218. *Bothrostoma mirabilis* (Kahl)


**Diagnosis**: Body elongated, flattened, anterior end often with a short beak and posterior end retracted; buccal cavity and undulating membrane strongly developed, cytostome extended almost to posterior extremity; macronucleus sausage-shaped or ovoid; contractile vacuole as in *B. nasuta*.

**Distribution**: India: West Bengal (Calcutta and Hugli districts); in freshwater. First report from India.

**Genus Brachonella Jankowski**

**Key to the species**

1(2) Anterior body part much exceeds the posterior body part; AZM beginning anteriorly and ending posteriorly ............................................................................................................................... *B. spiralis*

1(1) Anterior and posterior body parts almost equal in length but lower body part narrow; AZM equatorial beginning and ending in same level ......................................................... *B. campanula*

219. **Brachonella campanula** (Kahl)


**Diagnosis**: Body ovoid to pyriform with anterior and posterior body parts almost equal in length, but anterior body part wide and posterior body part narrow; AZM ring-like, equatorial, beginning and ending in same level; buccal cavity equatorial and cytostome posteriorly shifted; macronucleus round; contractile vacuole located at posterior end.

**Distribution**: India: West Bengal (Haora district); in freshwater. First record from India.

220. **Brachonella spiralis** (Smith)


**Material examined**: 3 exs., Shibpur, Haora, 32.viii.1959, K. N. Nair.

**Diagnosis**: Body broadly oval, brownish, anterior body parts much exceeding posterior one and resembling the 'Shield' of *Caenomorpha*; posterior end bearing tuft of long caudal cilia; AZM beginning anteriorly and ending posteriorly; cytostome shifted to posterior pole dorsally; macronucleus round or ovoid; contractile vacuole occupying posterior end.

**Distribution**: India: West Bengal (Calcutta and Haora districts); in freshwater. Rajasthan.

**Remarks**: Nair (1960) and Mahajan and Nair (1965) reported this species from West Bengal under the name *Metopus spiralis*.

**Genus Metopus Claparede and Lachmann**

**Key to the species**

1(10) Body elongated, anterior body-part much shorter than posterior body part

2(5) Contractile vacuole large, posterior end with raising edges

3(4) Body of clear brownish tint and irregular shape, posterior extremity flattened ............ *M. fuscus*
4(3) Body slightly reddish, oval, both anterior and posterior end rounded..........................*M. ovalis*

5(2) Contractile vacuole comparatively small, posterior end without any raising edge

6(7) Body flattened, oblong-oval, anterior left side tortion of the body very much pronounced to forming a beak.................................................................*M. rostratus*

7(6) Body sigmoid, anterior left side tortion of the body not forming any beak

8(9) Body comparatively large, its anterior left side tortion well pronounced, pellicular striations prominent.................................................................*M. es.*

9(8) Body small, its anterior left side tortion not well developed, pellicular striations absent........

10(1) Body rhomboid or ovoid, with rounded anterior and acute posterior ends, anterior part equal to posterior part.................................................................*M. striatus*

221. *Metopus daphnides* Jankowski


Diagnosis : Body more or less sigmoid, small in dimension (55-70 \(\mu\)m \(\times\) 25-40 \(\mu\)m), with convex right and concave left lateral sides; cytoplasm clear yellowish, pellicular striations absent, macronucleus single, long and ovoid, contractile vacuole without any raising edge and located at the posterior end.

Distribution : India: West Bengal (Calcutta and South 24-Parganas districts); in freshwater. New record from India.

222. *Metopus es* Muller


Diagnosis : Body characteristically sigmoid, comparatively large and slender (92 \(\mu\)m \(\times\) 26 \(\mu\)m), cytoplasm colourless, pellicular striations prominent, macronucleus single and sausage-shaped; contractile vacuole as in *M. daphnides*.

Distribution : India: West Bengal (Calcutta); in freshwater. Andhra Pradesh, Rajasthan.

Remarks : Mahajan and Nair (1965) reported this species from West Bengal for the first time.

223. *Metopus fuscus* Kahl


**Diagnosis**: Body of clear brownish tint and irregular in shape, posterior extremity flattened, pellicular striations fine, anterior left side torsion conspicuous, macronucleus single, oval or slightly reniform and sharply outlined; contractile vacuole large, with raising edges and located posteriorly.

**Distribution**: India: West Bengal (North and South 24-Parganas districts); in freshwater. Rajasthan.

224. *Metopus ovalis* Kahl


**Material examined**: 1 exs., Diamond Harbour, South 24-Parganas, 27.viii. 1964, K. N. Nair.

**Diagnosis**: Body oval, anterior and posterior ends, rounded, pellicular striations large and wide; macronucleus single, ovoid and not sharply outlined; contractile vacuole with raising edges and located at the posterior end.

**Distribution**: India: West Bengal (South 24-Parganas district); in freshwater. Rajasthan.

225. *Metopus rostratus* Kahl


**Material examined**: 2 exs., Sahid colony, Calcutta, 19.i.1963, K. N. Nair; 3 exs., Chandkhali (Taldi), South 24-Parganas, 22.viii & 5.xi.1968, K. N. Nair.

**Diagnosis**: Body flattened, oblong-oval, anterior left side body torsion very much pronounced to form a beak resembling *Loxophyllum* or *Litonotus* in shape; macronucleus single, ellipsoid; contractile vacuole without any raising edge and located at the posterior end.

**Distribution**: India: West Bengal (Calcutta and North 24-Parganas districts); in freshwater. First record from India.

226. *Metopus striatus* Mc Murrich


**Diagnosis**: Body rhomboid and triangular, flattened dorsoventrally, with rounded anterior and acute posterior ends, anterior body part equal to posterior body part but posterior one much wider; cytoplasm brownish; macronucleus single, rounded or slightly ovoid; contractile vacuole occupying the posterior end of the body.

**Distribution**: India: West Bengal (North 24-Parganas); in freshwater. New record from India.

**Family** CONDYLOSTOMATIDAE

**Genus** *Bryometopus* Kahl

Body flat, oval or ellipsoidal, undulating membrane absent, macronucleus round or oval with several micronuclei, contractile vacuole single, located near ventral side near posterior two third of the body, moss inhabiting.
227. **Bryometopus pseudochilodon** Kahl


*Diagnosis*: Body ellipsoidal, flat, contour resembling that of *Chilodon*; protoplasm colourless and glossy, macronucleus oval, micronuclei several and adjacent to macronucleus, contractile vacuole single and terminal.

*Distribution*: India: West Bengal (Calcutta). New record from India.

*Remarks*: This is a moss-inhabiting form and is collected from ground moss grown around Indian Museum tank in Calcutta.

**Family** STENTORIDAE

**Genus** *Stentor* Oken

Large, trumpet-shaped or cylindrical, highly contractile, peristome very conspicuous occupying almost whole of the anterior end, macronucleus round, oval, elongated or moniliform.

**Key to the species**

1(2) Body trumpet-shaped when fully expanded, macronucleus moniliform not extending entire length of the body ................................................................. *S. polymorphus*

2(1) Body elongately conical in fully expanded condition, macronucleus ribbon-shaped and coiled, extending entire length of the body ................................................................. *S. viridis*

228. **Stentor polymorphus** (Muller)


*Diagnosis*: Body colourless, yellow or sometimes green, trumpet-shaped in fully expanded condition; hair-like bristles present along the margin of the body; macronucleus moniliform; contractile vacuole situated near the mouth.


*Remarks*: Ghosh (1921a) collected this species from Calcutta and observed it to be attached to submerged aquatic plant.

229. **Stentor viridis** Ghosh


*Diagnosis*: Body yellow in colour, shape elongately conical with truncate apical end; macronucleus ribbon-shaped and coiled extending throughout the entire length of the body, contractile vacuole located just beneath the pseudostome with a backward canal presenting a fusiform dialation.

*Distribution*: India: West Bengal (Calcutta).
Remarks: Ghosh (1921a) collected this species from freshwater pond of Calcutta among Vorticella and Epistylis colonies.

Family BURSARIIDAE
Genus Bursaria Muller

Very large, ovoid, anterior end truncate, posterior end broadly rounded, peristome deep and wide extending about the middle of the body, cytostome bent to the left, macronucleus band shaped with numerous micronuclei.

230. Bursaria truncatella Muller


Diagnosis: Body ovate, purse-shaped, dorsal surface convex, ventral surface flat; peristome and nucleus as in the genus; contractile vacuoles many and distributed all over the body.

Distribution: India: West Bengal (Barddhaman, Nadia and South 24-Parganas districts); in freshwater. First report from India.

Suborder ARMOPHORINA
Family CAENOMORPHIDAE

Body top-shaped, pellicle rigid, cytostome near antepical pole, AZM usually encircling the body, spiralling posterior.

Genus Caenomorpha Perty

Body top-shaped, with a long caudal spine, a dense spiral field present around the caudal prolongation, strong marginal zone of about eight rows of cilia.

Key to the species

1(2) Body medusoid, more or less hemispherical, spine not exceeding the body length, macronuclei 3-4 in number..........................C. medusula

2(1) Body medusoid umbrella-shaped, spine usually exceeding the body length, macronuclei always 2 in number..........................C. lata

231. Caenomorpha lata Kahl


Diagnosis: Body diffused, bell shaped; caudal spine long and stout; macronucleus bi-articulate, micronucleus single and located below the connective strand of the ends of macronucleus; subpellicular granule stout.

Distribution: India: West Bengal (Calcutta and Haora districts); in freshwater. New record from India.

232. Caenomorpha medusula Perty


Diagnosis: Body dense, more or less hemispherical or bell-shaped with a long caudal projection; disposition of nucleus as in previous species, subpellicular granules very delicate.

Distribution: India: West Bengal (Barddhaman, Calcutta and Haora districts); in freshwater. Rajashthan.

Remarks: Mahajan and Nair (1971) were the first to record this species from India, that too from Calcutta.

Suborder COLIPHORINA
Family FOLLICULINIDAE

Lorca pseudochitinuous, ‘peristomial wings’ extending out from lorica; peristomial surface ciliated, undulating membrane lacking.

Genus Folliculina Lamarck

Body contractile and remains fixed to the lorica by its posterior extremity, peristomial cilia very long, peristomial wing very prominent.

233. Folliculina ampulla (O.F. Muller)
1786. Vorticella ampula O.F. Muller, Ilafniae et Lipsiae, pp.283-285, pl. 40, figs. 4-7.

Diagnosis: Lorica blue green, flask-shaped with neck upwards, attached laterally, body large, peristomial wings 3-6 times as long as broad, with sharply or bluntly pointed end, macronucleus spherical.

Distribution: India: West Bengal (South 24-Parganas).

Remarks: Annaldale (1907) collected this species from the brackishwater pond at Port Canning, South 24-Parganas district.

Order ODONTOSTOMATIDA
Family EPALXELLIDAE

“Chunky” forms, usually with short posterior spines and without cirri, anterior row of cilia on the left side.
Genus *Saprodinium* Lauterborn

Right carapace with one dorsal and one ventral ciliary row in posterior region; median teeth usually 4, sometimes 2 or 3, some anal teeth with and some without spine.

234. *Saprodinium dentatum* Lauterborn


*Diagnosis*: Very flat, translucent, front provided with a long thin tooth, frontal band with 2 projecting marginal ridge; peristomial cover broad and prominent, macronuclei 2 to 3 in number.

*Distribution*: India: West Bengal (Hugli district). First report from India.

Order **OLIGOTRICHIDA**

Suborder **OLIGOTRICHINA**

Key to the families

1(2) Circle of apical membranelles ‘open’ ....................................................... HALTERIIDAE

2(1) Circle of apical membranelles ‘closed’ ................................................... STROBILIDIIDAE

Family **HALTERIIDAE**

Genus *Halteria* Dujardin

Small, spherical or broadly fusiform, oral aperture terminal, eccentric and associated with large cilia, equatorial zone with long stiff springing bristles.

235. *Halteria grandinella* (Muller)


*Diagnosis*: Body broadly fusiform, sometimes globose, about 7 bristle-bearing grooves present in the equatorial zone, each bearing 3 long bristles; macronucleus oval; contractile vacuole single and located at the anterior half.

*Distribution*: India: West Bengal (Barddhaman, Calcutta, Koch Bihar, and West Dinajpur districts); in freshwater. New Record from India.

Family **STROBILIDIIDAE**

Genus *Strobilidium* Schewiakoff

Turnip-shaped, oral aperture apical and without cytopharynx, macronucleus horse-shoe shaped and located at the anterior end.
236. *Strobilidium gyrans* Stokes


*Diagnosis:* Body turnip-shaped or pyriform, posterior end truncate or with a knob-like projection, macronucleus as in the genus, contractile vacuole single and located below the middle of the body.

*Distribution:* India: West Bengal (Bankura, Calcutta, Darjiling, Puruliya and South 24-Parganas districts); in freshwater. Rajasthan.

**Order** HYPOTRICHIDA  
**Suborder** STICHOTrICHINA  
**Family** SPIROFILIDAE

Ventral cirri inconspicuous and in quite numerous and/or helically spiralled rows.

**Key to the genera**

1(2) Body pyriform, posterior end resembling a short tail, peristome large extending one-half the body length

2(1) Body slender, peristome bearing part beak-like/narrowed peristome extending over one-fourth but usually not up to one-half of the body-length

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**Genus** Hypotrichidium Ilowaisky


*Diagnosis:* Body pyriform, posterior, part arched and posterior end resembling a short tail; peristome large and deep; three long rows of cirri on the ventral side; macronuclei and micronuclei two in number.

*Distribution:* India: West Bengal (North 24-Parganas); in freshwater. New Record from India.

**Genus** Stichotricha Perty


**Diagnosis**: Body slender, ovoid, posterior end rounded and anterior end gradually attenuated; peristome extending more than half of the body; four spiral rows of ventral cirri present; living in gelatinous colonial tubes.

**Distribution**: India: West Bengal (Hugli district); in freshwater. New record from India.

239. *Balladinopsis nuda* Ghosh


**Diagnosis**: Body rigid, elliptical, with narrower anterior and wide posterior end; peristome narrow extending two thirds the body-length, three ventral cirri present and located near the peristomial margin at the anterior half of the body; anal cirri five, long and protruding beyond the posterior margin of the body; macronuclei oval and two in number.

**Distribution**: India: West Bengal (Calcutta).

**Remarks**: Ghosh (1921b) established the genus *Balladinopsis* and described a monotypic species *B. nuda*. Corliss (1979) considers this genus as *incertae sedis* under the suborder Stichotrichina.

**Suborder** SPORADOTRICHINA

**Key to the families**

1(2) Distinctive rows of right and left marginal cirri, (adoral zone of membranellae restricted to anterior third or quarter of the elongated body)..............................OXYTRICIDAE

2(1) Marginal cirri absent or greatly reduced

3(4) Adoral zone poorly developed, cirri reduced in number and limited to frontals and anals..........................ASPIDISCIDAE

4(3) Adoral zone well developed, transverse and frontoventral cirri often tremendously developed, anals of 5 cirri conspicuous...........................................EUPLOTIDAE

**Family** OXYTRICIDAE

**Key to their genera**

1(2) Marginal cirri continuous, three to four rows of ventral cirri between ventrals and marginals, seven anals, of which two more posteriorly located...............................*Pleurotricha*

2(1) Marginal cirri may or may not continuous, five ventral cirri and five anals present

3(4) Short or no caudal cirri..............................................................*Oxytricha*

4(3) Three well developed caudal cirri.............................................*Stylonychia*

**Genus Oxytricha** Bory de St. Vincent

240. *Oxytricha fallax* Stein

1859. *Oxytricha fallax* Stein, Der organismus der Infusionsthier, Leipzig, 1, p.189, pl.12, figs. 12-15.

Diagnosis: Ellipsoidal, posterior region broadly rounded; arrangement of cirri as in the genus; macronuclei usually in two parts; contractile vacuole single and located at the anterior end.

Distribution: India: West Bengal (Bankura, Birbhum, Calcutta, Darjiling, Jalpaiguri, Koch Bihar, Maldah, Murshidabad, Puruliya, West Dinajpur districts); in freshwater. Rajasthan.

Genus Pleurotricha Stein

241. Pleurotricha grandis Stein

1859. Pleurotricha grandis Stein, Lotos, 9, p.4.

Diagnosis: Elliptical in shape and widest at little behind the middle; five ventral cirri stout; macronuclei two in number; contractile vacuole single and located close to the posterior angle of peristome.

Distribution: India: Maharashtra, Madhya Pradesh, United Province, West Bengal (Haora).

Remarks: The only record of this species from this state has been made by Chaudhury (1929) from the soils of Sibpur, Haora district.

Genus Stytonichia Ehrenberg

242. Stytonichia mytilus Ehrenberg

1838. Stytonichia mytilus Ehrenberg, Die Infusionstierchen als vollkommene Organismen, Liepzig.

**Diagnosis**: Ovoid in shape with anterior part broader than posterior one, ventral surface flat and dorsal surface convex; macronuclei oval, two in number, contractile vacuole single and located at the anterior half.

**Distribution**: India: West Bengal (Darjiling and South 24-Parganas districts). New record from India.

**Family ASPIDISCIDAE**

**Genus Aspidisca Ehrenberg**

Small, ovoid or shield-shaped, dorsal surface conspicuously ridged, cirri strong and long; macronucleus curved or horse shoe-shaped.

**Key to the species**

1(2) Peristome obliquely crescentic occupying posterolateral portion of ventral surface, four frontal, five ventral and five anal cirri present......................................................A. bengalensis

2(1) Peristome starting from anterior end reaching up to anal cirri, seven fronto-ventral and five anal cirri present......................................................A. costata


**Diagnosis**: Body broadly ovate with a shallow notch just behind the anterior end; dorsal surface convex with six to seven longitudinal ridges; peristome obliquely crescentic, occupying posterolateral portion of ventral surface; four frontal, five ventral and five anal cirri present; contractile vacuole single posterior.

**Distribution**: India: West Bengal (Calcutta).

**Remarks**: Ghosh (1921b) described this species from the pond water of Calcutta. Since then no further report on this species is available till date.

244. **Aspidisca costata** (Dujardin) 1841. Aspidisca costata Dujardin, Histoire nat des zoophytes infusoires, p.446, pl.10. fig.1.

**Material examined**: 1 ex., Indian Museum tank, Calcutta, 27.i.1970, K.N. Nair.

**Diagnosis**: Body more or less ovate, rounded at both ends; dorsal surface convex with five to six distinct longitudinal ridges, peristome starting from the anterior end of the body extending up to the anal cirri, seven fronto-ventral and five anal cirri present; macronucleus curved, contractile vacuole single posterior.

**Distribution**: India: West Bengal (Calcutta).

**Family EUPLOLIDAE**

**Genus Euploites Ehrenberg**

Body ovoid, peristome well developed and broadly triangular; frontoventral cirri more than nine, anal cirri well developed and five in number, caudal cirri four and scattered.
Key to the species

1(2) Oval with a triangular wing on left, two right caudals furcated ............................ *E. leticiensis*

2(1) Subcircular, ellipsoid or asymmetrical, without any triangular wing, caudals not furcated

3(4) Macronucleus ‘C’ - shaped .................................................................................. *E. patella*

4(3) Macronucleus not ‘C’ - shaped

5(6) Body ellipsoid, macronucleus 3 - shaped .......................................................... *E. plumipes*

6(5) Body asymmetrical, macronucleus bent near posterior portion resembling ‘S’ to some extent...

................................................................. *E. gracilis*

245. *Euplotes leticiensis* Bovee


*Diagnosis* : Body oval, peristome large with a triangular wing on left; frontoventral cirri nine, caudals four, out of which two right caudals furcated.

*Distribution* : India : West Bengal (Birbhum and Barddhaman districts); in freshwater. New record from India.

246. *Euplotes gracilis* Kahl


*Diagnosis* : Body asymmetrical with two dorsal furrow; peristome narrow; frontoventral nine, caudals four nonfurcated; macronucleus bent near posterior end resembling ‘S’ to some extent.

*Distribution* : India : West Bengal (Koch Bihar and South 24-Parganas districts); in freshwater. New record from India.

247. *Euplotes patella* (Muller)


*Diagnosis* : Body subcircular to elliptical with narrow peristome, frontoventral cirri nine, caudals four nonfurcated, macronucleus ‘C’ - shaped.

*Distribution* : India : West Bengal (Calcutta, and Koch Bihar districts); in freshwater. Rajasthan.
248. *Euplotes plumipes* Stokes


*Diagnosis*: Body ellipsoid with wide and deep peristome, frowentoventrals 9-10, caudals 4 non-furcated, macronucleus ‘3’ - shaped.

*Distribution*: India: West Bengal (Barddhaman, Koch Bihar, Maldah, Murshidabad, Puruliya and South 24-Parganas districts); in freshwater. Rajasthan.

**GENERAL REMARKS ON DISTRIBUTION**

Freeliving protozoa occurring in each of 17 districts of West Bengal is shown in Map No.1 while district-wise distribution of each species has already been mentioned under the systematic account of the respective species.

A perusal of this distribution list reveals that out of 248 species only two species, both ciliates, viz., *Coleps hirtus* and *Paramecium caudatum* have been reported from all the 17 districts and seven other species as follows have been found from 10 or more districts of the state. Out of these seven species, five are rhizopods, viz., *Arcella discoides*, *Centropyxis aculeata*, *Centropyxis ecornix*, *Centropyxis spinosa* and *Diffugia lobostoma* and, two ciliates, viz., *Frontonia leucas* and *Oxytricha fallax*. This fact is interesting but misleading because the number of cosmopolitan species will invariably increase to a great extent if intensive collections and studies are made from the least surveyed districts.

For the convenience of analysis, district-wise distribution of protozoa of West Bengal reported/collected so far, is shown in the table.

From the table it is quite evident that number of freeliving protozoan species collected from Calcutta is considerably large compared to any other district of West Bengal. This is followed by the districts South 24-Parganas, Hugli and North 24-Parganas from where fifty or more species have been collected. This may be due to the reason that Hugli and erstwhile 24-Parganas were surveyed by ZSI scientists periodically and frequently from 1959 to 1967 for the collection and taxonomic study of freeliving protozoa. Furthermore, Simmons (1889-91) and Ghosh (1918-1929) collected a considerable number of protozoan species from the freshwater ponds, sewages and vegetable infusions of Calcutta. To the contrary, what has been reported from other districts is mostly the result of a single visit and single sampling, that too, from a very limited number of habitats. It is, therefore, quite probable that number of species occurring in those districts vis-a-vis West Bengal is many more than what is dealt with in this paper.
A comprehensive taxonomic account of freeliving protozoa known so far from West Bengal is presented in the paper. In all 248 species of protozoa, belonging to 2 phyla, 2 subphyla, 7 classes, 29 orders, 76 families and 124 genera are dealt with. One new species, *Vannella bengalensis* n.sp. (Class Lobosca, order Amoebida, and Family Thecamoebidae) is described and taxonomic status of a rhizopod genus *Greeffia* Singh end Hanumaiah along with the species *G. soli* Singh and Hanumaiah discussed. Further, key to the families, genera and species is given. In addition to these, diagnostic feature of each species, its detail locality record and district-wise distribution in West Bengal are also incorporated.

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<table>
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<th>Location</th>
<th>Rh Species</th>
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<td>Barddhaman</td>
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<td>Birbhum</td>
<td>(48, 51, 58, 62, 67, 74, 75, 84)</td>
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<td>Darjiling</td>
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<td>Haora</td>
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<td>Murshidabad</td>
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<td>Nadia</td>
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<td>Purulia</td>
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<td>South 24-Parganas</td>
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** The numerical number in the parenthesis indicates the serial number of the species given in the systematic list in pages 12-17.
Map. 1. Showing district-wise distribution of freeliving flagellates, rhizopods and ciliates (in number of species); numerical number indicates number of species of concerned group.

Fl – Flagellate; Cl – Ciliate; Rh – Rhizopod.
Map 2. Distribution of some common species of testacean rhizopods in West Bengal.
Map. 3. Distribution of some common species of freeliving ciliates in West Bengal.
Map. 4. Distribution of some rare species of testacean rhizopods in West Bengal.
Map 5. Distribution of some rare species of testacean rhizopods in West Bengal.
Map. 6. Distribution of some rare species of freeliving ciliates in West Bengal.
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Corliss, J.O. 1960. The problem of homonyms among generic names of ciliated protozoa, with proposal of several new names. J. Protozool. 7: 269-278.


PARASITIC PROTOZOA

A.K. DAS, A.K. MANDAL, N.C. NANDI, R. NANDI AND N.C. SARKAR
Zoological Survey of India, Calcutta

INTRODUCTION

The present communication is the second part of a treatise on the protozoa fauna of West Bengal, the first part of which deals with 248 species of freeliving protozoa of the state (Das, Mandal and Sarkar, 1992). Parasitic protozoa compared to their freeliving counterpart are more extensively studied throughout the globe including West Bengal. This may be due to the reason that man himself along with his livestock and other animals around him is sometimes severely affected by these organisms. In West Bengal, so also in India Lewis (1870) was probably the first to observe the cyst of a parasitic protozoa, Entamoeba coli from the faecal sample of man while he had been working on cholera evacuation programme at Calcutta. In subsequent years he (1878, 1879) found some flagellated organisms in blood of man, rat and other animals. These flagellates were ultimately placed under Trypanosoma lewisi.

Among flagellated parasites, trypanosomes have been studied comparatively thoroughly in West Bengal by several workers, more specially, Das Gupta and his co-workers (1972 onwards), Misra and his collaborators (1973-76), Mandal and his associates (1975-88) and Ray and his collaborators (1983 onwards). Mention is to be made here that Ray and Choudhury (1983) and Mandal (1984) published technical monographs on amphibian and fish trypanosomes respectively. Other groups of flagellated parasites and amoeba from man have been studied by Chatterjee (1915-23), while he was working in the Medical College, Calcutta.

Sarcodine and opalinate parasites of West Bengal are least studied. Ghosh (1919-22) and Chatterjee (op.cit) contributed on the subject. It is worth mentioning here that Mandal and Chowdhury (1986) reported Entamoeba histolytica in rhesus monkey from this State.

Parasitic protozoa belonging to the phylum Apicomplexa are extensively studied in West Bengal by large number of workers. Researches on septate gregarines were made by Ghosh (1923), Ray and Chakravarty (1933-36), Chakravarty (1933-59) and Haldar, Chakraborty, Sarkar, Kundu and others (1974 onwards). Aseptate gregarines were studied by Misra and Ray Choudhury (1973), Pradhan and Das Gupta (1980-82), Sarkar (1983) and, Roy Chowdhury and Haldar (1984).

In West Bengal work on haemosporidians which include malaria and related parasites was initiated by Sir Ronald Ross (1898a,b). He (op.cit.) elucidated the life cycle of malarial parasites and their transmissin by Cul-cx pipens in Calcutta. Misra, Haldar and Chakravarty (1972) and Mandal et al (1985) reported the occurrence of this group from Indian fishes, Ray and Choudhury (1981) from a frog, Rana limnocharis, Sarkar and Ray (1972), Nandi and Mandal (1977 onwards) and, Pal and Das Gupta (1980) from birds and, Nandi and Mandal (1976) from bat.
Coccidian parasites are well studied in this state. Knowles and Das Gupta (1934) recorded coccidial infection in man. Subsequently Ray and his collaborators (1935-73), Chakravarty and his co-workers (1943-65), Mandal (1963 onwards) and Bandyopadhyay (1982-87) recorded and described large number of coccidian species from different vertebrate hosts. Mandal (1987) made a significant contribution by publishing a fauna on Eimeriidae in the Fauna of India series. In addition, Ray (1983) described Lankesterella from frogs, Sarkar and Haldar (1979) and, Kundu and Haldar (1984) reported Dactylosoma from fishes and, Ray and Sarkar (1969) recorded a species of Gordonella (which is now synonymised with Schellackia) from a lizard, Colotes versicolor. So far as haemogregarines are concerned Mandal et al. (1985) reported this group from fishes, Ray and Choudhury (1984) published a monograph on this group from amphibia, Misra and his collaborators (1974-76), Sinha (1977 onwards) and, Ray and Bhattacharjee (1984) from reptilian hosts.

Myxozoan parasites of fishes are also elaborately searched in West Bengal by several workers among whom Chakravarty and his co-workers (1937-70), Haldar and his collaborators and, Sarkar and his associates (1982-89) deserve special mention. Besides, Mandal and Nair (1975) and, Choudhury and Nandi (1973) also reported some protozoa of this group from fishes. A single species of myxozoan parasites of frog, viz., Myxidium haldari has been reported so far from amphibian host (Sarkar, 1982) from this state, so also from India.

Microsporidian parasites have received inadequate attention from this state. Sen (1941) recorded 3 species of Thelohania from anopheline larvae collected in Calcutta and its vicinity.

Anderson (1889) was the first to describe a parasitic ciliate from West Bengal, namely, Anoplophrya aelosomatis from earthworms. Later Ghosh (1919-22), Ray (1932), Chatterjee and his associates (1919-35) worked on this group in this state. Subsequently Chakravarty and Chatterjee (1957), Das and Mukherjee (1974), Mukherjee and his collaborators (1974-90) and, Jamadar and Choudhury (1988) reported several species of parasitic ciliates from different invertebrate and vertebrate hosts.

All the parasitic protozoa reported so far from West Bengal and collected presently from 17 districts of this state in the course of mopping survey during the years 1984-88 as well as those already present in the National Collections of the Zoological Survey of India are being dealt with in the present communication excepting some microsporidian and 2 species of Plasmodium. These microsporidians were recorded by Ghosh (1989) from a Coleopteran stored - grain pest, Sitophilus oryzae collected from Hugli district. But, Ghosh (op.cit) could not determine their generic status and proposed a ‘collective name’ Microsporidian sitophilii for them. Two species of Plasmodium, viz., P. cynomolgi and P. gallinaceum are not included in this paper since these are recovered/studied from intermediate/experimental hosts (former from Anopheles annularis and A. cucilifacis and the latter from Aedes aegypti) but not from any definitive host.

The present communication includes taxonomic account of 596 species belonging to 5 phyla, 10 classes, 22 orders, 63 families and 131 genera recovered from 353 host-species. The systematic list of these species, a host-parasite list with collecting localities/districts and key to the families, genera and species are also incorporated. Further, district-wise distribution of these parasites is included in this paper in order to indicate the extent of work done on each group of protozoan parasites from each district of this state.
MATERIAL AND METHODS

The various parasitic protozoans collected from all the 17 districts of West Bengal during the course of mopping survey 1984-88 in addition to those already present in the National Zoological Collections of this department as well as other protozoan parasites reported so far from this state provided the materials for this study. The host samples, both invertebrates and vertebrates, collected from the fields, were brought to the camp laboratory where they were dissected and thoroughly examined for various parasitic groups from different organs/microhabitats viz., lumen of the digestive tract, body-cavity, blood, gills, gall bladder, lung, liver, spleen and other tissues. Gut-contents were examined after diluting them with physiological saline. Organ-smears and blood-smears were drawn on clean and grease-free slides, air-dried, fixed and/or stained mostly with Giemsa and Leishman’s stains. The lumen-dwelling forms as and when observed in physiological saline were usually fixed in Schaudinn’s fixative and stained with Heidenhain’s iron haematoxylin stain. Faecal samples were kept in 2.5% potassium dichromate solution for subsequent sporulation of the coccidial oocysts, if any. Dry silver impregnation technique was employed in some cases for studying the ciliary lines of some endocummensal ciliates.

Temporary preparations were often made for the detection different organelles with neutral red, methylene blue, Lugols iodine, ink in very dilute solutions. Extrusion of polar filaments was achieved in some cases with 5% to 10% KOH solution. Permanent preparatins were made through staining, differentiation, dehydration and mounting of slides in a neutral medium with DPX. Histological preparations were made in a few cases following standard histological procedure. For further details Mandal, Das and Nandi (1990) may be referred.

Observations were made under the oil immersion of Olympus/Carl Zeis microscope. Figures were drawn with the aid of a camera lucida. Linear measurements were taken with a calibrated ocular micrometer and expressed in micrometer (μm) after calibrating with a stage micrometer scale.

Area measurements were obtained by drawing the specimens on a graph paper (mm division) and by calibrating and counting the number of squares covered.

GENERAL TERMINOLOGY

As stated earlier, parasitic protozoa of this state represent diversified phyla, orders, classes and families. Therefore, some common terminologies used in the keys and the diagnostic features (plates 1-4) of these parasites are explained below for the convenience of the workers of this group. Moreover, some common protozoan parasites occurring in different group of hosts from this state are shown in plates 5-13.

**Acephaline** : A gregarine lacking an epimerite

**Anisogamy** : Conjugation between two dissimilar gametes.

**Apical complex** : Ultra structural complex structure at the apex of merozoite/sporozoite.

**Association** : A group formed by the attachment of two or more sporonts.
Biassociative : An association formed by the attachment of two sporonts.
Cephaline : A gregarine possessing an epimerite
Conoid : A truncated hollow cone of spirally fibrillar ultra structure, having 6-8 fibrils.
Cyst : Impervious membrane surrounding an organism or a pair of associated sporozoites at the beginning of reproduction
Deutomerite : The posterior portion of cephaline gregarine which is separated from the protomerite by a septum.
Disporous : Producing two spores.
Epimerite : Usually a knob-like structure used for attachment with the host-cell by the young gregarine.
Gamete : Specialised cells, tend to meet and fuse in conjugation.
Gametocyst : The cyst which surrounds two sporonts or gametocytes in associative stage.
Gametocyte : The mother cell that gives rise to a number of gametes.
Gametogony : The process of production of gametocytes or gametes by a gamont.
Gamont : An individual that tends to form gamete; also known as sporont.
Isogamete : Gametes which are similar in shape and size.
Isogamy : Conjugation between isogametes or similar gametes.
Macrogamete : The larger non-motile gamete of an anisogamous type of reproduction.
Macrogametocyte : The mother cell of macrogamete.
Merozoite : A product of asexual schizogony.
Microgamete : The smaller and motile gamete in anisogamous type of reproduction.
Microgametocyte : The mother cell of microgamete.
Micronemes : Small osmiophilic convoluted cord-like ultra structure at the anterior region of sporozoite/merozoite.
Micropore : An ultra structural organellae formed by the pellicle.
Microtubules : Ultra structural subpellicular fibrills originating at the polar ring and extending posteriorly.
Oocyst : A cyst containing conjugated gametes.
Ookinete : The motile zygote in Haemosporina.
Pellicle : Cell boundary of sporozoite and merozoite having outer and inner membranes closely associated with one another (ultra structure).
Polar capsul e: A sac-like structure containing polar filament in the spore of Myxozoa and Microspora.

Polar filament: A thread-like structure present coiled inside the polar capsule.

Polar ring: An osmiophilic ultra structural thickening formed by the inner membrane of the pellicle.

Primit e: The first sporont in the association of a gregarine.

Protomerite: The portion preceding the septum of a cephaline gregarine.


Satellite: The sporont(s) attached behind the primit e.

Scizogony: Asexual or agamic reproduction by equal, unequal or multiple division.

Schizont: The stage which is about to divide into a number of parts called merozoites.

Septate: In gregarines, it indicates a type which is having a septum between the protomerite and deutomerite.

Spore: The body into which the zygote develops after acquisition of a resistant outer coating.

Sporoduct: A tubular growth from the cyst of a gregarine through which spores are liberated.

Sporoblast: A cell which gives rise to spore.

Sporocyst: A cyst containing the spores.

Sporogony: Development of spores from the sporont.

Sporont: See gamont.

Sporozoite: The ultimate individual falciform bodies produced/ released from a spore.

Syzygy: An association of two or more sporonts in a linear fashion.

Trophozoite: The young feeding and growing stage.

Zygote: The cell formed by the fusion of two gametes.

SYSTEMATIC LIST OF PARASITE PROTOZOA

Subkingdom PROTOZOA
Phylum SARCOMASTIGOPHORA
Subphylum MASTIGOPHORA
Class PHYTOMASTIGOPHOREA
Order EUGLENIDA
Suborder EUGLENINA
<table>
<thead>
<tr>
<th>Family</th>
<th>Genus</th>
<th>Species</th>
<th>Order</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTASIIDAE</td>
<td><em>Copromonas</em> Dobell</td>
<td><em>C. ruminantum</em> Woodcock</td>
<td>CHRYSONONADIDA</td>
<td>Sundarban</td>
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<td></td>
<td></td>
<td><em>Sus scrofa</em></td>
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<td>CROMULINIDAE</td>
<td><em>Oikomonas</em> Kent</td>
<td><em>O. communis</em> Liebetanz</td>
<td>KINETOPLASTIDA</td>
<td>Tangra, Calcutta</td>
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<td><em>Capra hircus</em></td>
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<tr>
<td>BODONININA</td>
<td><em>Bodonomonas</em> Davis</td>
<td><em>B. rebae</em> Tripathi</td>
<td>BODONIDAE</td>
<td>West Bengal</td>
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<td></td>
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<td><em>Catla catla</em></td>
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<td></td>
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<td><em>Cirrhina mrigala</em></td>
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<td></td>
<td><em>Cirrhina reba</em></td>
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<td><em>Labeo rohita</em></td>
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<td>CRYPTOBIIDAE</td>
<td><em>Trypanoplasma</em> Laveran and Mesnil</td>
<td><em>T indica</em> (Mandal)</td>
<td>PROTOZOA</td>
<td>Champahati, South 24-Parganas</td>
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<td><em>Mystus vittatus</em></td>
<td>TRYPANOSOMATINA</td>
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<td>TRYPAHOSOMATIDAE</td>
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<td><em>Leishmania</em> Ross</td>
<td><em>L. donovani</em> Laveran &amp; Mesnil</td>
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<td>Barddhaman, Murshidabad, North and South 24-Parganas</td>
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<td><em>Phlebotomus papatasi</em></td>
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<td>GRUBY</td>
<td><em>Trypanosoma</em></td>
<td><em>T anabasi</em> Mandal</td>
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<td>Canning, Berhampore</td>
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<td><em>Anabas testudineus</em></td>
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<td></td>
<td></td>
<td><em>T armeti</em> Mandal</td>
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<td>Champahati</td>
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<td><em>Mastacembelus armatus</em></td>
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<td><em>T batrachi</em> Qadri</td>
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<td>Calcutta, Dinhata, Koch Bihar, South 24-Parganas</td>
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<td><em>Clarias batrachus</em></td>
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<td><em>T bengalensis</em> Mandal</td>
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<td>Canning and Champahati</td>
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<td><em>Mystus bleekeri</em></td>
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<td><em>T cancili</em> Mandal</td>
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<td>Raidighi</td>
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</table>
11. T. choudhuryi Mandal  
   Hemiclepsis m. marginata  
   Sarotherodon (= Tilapia) mossambica  
   Balitha, Bankura  
12. T danilewskyi saccobranchi Qadri  
   Heteropneustes fossilis  
   Berhampore, Calcutta market  
13. T. elongatus Ray Chaudhuri and Misra  
   Channa punctatus  
   Calcutta  
14. T gachii Misra, Chandra and Choudhury  
   Hemiclepsis marginata  
   Calcutta  
15. T. gobida Mandal  
   Channa gachua  
   Calcutta  
16. T granulosum Laveran and Mesnil  
   Glossogobius giuris  
   Canning  
   North 24-Parganas  
17. T. maguri Tandon and Joshi  
   Anguilla anguilla  
   Calcutta  
18. T mukundi Ray Chaudhuri and Misra  
   Clarias batrachus  
   Calcutta market  
19. T. nandi Mukherjee and Haldar  
   Heteropneustes fossilis  
   Calcutta market  
20. T. pancali Mandal  
   Nandus nandus  
   Kalyani  
21. T. punctati Hasan and Qasim  
   Ophicephalus punctatus  
   Raiganj  
22. T seenghali Joshi  
   Mystus seenghala  
   Calcutta market  
23. T. striati Qadri  
   Channa striatus  
   Raiganj, Calcutta  
24. T. tandoni Mandal  
   Wallago attu  
   Champahati  
25. T. vittati Tandon and Joshi  
   Mystus vittatus  
   Dinhata, Koch Bihar, Taki, North 24-Parganas  
26. T. xenentodoni Das, Sarkar and Bandyopadhyay  
   Xenentodon cancila  
   Malda  
27. T. sp.  
   Aorichthys aor  
   Calcutta market  
28. T. sp.  
   Nandus nandus  
   Maldah  

B. Trypanosoma of amphibians  
29. T chattoni Mathis and Leger  
   Rana limnocharis  
   Jalpaiguri  
30. T. inopinatum Sergent & Sergent  
   Rana hexadactyla  
   Bankura  
31. T karyozeukton Dutton and Todd  
   Rana tigrina  
   Bankura  
   Salikona, Hugli  
   Barddhaman and Darjiling
32. *T loricatum* (Mayer)  
   *Rana tigrina*  
   *Rana limnocharis*  
   Bankura  
   Balitha, Bankura

33. *T mega* Dutton and Todd  
   *Rana tigrina*  
   Barddhaman and Darjiling

34. *T ranarum* (Lankester)  
   *Rana tigrina*  
   Bankura  
   Bankura

35. *T rotatorium* (Mayer)  
   *Bufo melanostictus*  
   *Bufo stomaticus*  
   *Helobdella nociva*  
   (Expt.)  
   Berhampore  
   Calcutta  
   West Bengal

36. *T systoma* Ray and Chodhury  
   *Uperodon systoma*  
   Medinipur

37. *T taprobanica* Ray and Choudhury  
   *Rana tigrina*  
   Barddhaman, Medinipur, Darjiling, Puruliya

C. *Trypanosoma* of reptiles

38. *T balithaensis* Ray  
   *Helobdella nociva*  
   Lissemys punctata punctata  
   Balitha, Bankura  
   Balitha, Bankura

39. *T enhydris* Sinha and Mandal  
   *Enhydris enhydris*  
   Chakdah, Darjiling, Koch Bihar

40. *T gangetica* Sinha  
   *Trionyx gangeticus*  
   Bangaon market

D. *Trypanosoma* of birds

41. *T avium* Danilewsky  
   (=*T. knowlesi*)  
   *Acrocephalus dumetorum*  
   *Dicrurus adsimilis*  
   Calcutta  
   North & South 24-Parganas, Nadia

41a. *T avium bakeri* Chatterjee and Ray  
   (= *T. brimonti bakeri*)  
   *Dendrocittata vagabunda*  
   *Pyconotus jocosus*  
   Calcutta

42. *T hannae* Pittaluga  
   *Columba livia domestic*  
   Calcutta, South 24-Pgs.

43. *T lanii* Choudhury and Misra  
   *Lanius schach tricolor*  
   Calcutta

44. *T sp.*  
   *Lonchura p. punctulata*  
   Calcutta
E. Trypanosoma of mammals

45. *T. evansi* (Steel)  
   *Panthera pardus*  
   Darjiling zoo  
   *Panthera tigris*  
   Aliproe zoo  
   *Panthera tigris altaica*  
   Darjiling Zoo  
   *Panthera unca*  
   Calcutta  

46. *T. (Herpetosoma) lewisi* (Kent)  
   *Bandicota bengalensis*  
   Calcutta  
   *Mus musculus*  
   Sibpore, Haora  
   *Rattus decumenus*  
   Calcutta  
   (= *R. norvegicus*)  
   *Rattus rattus*  
   Singur, Hugli  
   *Rattus rattus arboreus*  
   Haora  

47. *T. indicum* Luhe  
   *Petaurista magnificus*  
   Darjiling  
   *Petaurista n. nobilis*  
   Darjiling  

48. *T. rhinolophonis* Pal and Dasgupta  
   *Rhinolophus rouxi rouxi*  
   Singhmari, Darjiling  

49. *T. sp.*  
   *Pataurista nobilis nobilis*  
   Darjiling  

Order RETORTOMONADIDA  
Family TETRAMITIDAE  
Genus *Costia* Leclerque  

50. *C. necatrix* (Henneguy)  
   *Channa punctatus*  
   Budge Budge  
   Belgharia  
   *Channa striatus*  
   Budge Budge  
   Belgharia  
   Indian carps  
   West Bengal  

Genus *Enteromonas* da Fonseca  

51. *E. hominis* da Fonseca  
   *Homo sapiens*  
   Calcutta  

Family CHILOMASTIGIDAE  
Genus *Chilomastix* Alexeieff  

52. *C. caprae* Fonseca  
   *Capra hircus*  
   Tangra, Calcutta  

53. *C. mesnili* Wenyon  
   *Homo sapiens*  
   Calcutta  

Family CALLIMASTIGIDA  
Genus *Callimastix* Weissenberg  

54. *C. frontalis* Braune  
   *Capra hircus*  
   Tangra, Calcutta
**Genus** *Selenomonas* Von Prowazek

55. *S. ruminantium* var. *caprae*  
*Capra hircus*  
Order DIPLOMONADIDA  
Suborder DIPLOMONADINA  
Family HEXAMITIDAE  
Genus *Giardia* Kuntsler

56. *G. intestinalis* (Lambl)  
*Homo sapiens*  
Order TRICHOMONADIDA  
Family MONOCERCOMONADIDAE  
Genus *Monocercomonas* Grassi

57. *M. caprae* Das Gupta  
*Capra hircus*  
58. *M. ruminantum* (Braune)  
*Axis axis*  
Family TRICHOMONADIDAE  
Genus *Trichomonas* Donne

59. *T gallinae* (Rivolta)  
*Milvus migrans*  
60. *T ruminatium* Braune  
*Capra hircus*  
61. *T thukuni* Ray and Singh  
*Cavia cutleri*  
62. *T vaginalis* Donne  
*Homo sapiens*  
Genus *Tetrastrichomonas* Hibler, Hammond, Caskey, Johnson & Fitzgerald

63. *T buttryi* (Hibler et al)  
*Sus scrofa*  
Genus *Pentatrichomonas* Bishop

64. *P. hominis* (Davaine)  
*Canis aureus*  
Order HYPERMASTIGIDA  
Suborder LOPHOMONADINA  
Family LOPHOMONADIDAE  
Genus *Lophomonas* Stein

65. *L. striata* Bütschli  
*Periplaneta americana*  
Subphylum OPALINATA  
Class OPALINATEA  
Order OPALINIDA  
Family OPALINIDAE  
Genus *Hegneriella* Earl

66. *H. mukundai* Chandra and Choudhury  
*Kaloula pulchra taprobanica*  
Medinipur
Genus | *Opalina* Purkinje and Valentin
---|---
67. *O. plicata* Ghosh | *Bufo melanostictus* Calcutta
68. *O. scalpriformis* Ghosh | *Bufo melanostictus* Calcutta, Maldah Murshidabad
69. *O. triangularis* Ghosh | *Bufo himalayana* Darjiling
70. *C. longa* (Bezzenberger) | *Bufo melanostictus* Calcutta, Maldah Murshidabad
71. *C. srivastavai* Mukherjee and Chakraborty | *Rhacophorus maculatus* Falta, South 24-Parganas

Genus | *Cepedea* Metcalf
---|---
72. *E. cervis* Mandal and Choudhury | *Axis axis* Sundarban, Calcutta Zoo
73. *E. chattoni* Swellengrebel | *Macaca mulatta* Sundarban
74. *E. chiropteris* Mandal and Choudhury | *Scotophilus kuhli kuhli* Sundarban Tiger Reserve
75. *E. coli* (Grassi) | *Homo sapiens* Calcutta, Sundarban
76. *E. histolytica* Schaudinn | *Macaca mulatta* Sundarban
77. *E. muris* (Grassi) | *Rattus rattus arboreus* Sundarban Tiger Reserve
78. *E. ovis* Swellengrebel | *Capra hircus* Tangra, Calcutta
79. *E. suis* Hartmann | *Sus scrofa scrofa* Sundarban Tiger Reserve

Genus | *Entamoeba* Casagrandi and Barbagallo
---|---
80. *D. fragilis* Jepps and Dobell | *Macaca irus* Calcutta, Sundarban
Genus *Iodamoeba* Debell
81. *I. butschlii* (Prowazek)  
*Macaca mulatta*  
*Sus scrofa scrofa*  
Sundarban forest

Phylum **APICOMPLEXA**  
Class **SPOROZOEAA**  
Subclass **GREGARINA**  
Order **EUGREGARINIDA**  
Suborder **ASEPTATINA**  
Family **MONOCYSTIDAE**

Genus *Monocystis* Stein
82. *M. beddardi* Ghosh  
*Eutyphoeus nicholsoni*  
Calcutta
83. *M. bengalensis* Ghosh  
*Pheretima posthuma*  
Calcutta
84. *M. illoidi* Ghosh  
*Pheretima posthuma*  
Calcutta
85. *M. senchalensis* Pradhan and Das Gupta  
*Apporectodea trapezoides*  
Senchal, Darjiling

Genus *Nematocystis* Hesse
86. *N. bengalensis* Roy Chowdhury and Halder  
*Eutyphoeus incommodus*  
Ashokenagar, North 24-Parganas
87. *N. levinei* Pradhan and Dasgupta  
*Eutyphoeus gammiei*  
Mangpoo, Darjiling
88. *N. mangpooensis* Pradhan and Dasgupta  
*Eutyphoeus gammiei*  
Mangpoo, Darjiling
89. *N. mauritii* Roy Chowdhury and Halder  
*Lampito mauriti*  
Ashokenagar, North 24-Parganas
90. *N. quadrakaryosomata* Pradhan and Dasgupta  
*Pheretima differingens*  
Goomti, Darjiling
91. *N. senchalensis* Pradhan and Dasgupta  
*Apporectodea trapezoides*  
Senchal, Darjiling
92. *N. theodoridis* Pradhan and Dasgupta  
*Pheretima differingens*  
Goomti, Darjiling

Genus *Apolocystis* Cognelti
93. *A. akaryosomiferus* Pradhan and Dasgupta  
*Pheretima robusta*  
North Point, Darjiling
94. *A. goomtiensis* Pradhan and Dasgupta  
*Pheretima differingens*  
Goomti, Darjiling
95. *A. monokaryosomiferus* Pradhan and Dasgupta  
*Pheretima robusta*  
North Point, Darjiling
96. *A. vacuolatus*  
Pradhan and Dasgupta

*Pheretima alexandri*  
Kalimpong, Darjiling

Genus *Informis* Pradhan and Dasgupta

97. *Informis informis*  
Pradhan and Dasgupta

*Apporectodea trapezoides*  
Senchal, Darjiling

98. *I. pseudotentaculatus*  
Pradhan and Dasgupta

*Apporectodea trapazoides*  
Senchal, Darjiling

Genus *Bisurculus* Pradhan and Dasgupta

99. *B. variegatus*  
Pradhan and Dasgupta

*Amynthas hawayanus*  
Goomti, Darjiling

Family STOMATOPHORIDAE

Genus *Stomatophora* Drazewecki

100. *S. bahli* Pradhan and Dasgupta

*Pheretima differingenus*  
Darjiling

101. *S. diadema* Hesse

*Pheretima posthuma*  
Calcutta

102. *S. globa*  
Pradhan and Dasgupta

*Pheretima alexandri*  
Jorpokhali, Darjiling

103. *S. pedongensis*  
Pradhan and Dasgupta

*Pheretima differingenst*  
Pedong, Darjiling

104. *S. pradhanis* Roy Chowdhury and Haldar

*Metaphire (=Pheretima) posthuma*  
Ashokenagar, North 24-Parganas

Genus *Chakravartiella*

105. *C. sugereiformes* Misra and Raychaudhury

*Trigonius goesii*  
Naihati, North 24-Parganas

Family ZYGOCYSTIDAE

Genus *Zygocystis* Stein

106. *Z. indicus* Pradhan and Das Gupta

*Pheretima (=Metaphire) californica*  
Kalimpong, Darjiling

Family ENTEROCYSTIDAE

Genus *Enterocystis* Zwetkow

107. *E. bengalensis* Sarkar

*Psocatropos sp.*  
Naihati, North 24-Parganas

Family DIPLOCYSTIDAE

Genus *Lankesterla* Mingazzini

108. *L. culicis* (Ross)

*Aedes (Stegomyia) aegypti*  
Calcutta

*Aedes (Stegomyia) albopictus*  
Calcutta
109. *L. mackiei* (Shortt and Swaminath)  
*Phlebotomus argentipes*  
*Phlebotomus papatasi*  
Suborder: SEPTATINA  
Family: GREGARINIDAE  
Genus: *Gregarina*

110. *G. alcidessi* Haldar and Chakravarty  
*Alcedes sp. nr. leopardus*  
Kalyani

111. *G. basiconstrictonesa* Ghosh, Sengupta and Haldar  
*Tribolium castaneum*  
Chinsurah

112. *G. biolobosa* Kundu and Haldar  
*Longitarsus sp.*  
Kalyani

113. *G. chaetocnemae* Sarkar  
*Chaetocnemena concinuipenis*  
Murshidabad

114. *G. crescentica* Haldar and Chakraborty  
*Amblyrrhinus sp.*  
Kalyani

115. *G. cylindrosa* Haldar and Kundu  
*Supella supellectilium*  
Kalyani

116. *G. dasguptai* Mandal et. al.  
*Coccinella septempunctata*  
Darjiling

117. *G. discocephala* Kundu and Haldar  
*Nymph of Blattodea*  
Ranaghat

118. *G. gryllodis* Haldar and Sarkar emend. Levine  
*Gryllodes sp.*  
Chinsurah

119. *G. guttiventra* Haldar and Sarkar  
*Plebeogryllus guttiventra*  
Naihati

120. *G. ischnopterae* Datta and Haldar  
*Ischnoptera sp.*  
Kalyani

121. *G. lewinei* Haldar and Sarkar emend. Levine  
*Pteronomobius fascipense*  
Chinsurah

122. *G. lygeusi* Haldar, Ray and Gupta  
*Lygeus hospes*  
Kalyani

123. *G. mukundai* Haldar and Kundu  
*Nymph of Dictyoptera*  
Ranaghat

124. *G. nalae* Datta and Haldar  
*Nala lividipes*  
Kalyani

125. *G. spraguei* Haldar and Chakraborty  
Unnamed curculionid beetle  
Kalyani

Genus: *Anisolobus* Vincent

126. *A. indicus* Haldar, Ray and Bose  
*Coccinella septempunctata*  
Kalyani

127. *A. royii* com. nov.  
*Oryzaephilus mercator*  
Calcutta
Family Didymophidae
Genus Didymophyes Stein

128. *D. indiae* Kundu, Datta and Haldar

129. *D. lipai* Ghose, Gupta and Haldar

130. *D. oryzaephilae* Ghose, Gupta and Haldar

131. *D. rigidus* Ghose, Gupta and Haldar

132. *D. tridactylea* Ghose, Gupta and Haldar

Genus Laterospora Haldar, Ray and Bose

133. *L. phenacocca* Haldar, Ray and Bose

Genus Liposcelis Sarkar and Haldar

134. *L. coronatus* Sarkar and Haldar

Genus Quadruhyalodiscus Kundu and Haldar

135. *Q. gallerucidae* Kundu and Haldar

Family HIRMOCYSTIDAE
Genus Hirmocystis Labbe

136. *H. bengalensis* Haldar and Chakraborty

137. *H. hoplasomae* Kundu and Haldar

138. *H. lepropi* Haldar and Chakraborty

139. *H. lophocateri* Ghose and Haldar

140. *H. minuta* (Ishii)

141. *H. oxeata* Ghose, Sengupta and Haldar

142. *H. pitcharis* Haldar and Chakraborty

143. *H. pseudoductis* Haldar and Chakraborty

128. *Euparatettix histicus* Ranaghat

129. *Oryzaephilus mercator* Calcutta

130. *Oryzaephilus mercator* Chinsurah

131. *Oryzaephilus mercator* Kanchrapara

132. *Tridactylus* sp. Kalyani

133. *Phenacoccus hirsutus* Medinipur, Nadia

134. *Liposcelis* sp. Naihati

135. *Gallerucida bicolor* Fulia, Nadia

136. *Myllocerus* sp.1 Kalyani

137. *Hoplasoma unicolor* Ranaghat

138. *Lepropus* sp. Kalyani

139. *Lophocateres pusillus* Kalyani

140. *Oryzaephilus mercator* Calcutta

141. *Tribolium castaneum* Chinsurah

142. *Zanthrochilus sp.* Kalyani

143. *Myllocerus* sp.2 Kalyani
144. *H. theodoridesi* Kundu and Haldar

Genus *Retractocephalus* Haldar and Chakraborty

145. *H. triboli* Ghose and Haldar

Family NEOHIRMOCYSTIDAE

Genus *Neohirmocystis* Ghose, Ray and Haldar

146. *R. aulacophorae* Haldar, Chakraborty & Kundu

147. *R. halticus* Haldar, Chakraborty & Kundu

148. *R. raphidopalpae* Haldar and Chakraborty

149. *R. spatulatus* Haldar, Chakraborty & Kundu

150. *R. spinosus* Haldar, Chakraborty & Kundu

151. *N. dercetini* Ghose, Ray and Haldar

152. *N. grassei* Ghose, Ray and Haldar

153. *H. cambolopisae* Chakraborty

154. *H. rayi* Chakraborty and Mitra

155. *S. ellipsoidi* Chakraborty

156. *S. khagendrae* Ray

157. *S. shyamaprasadi* Chakravarty

158. *L. guttiventra* Sarkar

159. *L. linguata* Haldar and Sarkar
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<td><em>P. reneae</em> Sarkar</td>
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</table>
Genus **Steinina** Leger and Duboscq

173. *S. alphitobii* Sarkar and Chakravarty emend. Levine  
*Alphitobius piceus*  
Calcutta

174. *S. microgoni* Sarkar and Chakravarty emend. Levine  
*Anoplogenus microgonus*  
Calcutta

175. *S. palorusi* Gupta and Haldar  
*Palorus* sp.  
Kalyani

176. *S. singhi* Ghose and Haldar  
*Palorus ratzebergii*  
Chinsurah, Hugli

Genus **Stylocystis** Leger

177. *S. chowdhurya* Sarkar  
*Cryptophagus* sp.  
West Bengal (exact locality not mentioned)

Genus **Chilogregarina** Levine

178. *C. bhatiae* Sarkar  
*Geophilus* sp.  
Chinsurah

Genus **Crucocephalus** Sarkar

179. *C. dufouri* Sarkar  
*Dermestes* sp  
Naihati

Genus **Harendraia** Sarkar

180. *H. intricata* Sarkar  
*Ptinus* sp.  
Naihati

Genus **Ancyrophora** Leger

181. *A. bengalensis* Sarkar and Haldar  
*Ceriagrion cerinorubellum*  
Chinsurah

Genus **Acanthospora** Leger

182. *A. ischnurae* Sarkar and Haldar  
*Ischnura senegalensis*  
Chinsurrah

183. *A. ovoides* Sarkar and Haldar  
*Ischnura delicata*  
Naihati

Genus **Ramicephalus** Obata

184. *R. olivacus* Sarkar and Haldar  
*Ceriagrion olivacum*  
Hugli

Genus **Quadruspinospora** Sarkar and Chakravarty

185. *Q. acridae* Haldar and Chakravarty emend. Levine  
*Acrida exaltata*  
Kalyani

186. *Q. ailopii* Sarkar and Chakravarty emend. Levine  
*Ailopus* sp.  
Haora

187. *Q. attractomorphae* Haldar and Chakravarty emend. Levine  
*Attractomorpha crenulata*  
Kalyani
188. *Q. chakravartyi* Chakraborty and Haldar emend. Levine
   - *Aiolopus tamulus* Kalyani

189. *Q. dichotoma* Kundu and Haldar
   - *Spathosternum sp.* Kalyani

190. *Q. indoaiolopi* Haldar and Chakraborty emend. Levine
   - *Aiolopus sp.* Kalyani

191. *Q. megaspinosa* Haldar and Chakraborty
   - *Trilophidia annulata* Kalyani

Genus **Tertractinospora** Sarkar and Haldar

192. *T victoris* Sarkar and Haldar
   - *Ceriagrion coromandelianum* Kalyani

Genus **Mukundella** Sarkar

193. *M. undulatus* Sarkar
   - *Enallagma sp.* Chinsurah, Naihati

Genus **Menospora** Leger

194. *M. coenagrii* Sarkar and Haldar
   - *Coenagrion dyeri* Hugli

195. *M. enallagmae* Sarkar and Haldar
   - *Enallagma parvum* Chinsurah

Genus **Hoplorrhynchus** Carus

196. *H. carusi* Sarkar and Mazumder
   - *Pseudagrion decorum* Mahanda Reserve Forest

197. *H. ramidigitus* Sarkar and Haldar
   - *Agriocnemis pygmaea* Chinsurah

Genus **Odonaticola** Sarkar and Haldar

198. *O. brachydiplaxi* Sarkar and Mazumder
   - *Brachidiplax farinosa* Mahanada Reserve Forest

199. *O. elliptica* Sakar
   - *Crocothemis s. servilia* West Bengal (exact locality not mentioned)

200. *O. hexacantha* Sakar and Haldar
   - *Brachythemis conteaminat* Chinsurah

201. *O. longicollara* Sarkar and Haldar
   - *Diplocodes trivialis* Chinsurah

202. *O. nonacantha* Devdhar and Deshpande
   - *Urothemis s. signata* Hugli

203. *O. orthetri* Sarkar and Haldar
   - *Orthetrum sabina* Chinsurah
204. *O. rodgii* Sarkar and Haldar  
*Neurothemis t. tullia*  
Family **CEPHALOIDOPHORIDAE**  
Genus *Cephaloidophora* Mavrodiadi

205. *C. metaplaxi*  
(*= Steinina metaplexi*)  
Family **BRUSTIOSPORIDAE**  
Genus *Brustiospora* Kundu and Haldar

206. *B. indicola* Kundu and Haldar  
*Stethorus sp.*  
Subclass **COCCIDIA**  
Order **EUCOCCIDA**  
Suborder **ADELEINA**  
Family **ADELEIDAE**  
Genus *Adelina* Hesse

207. *A. schellaki* Ray and Dasgupta  
*Cormocephalus dentipes*  
Family **HAEMOGREGARINIDAE**  
Genus *Haemogregarina* Danilewsky

A. *Haemogregarina* of fishes

208. *H. colisa* Madal, Ray, Sarkar and Kahali  
*Colisa fasciata*  
B. *Haemogregarina* of Amphibians

209. *H. berestneffi* Castellani and Willey  
*Rana cyanophlyctis*  
*Rana limnocharis*  
*Rana tigrina*  
Family **HAEMOGREGARINIDAE**  
Genus *Haemogregarina* Danilewsky

210. *H. kaloulae* Ray and Choudhury  
*Koloula pulchra*  
taprobanica  
Family **HAEMOGREGARINIDAE**  
Genus *Haemogregarina* Danilewsky

211. *H. maculatus* Ray and Choudhury  
*Rhacophorus maculatus*  
Family **HAEMOGREGARINIDAE**  
Genus *Haemogregarina* Danilewsky

212. *H. magna* (Grassi & Feletti)  
*Rana limnocharis*  
*Rana tigrina*  
Family **HAEMOGREGARINIDAE**  
Genus *Haemogregarina* Danilewsky

213. *H. nucleobisecans* Shortt  
*Bufo andersoni*  
*Bufo melanostictus*  
Family **HAEMOGREGARINIDAE**  
Genus *Haemogregarina* Danilewsky
214. *H. pattoni* Ray and Choudhury  
*Rana hexadactyla*  
Medinipur

215. *H. perinucleophilum* Ray and Choudhury  
*Rana tigrina*  
Balitha, Bankura

216. *H. pulchra* Ray and Choudhury  
*Kaloula pulchra*  
Santaldi, Puruliya

217. *H. systoma* Ray and Choudhury  
*Uperodon systoma*  
Puruliya

218. *H. sp.*  
*Bufo himalayanus*  
Darjiling

C. Haemogregarina of Reptiles

219. *H. choudhury* Ray and Bhattacharjee  
*Lissemys p. punctata*  
Balitha, Bankura

220. *H. gangeticus* Misra (= *H. simondi*)  
*Helobdella nociva*  
Balitha, Bankura

221. *H. mirabilis* Castallani and Willey  
*Natrix piscator*  
Koch Bihar

222. *H. xaveri* de Mello  
*Lissemys punctata*  
South 24-pgs.

223. *H. sp.*  
*Enhydris enhydris*  
Chakdah, Nadia

224. *H. sp.*  
*Mabuya carinata*  
Raiganj

225. *H. sp.*  
*Hemidactylus flaviviridis*  
Gorumara

226. *H. sp.*  
*Natrix stolata*  
Koch Bihar

227. *H. sp.*  
*Calotes versicolor*  
Reang, Darjiling

Genus Hepatozoon Miller

228. *H. mucus* Sinha  
*Ptyas mucosus*  
North 24-Pgs.

229. *H. sp.*  
*Petaurista magnificus*  
Darjiling

Suborder EIMERIIINA  
Family EIMERIIDAE  
Genus *Tyzzeria* Allen

230. *T. alleni* Chakravarty  
*Nettapus coromandelianus*  
Bidyadhari

Spill area; Mahis-bathan, Basirhat

231. *T. chenicusae* Ray and Sarkar  
*Nettapus coromandelianus*  
Basirhat

Genus Eimeria Schneider

A. Eimeria of Fishes

232. *E. glossogobi* Mukherjee and Haldar  
*Glossogobius giurus*  
Kalyani
233. *E. harpodoni* Setna and Bana  
*Harpodon nehereus*  
Port Canning

234. *E. notopter* Chakravarty and Kar  
*Notopterus notopterus*  
Calcutta market

235. *E. southwelli* Halawani  
*Scoliodon sorra*  
Sundarban

236. *E. zygaenac* Mandal  
*Zygaena blochii*  
Digha shore, Medinipur; Sundarban, South 24-Parganas

B. *Eimeria* of Amphibians

237. *E. cyanophlyctis* Chakravarty and Kar  
*Rana cyanophlyctis*  
Calcutta

238. *E. laminata* Ray  
*Bufo melanostictus*  
Calcutta

C. *Eimeria* of Reptiles

239. *E. bongaonensis* Sinha and Sinha  
*Gekko* (Linn.)  
Bangaon

240. *E. fibrilosa* Mandal  
*Enhydrids enhydrids*  
Chakdah

241. *E. falviviridis* Setna and Bana  
*Hemidactylus flavi*  
Barasat, North 24-Parganas; Calcutta

242. *E. gupti* Bhatia  
*Natrix piscator*  
Calcutta

243. *E. hemidactyli* Knowles and Dasgupta  
*Hemidactylus flavi*  
Calcutta

244. *E. irregularis* Kar  
*Lissemys punctata*  
Calcutta

245. *E. innominata* Kar  
*Lissemys punctata*  
Calcutta

246. *E. koormae* Dasgupta  
*Lissemys punctata*  
Basirhat, North 24-Parganas; Calcutta

247. *E. knowlesi* Bhatia  
*Hemidactylus flaviviridis*  
Calcutta

248. *E. naja* Ray and Dasgupta  
*Naja naja*  
Sundarban

249. *E. piscatori* Ray and Dasgupta  
*Natrix piscator*  
Calcutta

250. *E. stolatae* Ray And Dasgupta  
*Natrix stolata*  
Calcutta

251. *E. trionyxae* Chakravarty and Kar  
*Trionyx gangeticus*  
Calcutta

252. *E. triangularis* Chakravarty  
*Trionyx gangeticus*  
Calcutta

D. *Eimeria* of Birds

253. *E. alectorae* Ray and Hiregaudar  
*Alectoris graeca*  
Zoological garden, Calcutta

254. *E. anili* Halder, Ray and Mandal  
*Sturnas contra contra*  
Kalyani
255. *E. barbeta* Kar  
*Cyanops asiatica asiatica*  
Calcutta

256. *E. bengalensis* Paul, Ghosh and Haldar  
*Gallus domesticus*  
Kalna, Barddhaman

257. *E. bhutanensis* Ray and Hirengaoudar  
*Plyplectron bicoloratum*  
Zoological garden, Calcutta

258. *E. charadrii* Mandal  
*Charadrius asiaticus*  
Narayantala, South 24 Parganas

259. *E. columbae* Mitra and Dasgupta  
*Columba intermedia*  
Calcutta

260. *E. coturnicis* Chakravarty and Kar  
* Coturnix c. coturnix*  
Calcutta

261. *E. dauki* Bhatia and Pande  
*Amaurornis phoenicurus*  
Barasat

262. *E. gallinagoi* Mandal  
*Gallinago gallinago*  
Basanti, South 24-Pargans

263. *E. gallusae* Paul, Ghosh and Haldar  
*Gallus domesticus*  
Bagata, North 24-Parganas

264. *E. gennaeuscus* Ray and Hirengaoudar  
*Gennaeus horsfieldi*  
Zoological Garden, Calcutta

265. *E. kapotei* Chatterjee and Ray  
*Columba livia intermedia*  
Calcutta

266. *E. labbeana* (Labbe)  
*Columba livia intermedia*  
Calcutta

267. *E. malacce* Chakravarty and Kar  
*Lonchura m. malacca*  
Calcutta

268. *E. mandali* Banik and Ray  
*Pavo cristatus*  
Zoological Garden, Calcutta

269. *E. numeni* Mandal  
*Numenius arquata*  
Namkhana, South 24-Parganas

270. *E. pavonina* Banik and Ray  
*Pavo cristatus*  
Zoological Garden, Calcutta

271. *E. roscoviensis pluvialina* Mandal  
*Pluvialis appricaria*  
Namkhana, South 24-Parrganas

272. *E. tenella* (Raillet and Rucet)  
*Gallus domesticus*  
Calcutta

273. *E. tropicalis* Malhotra and Ray  
*Columba livia intermedia*  
Calcutta

274. *E. vanelli* Mandal  
*Vanellus malabaricus*  
Basanti, South 24-Parganas

**E. Eimeria of Mammals**

275. *E. ahsata* Honess  
*Ovis sp.*  
Calcutta

276. *E. hircus* Calcutta  
*Capra hircus*  
North & South 24-Parganas
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<td>Sinha and Sinha</td>
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<td><em>E. granulosa</em></td>
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### D. Isospora of Mammals

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<td><em>Homo sapiens</em></td>
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335. *I. leonina* Mandal and Ray  
*Panthera leo*  
Zological garden Calcutta

336. *I. rovolta* (Grassi)  
*Canis dingo*  
*Felis chaus*  
*Felis domestica*  
*Herpestes auropunctata*  
Calcutta

337. *I. sibporensis* Bandyopadhyay  
Nandi and Das  
*Rattus rattus arboreus*  
Sibpore, Haora

338. *I. sundarbanensis* Ray and  
Sarkar  
*Sus scrofa*  
Sundarban

339. *I. tropicalis* Mukherjee  
and Krassner  
*Canis aureus*  
Bandipore, Hugli

Genus *Dorisa* Levine

A. *Dorisa* of Birds

340. *D. aethiopsaris* (Chakravarty  
and Kar)  
*Acridotheres fuscus*  
Calcutta

341. *D. chakravartyi* (Ray and  
Sarkar)  
*Lonchura malabarica*  
*Lonchura punctulata*  
Calcutta

342. *D. graculae* Mandal, Nandi,  
Chakraborty, Bhowmik,  
Sarkar and Roy  
*Gracula religiosa*  
Darjiling

343. *D. hareni* (Chakravarty  
and Kar)  
*Amandava amandava*  
Calcutta

344. *D. mandali* (Ray and Sarkar)  
*Zosterops palpebrosa*  
Calcutta

345. *D. passeris* (Ray and Sarkar)  
*Passer domesticus*  
Calcutta

346. *D. vagabundae* (Mandal and  
Chakravarty)  
*Dendrocitta vagabunda*  
Calcutta

B. *Dorisa* of Mammals

347. *D. bengalensis* Bandyopadhyay  
and Ray  
*Funambulus pennanti*  
Hàora

348. *D. harpia* (Sinha and  
Dasgupta)  
*Harpiocephalus harpia*  
*lasyarus*  
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349. *D. indica* Bandyopadhyay,  
Ray and Bhattacharjee  
*Rattus rattus arboreus*  
Hàora
Genus *Wenyonella* Hoare

**A. Wenyonella of Birds**

350. *W. columbae* Haldar and Ray Chaudhury  
*Columba livia intermedia*  
Calcutta, Nadia (Kalyani)

351. *W. gagari* Sarkar and Ray  
*Anas boschus*  
Basirhat

**B. Wenyonella of mammals**

352. *W. hoarei* Ray and Das Gupta  
*Sciurus* sp.  
Shibpur Botanical garden, Haora

353. *W. levinei* Bandyopadhyay, Ray and Das Gupta  
*Rattus rattus arboreus*  
Haora

Genus *Octosporella* Ray and Raghavachari

354. *O. mabuiae* Ray  
*Mabuya* sp.  
Calcutta

Genus *Sivatoshella* Ray and Sarkar

355. *S. lonchurae* Ray and Sarkar  
*Lonchura malabarica*  
Calcutta  
*Lonchura punctulata*  
Calcutta

Genus *Pythonella* Ray and Dasgupta

356. *P. bengalensis* Ray and Dasgupta  
*Python* sp.  
Calcutta

**Family LANKESTERELLIDAE**

Genus *Lankesterella* Labbe

357. *L. bufonis* Mansour and Mohammad  
*Bufo melanostictus*  
Balitha & Kotalpur, Bankura

358. *L. minina* (Chaussat)  
*Rana limnocharis*  
Jalpaiguri  
*Rana tigrina*  
Berhampore, Bankura  
South 24-Parganas

359. *L. sp.*  
*Bufo himalayanus*  
Darjiling

360. *L. sp.*  
*Ploceus philippinus*  
Chakdah, Nadia

361. *L. sp.*  
*Passer domesticus*  
Chakdah, Nadia

362. *L. sp.*  
*Sturnus malabaricus*  
Chakdah, Nadia

**Family SARCOCYSTIDAE**

Genus *Sarcocystis*

363. *S. blanchardi* Doflein  
*Bos indicus*  
Calcutta  
*Bubalus bubalis*  
Calcutta

**Family TOXOPLASMATIDAE**

Genus *Toxoplasma* Nicoll and Manceaux
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B. **Plasmodium of Mammals**

379. *P. falciparum* (Welch)  
   Anopheles spp.  
   *Homo sapiens*  
   West Bengal

380. *P. malariae* Laveran  
   Anopheles spp.  
   *Homo sapiens*  
   Cosmopolitan

381. *P. vivax* (Grassi and Feletti)  
   Anopheles spp.  
   *Homo sapiens*  
   West Bengal

Genus *Mesnilium* Misra, Haldar and Chakravarty

382. *M. malariae* Misra, Haldar and Chakravarty  
   *Channa punctatus*  
   Calcutta and its suburbs

Family **HAEMOPROTEIDAE**
Genus *Haemoproteus* Kruse

A. **Haemoproteus of Fishes**

383. *H. rupicola* Mandal et al.  
   *Noemacheilus rupicola*  
   Darjiling

B. **Haemoproteus of Amphibians**

384. *H. ovalis* Ray and Choudhury  
   *Rana limnocharis*  
   Balitha, Bankura

C. **Haemoproteus of Reptiles**

385. *H. trionyxi* Misra and Choudhury  
   *Trionyx gangeticus*  
   Calcutta

D. **Haemoproteus of Birds**

386. *H. bennetti* Greiner, Mandal and Nandi  
   *Picus flavinucha*  
   Darjiling

387. *H. columbae* Kruse  
   *Columba livia*  
   Calcutta, Nadia, South 24-Pgs.

   *Columba livia domestica*  
   Cosmopolitan

   *Columba livia intermedia*  
   Cosmopolitan

   *Pseudolynchia canarenis*  
   Calcutta and South 24-Pgs.

388. *H. cornuata* Bennett and Nandi  
   *Megalaima haemacephala*  
   Chakdah, Nadia

389. *H. danilewskyi* Kruse  
   *Corvus splendens*  
   Calcutta

   *Dendroccita vasabunda*  
   Nadi

390. *H. dicruri* de Mello  
   *Dicrurus adsimilis*  
   Nadi

391. *H. fringillae* Labbe  
   *Copsychus saularis*  
   Calcutta, Nadi

392. *H. handai* Maqsood  
   *Psittacula krameri manillensis*  
   Calcutta

393. *H. himalayanus* Paul and Das Gupta  
   *Heterophasia capistrata*  
   Darjiling
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<td>419. <em>R. rayi</em> Das Gupta</td>
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<td>428. <em>T parva</em> (Theiler)</td>
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**Family** | **Genus** | **Species** | **Location** |
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**Family** | **Genus** | **Species** | **Location** |
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**Phylum** | **Class** | **Order** | **Suborder** | **Family** | **Genus** | **Species** | **Location** |
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Suborder APANSPOROBlastina
Family NOSEMATIDAE
Genus Nosema Nageli

443. *N. bombycis* Nageli *Bombyx mori* (eggs, larvae, pupae imago) Maldah, Murshidabad

Phylum MYXOZOA
Class MYXOSPOREA
Order BIVALVULIDA
Suborder BIPOLARINA
Family NOSEMATIDAE
Genus Nosema Nageli

444. *N. bombycis* Nageli *Bombyx mori* (eggs, larvae, pupae imago) Maldah, Murshidabad

Phylum MYXOZOA
Class MYXOSPOREA
Order BIVALVULIDA
Suborder BIPOLARINA
Family NOSEMATIDAE
Genus Nosema Nageli

443. *N. bombycis* Nageli *Bombyx mori* (eggs, larvae, pupae imago) Maldah, Murshidabad

Phylum MYXOZOA
Class MYXOSPOREA
Order BIVALVULIDA
Suborder BIPOLARINA
Family NOSEMATIDAE
Genus Nosema Nageli

A. **Myxidium** fishes

444. *M. appocryptae* Bajpai and Haldar *Apocryptes bato* Kalyani

445. *M. boddaerti* Choudhury and Nandi *Boleophthalmus boddaerti* Port Canning

446. *M. calcariferi* Chakravarty *Lates calcarifer* West Bengal

447. *M. fasciaticum* Sarkar *Colisa fasciata* Barrackpore

448. *M. glossogobi* Chakravarty *Glossogobius giuris* Calcutta

449. *M. heteropeustesi* Chakravarty *Heteropeustes fossilis* Calcutta

450. *M. islampurium* Sarkar and Pramanik

451. *M. islampurium* Sarkar and Pramanik

452. *M. leiberkuhni* Butschli *Anabas testudineus* Calcutta

453. *M. mystusium* Sarkar and Ray Chaudhuri *Mystus viattatus* Chinsurah

454. *M. mystusium* Sarkar and Ray Chaudhuri

455. *M. mystusium* Sarkar and Ray Chaudhuri

456. *M. mystusium* Sarkar and Ray Chaudhuri

457. *M. mystusium* Sarkar and Ray Chaudhuri

458. *M. mystusium* Sarkar and Ray Chaudhuri

B. **Myxidium** of Amphibians

459. *M. haldari* Sarkar *Hyla arborea* Chakdah, Nadia

Genus *Sphaeromyxa* Thelohan

460. *S. dighae* Sarkar and Mazumdar *Hilsa ilisha* Digha
461. S. harenii Sarkar  
   Tachysurus platystomus  
   Digha coast

462. S. pultai Tripathi  
   Odontamblyopus rubicundus  
   Barrackpore

463. S. theraponi Tripathi  
   Therapon jarbua  
   Port Canning

Genus Zschokkella Auerbach

A. Zschokkella of fishes

464. Z. fossilae Chakravarty  
   Heteropneustes fossilis  
   Calcutta

465. Z. illishae Chakravarty  
   Hilsa ilisha  
   Calcutta market

466. Z. platystomuse Sarkar  
   Tachysurus platystomus  
   Digha coast

B. Zschokkella of Amphibians

467. Z. auberachi (Weill)  
   Bufo melanostictus  
   Calcutta
   Rana limnocharis  
   Calcutta
   Rana tigrina  
   Calcutta

C. Zschokkella of Reptiles

469. Z. lissemysi Chakravarty  
   Lissemys punctata  
   Calcutta

Suborder EURYSPORINA
Family CERATOMYXIDAE
Genus Ceratomyxa Thelohan

469. C. gobioidesi Chakravarty  
   Odontamblyopus rubicundus  
   Calcutta

470. C. hilsae Chakravarty  
   Hilsha ilisha  
   Calcutta market

471. C. Sagarica Choudhury and Nandi  
   Boleophthalmus boddaerti  
   Port Canning

472. C. scatophagi Chakravarty  
   Scatophagus argus  
   West Bengal

473. C. tartoori Sarkar  
   Opisthopterus tartoor  
   Digha coast

474. C. sp.  
   Gobioides rubicundus  
   Calcutta

475. C. sp.  
   Trichogaster fasciatus  
   Calcutta

476. C. sp.  
   Macrones gulio  
   Calcutta

Genus Leptotheca Thelohan

477. L. latei Chakravarty  
   Lates calcarifer  
   West Bengal

478. L. macronesi Chakravarty  
   Macrones gulio  
   West Bengal

Genus Chloromyxum

479. C. amphipnou Ray  
   Amblypharygodon mola  
   Calcutta and Agarpara, North 24-Parganas

   Amphipnous cuchia  
   Calcutta

   Heteropneustes fossilis  
   Calcutta

480. C. meglisitchi Sarkar  
   Ophicephalus punctatus  
   North 24-Parganas
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501. *M. filamentosa* Haldar, Mukherjee and Kundu  
*Puntius filamentosus* Kalyani

502. *M. indirae* Kundu  
*Cirrhinus mrigala* Ranaghat

503. *M. magaudi* Bajpai and Halder  
*Colisa fasciatus* Ranaghat

504. *M. maruliensis* Sarkar  
*Channa maruliensis* Islampur, Murshidabad

505. *M. noblei* Sarkar  
*Ophicephalus striatus* Chinsurah, Hugli

506. *M. trichogasteri* Sarkar  
*Colisa fasciatus* Barrackpore

Genus *Thelohanellus* Kudo

507. *T. auerbachii* Sarkar  
*Tachysurus platystomus* Digha coast

508. *T. bengalensis* Sarkar and Raychaudhury  
*Catla catla* Chinsurah, Hugli

509. *T. calbasui* Tripathi  
*Labeo calbasu* Sheoraphulli Market, Hugli

510. *T. callae* Chakravarty and Basu  
*Catla catla* Bidyadharhi, Agarpara, North 24-Parganas

511. *T. coeli* Sarkar and Mazumdar  
*Tachysurus tenuispinis* West Bengal Coast

512. *T. gangeticus* Tripathi  
*Chela bacaila* Nimtita, North 24-Parganas

513. *T. jiroweci* Kundu and Haldar  
*Labeo bata* Ranaghat

514. *T. mrigalae* Tripathi  
*Cirrhinus mrigala* West Bengal

515. *T. ophthalmicus* Haldar, Das and Sharma  
*Catla catla* Krishnagar

516. *T. rodgii* Kundu and Haldar  
*Labeo calbasu* West Bengal

517. *T. rohitae* (Southwell and Prasad)  
*Labeo rohita* Bidyadharhi, Agarpara, North 24-Parganas

518. *T. sanjibi* Sarkar and Ghosh  
*Mystus gulio* Chinsurah

519. *T. seni* (Southwell and Prasad)  
*Catla catla* Calcutta, Bidyadharhi, Agarpara

520. *T. sudevi* Sarkar and Ghosh  
*Amblyophrayngodon mola* Chinsurah

Genus *Neothalohanellus* Das and Haldar

521. *N. callae* Das and Haldar  
*Catla catla* Krishnagar

522. *N. krishnagarensis* Das and Haldar  
*Labeo calbasu* Krishnagar, Nadia

Genus *Henneguya* Thelohan

523. *H. bengalensis* Ray and Chakravarty  
*Ophicephalus punctatus* Naihati
524. *H. bicornuata* Raychaudhury and Chakravarty

525. *H. bleekeri* Haldar and Mukherjee

526. *H. chaudhuryi* Bajpai and Haldar

527. *H. lates* Tripathi

528. *H. mystusia* Sarkar

529. *H. namae* Haldar, Das and Sharma

530. *H. ophicephali* Chakravarty

531. *H. renalis* Sarkar, Mazumdar and Pramanik

532. *H. riteae* Bajpai and Haldar

533. *H. rubicundi* Haldar and Mukherjee

534. *N. tetraradiata* Tripathi

535. *K. bengalensis* Sarkar and Mazumdar

536. *K. tachysurae* Sarkar and Mazumdar

537. *B. blattarum* Ghosh

538. *B. coli* (Malmsten)
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Subclass HYPOSTOMATIA
Order RHYNCHODIDA
Family ANCISTROCOMIDAE
Genus Ancistrocoma Chatton and Lwoff

552. *A. dissimilis* Kozloff
Genus *Mactra luzonica*  
Digha

553. *A. pelseneeri* Chatton and Lwoff
Genus *Mactra luzonica*  
Digha

554. *A. thorsoni* Fenchel
Genus *Raabella* Chatton and Lwoff
Genus *Mactra luzonica*  
Digha

555. *R. helensis* Chatton
Class OLIGOHYMENOPHOREA
Subclass HYMENOSTOMATIA
Order HYMENOSTOMATIDA
Suborder OPHRYOGLENINA
Class Modiolus striatusulus  
Hugli river, Calcutta
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581. *S. ubiquita* Hirshfield

- *Cirrhinus reba*
- *Labeo rohita*
- *Littorina melanostoma*
- *Littorina scabra scabra*

Suborder: MOBILINA

Family: TRICHODINIDAE

Genus: *Trichodina* Ehrenberg

582. *T gangetica* Jamadar and Choudhury

- *Modiolus striatulus*

583. *T indica* Tripathi

- *Amblypharyngodon mola*
- *Catla catla*
- *Chanda nama*
- *Chanda ranga*
- *Channa gachua*
- *Channa punctatus*
- *Cirrhinus mrigala*
- *Cirrhinus reba*
- *Labeo calbasu*
- *Labeo rohita*
- *Salmostoma bacaila*

584. *T nigra* Lom

- *Nandus nandus*
- *Tilapia mossambica*

585. *T pediculus* Ehrenberg

- *Tadpole*

586. *T* sp.

- *Ophicephalus punctatus*

587. *T* sp.

- *Sphaeroides oblongus*

588. *T* sp.

- *Tilapia mossambica*

Genus: *Tripartiella* Sramenk-Husek

589. *T bulbosa* (Davis)

- *Catla catla*
- *Chanda nama*
- *Cirrhinus mrigala*
- *Labeo rohita*
- *Mystus bleekeri*

590. *T copiosa* Lom

- *Cyprinus carpio*
- *Labeo rohita*
591. *T. obtusa* Ergens and Lom

- **Class**: POLYHYMENOPHOREA
- **Subclass**: SPIROTRICHA
- **Order**: HETEROTRICHIDA
- **Suborder**: CLEVELANDELLINA
- **Family**: NYCTOTHERIDAE
- **Genus**: *Ctenopharyngodon idella* Krishnagar

592. *N. chatterjeei* Chakravarty and Chatterjee

- **Genus**: *Gryllotalpa vulgaris* Calcutta, Hugli

593. *N. kempi* Ghosh

- **Genus**: *Pila globosa* Calcutta, South 24-Parganas

594. *N. ovalis* Leidy

- **Genus**: *Periplaneta americana* Calcutta, Maldah

595. *N. cordiformis* (Ehrenberg)

- **Genus**: *Bufo malanostictus* Calcutta, Hugli, North and South 24-Parganas

596. *S. macropharyngeus* (Bezzenberger)

- **Family**: SICUOPHORIDAE
- **Genus**: *Sicuophora* de Puytorac and Grain

**HOST PARASITE LIST**

**Phylum**: ANNELIDA

**Class**: Oligochaeta

1. *Aelosoma chlorosticum* 
   - **Parasite**: *Anoplophrya aelosomatis* Calcutta
2. *Amynthas diffringens* (= *Pheretima diffringens*)
   - **Parasite**: *Apolocystis goomtiensis* Goomti, Darjiling
   - **Parasite**: *Nematocystis quadrikaryomata* Goomti, Darjiling
   - **Parasite**: *Nematocystis theodoridis* Goomti, Darjiling
   - **Parasite**: *Stomatophora bahli* Darjiling
   - **Parasite**: *Stomatophora pedongensis* Darjiling
3. *Amynthas hawayanus*
   - **Parasite**: *Bisurculus variegatus* Goomti, Darjiling
4. *Apporectodea trapozoides*
   - **Parasite**: *Informis informis* Senchal, Darjiling
   - **Parasite**: *Informis pseudotentaculatus* Darjiling
   - **Parasite**: *Monocystis senchalensis* " "
   - **Parasite**: *Nematocystis senchalensis* " 
5. *Eutyphoeus gammiei*
   - **Parasite**: *Nematocystis levinei* Mongpoo, Darjiling
<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Location</th>
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<td>6.</td>
<td><em>Nematocystis mangpooensis</em> Mongpoo, Darjiling</td>
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<td>7.</td>
<td><em>Nematocystis bengalensis</em> Ashoknagar, North 24-Parganas</td>
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<td>8.</td>
<td><em>Monocystis beddardi</em> Calcutta</td>
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<td>9.</td>
<td><em>Nematocystis mauritii</em> Ashoknagar, North 24-Parganas</td>
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<td>10.</td>
<td><em>Anoplophrya aelosomatis</em> Calcutta</td>
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<td>11.</td>
<td><em>Anoplophrya lumbrici</em> Calcutta</td>
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<td><em>Anoplophrya lloydii</em> Calcutta</td>
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<td><em>Anoplophrya pheeretimi</em> Calcutta</td>
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<td><em>Monocystis bengalensis</em> Calcutta</td>
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<td><em>Monocystis uoide</em> Calcutta</td>
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<td><em>Stomatophora diadema</em> Calcutta</td>
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<td>17.</td>
<td><em>Stomatophora pradhanis</em> Ashoknagar, North 24-Parganas</td>
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<td>18.</td>
<td><em>Metaphir (Pheretima) posthuma</em></td>
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<td><em>Anoplophrya anili</em> Barrackpore, North 24-Parganas</td>
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<td><em>Anoplophrya chauhani</em></td>
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<td><em>Drilocineta perionyxi</em></td>
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<td><em>Maupesella nova anili</em></td>
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<td>23.</td>
<td><em>Pheretima alexandri</em> Apolocystis vacuolatus</td>
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<td>24.</td>
<td><em>Stomatophora globa</em></td>
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<td><em>Zygocystis indicus</em></td>
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<td><em>Anoplophrya lumbrici</em></td>
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<td><em>Apolocystis akaryosomiferus</em> North point, Darjiling</td>
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<td>28.</td>
<td><em>Apolocystis monokaryosomiferus</em></td>
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<td><em>Class HIRUDINARIA</em></td>
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<td><em>Helobdella nociva</em> Haemogregarina choudhuryi Balitha, Bankura</td>
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<td>31.</td>
<td><em>Trypanosoma balihaensis</em> Balitha, Bankura</td>
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<td>32.</td>
<td><em>Trypanosoma rotatorium</em> West Bengal (Experimental)</td>
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<td>33.</td>
<td><em>Trypanosoma gachuii</em> Calcutta</td>
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<td><em>Trypanosoma choudhuryi</em> Balitha, Bankura</td>
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<td>35.</td>
<td><em>Phylum MOLLUSCA</em></td>
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<td><em>Class GASTROPODA</em></td>
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<td>37.</td>
<td><em>Belamyta bengalensis</em> Anoplophrya cylindrica Calcutta</td>
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<td>38.</td>
<td><em>Scyphidia bengalensis</em> Sagar Island</td>
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<td>Cerithidea obtusa</td>
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<td>Ancistrumina obtusae</td>
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<td>Fenchelia kapili</td>
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<td>Fenchelia sagarica</td>
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<td>20.</td>
<td>Littorina melanostoma</td>
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<td>Scyphidia ubiquita</td>
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<td>21.</td>
<td>Littorina scabra scabra</td>
<td>Protophrya indica</td>
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<td>Scyphidia ubiquita</td>
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<td>22.</td>
<td>Pila globosa</td>
<td>Balantidium depressum</td>
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<td>Nyctotherus kempi</td>
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<td>23.</td>
<td>Small gastropod-</td>
<td>Anoplaphrya elongata</td>
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<td>(unidentified, freshwater)</td>
<td>Anoplaphrya variabilis</td>
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<td>BIVALVIA</td>
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<td>Crassostrea cucullata</td>
<td>Cristigera susamai</td>
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<td>Lamellidens marginallis</td>
<td>Conchopthirius curtus</td>
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<td>Conchopthirius lamellidens</td>
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<td>Ancistrocoma pelseneeri</td>
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<td>Boveria teredinidi</td>
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<td>Raabella helenis</td>
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<td>Trichodina gangetica</td>
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<td>Metaplex dentipes</td>
<td>Cephaloidophora (=Steinina) metaplexi</td>
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<td>Ctenolepis nigra</td>
<td>Lepismatophila rhombocephala</td>
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ORDER Odonata

31. *Agriocnemis pygmaea*    *Hoplorhynchus ramidigitus*                  Chinsurah
32. *Brachydiplax farinosa*  *Odonaticola brachydiplaxi*                Mahananda Reserve Forest, Darjiling
33. *Brachythemis contaminate*  *Odonaticola hexacantha*                  Chinsurah
34. *Ceriagrion cerinorubellum*  *Acanthospora bengalensis*                 Chinsurah
35. *Ceriagrion coromandalianum*  *Actinocephalus ceriagrionae*             Calcutta
                                *Tetractinospora victoris*                 Kalyani
36. *Ceriagrion olivacum*    *Ramicephalus olivacuas*                   Hugli
37. *Coenagrion dyari*         *Menospora coenagrii*                      Hugli
38. *Crocothemis s. servilia*  *Odonaticola elliptica*                    West Bengal
39. *Diplocodes trivialis*    *Odonaticola longicollara*                 Chinsurah
40. *Enallagma parvum*         *Menospora enallagmiae*                     Chinsurah
41. *Enallagma sp.*            *Mukundaella undulatus*                     Chinsurah and Naihati
42. *Ischnura delicata*        *Ancyrophora ovoides*                      Naihati
                                *Actinocephalus ellipsoidus*               Kalyani
43. *Ischnura senegalensis*   *Ancyrophora ischnurae*                     Chinsurah
44. *Neurothemis t. tulbia*    *Odonaticola rodgii*                      Kalyani
45. *Orthetrum sabina*         *Odonaticola orthetri*                      Chinsurah
46. *Pseudagrion decorum*      *Hoplorhynchus carusi*                      Mahananda Reserve Forest, Darjiling
47. *Urothemis s. signata*     *Odonaticola nonacontha*                   Hugli

ORDER Lepidoptera

48. *Bombyx morii*             *Nosema bombycis*                          Maldah and Murshidabad

ORDER Orthoptera

49. *Acrida exaltata*          *Quadruspinospora acridae*                 Kalyani
50. *Aiolopus tamulus*         *Quadruspinospora chakravartyi*               Kalyani
51. *Aiolopus sp.*             *Quadruspinospora aiolopii*                  Haora
52. *Aiolopus sp.*             *Quadruspinospora indoaiolopii*              Kalyani
53. *Attractomorpha crenulata* *Quadruspinospora attractomorphae*             Kalyani
54. *Euparatettix histricus*   *Didymophyes indiab*                         Ranaghat
55. *Gryllodes sp.*            *Gregarina gryllodis*                        Chinsurah
56. *Gryllotalpa africana*     *Hirmocystis theodoridesi*                    Ranaghat
57. *Gryllotalpa vulgaris*     *Nyctotherus chatterjeei*                      Calcutta, Hugli
<table>
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<tr>
<th>No.</th>
<th>Species</th>
<th>Genus</th>
<th>Location</th>
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<tr>
<td>58</td>
<td>Grylotalpa sp.</td>
<td>Nyctotherus chatterjeei</td>
<td>Calcutta, Falta, 24-Parganas</td>
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<td>59</td>
<td>Phleoba antennata</td>
<td>Phleobum gigantinum</td>
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<td>60</td>
<td>Phleoba infumata</td>
<td>Phleobum collarum</td>
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<td>Plebeogryllus guttiventra</td>
<td>Gregarina guttiventra</td>
<td>Naihati</td>
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<td>62</td>
<td>Pteronemobius concolor</td>
<td>Leidyana guttiventra</td>
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<td>63</td>
<td>Pteronemobius fascinense</td>
<td>Gregarina levinei</td>
<td>Chinsurah</td>
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<td>Spathosternum p. prasiniferum</td>
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<td>65</td>
<td>Spathosternum sp.</td>
<td>Qudruspinospora dichotoma</td>
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<td>66</td>
<td>Trilophidia annulata</td>
<td>Phleoba antennata</td>
<td>Kalyani</td>
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<td>67</td>
<td>Tridactylus sp.</td>
<td>Didymophyes tridactylae</td>
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<td><strong>Order: DICTYOPTERA</strong></td>
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<td>68</td>
<td>Ischnoptera sp.</td>
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<td>69</td>
<td>Periplaneta americana</td>
<td>Balantidium blattarum</td>
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<td>Balantidium ovatum</td>
<td>Calcutta</td>
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<td>Lophomonas striata</td>
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<td>Nyctotherus ovalis</td>
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<td>Supella supellectilium</td>
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<td>71</td>
<td>Nymphal stage of an unnamed Blattellida</td>
<td>Gregarina mukundai</td>
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<td>Nymphal stage of an unidentified Blattellida</td>
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<td>Lygeus hospes</td>
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<td>Laterospora phenacocca</td>
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<td>Steinina alphitobii</td>
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<td>89. Evorinea iota</td>
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<td>Quadruhyalodiscus gallerucida</td>
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<td>Retractocephalus halticus</td>
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<td>93. Hoplasoma unicolor</td>
<td>Hirmocystis hoplasomae</td>
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<td>94. Lema sp. 1</td>
<td>Retractocephalus spatulatus</td>
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<td>95. Lepropus sp.</td>
<td>Hirmocystis lepropi</td>
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<td>Hirmocystis lophocateri</td>
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<td>Gregarina bilobosa</td>
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<td>Retractocephalus spinousus</td>
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<td>99. Myllocerus sp. 1</td>
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<td>100. Myllocerus sp. 2</td>
<td>Hirmocystis pseudoductis</td>
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<td>Didymophyes lipai</td>
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<td>102. Palorus ratzebergii</td>
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<td><em>Raphidopalpa</em> (=<em>Aulacophora</em>) <em>foveicollis</em></td>
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<td>Phlebotomus papatasi</td>
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<td>Sphyra blochii (Zygaena blochii)</td>
<td>Eimeria zygaenae</td>
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<td>Notopterus chitala</td>
<td>Eimeria notopteri</td>
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139. *Notopterus notopterus*  
*Dactylosoma notopteri*  
*Eimeria notopteri*  
*Ranaghat and Krishnagar*

140. *Opisthopterus tartoor*  
*Ceratomyxa tartoori*  
*Digha coast*

141. *Anguilla anguilla*  
*Trypanosoma granulosum*  
*Calcutta market*

142. *Harpodon nehereus*  
*Eimeria harpodoni*  
*Port Canning, South 24-Parganas*

143. *Amblypharyngodon mola*  
*Chloromyxum amphinoui*  
*Calcutta, North 24-Parganas*

144. *Catla catla*  
*Thelohanellus sudevi*  
*Chinsurah*

145. *Cirrhinus mrigala*  
*Balanidium mrigalae*  
*Nadia*

Order **ANGUILLIFORMES**

Order **MYCTOPHIFORMES/SCOPELIFORMES**

Order **CYPRINIFORMES**
146. Cirhinus reba

- Myxobolus sphericum
- Myxosoma Indirae
- Scyphidia pyriformis
- Thelohanellus mirgalae
- Trichodina indica
- Tripartiella bulbosa

Bodomonas rebae
Chloromyxum mirgalae
Scyphidia pyriformis
Trichodina indica

147. Ctenopharyngodon idella

- Tripartiella obtusa

Triparliella obtusa

148. Cyprinus carpio

- Ichthyophthirius multifilis
- Thelohanellus jiroveci
- Thelohanellus rohitae

149. Labeo bata

- Myxobolus calbasui
- Neothelohanellus krishnagarensis
- Thelohanellus calbasui
- Thelohanellus rodgii
- Trichodina indica

150. Labeo calbasu

Bodomonas rebae
Ichthyophthirius sp.
Myxobolus calbasui
Myxobolus calae
Myxobolus rohitae
Myxosoma dermitis
Scyphidia pyriformis
Thelohanellus rohitae
Trichodina indica
Tripartiella bulbosa
Tripartiella copiosa

151. Labeo rohita

- Bodomonas rebae
- Ichthyophthirius sp.
- Myxobolus calbasui
- Myxobolus calae
- Myxobolus rohitae
- Myxosoma dermitis
- Scyphidia pyriformis
- Thelohanellus rohitae
- Trichodina indica
- Tripartiella bulbosa
- Tripartiella copiosa

152. Puntius filamentosus

Myxosoma filamentosa

153. Puntius sarana

(=Burbus sarana)

Myxobolus branchialis

State Fauna Series 3: Fauna of West Bengal
<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
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<tr>
<td>154.</td>
<td><em>Puntius ticto</em> (=<em>Burus tic to</em>)</td>
<td><em>Myxobolus barbi</em></td>
<td>Belghoria</td>
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<td><em>Salmo stoma bacaila</em></td>
<td><em>Trichodina indica</em></td>
<td>North 24-Parganas</td>
<td>West Bengal</td>
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<td>156.</td>
<td>Major carps (Indian carps)</td>
<td><em>Costia necatrix</em></td>
<td>West Bengal</td>
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<td><em>Ichthyophthirius</em> sp.</td>
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<td><em>Trichodona nigra</em></td>
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<td><strong>Order</strong></td>
<td><strong>SILURI FORMES</strong></td>
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<td><em>Trypanosoma</em> sp.</td>
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<td>158.</td>
<td><em>Clarias batrachus</em></td>
<td><em>Haemohormidium</em> (=<em>Babesiosoma</em>) <em>batrachi</em></td>
<td>Calcutta</td>
<td>Naihati</td>
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<td><em>Myxidium</em> sp.</td>
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<td><em>Heteropneustes fossilis</em> (=<em>Saccobranchus fossilis</em>)</td>
<td><em>Chloromyxum amphipnou</em></td>
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<td><em>Mystus bleekeri</em></td>
<td><em>Trypanosoma bengalensis</em></td>
<td>Canning and Champahati, South 24-Parganas</td>
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<td><em>Dactylosoma</em> sp.</td>
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</table>
State Fauna Series 3: Fauna of West Bengal

164. Mystus sp.  
165. Pangasius pangasius  
166. Wallago attu

Order Atheriniformes

167. Xenentodon cancila

Order Channiformes

168. Channa gachua 
169. Channa marulius 
170. Channa punctatus

Trypanosoma vittati  
Taldí, South 24-Parganas, Dinhata, Koch Bihar

Henneguya mystusia  
Chinsurah

Balanidium pangasi  
Kalyani

Trypanosoma tandoni  
Champahati

Order Atheriniformes

Trypanosoma cancili

Order Channiformes

Trypanosoma xenontodonii

Henneguya (=Unicauda) ophicephali  
Barrackpore

Myxosoma cylindrica  
Islampur, Murshidabad

Trichodina indica  
West Bengal

Trypanosoma gachuii  
Calcutta

Myxidium marulienisis  
Islampur, Murshidabad

Henneguya renalisis  
Domkal, Murshidabad

Chloromyxum meglisichi  
North 24-Parganas

Costia necatrix  
North and South 24-Parganas

Haemohormidium (=Babesiosoma) harenii  
Calcutta and Suburbs

Haemohormidium (=Babesiosoma) ophicephali  
Suburbs of Calcutta

Henneguya (=Unicauda) bengalensis  
Naihati

Henneguya (=Unicauda) bicornuata  
Naihati, Calcutta

Henneguya (=Unicauda) choudhuryi  
Kalyani

Henneguya (=Unicauda) ophicephali  
Calcutta

Mesnilium malariae  
Calcutta and its suburbs

Myxidium sp.  
Calcutta
Myxidium sp.  Nadia
Myxobolus aligarhensis  Naihati, Calcutta
Trichodina indica  West Bengal
Trichodina sp.  Kalyani
Trypanosoma elongatus  Calcutta
Trypanosoma punctata  Raiganj

171. *Channa striatus striatus*

Costia necatrix  North and South 24-Parganas
Dactylosoma striata  Sonarpur, South 24-Parganas
Myxidium striatusi  Chinsurah
Myxosoma noblei  Chinsurah
Trypanosoma striati  Calcutta, Raiganj, West Dinajpur

Order SYMBRANCHIFORMES

172. *Amphipnous cuchia*  Chloromyxum amphipnoui  Calcutta
(=Amphipnous kuchia)

173. *Amphiopnous sp.*  Trypanosoma granulosum  Habra, North 24-Parganas

Order PERCIFORMES

174. *Anabus testudineus*  Myxidium lieberkuhni  Calcutta
Trypanosoma anabari  Canning

175. *Boleophthalmus boddaerti*  Ceratomyxa sagarica  Canning
Myxidium boddaerti  Canning, South 24-Parganas

176. *Chanda nama*  Myxidium lieberkuhni  Krishnanagar
(=Ambassis nama)
Henneguya nameae  West Bengal
Trichodina indica  Kalyani
Tripartiella bulbosa  West Bengal

177. *Chanda ranga*  Myxidium lieberkuhni  "
(=Ambasis ranga)

177a. *Nandus nandus*  Myxidium lieberkuhni  "
Trichodina indica  Kalyani
Trypanosoma sp.  Maldah
Trypanosoma nandi  Kalyani

178. *Colisa fasciata*  Myxidium lieberkuhni  Calcutta
(=Trichogaster fasciatus)
Ceratomyxa sp.  Calcutta
179. **Glossogobius giuris**
   (=*Gobius giuris*)

   - *Haemogregarina colisa*
   - *Myxidium fasciatum*
   - *Myxosoma magauddi*
   - *Myxosoma trichogasteri*
   - *Eimeria glossogobi*

   - *Trypanosoma gobida*

   - **Canning,** South 24-Parganas
   - **Barrackpore**
   - **Ranaghat**
   - **Barrackpore**
   - **Kalyani**

180. **Lates calcarifer**

   - *Henneguya latesi*
   - *Leptotheca latesi*
   - *Myxidium calcariferi*

   - **West Bengal**
   - **West Bengal**

181. **Odontamblyopus rubicundus**
   (=*Gobioides rubicundus*)

   - *Ceratomyxa gobioidesi*

   - **Calcutta**

182. **Scatophagus argus**

   - *Ceratomyxa scatophagi*

   - **West Bengal**

183. **Therapon jarbua**

   - *Sphaeromyxa theraponi*

   - **Canning,** South 24-Parganas

184. **Tilapia mossambica**

   - *Trypanosoma choudhuryi*

   - **Bagmari,** North 24-Parganas

   - *Trichodina nigra*

   - **Kalyani**

   - *Trichodina sp.*

   - **Calcutta**

**Order**  
**MASTACEMBELIFORMES**

185. **Mastacembelus armatus**

   - *Trypanosoma armeti*

   - *Myxobolus eeli*

   - **Champahati,** South 24 Pgs.

186. **Mastacembelus pancatus**

   - *Trypanosoma pancali*

   - **Champahati,** South 24-Parganas

   - **Champahati,** South 24-Parganas

   - **Maldah,** Tiljala,

   - **Calcutta**

**Order**  
**TETRADONTIFORMES**

187. **Sphaeroides oblongus**

   - *Trichodina sp.*

   - **Digha**

**Aquarium Fish**

188. **Xiphophorus hellerii**

   - *Ichthyophthirius multifilis*

   - **Experimental**

**Miscellaneous**

189. **Apocrytes bato**

   - *Myxidium apocryptae*

   - **Kalyani**
<table>
<thead>
<tr>
<th>Species</th>
<th>Genus</th>
<th>Host/Country</th>
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</thead>
<tbody>
<tr>
<td>190. <em>Chirocentrus dorab</em></td>
<td><em>Unicapsula chirocentrusi</em></td>
<td>Indian Southern Coast</td>
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<tr>
<td>191. <em>Macrones gulio</em></td>
<td><em>Ceratomyxa</em> sp.</td>
<td>Calcutta</td>
</tr>
<tr>
<td>192. <em>Muraenesox sp.</em></td>
<td><em>Leptotheca macronesi</em></td>
<td>West Bengal</td>
</tr>
<tr>
<td>193. <em>Noemacheilus r. rupicola</em></td>
<td><em>Haemoproteus rupicola</em></td>
<td>Darjiling</td>
</tr>
<tr>
<td>194. <em>Rhinomugil corsula</em></td>
<td><em>Myxobolus anili</em></td>
<td>Coast of Bay of Bengal</td>
</tr>
<tr>
<td>195. <em>Rita rita</em></td>
<td><em>Henneguya (=Unicauda) riae</em></td>
<td>Chandannagar</td>
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<tr>
<td>196. <em>Sciaena bleekeri</em></td>
<td><em>Myxidium sciaenae</em></td>
<td>Digha coast</td>
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<tr>
<td>197. <em>Tachysurus platostomus</em></td>
<td><em>Kudoa bengalensis</em></td>
<td>West Bengal coast</td>
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<tr>
<td></td>
<td><em>Sphaeromyxa hareni</em></td>
<td>Digha</td>
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<td></td>
<td><em>Thelohanellus auerbachii</em></td>
<td>Digha coast</td>
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<tr>
<td></td>
<td><em>Zschokkella platostomusi</em></td>
<td>Digha coast</td>
</tr>
<tr>
<td>198. <em>Tachysurus tenuispinis</em></td>
<td><em>Kudoa tachysurae</em></td>
<td>West Bengal coast</td>
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<tr>
<td></td>
<td><em>Thelohanellus coeli</em></td>
<td>West Bengal coast</td>
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Class AMPHIBIA
Order CAUDATA

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<tr>
<td>199. <em>Tylotriton verrucossus</em></td>
<td><em>Balantidium rayi</em></td>
<td>Jorpukuri, Darjiling</td>
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<td></td>
<td><em>Balantidium tylotritonis</em></td>
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Order ANURA

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<th>Species</th>
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<th>Host/Country</th>
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<tr>
<td>200. <em>Bufo andersoni</em></td>
<td><em>Haemogregarina nucleobisecans</em></td>
<td>Bankura, Puruliya</td>
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<tr>
<td>201. <em>Bufo himalayana</em></td>
<td><em>Haemogregarina</em> sp.</td>
<td>Darjiling</td>
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<tr>
<td></td>
<td><em>Lankesterella</em> sp.</td>
<td>Darjiling</td>
</tr>
<tr>
<td></td>
<td><em>Opalina scalpriformes</em></td>
<td>Ghoom, Darjiling</td>
</tr>
<tr>
<td>202. <em>Bufo melanostictus</em></td>
<td><em>Cepedea longa</em></td>
<td>Calcutta (DumDum)</td>
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<tr>
<td></td>
<td><em>Eimeria laminata</em></td>
<td>Calcutta</td>
</tr>
<tr>
<td></td>
<td><em>Haemogregarina nucleobisecans</em></td>
<td>Maldah, Bankura, Puruliya, South 24-Parganas</td>
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<td></td>
<td><em>Isospora wenyonii</em></td>
<td>Calcutta</td>
</tr>
<tr>
<td></td>
<td><em>Lankesterella bufonis</em></td>
<td>Balitha, Kotalpur, Bankura</td>
</tr>
<tr>
<td></td>
<td><em>Nyctotheroides cordiformis</em></td>
<td>Calcutta, Hugli North &amp; South 24-Parganas</td>
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<tr>
<td>203. <em>Bufo stomaticus</em></td>
<td>Opalina plicata</td>
<td>Calcutta</td>
</tr>
<tr>
<td>------------------------------</td>
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<tr>
<td></td>
<td>Opalina scalpriformes</td>
<td>Calcutta, Maldah, Murshidabad</td>
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<tr>
<td></td>
<td>Opalina triangularis</td>
<td>Birbhum, Calcutta, Koch Bihar</td>
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<td></td>
<td>Trypanosoma rotatorium</td>
<td>Berhampore</td>
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<td></td>
<td>Zschokkella auebach</td>
<td>Calcutta</td>
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<tr>
<td></td>
<td>Isospora stomaticae</td>
<td>Calcutta</td>
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<td>204. <em>Hyla arborea</em></td>
<td>Myxidium haldari</td>
<td>Chakdah, Nadia</td>
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<td>205. <em>Kaloula pulchra</em></td>
<td>Haemogregarina pulchra</td>
<td>Santaldi, Puruliya</td>
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<td>206. <em>Kaloula pulchra</em> taprobanica</td>
<td>Hegneriella mukundai</td>
<td>Medinipur</td>
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<td></td>
<td>Haemogregarina kaloulae</td>
<td>Bishnupur, Bankura; Murshidabad</td>
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<tr>
<td></td>
<td>Sicuophora (=Nyctotherus) macropharyngeus</td>
<td>Puruliya</td>
</tr>
<tr>
<td></td>
<td>Trypanosoma taprobanica</td>
<td>Barddhaman, Darjiling, Medinipur, Puruliya</td>
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<tr>
<td>207. <em>Rana cyanophyctis</em></td>
<td>Balantidium helenae</td>
<td>Puruliya</td>
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<tr>
<td></td>
<td>Eimeria cyanophyctis</td>
<td>Calcutta</td>
</tr>
<tr>
<td></td>
<td>Haemogregarina berestneffi</td>
<td>Balitha, Bankura, Berhampore, Murshidabad, Reang, Darjiling</td>
</tr>
<tr>
<td></td>
<td>Sicuophora (=Nyctotherus) macropharyngeus</td>
<td>Puruliya</td>
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<td>Trypanosoma rotatorium</td>
<td>Garumara, Maldah</td>
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<td>208. <em>Rana hexadactyla</em></td>
<td>Balantidium helenae</td>
<td>Calcutta</td>
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<tr>
<td></td>
<td>Balantidium rotundum</td>
<td>Puruliya</td>
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<tr>
<td></td>
<td>Haemogregarina pattoni</td>
<td>Medinipur</td>
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<td></td>
<td>Trypanosoma inopinatum</td>
<td>Bankura</td>
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<td></td>
<td>Trypanosoma karyozeukton</td>
<td>Salikona, Hugli</td>
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<td>209. <em>Rana limnocharis</em></td>
<td>Balantidium helenae</td>
<td>Puruliya</td>
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<tr>
<td></td>
<td>Haemogregarina berestneffi</td>
<td>Reang, Darjiling; Bankura</td>
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<tr>
<td></td>
<td>Haemogregarina magna</td>
<td>Bishnupur</td>
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<tr>
<td></td>
<td>Haemoproteus ovalis</td>
<td>Balitha, Bankura</td>
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<tr>
<td></td>
<td>Isospora wenyoni</td>
<td>Calcutta</td>
</tr>
<tr>
<td></td>
<td>Lankesterella minima</td>
<td>Jalpaiguri</td>
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</table>
210. *Rana tigrina*

- *Trypanosoma chattoni*  
  Jalpaiguri
- *Trypanosoma loricatum*  
  Balitha & Bishnupur, Bankura
- *Trypanosoma rotatorium*  
  Rangpoo, Darjiling and Koch Bihar
- *Zschokkella auerbachi*  
  Calcutta
- *Balantidium helenae*  
  Calcutta
- *Balantidium ranarum*  
  Calcutta
- *Balantidium rotundum*  
  North 24-Parganas and Puruliya
- *Balantidium sushilli*  
  Calcutta, Puruliya
- *Haemogregarina berestneffi*  
  Berhampore, Bankura
- *Haemogregarina magna*  
  Garumara
- *Haemogregarina perinucleophilum*  
  Balitha, Bankura
- *Isospora wenyoni*  
  Calcutta
- *Lankesteralla minima*  
  Berhampore, Bankura, South 24-Parganas, Murshidabad
- *Nyctotheroides cordiformes*  
  Calcutta
- *Sicuophora macropharyngeus*  
  Calcutta, North 24-Parganas
- *Trypanosoma inopinatum*  
  Bankura
- *Trypanosoma karyozeuktton*  
  Barddhaman, Hugli and Darjiling
- *Trypanosoma loricatum*  
  Barddhaman
- *Trypanosoma mega*  
  Barddhaman, Darjiling
- *Trypanosoma ranarum*  
  Bankura
- *Trypanosoma rotatorium*  
  Garumara, Jalpaiguri, Bankura and Hugli
- *Trypanosoma taprobanica*  
  Barddhaman, Darjiling & Puruliya
- *Zschokkella auerbachi*  
  Calcutta

211. *Rana sp.*

212. *Rhacophorus maculatus*

- *Trypanosoma ranarum*  
  Bankura
- *Cepedea longa*  
  South 24-Parganas
- *Cepedea srivastavai*  
  Calcutta
- *Haemogregarina maculatus*  
  Balitha, Bankura
- *Trypanosoma rotatorium*  
  Bankura

213. *Uperodon systoma*

- *Haemogregarina systoma*  
  Puruliya
- *Trypanosoma systoma*  
  Medinipur
214. Tadpole

Class REPTILIA
Order CHELONIA

215. Lissemys punctata

Eimeria irregularis
Eimeria koormae
Eimeria innominata
Haemogregarina xaveri
Zschokkella lissemysi

216. Lissemys punctata punctata

Balantidium dogieli
Haemogregarina choudhuryi
Trypanosoma balithaeni

217. Trionyx gangeticus

Eimeria triangularis
Eimeria trionyxa
Haemogregarina gangetica
Haemoproteus trionyxi
Trypanosoma gangetica

Order SQUAMATA
Suborder LACERTILIA

218. Calotes versicolor

Isospora calotesi
Haemogregarina sp.

219. Gecko gecko

Caryospora geckonis
Eimeria bongaonensis

220. Hemidactylus flaviviridis

Eimeria flaviviridis
Eimeria hemidactyli
Eimeria knowlesi
Haemogregarina sp.
Isospora knowlesi

221. Mabuya carinata

Haemogregarina sp.

222. Mabuya sp.

Octosporella mabuiae

Suborder OPHIDIA

223. Enhydris enhydris

Caryospora bengalensis
Eimeria fibrilosa
Haemogregarina sp.
Trypanosoma enhydris

Chakdah, Nadia
Chakdah, Nadia
Chakdah, Nadia
Darjiling, Koch Bihar,
Chakdah, Nadia
<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Genus</th>
<th>Location</th>
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<tbody>
<tr>
<td>224.</td>
<td><em>Naja naja</em></td>
<td><em>Caryospora cobrae</em></td>
<td>Barddhaman</td>
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<td><em>Eimeria najae</em></td>
<td>Sundarban</td>
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<td><em>Isospora minuta</em></td>
<td>Calcutta</td>
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<td>225.</td>
<td><em>Natrix piscator</em></td>
<td><em>Eimeria gupti</em></td>
<td>Calcutta</td>
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<td></td>
<td></td>
<td>(= <em>Eimeria cylindrica</em>)</td>
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<td></td>
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<td><em>Eimeria piscatori</em></td>
<td>Calcutta</td>
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<td><em>Haemogregarina mirabilis</em></td>
<td>Koch Bihar</td>
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<td>226.</td>
<td><em>Natrix stolata</em></td>
<td><em>Eimeria stolatae</em></td>
<td>Calcutta</td>
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<td><em>Haemogregarina sp.</em></td>
<td>Koch Bihar</td>
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<td>227.</td>
<td><em>Python sp.</em></td>
<td><em>Pythonella bengalensis</em></td>
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<td>228.</td>
<td><em>Ptyas mucosus</em></td>
<td><em>Hepatozoon mucosus</em></td>
<td>North 24-Parganas</td>
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<td><strong>Class AVES</strong></td>
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<td><strong>Order CICONIFORMES</strong></td>
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<td>229.</td>
<td><em>Ardeola grayi</em></td>
<td><em>Plasmodium circumflexum</em></td>
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<td></td>
<td>(Syn. <em>Plasmodium heroni</em>)</td>
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<td><strong>Order ANSERIFORMES</strong></td>
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<td>230.</td>
<td><em>Anas bosohus</em></td>
<td><em>Wenyonella gagari</em></td>
<td>Basirhat</td>
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<td><em>Nettapus coromandelianus</em></td>
<td><em>Tyzzeria alleni</em></td>
<td>Bidyadhari spill area, Mahisbathan, North 24-Parganas</td>
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<td>Basirhat, North 24-Parganas</td>
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<td><em>Tyzzeria chenicusae</em></td>
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<td><strong>Order FALCONIFORMES</strong></td>
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<td>232.</td>
<td><em>Accipiter virgatus affinis</em></td>
<td><em>Plasmodium sp.</em></td>
<td>Darjiling</td>
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<td>233.</td>
<td><em>Gyps bengalensis</em></td>
<td><em>Isospora gypsi</em></td>
<td>Beliaghata, Calcutta</td>
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<td>234.</td>
<td><em>Milvus migrans</em></td>
<td><em>Trichomonas gallinae</em></td>
<td>Calcutta</td>
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<td><strong>Order GALLIFORMES</strong></td>
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<td>235.</td>
<td><em>Alectoris graeca</em></td>
<td><em>Eimeria alectorae</em></td>
<td>Zoological Gardens, Calcutta</td>
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<td>236.</td>
<td>* Coturnix coromandelica*</td>
<td><em>Plasmodium coturnixae</em></td>
<td>Calcutta</td>
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<td><em>Plasmodium garnhami</em></td>
<td>Calcutta (Expt.)</td>
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<td>237.</td>
<td><em>Coturnix c. coturnix</em></td>
<td><em>Eimeria coturnicus</em></td>
<td>Calcutta market</td>
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<td>238.</td>
<td><em>Gallus domesticus</em></td>
<td><em>Eimeria bengalensis</em></td>
<td>Kalna, Barddhaman</td>
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<td><em>Eimeria gallusae</em></td>
<td>Bagata, North 24-Parganas (experimental)</td>
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<td><em>Eimeria tenella</em></td>
<td>Calcutta</td>
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239. Gallus gallus murghi
240. Gallus sp.
241. Gennaeus horsfieldi
242. Ithaginis cruentus
243. Pavo cristatus
244. Polyplectron bicoloratum
245. Tragopan satyra

Order GRUIFORMES
246. Amaurornis phoenicurus
247. Bellerica pavonina regulorum

Order CHARADRIIFORMES
248. Charadrius asiaticus
249. Gallinago
250. Numenius arquata
251. Pluvialis apricaria
252. Vanellus malabaricus

Order COLUMBIFORMES
253. Columba livia
254. Columba livia domestica
255. Columba livia intermedia

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Trypanosoma evansi
Leucocytozoon sabrazesi
Eimeria gennaeuscus
Plasmodium relictum
Eimeria cristatus

Trypanosoma avium bakeri
Haemoproteus columbae
Trypanosoma hannaie
Eimeria columbae
Eimeria kapotei

Calcutta
Darjiling
Darjiling
Zoological Garden, Calcutta
Zoological Garden, Calcutta
Darjiling

Leucocytozoon sabrazesi
Eimeria mandali

Plasmodium relictum
Eimeria pavonina
Isospora bellericae

Eimeria charadrii
Eimeria gallinagoi
Eimeria numenii
Eimeria roscoviensis pluvialina
Eimeria vanelli

Narayantala, South 24-Parganas
Basanti, South 24-Parganas
Namkhana, South 24-Parganas
Basanti, South 24-Parganas

Haemoproteus columbae
Trypanosoma avium bakeri

Eimeria labbeana
Eimeria kapotei

Calcutta
Calcutta (experimental)
All districts
Calcutta and South 24-Parganas
Calcutta
Calcutta
Calcutta

Calcutta market
Zoological Garden, Calcutta
Darjiling
Zoological Garden, Calcutta
Calcutta

Eimeria tropicalis  
Haemoproteus columbae  
Plasmodium relictum  
Weneyonell columbae  

Order  PSITTACIFORMES

256. Psittacula eupatria nipalensis  
   Isopora psittaculae  
   Calcutta

257. Psittacula krameri manillensis  
   Haemoproteus handai  
   Calcutta

Order  CUCULIFORMES

258. Centropus sinensis  
   Plasmodium sp.  
   North 24-Parganas

Order  STRIGIFORMES

259. Otus scops  
   Haemoproteus syrni  
   Nadia

Order  PICIFORMES

260. Megalaima a. asiatica  
   (= Cyanops a. asiatica)  
   Eimeria barbata  
   Calcutta

261. Megalaima haemacephala  
   Haemoproteus cornuata  
   Chakda, Nadia
   Haemoproteus thereicercyis  
   Nadia
   Plasmodium sp.  
   Nadia, Calcutta
   Isospora megalaimae  
   Subarb. of Calcutta

262. Megalaima zeylanicus caniceps  
   Isospora zosteropis  
   Calcutta

263. Picus flavinucha  
   Haemoproteus bennetti  
   Darjiling

Order  PASSERIFORMES

264. Acridotheres fuscus fuscus  
   Dorisa aethiopsaris  
   Calcutta

265. Acridotheres giginianus  
   Isospora giginiana  
   Calcutta
   Isospora lacazei  
   Calcutta

266. Acridotheres tritis tritis  
   Isospora giginiana tritis  
   Calcutta
   Isospora lacazei  
   Calcutta

267. Acrocephalus arundianceus  
   Haemoproteus sp.  
   West Bengal

268. Acrocephalus dumetorum  
   Haemoproteus fringittae  
   Calcutta, Sagar Island
   Haemoprotus sp.  
   "
   Trypanosoma avium  
   Calcutta

269. Acrocephalus stenoteres  
   Haemoproteus sp.  
   West Bengal

270. Aegithalos concinus rubricapillus  
   Isospora concinnus  
   Darjiling

271. Amandava amandava  
   Dorisa harenii  
   Calcutta

272. Copsychus malabaricus  
   Haemoproteus sp.  
   West Bengal
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<tr>
<th>273. Copschus saularis</th>
<th>Haemoproteus fringillae</th>
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<td>282. Ithopyga saturata</td>
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<td>283. Lanius schach tricolor</td>
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<td>285. Lonchura malacca</td>
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286. Lonchura malacca atricapilla Plasmodium relictum (= P. praecax var. muniae) Calcutta, South 24-Parganas
287. Lonchura malacca malacca Dorisa harenii Calcutta
Eimeria malaccae "
Isospora muniae "
288. Lonchura malacca rubrongier Dorisa harenii Calcutta
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289. Lonchura punctulata Dorisa chakravartyi Calcutta
Dorisa harenii Calcutta
Haemoproteus oryzivora (= Haemoproteus garnhami) Calcutta
Isospora lonchurae Calcutta
Sivatoshella lonchurae Calcutta
290. Lonchura p. punctulata Trypanosoma sp. Calcutta
291. Lonchura striata Isospora mandali Calcutta
292. Muscicapa parva Haemoproteus sp. Calcutta
293. Muscicapa sundra Plasmodium sp. Darjiling
294. Passer domesticus Dorisa passeris Calcutta
Isospora lacazei Calcutta and Subarb.
Lankesterilla sp. Chakda, Nadia
295. Pericrocotus cinnamomeus Peregrinus Plasmodium relictum (= P. pericrocoti) Calcutta
296. Ploceus manyar Haemoproteus sp. West Bengal
297. Ploceus philippinus Haemoproteus oryzivora Nadia
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Lankesterella sp. Nadia
Plasmodium relictum (= P. ploceii) Nadia, Calcutta
Plasmodium sp. Nadia
298. Pycnonotus cafer Isospora lacazei Calcutta
299. Pycnonotus jocosus Isospora pycnonotae Calcutta
Trypanosoma avium bakeri Calcutta
300. Pycnonotus jocosus emerita Haemoproteus sanguinis Calcutta
Isospora psittaculae Calcutta
301. Sturnus contra Haemoproteus pastoris Nadia, South 24-Parganas
Haemoproteus sp. Gangetic West Bengal
Isospora lacazei Calcutta
Isospora lonchurae Calcutta
Plasmodium sp. Nadia, Gangetic West Bengal

302. Sturnus contra contra Eimeria anili Kalyani
303. Sturnus malabaricus Haemoproteus pastoris Nadia, Sagar Island
Lankestrella sp. Chakdah, Nadia
Plasmodium nucleophilum Nadia
Plasmodium sp. Gangtcic West Bengal

304. Sturnus pagodarum Isospora temenuchii Calcutta
305. Turdoides striatus Haemoproteus oryzivorae Sagar Island
Isospora pycnonoti Calcutta

306. Zosterops palpebrosa Dorisa mandali Calcutta
307. Zosterops p. palpebrosa Dorisa mandali Calcutta
Haemoproteus zostepopis Calcutta
Isospora zostepopis Calcutta

Class MAMMALIA
Order INSECTIVORA

308. Suncus murinus Eimeria murinus Haora
309. Suncus murinus soccatus Eimeria darjeelingensis Darjiling and Calcutta

Order CHIROPTERA

310. Harpiocephalus harpia Dorisa harpia Darjiling
lasyurus
311. Hipposideros lankadiva Polychromophilus murinus Jalpaiguri
312. Rhinolophus rouxi rouxi Polychromophilus Darjiling
Trypanosoma rhinolophonis Singhmari, Darjiling
313. Scotophilus k. kuhli Babesia vesperuginis Sundarban
Entamoeba chiropteris Sundarban
314. Indian bat Anaplasma sp. Calcutta

Order RODENTIA

315. Bandicota bengalensis Eimeria bandicota Darjiling
Trypanosoma (Herpetosoma) Calcutta
lewisi
316. Bandicota indica Eimeria biswapati Haora
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<td>Rayella gigantica Hepatocystis sp.</td>
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<tr>
<td><strong>Iodamoeba butschili</strong></td>
<td>Sundarban</td>
</tr>
<tr>
<td><strong>Isospora sundarbanensis</strong></td>
<td>Sajnekhali, Sundarban</td>
</tr>
<tr>
<td><strong>Tetratrichomonas buttreyi</strong></td>
<td>Sundarban</td>
</tr>
</tbody>
</table>

**Order PRIMATE**

<table>
<thead>
<tr>
<th>Parasite Name</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Balantidium coli</strong></td>
<td>Calcutta</td>
</tr>
<tr>
<td><strong>Chilomastix mesnili</strong></td>
<td>Calcutta</td>
</tr>
<tr>
<td><strong>Eimeria clupearum</strong></td>
<td>Calcutta</td>
</tr>
<tr>
<td><strong>Entameoba coli</strong></td>
<td>Calcutta</td>
</tr>
<tr>
<td><strong>Entamoeba histolytica</strong></td>
<td>Almost all parts of West Bengal</td>
</tr>
<tr>
<td><strong>Enteromonas hominis</strong></td>
<td>Calcutta</td>
</tr>
<tr>
<td><strong>Giardia intestinalis</strong></td>
<td>Almost all parts of West Bengal</td>
</tr>
<tr>
<td><strong>Isospora belli</strong></td>
<td>Calcutta</td>
</tr>
<tr>
<td><strong>Isospora hominis</strong></td>
<td>Calcutta</td>
</tr>
<tr>
<td><strong>Plasmodium falciparum</strong></td>
<td>Almost all parts of West Bengal</td>
</tr>
</tbody>
</table>
Plasmodium malariae
Plasmodium vivax
Trichomonas vaginalis

Almost all parts of West Bengal

351. Macaca irus
Dientamoeba fragilis
Calcutta
352. Macaca mulatta
Balatidium rhesum
Calcutta
Dientamoeba fragilis
Sundarban
Entameoba coli
Sundarban
Entameoba histolytica
Sundarban
Entamoeba chattoni
Sundarban
Iodamoeba butschlii
Sundarban

SYSTEMATIC ACCOUNT

Subkingdom PROTOZOA
Phylum SARCOMASTIGOPHORA
Subphylum MASTIGOPHORA
Class PHYTOMASTGOPHOREA
Order EUGLENIDA
Family ASTASIIDAE

Diagnosis: Body highly plastic, usually elongate spindle during locomotion; single flagellum arising from a blepharoplast located at anterior end; without any chromatophores.

Genus Copromonas Dobell

Diagnosis: Body elongate-ovoid; a small cytostome present at anterior end.

1. Copromonas ruminantium Woodcock


Diagnosis: Body oval or elongate, dimensions 4.41-11.27 (9.72) μm x 2.40 - 5.74 (4.59) μm; flagellum single longer than the body length and originating from the blepharoplast located at the base of the cytopharynx; nucleus oval or spherical, vesicular with a large endosome.

Host: Wild Boar, Sus scrofa; from faecal sample collected from Sundarban Tiger Reserve and Bhagabatpur Crocodile Project area, South 24-Parganas.

Distribution: India: West Bengal (South 24-Parganas district).

Remarks: This species has been reported by Mandal and Choudhury (1985) from West Bengal.

Order CHRYSONOMADIDA
Family CROMULINIDAE

Diagnosis: Forms minute, naked or sculptured shell; with a single flagellum.
Genus *Oikomonas* Kent

*Diagnosis*: Oval or spherical, round in cross section, without any chromatophore, nucleus single.

2. *Oikomonas communis* Liebetanz


*Diagnosis*: Body small, spherical or ovoidal with a long flagellum at one end; cytoplasm filled with minute granules stained green with Giemsa.

*Host*: *Capra hircus*; site of infection: stomach.

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Das Gupta (1935) reported this species from the stomach contents of *Capra hircus* procured from a slaughter house at Tangra, Calcutta.

**Class** ZOOMASTIGOPHOREA

**Order** KINETOPLASTIDA

Key to the families

1(4) Typically two heterodynamic flagella, adbasal kinetoplast arranged in several discrete bodies or dispersed throughout mitochondrion .................................................................

2(3) With two flagella, one free and the other marking outer margin of undulating membrane, body leaf-like ...........................................................................................................CRYPTOBIIDAE

3(2) With two flagella, one directed anteriorly and the other posteriorly and trailing, body ovoid or elongate ...........................................................................................................BODONIDAE

4(1) Single flagellum attached to the body by undulating membrane, kinetoplast relatively small and compact, body characteristically leaf-like ..................TRYPANOSOMATIDAE

**Family** BODONIDAE

**Genus** *Bodomonas* Davis

*Diagnosis*: Body elongate, with a small depression at anterior end; two flagella, anterior one small and posterior one long and trailing.

3. *Bodomonas rebae* Tripathi


*Diagnosis*: Body elongate, with broad and flattened anterior end and tapering posterior end; cytoplasm granular, contractile vacuole round; cytopharynx small depression at the anterior end; nucleus spherical; flagella two in number, anterior one small and posterior one extending beyond the body.

*Host*: *Cirrhinus reba*, *C. mrigala*, *Catla catla* and *Labeo rohita*; site of infection: skin
**Distribution**: India: West Bengal (locality not mentioned).

**Family** CRYPTOBIDAE

**Genus** Trypanoplasma Laveran and Mesnil

**Diagnosis**: Body leaf-like, blepharoplast elongated rod-like, parasitic in the blood of fishes.

4. *Trypanoplasma indica* (Mandal)


**Material examined**: Sev. exs., Champahati, South 24-Parganas, 18. viii. 1977, A.K. Mandal.

**Diagnosis**: Monomorphic, broad and sickle-shaped, dimensions 25-30 (28.5) μm × 6-10 (8.5) μm; cytoplasm having fine granules distributed all over the body; nucleus reniform or ovoidal situated anteriorly; anterior flagellum long, posterior flagellum trailing along the margin of the body forming an undulating membrane and extending as free portion.

**Host**: Mystus vittatus; site of infection: blood.

**Distribution**: India: West Bengal (South 24-Parganas district).

**Family** TRYPANOSOMATIDAE

**Key to the genera**

1(2) Body highly flattened leaf-like, pointed at flagellar end and bluntly rounded or pointed at the other, parasitic in the circulatory system of vertebrates ...........Genus *Trypanosoma*

2(1) Body ovoid or round in leishmanial stage and spindle-shaped in leptomonad stage, intracellular parasite in the cells of reticulo-endothelial system.........Genus *Leishmania*

**Genus** Leishmania Ross

5. *Leishmania donovani* (Laveran and Mesnil)


**Diagnosis**: Ovoid or round, dimensions 2.5-5.0 μm × 1.5-2.0 μm; nucleus and kinetoplast visible in stained preparations; an internal fibrilar representing the flagellum sometimes be traced; leishmanial stage occurring in man and others in mammals primarily rodents; heteroxenous parasite transmitted by sandflies belonging to the genus *Phlebotomus* in which spindle shaped leptomonad stage measuring about 14 to 20 μm long and 1.5 to 3.5 μm wide be found.

**Host**: Man, Dog, other mammals primarily rodents; site of infection: reticulo-endothelial system.

**Distribution**: India: West Bengal (Baroddhaman, Murshidabad, North and South 24-Parganas districts), Assam and Bihar.
Remarks: It causes a disease known as kala-azar, dum-dum fever or visceral leishmaniasis.

Genus Trypanosoma Grudy

In all, 44 species of Trypanosoma have so far been reported from West Bengal out of which 23 are recovered from fishes, 9 from amphibians, 3 from reptiles, 4 from birds and 5 from mammals. Since these species are host specific at least in their hosts class level, such host-wise key is given below for the convenience of identification of these species.

A. Key to the species of Trypanosoma of fishes

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Trypomastigote form monomorphic</td>
<td>T. xenentodonii</td>
</tr>
<tr>
<td>2</td>
<td>Granules form conspicuous striations</td>
<td>T. xenentodonii</td>
</tr>
<tr>
<td>3</td>
<td>Such striations lacking</td>
<td>T. xenentodonii</td>
</tr>
<tr>
<td>4</td>
<td>Cytoplasm uniformly granular, vacuoles scattered throughout the cytoplasm</td>
<td>T. xenentodonii</td>
</tr>
<tr>
<td>5</td>
<td>Body ‘C’ to ‘S’ shaped, length of cell body 26.5-38.5 μm, vacuoles concentrated more towards posterior part of the body</td>
<td>T. anabasi</td>
</tr>
<tr>
<td>6</td>
<td>Body elongated, slender, gradually attenuated, length of cell body 18.5-20.5 μm, vacuoles uniformly scattered</td>
<td>T. cancili</td>
</tr>
<tr>
<td>7</td>
<td>Cytoplasm not uniformly granular, localisation of vacuoles diverse</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Granules concentrated more towards the side opposite to undulating membrane</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Nucleus elongated, compact and located at the posterior half of the body</td>
<td>T. danilewskyi</td>
</tr>
<tr>
<td>10</td>
<td>Nucleus sausage or bean-shaped</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Two large vacuoles found at both extremities of the nucleus</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Nucleus bean-shaped, length of the cell body 14.0 - 17.5 μm</td>
<td>T. bengalensis</td>
</tr>
<tr>
<td>13</td>
<td>Nucleus sausage-shaped, length of the cell body 16.5 - 25.32 μm</td>
<td>T. choudhuryi</td>
</tr>
<tr>
<td>14</td>
<td>Small vacuoles present</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Length of cell body 35 -40 μm, small vacuoles distributed throughout the body</td>
<td>T. panchali</td>
</tr>
<tr>
<td>16</td>
<td>Length of cell body 20.5-27.5 μm, few small vacuoles (2-5 in number) found anterior to the nucleus</td>
<td>T. tandoni</td>
</tr>
<tr>
<td>17</td>
<td>Concentration of granules in a different fashion</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Nucleus bean-shaped</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Nucleus located towards anterior end, chromatin granules concentrated at the centre, length of cell body 55-85 μm</td>
<td>T. granulosum</td>
</tr>
</tbody>
</table>
20(19) Nucleus located at the middle of the body, with compact chromatin material, length of cell body 20.0-35.5 μm. .................................................................T. viitati

21(18) Nucleus oval or oblong. ........................................................................................................................................................................

22(23) Nucleus oval, located towards posterior third of the body, nuclear membrane not distinct, length of cell body 43.0- 44.5 μm. .................................................T. elongatus

23(22) Nucleus large, oblong with distinct nuclear membrane and located at the anterior half of the body, length of cell body 30.9 - 36.2 μm. ..............................T. punctati

24 (1) Trypomastigote form not monomorphic .................................................................................................................................

25(38) Trpomastigote form dimorphic ........................................................................................................................................................................................

26(33) Nucleus located almost at the middle of the body ........................................................................................................................................

27(30) Scattered volutin granules present throughout the body ........................................................................................................

28(29) Length of the cell body 46.5-51.5 μm in large form, small vacuoles distributed throughout the body ......................................................T. gobida

29(28) Length of the cell body 28.8-42.7 μm in large forms, vacuoles not present ................................................................................................................................

30(27) Volutin granules lacking ........................................................................................................................................................................

31(32) Small vacuoles present throughout the cytoplasm, length of the cell body in large forms 38-40 μm .................................................................T. armeti

32(31) Few small vacuoles present in the posterior half of the body, length of the cell body in large form 24-28.5 μm .................................................................T. mukundi

33(26) Nucleus located at anterior or posterior part of the body ................................................................................................................................

34(35) Volutin granules present sometimes in the form of compact mass, length of the cell body in large forms 22-29 μm .................................................................T. batrachii

35(34) Volutin granules lacking ........................................................................................................................................................................

36(37) Posterior part of the body devoid of any vacuole, length of the cell body in large forms 17.8-28 μm .................................................................T. seenghali

37(36) Posterior part of the body vacuolated, length of cell body in large forms 23.3 - 26.4 μm .................................................................T. gachui

38(25) Trypomastigote form pleomorphic ........................................................................................................................................................................

39(40) Nucleus spherical, oval or pear-shaped and located at the anterior half of the body, length of the cell body in large form 54.75 μm .................................................................T. striati

40(39) Nucleus oval or reniform and located in the middle to posterior part of the body, length of the cell body in large form 18.00 – 35.5 (25.5) μm ........................................................................................................
B. Key to the species of Trypanosoma of amphibians

1(16) Body leaf-like

2(7) Trypomastigote form monomorphic

3(4) Body small, ‘C’ or ‘S’ - shaped in configuration, length of the cell body 15-18.5 (16.64) μm......................... *T. taprobanica*

4(3) Body slender elongate

5(6) Nucleus elliptical and located near the centre of the body, length of the cell body 30.34 μm................................. *T. inopinatum*

6(5) Nucleus oval or kidney-shaped located at posterior-third of the body, length of the cell body 27.42 μm................................. *T. systoma*

7(2) Trypomastigote form bi or pleomorphic

8(9) Trypomastigote form dimorphic, nucleus rounded to oval located at the posterior part of the body, length of the cell body 16.25-20.76 μm................................. *T. loricatum*

9(8) Trypomastigote form pleomorphic

10(11) Nucleus located at the anterior-third to middle-third of the body, length of the cell body 74.1 μm................................. *T. ranarum*

11(10) Nucleus located at middle to posterior-third of the body

12(13) Cytoplasm more densely granular in the posterior two-third of the body with 2-3 striated myonemes along longitudinal axis................................. *T. rotatorium*

13(12) Cytoplasm densely and coarsely granular in prenuclear region with dark striations....

14(15) Nucleus round on oval and located near the junction of middle and posterior thirds of the body, lying parallel to the body axis, nuclear index 0.40........ *T. karyozeukton*

15(14) Nucleus oval or elliptical and situated middle third of the body, lying transverse to the long body axis, nuclear index 0.63................................. *T. mega*

16(1) Body spherical, length of the cell body 19.74-26.15 μm................................. *T. chattoni*

C. Key to the species of Trypanosoma of reptiles

1(4) Trypomastigote form monomorphic

2(3) Cytoplasm non-vacuolated, nucleus located at posterior half of the body, kinetoplast not surrounded by a halo, length of the cell body 30-35 (32.5) μm................................. *T. balithaensis*

3(2) Cytoplasm with 7-10 vacuoles, nucleus located at the middle of the body, kinetoplast always surrounded by a halo, length of the cell body 32.7-36.7 (34.7) μm .................. *T. gangetica*
4(1) Trypomastigote form pleomorphic (with small, intermediate and large forms, nucleus round or oval situated almost at the middle, length of the cell body in large form 106 μm)............................................................................................................. T. enhydris

D. Key to the species of Trypanosoma of birds

1(2) Pleomorphic, in large form posterior end with a prominent caudal prolongation, mostly occur in bone marrows of shrike................................................................. T. lanii

2(1) Pleomorphic, large form without such prominent caudal prolongation, usually occur in peripheral blood...........................................................................................................

3(4) Occurring in a wide range of hosts................................................................. T. avium

4(3) Occurring in columbiform hosts....................................................................... T. hannae

E. Key to the species of Trypanosoma of mammals

1(2) Trypomastigote form with an enormous size of vacuole adjacent to nucleus; length of the cell body 26-30 μm................................................................................ T. rihnoilocophonis

2(1) Trypomastigote form without such vacuole....................................................... T. lewisi

3(6) Kinetoplast large, posterior end of the body pointed........................................ T. indicum

4(5) Occurring in rats, length of the cell body 27-36 μm...................................... T. evansi

6(3) Kinetoplast small, posterior end of the body usually blunt, occurring in bovines, equines, camels, dogs etc., length of the cell body 15-34 μm................................. T. evansi

A. Trypanosoma of fishes

6. Trypanosoma anabasi Mandal


Diagnosis: Trypomastigote form monomorphic, body 'C' to 'S' - shaped, length of cell body 26.5 - 38.5 μm, cytoplasm uniformly granular, vacuoles scattered throughout but concentrated more towards posterior part of the body; nucleus almost oval and located near the middle of the body, undulating memerane conspicuous and having 6-8 large folds.

Host: Anabas testudineus ; site of infection : blood.

Distribution: India : West Bengal (Murshidabad and South 24-Parganas district).

7. Trypanosoma armeti Mandal


Diagnosis: Trypomastigote form dimorphic, slender form 42 (43.5) μm in length and stumpy form 38-40 (39.5) μm in length excluding free flagellum; cytoplasm granular with stray vacuoles throughout; nucleus ovoidal or bean-shaped in stumpy forms and elongated in slender forms and located almost at the middle of the body; undulating membrane conspicuous but narrow having 8-10 folds.

Host: Mastacembelus armatus, site of infection: blood.

Distribution: India: West Bengal (South 24-Parganas district).

8. Trypanosoma batrachi Qadri


Diagnosis: Trypomastigote form dimorphic, cytoplasm granular, volutin granules present sometimes as compact mass, nucleus situated towards posterior end and always encircled with a clear halo, cell body in large form measuring 22-29 μm, with long flagellum 9-14 μm in length.

Host: Clarias batrachus; site of infection: blood

Distribution: India: West Bengal (Calcutta, Koch Bihar and South 24-Parganas districts).

Remarks: Qadri (1962) described this species as dimorphic but Mandal (1984) did not come across any stumpy form.

9. Trypanosoma bengalensis Mandal


Diagnosis: Trypomastigote form monomorphic cytoplasm granular, arranged along the border opposite to undulating membrane, nucleus bean-shaped and centrally placed, length of cell body 14.0- 17.5 μm, undulating membrane having 3-7 folds.

Host: Mystus bleekeri; site of infection: blood.

Distribution: India: West Bengal (South 24-Parganas district).

10. Trypanosoma cancili Mandal


Diagnosis: Trypomastigote form monomorphic, body elongated gradually attenuated at both ends, cytoplasm coarsely granular with large number of small vacuoles scattered throughout, length of the cell body 18.5 - 20.5 μm, nucleus ovoidal situated almost at the middle, undulating membrane having 5-7 folds.
Host: Xenentodon cancila; site of infection: blood.

Distribution: India: West Bengal (South 24-Parganas district).

11. Trypanosoma choudhuryi Mandal


Diagnosis: Trypomastigote form monomorphic, attenuated at both ends, cytoplasm possessing numerous granules mainly on the border opposite to undulating membrane, nucleus sausage-shaped, situated at the middle, length of the cell body 16.5 - 25.32 μm, length of free flagellum 6.5 - 12.5 μm.

Host: Tilapia mossambica; site of infection: blood.

Intermediate host: Hemiclepsis marginata marginata.

Distribution: India: West Bengal (North 24-Parganas and Bankura districts).

12. Trypanosoma danilewskyi saccobranchi Qadri


Diagnosis: Trypomastigote form monomorphic, cytoplasm granular with large vacuoles at the anterior end, nucleus elongated, compact situated at posterior half; flagellum very thick and prominent, undulating membrane having 6-9 folds.

Host: Heteropneustes fossilis; site of infection: blood.

Distribution: India: West Bengal (Calcutta and Murshidabad districts).

13. Trypanosoma elongatus Raychaudhuri and Misra


Diagnosis: Trypomastigote form monomorphic, slender and fusiform in shape; cytoplasm granular towards the posterior end, nucleus oval located at the posterior third of the body, cell body measuring 43.0 - 44.5 μm.

Host: Ophicephalus punctatus; site of infection: blood.

Distribution: India: West Bengal (Calcutta district).


*Diagnosis*: Trypomastigote form dimorphic, short slender and long slender forms; the former having pointed posterior end and the latter with blunt posterior end; nucleus situated more towards posterior end, cell body length (long form) 38.4-44.4 μm and (short slender form) 23.3 - 26.4 μm.

*Host*: *Channa gachua*; site of infection: blood.

*Intermediate host*: *Hemiciepsis marginata*.

*Distribution*: India: West Bengal (Calcutta district).

15. *Trypanosoma gobida* Mandal


*Diagnosis*: Trypomastigote form dimorphic, stumpy and slender; stumpy form: broad having numerous small vacuoles in the cytoplasm, nucleus round situated almost at the middle; slender form; length of the cell body 46.5-51.5 μm, small vacuoles distributed throughout the body, nucleus situated at the middle of the body.

*Host*: *Glossogobius giuris*; site of infection: blood.

*Distribution*: India: West Bengal (South 24-Parganas district).

16. *Trypanosoma granulosum* Lavern and Mesnil


*Diagnosis*: Trypomastigote form monomorphic, attenuated at both ends, cytoplasm highly granular towards anterior half, nucleus bean shaped, situated anteriorly having central concentration of chromatin granules, length of the cell body 20.0 - 35.5 μm, undulating membrane distinct.

*Host*: *Anguilla anguilla* and *Amphipnous* sp.; site of infection: blood.

*Distribution*: India: West Bengal (Calcutta and North 24-Parganas districts).

17. *Trypanosoma maguri* Tandon and Joshi


*Diagnosis*: Pleomorphic, attenuated at both ends, cytoplasm granular, arranged throughout, nucleus oval or reniform located in the middle to posterior part of the body, length of the cell body (Large form) 18.00-35.5 μm.
Host: *Clarias batrachus*; site of infection: blood.

Distribution: India: West Bengal (Calcutta district). Uttar Pradesh (Lucknow).

18. *Trypanosoma mukundi* Raychoudhury and Misra


Diagnosis: Dimorphic, slender and stumpy; slender form having long flagellum, cytoplasm possessing small vacuoles at the posterior half, length of the cell body 24.0 - 28.5 μm, stumpy form having small free flagellum with narrowly pointed posterior end.

Host: India: West Bengal (Calcutta district).

19. *Trypanosoma nandi*, Mukherjee and Halder


Diagnosis: Dimorphic, Large form with short flagellum and smaller forms with long flagellum; cytoplasm devoid of any vacuole, nucleus ovoidal, length of cell body in large form 28.8 - 42.7 μm and in short form 18.7 - 28.7 μm, length of free flagellum 2.3 - 3.3 μm and 6.6-8.6 μm, respectively.

Host: *Nandus nandus*; site of infection: blood.

Distribution: India: West Bengal (Nadia district).

20. *Trypanosoma pancali* Mandal


Diagnosis: Monomorphic, attenuated at both ends, cytoplasm possessing small vacuoles throughout, volution granules present and arranged in a linear fashion opposite to undulating membrane-nucleus sausage-shaped, kinetoplast conical encircled with a clear halo, length of the cell body 35.6 - 40.0 μm.

Host: *Mastacembelus pancalus*; site of infection: blood.

Distribution: India: West Bengal (South 24-Parganas district).

21. *Trypanosoma punctati* Hassan and Qasim


Diagnosis: Trypomastigote form monomorphic, spindle shaped, cytoplasm granular possessing a number of vacuoles, nucleus oblong located at anterior half of the body, length of the cell body 30.6-36.2 μm, flagellum very long, undulating membrane narrow with 5-6 folds.

Host: *Ophicephalus (=Channa) punctatus*; site of infection: blood.

Distribution: India: West Bengal (West Dinajpur), Uttar Pradesh (Aligarh).
22. *Trypanosoma seenghali* Joshi


*Diagnosis*: Trypomastigote dimorphic, tapering at both ends, cytoplasm finely granular, nucleus oval or round situated at the anterior half, posterior part devoid of any vacuole, flagellum short or long with variable free flagellar length, cell body in large form measuring 19.8 - 28.0 μm.

*Host*: *Mystus seenghala* (Sykes); site of infection: blood.

*Distribution*: India: West Bengal (Calcutta district), Uttar Pradesh (Lucknow).

23. *Trypanosoma striati* Qadri


*Diagnosis*: Trypomastigote pleomorphic with small, intermediate and large forms; cytoplasm granular with very few vacuoles in small form, less granular with many vacuoles in large form and intermediate type in intermediate form, nucleus spherical or oval or pear-shaped, located at the anterior half of the body, length of the cell body in large form 54.75μm; free flagellum large in small and intermediate forms and short in stumpy forms.

*Host*: *Ophicephalus striatus* (=*Channa striatus*); site of infection: blood.

*Distribution*: India: West Bengal (Calcutta, South 24- Parganas and West Dinajpur districts), Andhra Pradesh (Hyderabad).

24. *Trypanosoma tandoni* Mandal


*Diagnosis*: Trypomastigote monomorphic, cytoplasm granular with a few vacuoles situated anterior to nucleus, nucleus sausage-shaped placed at the middle, length of the cell body 20.5 - 27.5 μm, undulating membrane with 5-9 folds.

*Host*: *Wallago attu*; site of infection: blood.

*Distribution*: India: West Bengal (South 24-Parganas district).

25. *Trypanosoma vittati* Tandon and Joshi


Diagnosis Trypomastigote monomorphic, cytoplasm uniformly granular with a few small vacuoles, nucleus bean-shaped situated at the middle with compact chromatin material, length of cell body 20.0-35.5 μm.

Host: Mystus vittatus; site of infection: blood.

Distribution: India: West Bengal (Koch Bihar and South 24-Parganas districts), Uttar Pradesh (Lucknow).

26. Trypanosoma xenentodoni Das, Sarkar and Bandyopadhyay


Diagnosis: Trypomastigote monomorphic, volutin granules present and forming striations on the cytoplasm, nucleus slightly anterior in position, undulating membrane with 5-7 folds, length of the cell body 45.5-55.6 μm.

Host: Xenentodon cancila; site of infection: blood.

Distribution: India: West Bengal (Maldah district).

27. Trypanosoma sp.

Host: Aorichthys aor; site of infection: blood.

Distribution: India: West Bengal (Calcutta district).

Remarks: Mandal (1984) reported this species from the blood samples taken from the above cited host collected from Calcutta market. This species is monomorphic with configuration mostly seen as ‘S’, length of the cell body 30 - 38.5 (32.5) μm, cytoplasm granular; nucleus elongated and located at the middle of the body, undulating membrane with 4-5 folds.

28. Trypanosoma sp.

Host: Nandus nandus; site of infection: blood.

Distribution: India: West Bengal (Maldah district).

Remarks: Tiwari and Ray (1981) recorded this species from the blood of Nandus nandus collected from Maldah, They, however, did not give any description of this parasite.

B. Trypanosoma of amphibians

29. Trypanosoma chattoni Mathis and Leger


Diagnosis: Trypomastigote form spherical having smooth occasionally irregular wrinkled surface, nucleus centrally placed, flagellum very short, length of the cell body 19.74 - 26.15 µm.

Host: *Bufo melanostictus, Bufo stomaticus, Rana limoncharis, Rana tigrina, Rhacophorus maculatus, Rhacophorus malabaricus* and *Microhyla ornata*; site of infection: blood.

Distribution: India: West Bengal (Jalpaiguri district) and Goa.

30. *Trypanosoma inopinatum* Sergent and Sergent


Diagnosis: Trypomastigote form elongated, tapering at both ends, cytoplasm granular and vacuolated at the anterior half of the body, nucleus elliptical situated near the centre of the body, length of the cell body 30-34 µm; flagellum, when present, very short.

Host: *Rana hexadactyla* and *Rana tigrina*; site of infection: blood.

Distribution: India: West Bengal (Bankura district).

Remarks: This species is known in cause ‘Redleg’ disease among the common European frog *Rana esculenta* but such disease is not so far been reported from Indian frog. In this connection mention may be made that this is the only anuran trypanosome which is known as pathogenic.

31. *Trypanosoma karyozeukton* Dutton and Todd


Diagnosis: Vermiform, elongated and coiled body, cytoplasm granular, nucleus round or oval located near the junction of middle and posterior third of the body and lying parallel to the body axis; nuclear index 40, length of the cell body 43-47 µm.

Host: *Rana hexadactyla*; site of infection: blood.

Distribution: India: West Bengal (Barddhaman, Darjiling and Hugli districts).

32. *Trypanosoma loricatum* (Mayer)


Diagnosis: Trypomastigote dimorphic, slender and broad; in the former the cytoplasm homogeneous and devoid of any striation but latter with thick and densely granular cytoplasm
having striations on the subpellicular surface, nucleus round to oval, located at the posterior part of the body, length of the cell body 16.25-20.76 µm.

*Host*: *Rana tigrina, Rana limnocharis*; site of infection: blood.

*Distribution*: India: West Bengal (Bankura district).

33. *Trypanosoma mega* Dutton and Todd


*Diagnosis*: Trypomastigote form elongated, cytoplasm dark and granular with longitudinal striations in the prenuclear region, nucleus oval or elliptical and situated middle third of the body lying transverse to the long axis of the body, nuclear index 0.63, length of the cell body 31.5-37.0 µm.

*Host*: *Rana tigrina*; site of infection: blood.

*Distribution*: India: West bengal (Barddhaman and Darjiling districts).

34. *Trypanosoma ranarum* (Lankester)


*Diagnosis*: Trypomastigote form pleomorphic designated as Type I and II; body surface of Type I smooth but in Type II costate and flattened; nucleus round or elliptical located at anterior third to middle third of the body, body length varying between 71.1µm and 74.1 µm.

*Host*: *Rana tigrina* and *Rana* sp.; site of infection: blood.

*Distribution*: India: West Bengal (Bankura district), Andhra Pradesh, (Warangal).

35. *Trypanosoma rotatorium* (Mayer)


*Diagnosis*: Trypomastigote form pleomorphic viz. Type I, II, and III; cytoplasm densely granular in the posterior two thirds of the body, having 2-3 striated myonemes along longitudinal axis, length of the cell body 29-34 µm.
Host: Rana tigrina, Rana limnocharis, Rana cyanophlyctis, Bufo melanostictus, Bufo stomaticus; site of infection: blood.

Intermediate hosts: Helobdella nociva (Rhyncobdellid leech)

Distribution: India: West Bengal (Bankura, Hugli, Maldah, Koch Bihar, Jalpaiguri and Darjiling districts); Goa, Orissa, Tripura and Andaman Island.

36. Trypanosoma systoma Ray and Choudhury


*Diagnosis*: Trypomastigote form monomorphic, cytoplasm granular and vacuolated, nucleus oval or kidney-shaped situated on the posterior third of the body, length of the cell body 27-42 μm, undulating membrane well marked.

*Host*: Uperodon systoma; site of infection: blood.

*Distribution*: India: West Bengal (Medinipur district).

37. Trypanosoma taprobanica Ray and Choudhury


*Diagnosis*: Trypomastigote monomorphic, attenuated at both ends, cytoplasm finely granular, body shape varying between ‘C’ or ‘S’, nucleus round to oval, length of the cell body 15-18.5 μm.

*Host*: Kaloula pulchra taprobanica; site of infection: blood

*Distribution*: India: West Bengal (Puruliya)

C. *Trypanosoma* of reptiles

38. Trypanosoma balithaensis Ray


*Diagnosis*: Trypomastigote monomorphic, cell body measuring 30-35 μm in length and 1.5-2.5 μm in width; free flagellum measuring 17.5-20.0 μm, nucleus round situated close to kinetoplast, cytoplasm homogeneous, granular without any striation.

*Host*: Lissemys p. punctata; site of infection: blood.

*Intermediate host*: Helobdella nociva.

*Distribution*: India: West Bengal (Bankura district).

39. Trypanosoma enhydris Sinha and Mandal


Diagnosis: Trypomastigote pleomorphic, small form with long free flagellum (12-14 μm), intermediate form also with long free flagellum (14.5-17.5 μm) and large form with short free flagellum (9-11.0 μm); cytoplasm granular, nucleus round or oval situated almost at the middle, length of the cell body 10.6 μm.

Host: Enhydris enhydris; site of infection: blood.

Distribution: India: West Bengal (Nadia, Darjiling and Koch Bihar districts).

40. Trypanosoma gangetica Sinha


Diagnosis: Monomorphic, dimensions 55.7 μm x 2.45 μm, cytoplasm homogenous with 7-10 vacuoles and without any volutin granules; nucleus centrally located, undulating membrane with 7-8 folds, free flagellum long measuring 19.2 μm in length.

Host: Trionyx gangeticus; site of infection: blood.

Distribution: India: West Bengal (North 24-Parganas district).

D. Trypanosoma of birds

41. Trypanosoma avium Danilewsky


Diagnosis: Highly pleomorphic, sometimes attaining a great size of 26 to 60 μm or even longer; kinetoplast elliptical stained deep red, situated a long distance away from the posterior end, measuring 0.6-0.9 μm in diameter; nucleus oval located almost at the middle, free flagellum short.

Hosts: Acrocephalus dumetorum, Dicrurus adsimilis and Lonchura malabarica; site of infection: blood.

Distribution: India: West Bengal (Calcutta, Nadia, South and North 24-Parganas districts); Delhi, Jammu and Kashmir; a cosmopolitan species with worldwide distribution.

41a. Trypanosoma avium bakeri Chatterjee and Ray


Diagnosis: Pleomorphic varying widely in length, width and shape and longitudinally striated measuring 50-60 μm; cytoplasm coarse, kinetoplast round or oval, nucleus small, round, granulated and sometimes lodged in a vacuole.

Hosts: Pycnonotus jocosus, Dendrocitta vagabunda and Columba livia; site of infection: blood and bone marrow.
Distribution : India : West Bengal (Calcutta and Nadia districts).

42. Trypanosoma hannahae Pittaluga


Host : Columba livia domestica; site of infection : blood.

Distribution : India : West Bengal (Calcutta and South 24-Parganas districts).

Intermediate host : Pseudolynchia canarensis.

Remarks : Diagnostic features of this species can not be given due to nonavailability of concerned literature.

43. Trypanosoma lanii Choudhury and Misra


Diagnosis : Trimorphic - large thick, short thin and intermediate forms; cytoplasm granular in large form, having no granules in short and intermediate forms; in large form nucleus situated at one third portion in the cell body but in other two forms nucleus situated at the middle.

Host : Lanius schach tricolor; site of infection : blood and bone marrow.

Distribution : India : West Bengal (Calcutta district).

44. Trypanosoma sp.

Host : Lonchura p. punctulata; site of infection : blood.

Distribution : India : West Bengal (Calcutta district).

Remarks : Choudhury, Sarkar and Roy (1969) reported this parasite from the blood of the aforesaid host without assigning any specific status.

E. Trypanosoma of mammals

45. Trypanosoma evansi (Steel)

1885. Spirochaele evansi, Steel Investigations into an obscure and fatal disease among transport mules in British Burma.


Diagnosis : Pleomorphic with slender, intermediate, and stumpy forms; slender form with long flagellum and cell body measuring 15-34 μm; intermediate form with short free flagellum and cell body measuring 19.5-20.7 μm; stumpy form with short free flagellum and the cell body measuring 16.8-19.6 μm; kinetoplast small, posterior end of body usually blunt.

Host : Panthera tigris, Panthera pardus, Panthere unca (Alipore and Darjiling Zoo) and cattle (sporadic); site of infection : blood.

Distribution : India : West Bengal (Calcutta and Darjiling districts).
46. *Trypanosoma lewisi* (Kent)

1880. *Herpetomonas lewisi* Kent, *A manual of Infusoria*


*Diagnosis*: Trypomastigote form monomorphic, cell body measuring 21-36.5 μm, nucleus oval situated at the anterior half of the body, free flagellum measuring 7.2-7.8 μm.

*Host*: *Bandicota bengalensis, Rattus rattus arboreus, R. norvegicus, Mus musculus*; site of infection: blood.

*Distribution*: India: West Bengal (Calcutta, Hugli and Haora districts) and sporadically reported in other states.

47. *Trypanosoma indicum* Luhe


*Diagnosis*: Trypomastigote form monomorphic, cytoplasm having 3-5 vacuoles, nucleus subspherical to oval length of the cell body 20-25 μm.

*Host*: *Petaurista magnificus* and *Petaurista n. nobilis*; site of infection: blood.

*Distribution*: India: West Bengal (Darjiling district)

48. *Trypanosoma rhinolophonis* Pal and Dasgupta


*Diagnosis*: Trypomastigote form monomorphic; nucleus small, posteriorly placed, enormous size of the vacuole with juxtanuclear position, length of the cell body 26-30 μm.

*Host*: *Rhinolophus rouxi rouxi*; site of infection: blood.

*Distribution*: India: West Bengal (Darjiling district).

49. *Trypanosoma* sp.

*Host*: *Petaurista nobilis nobilis*; site of infection: blood.

*Distribution*: India: West Bengal (Darjiling district).

*Remarks*: Sinha and Dasgupta (1978) reported this parasite from the above mentioned host without assigning any specific status.

Order RETORTAMONADIIDA

Key to the families

1 (2) Flagella one or more in number, occurring in stomach of ruminants or in caecum and
colon of horse.................................................................CALLIMASTIGIDAE

2 (1) Flagella 4 in number, one turn posteriorly, both freeliving and parasitic............

3 (4) Among 4 flagella, one undulates in the cytostome .........................CHILOMASTIGIDAE

4 (3) Among 4 flagella, one trails.......................................................TETRAMITIDAE

Family TETRAMITIDAE

Key to the genera

1(2) Body ovoid or pyriform, a shallow cytostome present towards right side, two long and two short flagella extending from cytostome..............................................Costia

2(1) Body spherical or pyriform, cytostome lacking, three anterior flagella present, the fourth flagellum running along the flattened body surface and extending little freely at the posterior tip of the body..............................................Enteromonas

Genus Costia Leclerque

50. Costia necatrix (Henneguy)


Diagnosis: Body pear-shaped, a funnel-like depression at pointed anterior end, flagella 4 in number, two long and two short, dimensions 10-20 μm x 5-10 μm; nucleus spherical.

Host: Channa punctatus, C. striatus and Indian carps; site of infection: epidermal layer of skin.

Distribution: India: West Bengal (North and South 24-Parganas districts).

Remarks: This parasite produces ‘costiasis’ in both wild and reared fishes. The infection may at times cause considerable mortality of fishes. Recently Mandal et al., (1990) observed this parasite in large numbers in association with epizootic ulcerative syndrome in C. punctatus and C. striatus from freshwater ponds of West Bengal.

51. Enteromonas hominis da Fonseca


Diagnosis: Trophozoite oval, dimensions 4-10 μm x 3-6 μm, nucleus circular or pyriform with a large endosome located near anterior end, cytoplasm vacuolated or reticulated containing bacteria.

Host: Man, macaques and golden hamster; site of infection: caecum.
**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Chatterjee (1919) described *Enteromonas bengalensis* from human intestinal contents. This species has been synonymised under *E. hominis* (see Levine, 1961).

**Family**  
**Genus** *Chilomastix* Alexeieff

**Diagnosis**: Body pyriform with a large cytostomal cleft at anterior end, 3 longer flagella anteriorly directed, fourth flagellum short and undulates within the cleft.

**Key to the species**

1 (2) Pear-shaped body with a large cytostomal cleft, parastic in ruminants ............. *C. caprae*

2 (1) Body oval or pyriform with a large cytostomal cleft at anterior end, parastic in primates ............................................................. *C. mesnili*

52. *Chilomastix caprae* Fonseca


**Diagnosis**: Pear-shaped body with 3 anteriorly directed flagella, fourth flagellum within a large cytostomal cleft, dimensions 8-10 μm × 4-6 μm.

**Host**: *Capra hircus*; site of infection: rumen.

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Das Gupta (1935) reported this species from the rumen contents of goat procured from a public slaughter house at Tangra, Calcutta.

53. *Chilomastix mesnili* (Wenyon)


**Diagnosis**: Trophozoite oval or pyriform, dimensions 5-36 μm × 2-6 μm, flagellar arrangements as in *C. caprae*.

**Host**: Man, Orang-utan, Chimpanzee and monkeys; site of infection: caecum and colon.

**Distribution**: India: West Bengal (Calcutta district); cosmopolitan.

**Remarks**: Chatterjee (1923) reported this species from the stools of patients (man) suffering from chronic intestinal complaints. In one occasion he (op.cit.) found this parasite in large numbers in association with innumerable *Entamaeba coli*.

Mention may be made here that Chatterjee (op. cit.) reported this parasite as a new species *Tetrachilomastix bengalensis* but according to Wenyon (1926) who happened to examine Chatterjee's material, this species is quite similar with *C. mesnili*. Chatterjee (1917a) also described another species *Trichomastix hominis* which appears to be a synonym *C. mesnili* (see Wenyon, 1926).
Family CALLIMASTIGIDAE

Key to the genera

1 (2) Body kidney to crescent-shaped, one or two flagella attached to the middle of the concave side ................................................................. Selenomonas

2 (1) Body ovoid, 12-15 long flagella near anterior end ..................................... Callimastix

54. Callimastix frontalis Braune


Diagnosis: Body spherical or ovoid with about 12 μm in diameter, flagella 12 in number and about 30 μm long, arising from a row of basal granules on the anterior margin of the body.

Host: Cattle, sheep and goats; site of infection: rumen.

Distribution: India: West Bengal (Calcutta district); cosmopolitan.

Remarks: Das Gupta (1935) reported this species from the rumen contents of goat procured from Tangra, Calcutta.

Genus Selenomonas Von Prowazek

55. Selenomonas ruminantium var. caprae Das Gupta


1935 Selenomonas ruminantium var. caprae Das Gupta, Arch. Protistenk., 85, p. 156.

Diagnosis: Body crescent-shaped, dimensions 6.15-8.20 μm x 1.50-2.05 μm, 3-4 flagella arising from the centre of the concave side, nucleus located at the centre of the crescent.

Host: Capra hircus; site of infection: rumen.

Distribution: India: West Bengal (Calcutta district).

Remarks: Several authors placed Selenomonas in the Spirillaceae among bacteria but Jeynes (1955, 1956; cited from Levine, 1967) showed that it is actually a protozoon. Das Gupta (1935) described this variety from the rumen contents of goat procured from a slaughter house at Tangra, Calcutta.

Order DIPLOMONADIDA
Family HEXAMITIDAE

Diagnosis: Two karyomastigonts, body with two-fold rotational symmetry or bilateral symmetry, each mastigont with 4 flagella, one of them recurrent.

Genus Giardia Kuntsler

Diagnosis: Body pyriform to ellipsoid with anterior end broadly round and posterior end drawn out, bilaterally symmetrical, ventral side with a sucking disc in anterior half, 2 anterior nuclei, 2 slender axostyles and 8 flagella in 4 pairs present.
56. *Giardia intestinalis* (Lambl)


Diagnosis: Trophozoite broadly pyriform, dimensions 9-20 μm x 5-10 μm, axostyles needle-like, nuclei vesicular and located near anterior margin.

Host: Man, monkeys and pig; site of infection: duodenum, jejunum and upper small intestine.

Distribution: India: West Bengal (in all districts); cosmopolitan.

Remarks: This species is common in man and known to cause giardiosis.

Order TRICHOMEONADIDA

Key to families

1 (2) Anterior flagella variable in number, undulating membrane bordered by a flagella, a filamentous costa arising from the blepharoplast.................TRICHOMEONADIDAE

2 (1) Two or three anterior flagella and a trailing flagellum which is either free or adherent, undulating membrane and costa lacking..................MONOCERCOMONADIDAE

Family MONOCERCOMONADIDAE

Genus *Monocercomonas* Grassi

Diagnosis: Body pyriform with a rounded anterior end; cytostome and nucleus anterior, axostyle projecting beyond posterior end of the body.

Key to the species

1 (2) Body oval with 2 anterior flagella, dimensions 6-12 μm x 4-8 μm...............*M. caprae*

2 (1) Body ellipsoidal or oval with 3 anterior flagella, dimensions 5.6-11.3 μm x 3.2-8 μm ..................................................*M. runinantum*

57. *Monocercomonas caprae* Das Gupta


Diagnosis: Body oval with four free flagella arising in groups of two from two anterior blepharoplasts, dimensions 6-12 μm x 4-8 μm, two blepharoplasts joined by a chromatic line.

Host: *Capra hircus*; site of infection: rumen.

Distribution: India: West Bengal (Calcutta district).

Remarks: Das Gupta (1935) described this species from the rumen contents of goats procured from slaughter house at Tangra, Calcutta.
58. *Monocercomonas ruminatum* (Braune)


*Diagnosis*: Body ellipsoidal or oval, dimensions 5.6-11.3 μm x 3.2-8 μm, 3 long anterior flagella and 1 longer trailing flagellum.

*Host*: Cattle and deer; site of infection; rumen.

*Distribution*: India: West Bengal (South 24 Parganas district); common in cattle.

*Remarks*: Mandal and Choudhury (1984) reported this species from the faecal pellets of Spotted Deer, *Axis axis* from Sunderban, West Bengal. Mention may be made here that Levine (1967) has placed it under *Monocercomonoides caprae*.

**Family TRICHEROMONADIDAE**

**Key to the genera**

1 (4) Anterior flagella 4 in number
2 (3) A knob-like or spatulate structure present at terminal ende of flagella

3 (2) Such knob-like or spatulate structure lacking
4 (1) Anterior flagella 5 in number

**Genus Trichomonas* Donne**

**Key to the species***

1 (2) Parabasal body sausage-shaped, dimensions 6-19 μm x 2-9 μm, parasitic in digestive tract of various birds
2 (1) Parabasal body not sausage-shaped, parasitic in mammals
3 (4) Parastic in vagina, prostrate gland and urethra of man, dimensions 7-23 μm x 5-12 μm
4 (3) Parasitic in the rumen of goat, dimensions 8-17 μm x 5-15 μm

* *T. thukuni* is excluded from the key due to lack of its descriptive information.

59. *Trichomonas gallinae* (Rivolta)


*Diagnosis*: Body roughly pyriform, dimensions 6-19 μm x 2-9 μm, parabasal body sausage-
shaped 4 μm long; nucleus ovoid located at anterior part, axostyle protrudes a little out of the body.

*Host*: Pigeon, turkey, chicken, doves, hawks and kites; site of infection: digestive tract.

*Distribution*: India: West Bengal (Calcutta district), Orissa; cosmopolitan.

*Remarks*: This species is fairly common in domestic pigeons in which it often causes serious losses. However, this parasite has been recovered from the digestive tract of *Milvas migrans* from Calcutta.

60. *Trichomonas ruminatium* Braune


*Diagnosis*: General morphology as far *T. gallinae*, dimensions 8-17 μm × 5-15 μm, axostyle rigid.

*Host*: *Capra hircus*; site of infection: rumen.

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Das Gupta (1935) observed this species in small numbers in rumen contents of goats collected from a slaughter house at Tangra, Calcutta.

61. *Trichomonas thukuni* Ray and Singh


*Host*: *Cavia cutleri*; site of infection: Caecum

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Ray and Singh (1949) reported this species from the caecum of a guineapig, *Cavia cutleri* but, this description is not available.

62. *Trichomonas vaginalis* Donne


*Diagnosis*: Body broadly pyriform, dimensions 7-23 μm × 5-12 μm, costa very narrow, parabasal body long and cylindrical with a parabasal filament, paracostal and extra axostylar granules numerous, undulating membrane with 3-4 waves extending a little more than half the body length.

*Host*: Man; site of infection: vagina, prostrate gland and urethra.

*Distribution*: India: West Bengal (in all districts); cosmopolitan.

*Remarks*: This parasite causes 'Trichomonad vaginitis'. It has world-wide distribution.

Genus *Tetratrichomonas* Parisi

63. *Tetratrichomonas buttreyi* (Hibler, Hammond, Caskey, Johnson & Fitzgerald)


*Diagnosis*: Body ovoid or ellipsoidal, dimensions 3.2-8.0 μm × 2.4-6.4 μm, knob-like or spatulate structure present at the terminal ends of flagella, undulating numbrane with 2-5 undulations extending to the posterior end of the body, axostyle relatively narrow protruding beyond the body.

*Host*: *Sus scrofa*; site of infection: caecum, colon and rarely small intestine.

*Distribution*: India: West Bengal (South 24 Parganas district).


**Genus Pentadrichomonas Bishop**

64. *Pentadrichomonas hominis* (Davaine)


*Diagnosis*: Body pyriform, dimensions 8-20 μm × 3-14 μm; anterior flagella usually five, rarely four, very rarely three, four of anterior flagella grouped together and fifth one separate and directed posteriorly; sixth flagellum running along undulating membrane and extending beyond it as free trailing flagellum, pelta crescent-shaped prolonged dorsally as a filament.

*Host*: Man, Gibbon, Chimpanzee, Orang-utan, various monkeys, baboon, dog, cat, rodents, golden hamster (see Levine, 1967); site of infection: caecum and colon.

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Chatterjee, Ray and Mitra (1927) reported this species under the name *Pentadrichomonas canis auri* (see Levine, 1967) from the caecal contents of an Indian jackal, *Canis aureus*.

**Order HYPERMASTIGIDA**

**Family LOPHOMONADIDAE**

*Diagnosis*: Mastigont system with numerous flagella, extranuclear organellae arranged in one system, anterior flagellar tuft single.

**Genus Lophomonas Stein**

65. *Lophomonas striata* Biitschli


*Diagnosis*: Body elongate, spindle-shaped with obliquely arranged needle-like structures, bundle of axial filament short and never protruding.
Host: Cockroach, *Periplaneta americana*; site of infection: colon.

Distribution: India: West Bengal (Calcutta district); cosmopolitan.

Subphylum: OPALINATA  
Class: OPALINATEA  
Order: OPALINIDA  
Family: OPALINIDAE

*Diagnosis:* Numerous cilia in oblique longitudinal rows over entire body surface, cytostome absent, nucleus of one kind ranging from one to many.

Key to the genera

1. (2) One large nucleus present
   - *Hegneriella*

2. (1) Nuclei more than one
   - *

3. (4) Body cylindrical or pyriform, multinucleate
   - *Cepedea*

4. (3) Body highly flattened, multinucleate
   - *Opalinula*

Genus *Hegneriella* Earl

66. *Hegneriella mukundai* Chandra and Choudhury


*Diagnosis:* Body oval, posterior end broader than the anterior, dimensions 81.7-107.5 μm x 47.3-73.1 μm, nucleus single, large and ovoid, and centrally located, nucleoplasm containing 8-10 scattered nucleoli

Host: *Kaloula pulchra taprobanica*; site of infection: rectum.

Distribution: India: West Bengal (Medinipur district).

Remarks: This is the only species of *Hegneriella* reported so far from India.

Genus *Opalinula* Purkinje and Valentin

Key to the species

1. (2) Anterior end of the body distinctly narrower than the posterior end, width always greater than half the length
   - *O. plicata*

2. (1) Anterior end only slightly narrower than the posterior end, width less than half the length up to two-third

3. (4) Body about twice as long as broad
   - *O. triangularis*

4. (3) Body about three to five times as long as broad
   - *O. scalpriformes*
67. **Opalina plicata** Ghosh


*Diagnosis*: Body broadly or elongately ovate, tapering and rounded anteriorly, wide and rounded posteriorly, dorsal surface with 2 or 4 ridges, nuclei numerous.

*Host*: *Bufo melanostictus*; site of infection: intestine and rectum.

*Distribution*: India: West Bengal (Calcutta district).

68. **Opalina scalpriformes** Ghosh


*Diagnosis*: Body elongated cylindrical, anteriorly rounded and posteriorly narrower; anterior part of the body thrown into several longitudinal folds or ridges, dimensions 75-200 µm × 60-78 µm, nuclei numerous.

*Host*: *Bufo melanostictus, B. himalayana*; site of infection: intestine and rectum.

*Distribution*: India: West Bengal (Calcutta, Darjiling, Maldah, Murshidabad districts), Goa and Uttar Pradesh.

69. **Opalina triangularis** Ghosh


*Diagnosis*: Body lanceolate, more or less rounded and widest anteriorly and tapering posteriorly; one side nearly straight or concave and other side strongly convex, dimensions 85-250 µm × 40-135 µm, nuclei numerous.

*Host*: *Bufo melanostictus*; site of infection: intestine and rectum.

*Distribution*: India: West Bengal (Birbhum, Calcutta and Koch Bihar districts), Goa,

Genus **Cepedea** Metcalf

Key to the species

1 (2) Body very much elongated, anterior end rounded and posterior end tapering to point, length 200-600 µm................................................................. *C. longa*

2 (1) Body not much elongated, both anterior and posterior ends rounded, 150-180 µm in length........................................................................................................ *C. srivastavai*

70. **Cepedea longa** (Bezzenberger)


*Diagnosis*: Body greatly elongated, rounded in front, tapering posteriorly to a point, endoplasm with thick central zone of compact alveoli and loose peripheral zone, nuclei ellipsoidal or spherical, 200-600 μm in length.

*Host*: *Bufo melanostictus, Rhacophorus maculatus*; site of infection: rectum.

*Distribution*: India: West Bengal (Calcutta and South 24- Parganas districts).

71. *Cepedea srivastavai* Mukherjee and Chakraborti


*Diagnosis*: Body elongated, slender, anterior end broadly rounded, posterior end narrower and rounded, 150-180 μm in length, cytoplasm alveolar.

*Host*: *Rhacophorus maculatus*; site of infection: rectum

*Distribution*: India: West Bengal (Calcutta district).

Subphylum: SARCODINA
Class: LOBOSEA
Subclass: GYMNAMOEBA
Order: AMOEUBIDA
Family: ENDMOEUBIDAE

Key to the genera

1 (4) Trophozoite with single nucleus

2 (3) Nucleus vesicular, with a comparatively small endosome located at or near its centre, with varying number of peripheral granules

3 (2) Nucleus vesicular with a large endosome, some achromatic stands between endosome and nuclear membrane

4 (1) Trophozoite usually with two nuclei, vesicular nucleus with a delicate membrane and an endosome connected the membrane by delicate strands

Genus *Entamoeba* Casagrandi and Barbagallo

Key to the species

1(8) Mature cysts uniculate

2(5) Mature cysts with numerous chromatoid bodies
3(4) Usually parasitic in macaques and other monkeys, trophozoites 9-20 μm long and cysts 6-18 μm in diameter.......................................................... E. chattoni

4(3) Usually parasitic in antelopes and goats, trophozoites 11-12 μm long and cysts 4-13 μm in diameter.......................................................... E. ovis

5(2) Mature cysts without chromatoid bodies.......................................................................................... E. cervis

6(7) Parasitic in swine, trophozoites 5-25 μm long and cysts 4-17 μm in diameter......................... E. suis

7(6) Parasitic in deer, trophozoites 6.31-10.40 μm long and cysts 4.2-8.4 μm in diameter........ E. cervis

8(1) Mature cysts with 4-8 nuclei........................................................................................................ E. cervis

9(10) Mature cysts tetranucleate, nucleus with small central endosome, trophozoites often ingest erythrocytes, and measuring 20-30 μm in length and cysts 1-20 μm in diameter.......................................................... E. histolytica

10(9) Mature cysts octonucleate........................................................................................................ E. histolytica

11(12) Eight nuclei of mature cysts generally occupy central area arranged in a cluster........ E. chiropteris

12(11) Such nuclear arrangement in cysts lacking.............................................................................. E. chiropteris

13(14) Both trophozoites and cysts comparatively larger having 15-20 μm and 10-30 μm length respectively, usually parasitic in man.................................................. E. coli

14(13) Both trophozoites and cysts comparatively smaller, having 6.31-13.94 μm and 6.44-11.27 μm length respectively, parasitic in rat.................................................. E. muris

72. Entamoeba cervis Mandal and Choudhury


Diagnosis: Trophozoites oval, 6.31-10.40 μm in length cytoplasm differentiated into ectoplasm and granular endoplasm, cyst always uninucleated with 4.2 - 8.4 μm in diameter, no glycogen granule found in cytoplasm.

Host: Spotted Deer, Axis axis; site of infection: unknown.

Distribution: India: West Bengal (Calcutta and South 24 Parganas districts).

Remarks: Mandal and Choudhury (1981) collected this species from the faecal samples of Spotted Deer from Sundarban Tiger Reserve and Calcutta Zoo.

73. Entamoeba chattoni Swallengrebel


Diagnosis: Trophozoites 9-25 μm long, nucleus with a large or small, central or eccentric endosome, cysts always uninucleate 6-18 μm in diameter chromatoid bodies usually irregular and small.
Host: Macaques and other monkeys; site of infection: large intestine.

Distribution: India: West Bengal (South 24-Parganas district).

Remarks: Mandal and Choudhury (1988) reported this species from the faecal samples of *Macaca mulatta* from Sundarban forests, West Bengal.

74. *Entamoeba chiropteris* Mandal and Choudhury


Diagnosis: Trophozoite 8.41-22.61 μm × 5.78-22.61μm; ectoplasm finely granular, endoplasm with vacuoles containing bacteria, chromatoid bars not found, nucleus with a large, compact endosome with several granular structures, matured cysts octonucleated, nuclei generally occupy a central area arranged in a cluster.

Host: Bat, *Scotophilus kuhli kuhli*; site of infection: intestine

Distribution: India: West Bengal (South 24-Parganas).

Remarks: Mandal and Choudhury (1986a) described this species from gut contents of bat collected from Sajnakhali, Sundarban Tiger Reserve, West Bengal.

75. *Entamoeba coli* (Grassi)


Diagnosis: Trophozoites 15-50 μm in diameter, cytoplasm filled with bacteria and debris, ectoplasm thin, nucleus with a large eccentric endosome, mature cysts 10-30 μm in diameter with 8 nuclei, cysts containing splinter-like chromatoid bodies with sharp, fracture or square ends.

Hosts: Usually man, also other primates; site of infection: caecum and colon.

Distribution: India: West Bengal (Calcutta, South 24-Pargans districts); cosmopolitan.

Remarks: This parasite is common in man. However, Mandal and Choudhury (1988) reported this species from *Macaca mulatta* from Sundarban forests.

76. *Entamoeba histolytica* Schaudinn


Diagnosis: Trophozoites of pathogenic race large, 22-30 μm in diameter and those of small race 12-15 μm in diameter, clear layer of ectoplasm and granular endoplasm present, nucleus with small central endosome, a ring of small peripheral granules and a few scattered chromatin granules in between. Mature cysts of both races 10-20 μm in diameter and with 4 nuclei, trophozoites often ingest erythrocytes.

Hosts: Man and many other primates, dog, cat, pig, rat, possibly cattle; site of infection; large intestine, sometimes liver, occasionally lungs, and rarely brain, spleen etc.
Distribution: India: West Bengal (in all districts), cosmopolitan.

Remarks: *E. histolytica* is pathogenic to man, causing amoebic dysentry. Mandal and Choudhury (1986) reported this species from *Macaca mulatta* in Sundarban forests.

77. *Entamoeba muris* (Grassi)


Diagnosis: Trophozoites 6.31-13.94 \( \mu \text{m} \times 4.73-9.84 \mu \text{m} \), morphologically similar to *E. coli* but smaller in dimensions, matured cysts octanucleated, 4.64-11.27 \( \mu \text{m} \) in diameter.

Hosts: Rats, mice, and golden hamster; site of infection: caecum and colon.

Distribution: India: West Bengal (South 24-Parganas district).

Remarks: Mandal and Choudhury (1986a) reported this parasite from the faecal sample of *Rattus rattus arboreus* from Sundarban Tiger Reserve, West Bengal.

78. *Entamoeba ovis* Swallengrebel


Diagnosis: Trophozoites 5-8 \( \mu \text{m} \) in diameter, nucleus typically contains a large pale endosomes generally composed of several granules, a ring of peripheral chromatins and many small granules present between endosome and nuclear membrane, cysts uninucleated, 4 \( \mu \text{m} \) in diameter, containing numerous chromatoid bodies of varying size and a glycogen vacuole.

Host: *Capra hircus*; site of infection: rumen.

Distribution: India: West Bengal (Calcutta district).

Remarks: Das Gupta (1935) reported this species from rumen of goat procured from a tannery at Tangra, Calcutta.

79. *Entamoeba suis* Hartmann


Diagnosis: Trophozoites usually oval, dimensions 7.89-16.30 \( \mu \text{m} \times 4.73-12.62 \mu \text{m} \), endosome central and usually quite large, almost filling the nucleus, cyst spherical, uninucleated measuring 7.24-11.27 \( \mu \text{m} \) and without chromatoid bodies or glycogen vacuoles.

Host: Swine; site of infection: caecum and colon.

Distribution: India; West Bengal (South 24-Parganas district).

Remarks: Mandal and Choudhury (1986) recorded this species from the faeces of wild pig, *Sus scrofa scrofa* from Sundarban forests, West Bengal.
Genus *Dientamoeba* Jepps and Dobell

80. *Dientamoeba fragilis* Jepps and Dobell


**Diagnosis**: Trophozoites 3-22 μm, usually 6-12 μm in diameter, ectoplasm and endoplasm well differentiated, endoplasm with food vacuoles containing bacteria, yeast, starch granules and parts of cell, usually binucleate but sometimes uninucleate, each nucleus vesicular with an endosome composed 4-8 chromatin granules, granules connected with the membrane by delicate strands.

**Hosts**: Man and also some monkeys; site of infection: colon.

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Knowles and Das Gupta (1936, *Indian J. Med. Res.*, 24: 547-556) found this species in the faecal contents of *Macaca irus* in Calcutta, Mention is to be made here that only trophozoites of this species are known till date.

Genus *Iodamoeba* Dobell

81. *Iodamoeba butschlii* (Prowazek)


**Diagnosis**: Trophozoites 4.73-9.60 μm × 3.15-4.83 μm, nucleus with large endosome surrounded by small spherules, most of trophozoites containing one large iodophilic vacuole, periendosomal space filled up by some loosely arranged fibrillar structure radiating from endosomal area to nuclear membrane, cysts of somewhat irregular in shape with 3.22-6.44 μm in diameter.

**Host**: Man and other mammals; site of infection: intestine.

**Distribution**: India: West Bengal (South 24-Parganas district), cosmopolitan.

**Remarks**: Mandal and Choudhury (1986) reported this species from the faecal samples of *Macaca mulatta* and *Sus scrofa scrofa* from Sundarban forests.

**Phylum** APICOMPLEXA
**Class** SPOROZOA
**Order** EUGREGARINIDA
**Suborder** ASEPTATINA

Key to the families

1(4) Adult trophozoites always associated in pairs.................................................................
2(3) Oocyst navicular or biconical................................................................. ZYGOCYSTIDAE
3(2) Oocyst ellipsoidal................................................................. ENTEROCYSTIDAE
4(1) Adult trophozoites solitary...........................................................................
5(8) Trophozoites with a differentiation at the anterior end ...........................................

6(7) Anterior end of trophozoites sucker-like, sporocysts biconical, with similar, non-appendiculate poles, octozoic ........................................... STOMATOPHORIDAE

7(6) Anterior end of trophozoites with or without an epimerite, sporocysts oval or spherical, octozoic .......................................................... DIPLOCYSTIDAE

8(5) Trophozoites without any differentiation at the anterior end, except in one genus, sporocysts biconical, octozoic ........................................... MONOCYSTIDAE

Family MONOSYSTIDAE

Key to the genera

1(8) Trophozoites monomorphic ......................................................................................

2(5) Trophozoites elongated, cylindrical .............................................................................

3(4) Resembling a nematode worm and having a constant shape .................... Nematocystis

4(3) Elongated in appearance but changing shape constantly ............................... Informis

5(2) Trophozoites ovoid or spherical ..................................................................................

6(4) Trophozoites ovoid ....................................................................................... Monocystis

7(6) Trophozoites spherical ......................................................................................... Apolocystis

8(1) Trophozoites occurring in two forms, a larger form and a smaller form ................. Bisurculus

Genus Monocystis Stein

Key to the species

1(4) Trophozoites elongated and more or less fusiform ..............................................

2(3) Often with a clear cylindrical process at one end, nucleus spherical with a large central karyosome ................................................................. M. beddardi

3(2) Without any cylindrical process, nucleus with a small eccentric karyosome ................... M. illioidi

4(1) Trophozoites elongated and cylindrical or club-shaped ............................................

5(6) Trophozoites elongated, cylindrical, blunt at both ends, nucleus spherical to ovoid with indistinguishable karyosome ........................................ M. senegalensis

6(5) Trophozoites elongated and club-shaped, nucleus rounded with a large irregular karyosome ................................................................. M. bengalensis
82. *Monocystis beddardi* Ghosh


*Diagnosis*: Trophozoite elongated dimensions 100-150 μm × 30-40 μm or variable in shape including appearance and disappearance of bulbous swelling; often with a clear cylindrical process at one end; ectoplasm very thin and endoplasm highly granular; nucleus spherical with a large central karyosome; gametocyst spherical measuring 80-100 μm in diameter gametocytes hemispherical or irregularly oval.

*Host*: *Eutypheus nicholsoni* (Beddard) [Annelida: Oligochaeta]; site of infection: seminal vesicles.

*Distribution*: India: West Bengal (Calcutta district), Uttar Pradesh (Lucknow).

83. *Monocystis bengalensis* Ghosh


*Diagnosis*: Trophozoite elongated and club-shaped, dimensions 40-80 μm × 12-30 μm; ectoplasm very thin and endoplasm highly granular, myonemes indistinct; nucleus rounded with a large irregular karyosome; gametocysts irregularly hemispherical 70-80 μm in diameter; gametocytes rounded or oval.

*Host*: *Pheretima posthuma* (L. Vaill) [Annelida: Oligochaeta]; site of infection: seminal vesicles.

*Distribution*: India: West Bengal (Calcutta district).

84. *Monocystis lloidi* Ghosh


*Diagnosis*: Mature trophozoites somewhat fusiform in shape without any cylindrical process at the ends, measuring 100 μm in length; cytoplasm comparatively thick, endoplasm finely granular, paramylum grains indistinct; nucleus with a small eccentric karyosome; gametocysts spherical or oval 84 μm in diameter.

*Host*: *Pheretima posthuma* (L. Vaill); site of infection: seminal vesicles.

*Distribution*: India: West Bengal (Calcutta district).

85. *Monocystis senchalensis* Pradhan and Das Gupta


*Diagnosis*: Trophozoites elongated, more or less cylindrical, blunt at both ends, measuring 43.02 - 185.4 μm × 10.8 - 48.6 μm, widest at the middle; cytoplasm alveolated; nucleus spherical to ovoid; endosome indistinguishable; spore biconical with ends drawn out.

*Host*: *Apporectodea trapezoides* Duges [Annelida: Oligochaeta]; site of infection: seminal vesicles.

*Distribution*: India: West Bengal (Darjiling district).
Genus *Nematocystis* Hesse

Key to the species

1(2) Trophozoites very large, about 2.5 mm in length, nucleus without any karyosome......

........................................................................................................................................

N. levinei

2(1) Trophozoites less than 2 mm in length, nucleus with or without any karyosome........

3(6) Nucleus without any karyosome...................................................................................

4(5) Trophozoites 91.2 - 286.9 μm long, vermiform with one end narrow and other end rounded, nucleus slightly ellipsoidal.................................................................N. senchalensis

5(4) Trophozoite 212.7 - 444.6 μm long, vermiform and ribbon-shaped, one pole with distinct funnel-like structure followed by a neck, other end blunt, nucleus spindle-shaped

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N. theodoridis

6(3) Nucleus with distinct karyosome..................................................................................

7(10) Karyosome single...........................................................................................................

8(9) Nucleus spherical, generally located at anterior part of the body, with a centrally located condensed karyosome.................................................................N. bengalensis

9(8) Nucleus long spindle-shaped with a karyosome surrounded a faintly stained area, location of nucleus variable.................................................................N. mangpooensis

10(7) Karyosome more than one in number.........................................................................

11(12) Nucleus elongated, generally located at the middle with double karyosome of which one spherical and other rod-like.................................................................N. mauritii

12(11) Nucleuss elongated located towards the posterior end, with four karyosomes........

........................................................................................................................................

N. quadrikaryosomata

86. *Nematocystis bengalensis* Roy Chowdhury and Haldar


*Diagnosis*: Trophozoites elongated, dumbel-shaped, rounded or nematode-like, dimensions 191.3 - 578.0 (334.0) μm x 37.0 - 50.0 (44.0) μm; anterior end swollen, terminating in a conical projection, posterior end abruptly tapering; pellicle smooth; nucleus spherical to ovoidal, usually located at the anterior broader portion, measuring 8.3 - 12.5 (12.2) μm x 4.1 - 8.3 (8.0) μm, endosome centrally located; gametocyst and spore unknown.

*Host*: *Eutypheus incommodus* (Beddard); site of infection: seminal vesicles.

*Distribution*: India: West Bengal (North 24-Parganas district).
87. Nematocystis levinei Pradhan and Das Gupta

1980. *Nematocystis levinei* Pradhan and Das Gupta, *North Bengal Univ. Rev. (Sci. & Tech.)*, 1(2); p. 136, pl. 3, fig. 1.

*Diagnosis*: Trophozoites very large and elongated, measuring up to 2523.04 μm × 107.3 μm; blunt at both ends, in most cases one end usually broader than the other; epicyte clear; fine longitudinal striations along the length of the body converging at both ends; endoplasm with unevenly distributed elongated to ellipsoidal paraglycogen granules. Nucleus elongated, eccentric, measuring 36.3 - 98.8 μm × 13.2 - 28.2 μm; karyosome not visible.

*Host*: Eutyphoeus gammiei Beddard; site of infection: seminal vesicles.

*Distribution*: India: West Bengal (Darjiling district).

88. Nematocystis mangpooensis Pradhan and Dasgupta


*Diagnosis*: Trophozoites elongated, vermiciform, measuring 760 - 1339 μm × 77.52 - 150.48 μm; ends usually dissimilar, one end sometimes club-shaped and the other slender or tail-like; epicyte clear and thin; endoplasm with large paraglycogen granules; longitudinal striations converging at both ends; nucleus long, spindle-shaped, measuring 64.6 μm × 19 - 26.9 μm; karyosome 13.5 μm in diameter.

*Host*: Eutyphoeus gammiei Beddard; site of infection: seminal vesicles.

*Distribution*: India: West Bengal (Darjiling District).

89. Nematocystis mauritii Roy Chowdhury and Haldar


*Diagnosis*: Trophozoites vermicular, cylindrical but of unequal breadth, measuring 87.4 - 408.0 (366.0) μm × 29.1 - 62.4 (40.2) μm; pellicle thin; ectosarc clear, endosarc granulated; nucleus elongated with two endosomes, one spherical and the other rod-like; usually located at the middle and measuring 8.3 - 25.0 (14.0) μm × 8.3 - 17.0 (13.1) μm; gametocyst and spore unknown.

*Host*: Lampito mauritii Kingberg; site of infection: seminal vesicles.

*Distribution*: India: West Bengal (North 24-Parganas district).

90. Nematocystis quadrikaryosomata Pradhan and Dasgupta


*Diagnosis*: Trophozoites vermiculer, cylindrical but of unequal breadth, measuring 273.22 μm long and 30.78 μm in its widest part; narrower end terminates in a bulbous area followed by a constricted 'neck', broader end with a flattened rim. Nucleus elongated, located towards the narrow end, measuring 25.8 μm × 11.4 μm; with four karyosomes of 7.2 μm in diameter.
**Host**: Pheretima diffringens Baird; site of infection: coelomic fluid.

**Distribution**: India: West Bengal (Darjiling district).

91. *Nematocystis senchalansis* Pradhan and Dasgupta


**Diagnosis**: Trophozoites vermiform, with one narrow end and the other end rounded; measuring 91.2-289.9 μm × 15.2-45.22 μm and with faint diagonal striations throughout the body length; nucleus large, slightly ellipsoidal, measuring 16.72-32.3 μm × 11.78-22 μm, usually lacking a karyosome; gametocyst and spore unknown.

**Host**: Apporectodea trapezoides Duges; site of infection: coelomic fluid.

**Distribution**: India: West Bengal (Darjiling district).

92. *Nematocystis theodoridis* Pradhan and Dasgupta


**Diagnosis**: Trophozoites long, ribbon-shaped and vermiform measuring 212.7 - 444.6 μm × 14.76 - 55.10 μm; one end funnel-like followed by a constricted 'neck', other end blunt; endoplasm loosely packed with paraglycogen granules; nucleus spindle-shaped, 14.76 - 30.04 μm × 6.84 - 13.30 μm; karyosome not visible.

**Host**: Pheretima diffringens Baird; site of infection: coelomic fluid.

**Distribution**: India: West Bengal (Darjiling district).

Genus *Apolocystis* Cognetti de Martiis

**Key to the species**

1(2) In trophozoites outer pellicle with a ectoplasmic process....................*A. goomtiensis*

2(1) In trophozoites outer pellicle without any ectoplasmic process

3(4) Nucleus vacuolated with a deeply stained round karyosome..................*A. vacuolatus*

4(3) Nucleus not vacuolated and with or without any karyosome

5(6) Nucleus round and large without any karyosome..............................*A. akaryosomiferus*

6(5) Nucleus spherical and large with a very distinct karyosome having a halo around it......

.......................... .............................................. *A. monokaryosomiferus*

93. *Apolocystis akaryosomiferus* Pradhan and Dasgupta


**Diagnosis**: Trophozoites spherical, solitary, 54 - 100 μm in diameter; outer pellicle thin and complete, devoid of any ectoplasmic processes. Nucleus large and round, measuring 11.8 - 18 μm
in diameter. Spores biconical with slightly wing out truncated ends; fine granulations on the surface of spore.

*Host:* *Pheretima robusta* Perrier [Annelida : Oligochaeta]; site of infection : blood vessel.

*Distribution:* India : West Bengal (Darjiling district).

94. *Apolocystis goomtiensis* Pradhan and Dasgupta


*Diagnosis:* Trophozoites spherical, 57.6-154.8 μm in diameter; pallicle fine; endoplasm granulated; nucleus round to ellipsoidal, 10.2-28.8 μm × 14.4-25.2 μm in measurements, located at various positions; karyosome not visible. Spores unknown.

*Host:* *Pheretima diffringens* Baird; site of infection : coelomic fluid.

*Distribution:* India : West Bengal (Darjiling district).

95. *Apolocystis monokaryosomiferus* Pradhan and Dasgupta


*Diagnosis:* Trophozoite spherical, solitary, 61.2 - 115.2 μm in diameter; pellicle thin and devoid of any ectoplasmic processes; nucleus spherical and eccentric, 14.4 - 29.16 m in diameter, nuclear membrane unstained, karyosome single deeply stained, 4.32 - 9 μm in diameter. Spore biconical with slightly flattened ends.

*Host:* *Pheretima robusta* Perrier [Annelida : Oligochaeta]; site of infection : blood vessel.

*Distribution:* India : West Bengal (Darjiling district).

96. *Apolocystis vacuolatus* Pradhan and Dasgupta


*Diagnosis:* Trophozoites spherical, 228-235.5 μm in diameter; pellicle fine and devoid of any ectoplasmic processes; cytoplasm granulated; nucleus spherical, eccentric, 39.52 -45.06 μm in diameter; nuclear membrane well-defined; karyosome round, eccentric, 14.4 μm in diameter, with 2-8 vacuoles of varying shapes and sizes. Spores unknown.

*Host:* *Pheretima alexandri* Beddard; site of infection : intestine.

*Distribution:* India : West Bengal (Darjiling district).

Genus *Informis* Pradhan and Dasgupta

Key to the species

1 (2) Trophozoite possessing one or two elongated extensions of the body formed of pellicle alone, nucleus ellipsoidal with a spherical and deeply stained karyosome........................

...........................................................................................................*J. pseudotentaculatus*
23(1) Trophozoite without any pellicular extension, nucleus ellipsoidal with karyosome of variable shape and size, having darkly stained and lightly stained areas..................

97. *Informis informis* Pradhan and Dasgupta


*Diagnosis*: Trophozoites elongated, 254.2-448.4 μm × 34.2-83.52 μm in dimension, constantly changing its shape, one end blunt and rounded and the other end tapering to a point; pellicle thin; cytoplasm filled with paraglycogen granules. Nucleus ellipsoidal, 19-38 μm × 17.1-25.2 μm, nuclear membrane not uniformly thick; karyosome variable in shape, thin connection from nuclear membrane keeping it suspended within the nucleus; empty areas between connections appearing vacuolated; spores large, biconical, measuring 29.5 μm × 10.8 μm

*Host*: *Apporectodea trapezoides* Duges; site of infection: coelomic fluid.

*Distribution*: India: West Bengal (Darjiling district).

98. *Informis pseudotentaculatus* Pradhan and Dasgupta


*Diagnosis*: Trophozoites 63-323 μm × 14.04 - 98.08 μm, capable of changing shape actively, with one or two elongated processes of the pellicle at the terminal ends of the body; endoplasm packed with large and elongated paraglycogen granules with spherical, deeply stained bodies scattered in between; nucleus ellipsoidal, 9-28.5 μm × 9-20.9 μm; karyosome spherical 6.48-11.04 μm in diameter, eccentric in position. Spores 25.2 μm × 10 μm.

*Host*: *Apporectodea trapezoides* Duges; site of infection: coelomic fluid.

*Distribution*: India: West Bengal (Darjiling district).

Genus *Bisurculus* Pradhan and Dasgupta

99. *Bisurculus variegatus* Pradhan and Dasgupta


*Diagnosis*: Trophozoites occurring in two forms, a larger variety of shapes, measuring 140-306 μm × 57.96 - 147 μm; smaller form 54.8 - 172.44 μm × 14.1-53 μm, sausage-shaped, occasionally bent in the middle; epimerite at both ends having 4-7 short, thin contractile processes; nucleus eccentric, 34.16 μm × 17.66 μm in larger forms and 14.76 - 29.52 μm × 17.6 μm; spores biconical in shape measuring 11.42 μm × 5.44 μm.

*Host*: *Amynthas hawayanus* Rosa [Annelida: Oligochaeta]; site of infection: coelomic fluid.

*Distribution*: India: West Bengal (Darjiling district).
Family **STOMATOPHORIDAE**

Key to the genera

1 (2) Trophozoites ovoid or spherical, anterior end provided with a sucker-like epimerite, exclusively occurring in seminal vesicle of oligochaetes.......................... **Stomatophora**

2 (1) Trophozoites elongated and cylindrical, anterior end provided with a sucker-like organellae with a neck behind, occurring in the gut of millipedes.............. **Chakravartiella**

Genus **Stomatophora** Drzewacki

Key to the species

1 (2) Trophozoites spherical, sucker without mucron................................................ S. globa

2 (1) Trophozoites resembling a sphere or flattened disc, sucker with mucron..................

3 (4) Mucron wide measuring 10.8-28.8 µm and filled with small vacuole-like areas..........

.......................................................... ........................................ S. pedongensis

4 (3) Mucron not such wide as above and without any vacuolated areas........................

5 (8) Trophozoites plate or disc-like, marked by furrows and divided into a number of irregular lobes............................................................................ S. pradhanis

6 (7) Trophozoites 105 µm long and gametocysts 125-170 µm in diameter.............. S. diadema

7 (6) Trophozoites 33.2-50 µm long and gametocysts 83.2-91.5 × 71-83.2 µm in dimension

.......................................................... ........................................ S. pradhanis

8 (5) Trophozoites resembling a flattened disc and not divisible into any lobe ............. S. bahli

100. **Stomatophora bahli** Pradhan and Dasgupta


*Diagnosis*: Trophozoites solitary, disc-like, flattened, measuring 43.2-82.8 µm in diameter; and outline wavy, petaloid in appearance; pellicle thin; sucker 9-36 µm in diameter located centrally, petaloid in outline, mucron clear and ring-like, centrally located in the sucker, measuring 4.32-10.8 µm in diameter; epicystal striations extending from the mucron towards the periphery; nucleus eccentric, round to slightly ellipsoidal, measuring 10.8-25.2 µm in diameter; karyosome not visible.

*Host*: *Pheretima diffingens* Baird; site of infection: seminal vesicles.

*Distribution*: India: West Bengal (Darjiling district).

101. **Stomatophora diadema** Hesse

1909. **Stomatophora diadema** Hesse, *Arch. zool. exp. jen.,* 3(5); p. 87.

*Diagnosis*: Trophozoite spherical, compressed, disc-like, 105 µm in diameter, marked by
furrows and irregular lobes; sucker shallow cup-like depression in the centre of the body with a central conical projection; nucleus rounded or oval, eccentric, with a large karyosome; gametocysts spherical, 125-170 \( \mu \text{m} \) in diameter; sporocysts navicular with truncated ends.

**Host:** *Pheretima posthuma*; site of infection: seminal vesicles

**Distribution:** India: West Bengal (Calcutta district).

102. *Stomatophora globa* Pradhan and Dasgupta


**Diagnosis:** Trophozoites spherical, measuring 30.6-97.2 \( \mu \text{m} \) in diameter; cytoplasm alveolated; sucker 12.6-39.6 \( \mu \text{m} \) in diameter, surrounded by a clear halo, with variable number of long prolongations radiating outwards; mucron not visible; nucleus round 10.8-25.2 \( \mu \text{m} \) in diameter, located towards the periphery; karyosome not visible.

**Host:** *Pheretima alexandri* Beddard; site of infection: seminal vesicles.

**Distribution:** India: West Bengal (Darjiling district).

103. *Stomatophora pedongensis* Pradhan and Dasgupta


**Diagnosis:** Trophozoites solitary, flattened disc-like and measuring 50.4-93.6 \( \mu \text{m} \) in diameter; outline wavy and petaloid in appearance; sucker petaloid central, measuring 21.6-39.6 \( \mu \text{m} \) in diameter, mucron wide filled with small vacuole-like areas, measuring 10.8-28.8 \( \mu \text{m} \) in diameter; nucleus round to ellipsoidal, 10.8-18.0 \( \mu \text{m} \) in diameter; karyosome not visible; gametocysts spherical, 90-118.8 \( \mu \text{m} \) in diameter; spores navicular, 7.10 \( \times \) 3.55 - 4.4 \( \mu \text{m} \).

**Host:** *Pheretima diffringens* Baird; site of infection: seminal vesicles.

**Distribution:** India: West Bengal (Darjiling district).

104. *Stomatophora pradhanis* Ray Chowdhury and Haldar


**Diagnosis:** Trophozoites 33.2 - 50.0 \( \mu \text{m} \) in diameter, flattened disc-like with epicteal striations; pellicle well developed; sucker cup-like, almost centrally located, measuring 12.5 \( \times \) 17.5 \( \mu \text{m} \); nucleus round, eccentric, measuring 4.1-8.3 \( \mu \text{m} \) in diameter with an endosome inside. Gametocyst ovoidal, 89.0 \( \times \) 75.0 \( \mu \text{m} \); spore biconvex with sharply pointed ends, 83 \( \times \) 3.3 \( \mu \text{m} \) in dimension.

**Host:** *Metaphire (=Pheretima) posthuma* (Vaillant); site of infection: seminal vesicles.

**Distribution:** India: West Bengal (North 24-Parganas district).

**Remarks:** As per International Code of Zoological Nomenclature this species is to be named as *S. pradhanii* since it is named by authors (Ray Chowdhury and Haldar, 1984) after Dr. (Ms.) Debika Pradhan.
Genus *Chakravartiella* Misra and Ray Chaudhury


*Diagnosis*: Trophozoites solitary, elongated cylindrical, measuring 315.4-365.2 (346.6) μm × 90.5 - 125 (101.9) μm; anterior end flat bearing a sucker with tooth-like structures, posterior end blunt; ectoplasm thin and transparent, endoplasm dense and granulated; nucleus single, large, oval to ovoid in shape, usually at the anterior end of the body, measuring 26.5 - 33.0 μm × 13.2-22.6 μm, with a large nucleolus at one side.

*Host*: *Trigoniulus goesii* Pocock [Arthropoda: Diplopoda]; site of infection: gut lumen.

*Distribution*: India: West Bengal (North 24-Parganas district).

Family *ZYGOCYSTIDAE*

Genus *Zygocystis* Stein

*Diagnosis*: Sporadins pyriform, two to three in syzygy; spores biconical with peculiar thickening at extremities, octozoic.

106. *Zygocystis indicus* Pradhan and Dasgupta


*Diagnosis*: Trophozoites ovate, usually occurring in pairs, lying closely apposed to each other along their breadth, the cup-shaped concavity of one filling into the cone-shaped projection of the other; measuring 43.2 - 86 μm × 23.4 - 58.6 μm in dimension; pellicle thick; cytoplasm packed with paraglycogen granules. Nucleus round or ellipsoidal, 5.4-10.8 μm in diameter; gametocysts slightly ellipsoidal measuring 75.6 - 144 μm × 86.4 - 133 μm; spore biconical, barrel-like with distinct plugs at both ends.

*Type host*: (Metaphire) *Pheretima californica* Kinberg; site of infection: seminal vesicles.

*Distribution*: India: West Bengal (Darjiling district)

Family *ENTEROCYSTIDAE*

Genus *Enterocystis* Zwetkow

*Diagnosis*: Early stages of trophozoite in syzygy; sporadins in association ensiform, cysts spherical without duct, spores elongate ovoid, octozoic.

107. *Enterocystis bengalensis* Sarkar


*Diagnosis*: Immature form small, spherical, aseptate and attached to midgut epithelium; mature gamonts elongated, 49-140 (90) μm × 14-42 (24.6) μm in dimensions, aseptate with spherical nucleus; syzygy occasional, caudo-frontal; gametocysts spherical, thin walled; oocysts ellipsoidal with truncated and thickened ends liberated by simple rupture; sporozoites filiform.
Host: *Psocatropos* sp. [Insecta: Psocoptera]; site of infection: midgut and hindgut.

Distribution: India: West Bengal (North 24 Parganas district).

Family DIPLOCYSTIDAE

Genus *Lankesteria* Mingazzini

Diagnosis: trophozoites more or less spatulate or leaf-shaped, epimerite small, gametocysts spherical produced by association of two individuals after contraction, sporocysts oval and octozoic.

Key to the species

1(2) Trophozoite elongate 50-200 μm long, gametocysts spherical......................*L. culicis*

2(1) Trophozoite egg-shaped or pear-shaped, dimensions 101.4 μm × 78 μm, gametocysts spherical or broadly oval..............................*L. mackiei*

108. *Lankesteria culicis* (Ross)


Diagnosis: Trophozoite elongated, 50-200 μm in length, cytoplasm granular; a large central nucleus with a large karyosome; development intracellular; usually attached to the epithelial cell; gametocysts spherical.

Host: *Aedes (Stegomyia) aegypti* (Linn.) [Insecta: Diptera]; Indian hosts: *Aedes (Stegomyia) albopictus* Skuse; site of infection: stomach and malpighian tubules of pupa and adult mosquito.

Distribution: India: West Bengal (Calcutta district).

109. *Lankesteria mackiei* (Short and Swaminath)


Diagnosis: Trophozoites egg-shaped or pear shaped, dimensions 101.4 μm × 78 μm, epicyst wall marked with striations; nucleus large, spherical or subspherical, 30 μm in diameter, eccentrically placed; gametocyst spherical or broadly oval; 66.3 - 105.1 μm in length; sporocyst broadly spindle-shaped with a knob-like projections at each end, 9.6 μm × 5.8 μm, octozoic.

Host: *Phlebotomus argentipes* and *P. papatasi* [Insecta: Diptera]; site of infection: alimentary canal and body cavity.

Distribution: India: West Bengal (Calcutta district), Assam.

Superorder SEPTATINA

Key to the families

1(2) Parasitic in the gut of crustacea and relatively primitive arthropods, (epimerite present, oocysts ovoid or spherical, with protruding equatorial ridge).................................................. ..........CEPHALOIDOPHORIDAE
<table>
<thead>
<tr>
<th>2(1)</th>
<th>Parasitic in the gut of insects.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(10)</td>
<td>Sporonts in association or solitary</td>
</tr>
<tr>
<td>4(7)</td>
<td>Sporonts in association only.</td>
</tr>
<tr>
<td>5(6)</td>
<td>Sporonts in association of 2 or 3, epimerite a small simple papilla, oocysts ellipsoidal.</td>
</tr>
<tr>
<td></td>
<td>DIDYMOPHIDAE</td>
</tr>
<tr>
<td>6(5)</td>
<td>Sporonts in association upto 12, epimerite resembling a simple papilla or simple knob, oocysts of diverse shape.</td>
</tr>
<tr>
<td></td>
<td>HIRMOCYSTIDAE</td>
</tr>
<tr>
<td>7(4)</td>
<td>Sporonts solitary as well as in association.</td>
</tr>
<tr>
<td>8(9)</td>
<td>Sporonts solitary as biassociative, epimerite lacking.</td>
</tr>
<tr>
<td></td>
<td>NEOHIRMOCYSTIDAE</td>
</tr>
<tr>
<td>9(8)</td>
<td>Sporonts solitary or in association up to 12, epimerite simple and symmetrical.</td>
</tr>
<tr>
<td></td>
<td>GREGARINIDAE</td>
</tr>
<tr>
<td>10(3)</td>
<td>Sporonts solitary only.</td>
</tr>
<tr>
<td>11(14)</td>
<td>Epimerite absent, rudimentary or simple.</td>
</tr>
<tr>
<td>12(13)</td>
<td>Epimerite absent or rudimentary, gametocyst without sporoduct, oocyst ovoid or ellipsoidal.</td>
</tr>
<tr>
<td></td>
<td>STENOPHORIDAE</td>
</tr>
<tr>
<td>13(19)</td>
<td>Epimerite simple knob-like, gametocysts with several sporoduct, oocysts doliform.</td>
</tr>
<tr>
<td></td>
<td>LEIDYNIDAE</td>
</tr>
<tr>
<td>14(11)</td>
<td>Epimerite more or less complex.</td>
</tr>
<tr>
<td>15(18)</td>
<td>Epimerite with a distinct neck.</td>
</tr>
<tr>
<td>16(17)</td>
<td>Epimerite digited with a long neck, gametocyst generally with a single residuum, oocysts cylindrical with rounded ends.</td>
</tr>
<tr>
<td></td>
<td>DACTYLOPHORIDAE</td>
</tr>
<tr>
<td>17(16)</td>
<td>Epimerite short with fine bristles, gametocyst without any residuum, oocysts spherical set with brush border and chained with fine filamentous process.</td>
</tr>
<tr>
<td></td>
<td>BRUSTIOSPORIDAE</td>
</tr>
<tr>
<td>18(15)</td>
<td>Epimerite without any neck.</td>
</tr>
<tr>
<td>19(22)</td>
<td>Epimerite with or without appendages, oocysts without any epispore.</td>
</tr>
<tr>
<td>20(21)</td>
<td>Gametocysts residuum present, oocysts purse or hat-shaped, emitted in chains.</td>
</tr>
<tr>
<td></td>
<td>STYLOCEPHALIDAE</td>
</tr>
<tr>
<td>21(20)</td>
<td>Gametocysts residuum lacking, oocysts biconical, cylindro-biconical or irregular, gametocyst generally dehiscing by simply rupture.</td>
</tr>
<tr>
<td></td>
<td>ACTINOCEPHALIDAE</td>
</tr>
<tr>
<td>22(19)</td>
<td>Epimerite with prongs, oocysts ellipsoidal or ovoid with hyaline epispore.</td>
</tr>
<tr>
<td></td>
<td>MONODUCTIDAE</td>
</tr>
</tbody>
</table>
Family  GREGARINIDAE

Key to the genera

1 (2) Epimerite small, globular or cylindrical, protomerite of primite not forming any sucker like organellae.................................................. Gregarina
2 (1) Epimerite lacking, protomerite of the primite expanded to form sucker-like organellae ................................................................. Anisolobus.

Genus  Gregarina Dufour

Key to the species

1(16) Gametocysts with ectocyst.................................................................
2(7) Gametocyst cylindrical or barrel shaped.............................................
3(6) Epimerite hemispherical.................................................................
4(5) Gametocyst cylindrical, protomerite rectangular, deutomerite elongated cylindrical................................................................. G. cylindrosa
5(4) Gametocyst barrel-shaped, protomerite conical deutomerite short and semicircular..........
6(3) Epimerite disc-like; (protomerite pitcher-like, deutomerite elongated cylindrical, gametocyst cylindrical)........................................ G. discocephala
7(2) Gametocyst spherical or oval.............................................................
8(13) Gametocyst spherical......................................................................
9(10) Epimerite spherical, hyaline.......................................................... G. guttiventra
10(9) Epimerite not hyaline......................................................................
11(12) Protomerite conical to subspherical, deutomerite obese............... G. ischnopterae
12(11) Protomerite hemispherical, deutomerite conical.......................... G. nalae
13 (8) Gametocyst oval...........................................................................
14(15) Epimerite knob-like, protomerite hemispherical, deutomerite ovoid .... G. alcidessi
15(14) Epidermite globuler, protomerite conical deutomerite elongated ........ G. levinei
16 (1) Gametocyst without ectocyst..........................................................
17(18) Epidermite hyaline knob-like, gametocyst oval with unequal gametocysts ........ G. spraguei
18(17) Epidermite not hyaline, gametocyst spherical or oval with equal or unequal gametocysts
19(26) Epidermite globuler or knob-like .................................................................
20(21) Gametocyst with unequal gametocytes (epidermite knob-like, protomerite subspherical, deutomerite elongate ......................................................... G. crescentica
21(20) Gametocyst with equal gametocytes ...................................................................................
22(23) Gametocyst globular (protomerite cylindrical, deutomerite elongated, gametocysts spherical, rarely oval ......................................................... G. dasguptai
23(22) Gametocyst ovoidal or elliptical ........................................................................................................
24(25) Protomerite round or oval, deutomerite cylindro-conical ..................... G. chaetocnemae
25(24) Protomerite conical, deutomerite cylindrical .............................................. G. lygeusi
26(19) Epimerite not knob-like ........................................................................................................
27(28) Epimerite bilobose (protomerite hemispherical deutomerite obese) .......... G. bilobosa
28(27) Epimerite papilla-like or conical ........................................................................
29(30) Gametocysts with 4 sporoducts, each of which characteristically constricted at its base ................................................................. G. basiconstrictonia
30(29) Gametocysts with 7-10 sporoducts: without any constriction ................. G. gryllodes

110. Gregarina alcidessi Haldar and Chakraborty


Diagnosis: Trophozoites 52.5 - 350.0 (212.6) μm with a small, transparent, knob-like epimerite, hemispherical protomerite and ovoidal deutomerite, sporadins solitary or biaassociative, primite smaller than satellite, with epicyteal striations; gametocyst ovoidal, 220 μm × 150 μm × - 320 μm × 170 μm excluding ectocyst, gelatinous ectocyst of 40-150 μm thickness, gametocytes of unequal size; three sporoducts, 30 μm long, broad at the base, tapering towards the tip; spores oval 6 μm × 5 μm, two knobs at each pole, released in chain; development intracellular.

Host: Alcides sp. nr. leopardus [Insecta: Coleoptera]; site of infection: midgut.

Distribution: India: West Bengal (Nadia district).

111. Gregarina basiconstrictonea Ghose, Sengupta and Haldar


Diagnosis: Trophozoite elongated 45.9-48.6 (47.7) μm in length; epimerite small, papilla-like and occasionally expanding greatly in the form of a bulb; protomerite tongue-shaped; deutomerite large, cylindrical to obose in shape with a rounded posterior end; sporadin oval and solitary at the early stage, mature sporading cylindrical in shape with dome-shaped protomerite, cylindrical deutomerite; syzygy between two sporadins always caudo-frontal in nature; primite fan-like and
satellite somewhat barrel-shaped; gametocyst rounded with two equal gametocytes inside and four sporoducts on the cyst surface, each sporoduct characteristically constricted at its base; spore double-walled, barrel-shaped with two knob-like structures at each pole; sporozites rounded, 8 in each spore, arranged in two oblique rows.

*Host*: *Tribolium castaneum* (Herbst), [Insecta : Coleoptera] from ground nuts; site of infection: midgut.

*Distribution*: India : West Bengal (Hugli district).

112. *Gregarina bilobosa* Kundu and Haldar.


*Diagnosis*: Trophozoites solitary, elongated, 34.0 - 246.0 (124.7) μm; epimerite bilobose, protomerite hemispherical, deutomerite obese, nucleus round, 10.9 μm in diameter with a large endosome; sporadin solitary or biassociative, association caudo-frontal, primite and satellite differed markedly in structure, syzygy showed epicyteal striations only in the primite; gametocysts oval enclosing two equal sized gametocytes; 3 small discs on the cyst surface and 3 sporoducts with broad basal and narrow distal portion, dehiscing spores through these ducts in short chains; spores barrel-shaped, double-walled, 6 μm × 3 μm; development intracellular.

*Host*: *Longitarsus* sp. (Insecta : Coleoptera); site of infection : midgut.

*Distribution*: India : West Bengal (Nadia district).

113. *Gregarina chaetocnemae* Sarkar


*Diagnosis*: Trophozoite 39.8 - 77.0 (50.2) μm × 21.0 - 28.0 (24.5) μm with very small, spherula-like sessile epimerite, round to oval protomerite and oval to cylindro-conical deutomerite, sporadin 32.7-144.8 (87.0) μm × 18.7 - 79.4 (65.5) μm, solitary and also in caudo-frontal association; gamatocyst small ellipsoidal with two pairs of sporoducts, symmetrically arranged; sporocyst cylindrical with truncate ends released in long chain.

*Host*: *Chaetocnema concinnipenis*; site of infection : gut.

*Distribution*: India : West Bengal (Murshidabad district).

114. *Gregarina crescentica* Haldar and Chakraborty


*Diagnosis*: Trophozoites 70-380 (154.2) μm, obese to elongated cylindrical; epimerite knob-like, protomerite subospherical, broader than long; deutomerite elongated, broadest behind septum, with rounded posterior extremity; nucleus spherical 14.3 μm in diameter with a centrally located endosome; sporadins solitary or caudofrontally biassociative, primite always smaller than satellite; Gametocyst oval, 340 μm × 210 μm, with 6 sporoducts, spores doliiform, 7 μm × 6 μm, with 4 minute knobs, 2 at each poles attached to the outer wall, dehisce in chains. Development intracellular.

*Host*: *Amblyrrhinus* sp. (Insecta : Colcoptera); site of infection : midgut.

*Distribution*: India : West Bengal (Nadia district).
115. *Gregarina cylindrosa* Haldar and Kundu


*Diagnosis*: Trophozoite elongated, 90.0 - 390.0 (203.3) μm; epimerite hemispherical, protomerite rectangular, broader than long, deutomerite elongated and cylindrical with a constriction at the septum; nucleus spherical or elliptical, 17.5 μm in diameter; sporadins solitary or biassociative, syzygy caudo-frontal, primite always larger than satellite; gametocyst cylindrical, 600 μm × 150 μm, with a gelatinous ectocyst. widest at poles, reaching a thickness of up to 105.0 μm; with six sporoducts slightly dialated at their bases, spores liberated singly; spores cylindrical, 10 μm × 5 μm in dimension development intracellular.

*Host*: *Supella supellectilium* (Serv.) [Insecta : Blattodea]; site of infection : midgut.

*Distribution*: India : West Bengal (Nadia district).

116. *Gregarina dasguptai* Mandal, Rai, Pradhan, Gurung, Sharma, Rai and Mandal


*Diagnosis*: Trophozoite 66.69 - 280.80 μm × 17.50-140.40 μm; epimerite small, globular, 3.51 - 21.06 μm × 5.26 - 28.08 μm; protomerite cylindrical 14.04 - 63.18 μm × 14.0-62.92 μm; deutomerite elongated 45.63 - 214.11 μm × 17.55 - 140.40 μm. Sporadins solitary, syzygy caudofrontal; gametocyst spherical, rarely oval, 90.90 - 177.27 μm in diameter; spore barrel-shaped released in chains through sporoduct.

*Host*: *Coccinella septempunctata* L. [Insecta : Coleoptera ]; site of infection : midgut.

*Distribution*: India : West Bengal (Darjiling district).

117. *Gregarina discocephala* Kundu and Haldar


*Diagnosis*: Trophozoites solitary, elongated, 42.5 - 415.0 (166.0) μm, with a circular disc-like epimerite, pitcher-like protomerite and elongated and cylindrical deutomerite; nucleus spherical 20.8 μm in diameter with a large endosome; sporadins solitary or biassociative, association caudofrontal type; primite always smaller than satellite, epicyleal striations distinct in the uniting individuals; gametocysts with two cylindrical, equal-sized gametocytes; a transparent, gelatinous ectocyst and four sporoducts, two at each poles, 80 μm × 10 μm, with a broad basal and narrow distal portion connected by a screw headed structure; spores cylindrical, released in short chains, spore-wall with four rounded disc-like processes, two at each pole; development intracellular.

*Host*: Nymphal stage of Blattellidae; site of infection : midgut and caeca.

*Distribution*: India : West Bengal (Nadia district).

118. *Gregarina gryllodesii* Haldar and Sarkar


*Diagnosis*: Trophozoite 84.0 - 400.0 (307.0) μm with conical epimerite, broad hemispherical protomerite and sub-cylindrical deutomerite; sporadin 225.0 - 400.0 μm biassociative caudofrontally; gametocyst spherical with 7 to 10 sporoducts; spore barrel-shaped extruded in chains.
Host: Gryllodes sp. [Insecta: Orthoptera]; site of infection: intestinal caeca and midgut.

Distribution: India: West Bengal (Hugli district).

119. Gregarina guttiventra Haldar and Sarkar

Diagnosis: Trophozoite 24.0-40.0 μm, with epimerite hyaline, spherical; protomerite obese and deutomerite subspherical; sporadian 31.0 - 400.0 μm, elongated, cylindrical, biassociative caudo-frontally; gametocyst small, spherical with a gelatinous ectocyst and a long sporoduct; spore small, doliform, extruded singly.

Host: Gryllodes sp. [Insecta: Orthoptera]; site of infection: intestinal caeca and midgut.

Distribution: India: West Bengal (Hugli district).

120. Gregarina ischnopterae Datta and Haldar

Diagnosis: Trophozoite elongated 83.3 - 166.6 (116.6) μm; epimerite knob-like, protomerite conical to subspherical; deutomerite obese in shape; sporadin 83.3 - 358.2 (174.7) μm, either solitary or in caudo-frontal association; gametocyst more or less spherical; gametocytes of equal size; ectocyst thick; sporoduct gradually tapering; spores barrel-shaped, released in long chains. Development possibly extracellular.

Host: Ischnoptera sp. [Insecta: Dictyoptera], site of infection: midgut.

Distribution: India: West Bengal (Nadia district).

121. Gregarina levinei Haldar and Sarkar emend Levine


Diagnosis: Trophozoite 107.8 - 127.0 μm in length, elongated with globular epimerite, conical protomerite and an elongated deutomerite; sporadin 246.2 μm x 46.2, μm solitary or biassociative caudo-frontally; gametocyst oval with a thick gelatinous ectocyst, three small processes and a short sporoduct; spore doliform with truncated ends, extruded in short chains.

Host: Gryllodes sp. [Insecta: Orthoptera]; site of infection: midgut.

Distribution: India: West Bengal (Hugli district).

122. Gregarina lygeusi Haldar, Ray and Gupta

Diagnosis: Trophozoite elongated, 116.5 - 230.9 μm; epimerite simple globular, protomerite conical, deutomerite cylindrical; constriction between epimerite and protomerite very deep, septum between protomerite and deutomerite very distinct; sporadins solitary or biassociative, protomerite occasionally drawn into a long neck, syzygy always caudo-frontal; gametocysts ovoidal, 232.4 μm x 199.2 μm to 298.8 μm x 232.4 μm, with 4 sporoducts, slightly broader at their bases.
and gradually tapering towards the free end; spores dolioform, double walled, 7.5 μm x 3.3 μm, with 4 disc-like processes, two at each pole.

*Host*: *Lygeus hospes* Fabricius [Insecta: Hemiptera]; site of infection: midgut contents.

*Distribution*: India: West Bengal (Nadia district).

123. *Gregarina mukundai* Haldar and Kundu


*Diagnosis*: Trophozoites conical, 52.5 - 510.0 (295.8) μm; epimerite subspherical, protomerite somewhat conical, broader than long; deutomerite short, semilunar with a slight constrictin at the septum; sporadins solitary or biassociative, syzygy caudofrontal; primite larger than satellite; gametocysts 840 μm x 210 μm, barrel-shaped, enclosing two equal sized gametocytes; ectocyst widest at poles, measuring 1170 μm x 240 μm at the middle and 1,170 μm x 300 μm at the ends; sporoducts always remained within the cyst wall liberation of spores through the elevated regions in short chains; spores barrel-shaped, 10 μm x 5 μm in size with four knob-like processes, two at each poles.

*Host*: Nymphal stage of an undetermined insect species belonging to the family Blattellidae; site of infection: midgut content.

*Distribution*: India: West Bengal (Nadia district).

124. *Gregarina nalae* Datta and Haldar


*Diagnosis*: Trophozoite 42.5 μm in length with knob-like epimerite; hemispherical protomerite and conical deutomerite; sporadin 85.0 - 366.5 (219.9) μm, solitary or in caudo-frontal association; gametocyst spherical, with ectocyst and six short sporoducts; spores barrel-shaped; liberation in long chains through sporoduct.

*Host*: *Nala lividipes* (Dufour) [Insecta: Dermoptera]; site of infection: midgut.

*Distribution*: India: West Bengal (Nadia district).

125. *Gregarina spraguei* Haldar and Chakraborty


*Diagnosis*: Trophozoites elongated, 112.5 - 280.0 μm; epimerite hyaline knob-like, protomerite hemispherical, slightly broader than long; deutomerite broadest slightly below the septum, sporadin solitary or biassociative caudofrontaly, primite smaller than satellite; gametocyst oval, 270 μm x 200 μm - 310 μm x 200 μm, enclosing two gametocytes of unequal size; with four sporoducts, broad at the base and gradually tapering at the tip, releasing spares in chains; spores ovoidal 8 μm x 6 μm, with 4 knobs attached on the outer wall development intracellular.

*Host*: An unidentified beetle of subfamily Branchyderinae, family Curculionidae (Coleoptera); site of infection: midgut.

*Distribution*: India: West Bengal (Nadia district).
Genus *Anisolobus* Vincent

Key to the species

1 (2) Protomerite elongated and cylindrical, deutomerite cylindrical, gametocysts more or less spherical with two sporoducts.......................................................... *A. indicus*

2 (1) Protomerite flattened, sucker-like, deutomerite almost oval, gametocyst oval with 6-8 sporoducts.............................................................................................................. *A. royii* comb. nov.

126. *Anisolobus indicus* Haldar, Ray and Bose


*Diagnosis:* Body divisible into elongated and cylindrical protomerite and cylindrical deutomerite; true epimerite absent, a sucker-like structure attached to the anterior end of protomerite; measuring 117.5 μm in length; sporadins biassociative, primite retains its sucker-like structure, satellite possessing a cup-shaped concavity in the same place to accomodate the deutomerite of primite; gametocyst isogamous, more or less spherical, 132.8 - 149.4 μm × 99.6 - 116.2 μm in dimension, ectocyst absent but with two sporoducts 58.1 μm × 16.6 μm; spores barrel-shaped, released in long chains, measuring 5.8 μm × 3.3 μm.

*Type host:* *Coccinella septempunctata* L. [Insecta : Coleoptera] from cabbage, *Brassica campestris*; site of infection : midgut.

*Distribution:* India : West Bengal (Nadia district).

127. *Anisolobus royii* comb. nov.


*Diagnosis:* Trophozoite with no true epimerite, protomerite flattened, sucker-like measuring 26 (21-30) μm × 51 (38-64) μm, deutomerite almost oval 51 (47-103) μm × 38.5 (17-51) μm; sporadin 102 - 324 μm in length, biassociative, association caudofrontal; gametocyst ovale, 60-107 μm × 43-73 μm, cyst with a thick envelope measuring 64-115 μm × 47-81 μm, dehisces through 6-8 sporoducts; spore barrel-shaped (6 μm × 4 μm) released in long chains.

*Host:* *Oryzaeophilus mercator* F. (Insecta : Coleoptera); site of infection : intestine.

*Distribution:* India : West Bengal (Calcutta district).

Remarks: Since the specific name *Anisolobus indicus* is preoccupied (see Halder, Ray and Bose, 1988), *Anisolobus royii* comb. nov. is proposed for the present species as per International code of Zoological Nomenclature.

Family DIDYMOPHIDAE

Key to the genera

1(4) Epimerite spherical with a corona........................................................................................................

2(3) Corona consisting of 14-16 ridges and not provided with any stalk.................. *Liposcelis*
3 (2) Corona comprising of 4 sucker-like hyaline discs provided with a very short stalk. .......... Quadruhyalodiscus
4 (1) Epimerite cylindro-conical or inverted cap-like without any corona. .........................
5 (6) Epimerite cylindro-conical with a small pointed papilla. ......................... Didymophyes
6 (5) Epimerite inverted cap-like on the top of a stalk. ......................... Laterospora

Genus Didymophyes Stein

Key to the species

1 (2) Gametocyst with ectocyst ................................................. D. tridactyla
2 (1) Gametocyst without any ectocyst .................................................................
3 (6) Trophozoite vase-like ......................................................................................
4 (5) Epimerite with prominent ridges radiating from central area .......... D. rigidus
5 (4) Epimerite without any ridge ........................................................................ D. oryzaephilae
6 (3) Trophozoite ovoidal .........................................................................................
7 (8) Protomerite hemispherical, deutomerite obese or flat, spore spherical .......... D. lipai
8 (7) Protomerite rectangular, always broader than long, deutomerite ovoidal or cylindrical, spores ovoidal ......................................... D. indiae

128. Didymophyes indiae Kundu, Datta and Haldar


Diagnosis: Trophozoites ovoidal or elongated, 55.0 - 125.0 (80.5) µm x 27.5-75.0 (47.5) µm; epimerite subconical, papilla-like; protomerite rectangular, always broader than long; deutomerite ovoidal or cylindrical; nucleus spherical variously located; sporadins solitary or biassociative, 35.0 - 205.0 (133.0) µm x 25. - 125.0 (85.0) µm, association caudo-frontal; gametocyst spherical, 161.0 µm in diameter; spores smooth ovoidal with remarkably thick spore wall.

Host: Euparatetix histricus (Stal) (Insecta: Orthoptera); site of infection: midgut and hepatic ceca.

Distribution: India: West Bengal (Nadia district).

129. Didymophyes lipai Ghose, Gupta and Haldar


Diagnosis: Trophozoites ovoidal 22.95-35.1 µm x 8.64 - 26.65 µm; epimerite egg-shaped or conical with pointed anterior end; protomerite rectangular, always broader than long; deutomerite ovoidal or cylindrical; nucleus spherical variously located; sporadins solitary or biassociative, primite larger than satellite, association caudo-frontal; gametocysts rounded, 67.2 µm in dimension, burst by simple rupture,
liberating spore in chains; spores spherical, double walled, 8.25 µm × 6.6 µm; development intracellular.

*Host*: *Oryzaephilus mercator* (F), larvae and adult, from *Anacardium occidentalis* L. (Cashew nuts); site of infection: midgut.

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Roy (1989) opines that this species belongs to the genus *Hirmocystis* and is a synonym of *H. minuta*.

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130. *Didymophyes oryzaephilae* Ghose, Gupta and Haldar


*Diagnosis*: Trophozoites small, vase-like, measuring 24.3 - 32.4 µm × 11.0 - 16.2 µm; epimerite small, cashew nut-like, protomerite rectangular, deutomerite vase-like; nucleus spherical, centrally located; sporadins solitary or biassociative, association caudo-frontal; gametocysts spherical, dehiscing by simple rupture, 47.2 µm × 42.6 µm in dimension; spores double walled, smooth, ellipsoidal; early development intracellular.

*Type host*: *Oryzaephilus mercator* (F) [Insecta: Coleoptera] from *Juglans regia* L. (Ground nuts); site of infection: midgut.

*Distribution*: India: West Bengal (Hugli district).

*Remarks*: Roy (1989) opines that this species belongs to the genus *Hirmocystis* and is a synonym of *H. minuta*.

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131. *Didymophyes rigidus* Ghose, Gupta and Haldar


*Diagnosis*: Trophozoite vase-like, measuring 23.8 µm × 10.8 µm; epimerite papilla-like, with prominent ridges radiating from central area while viewing from the top; protomerite rectangular or hemispherical, broader than long; deutomerite rectangular or cylindrical; sporadins solitary or biassociative, ovoidal to cylindrical; gametocysts spherical, dehiscing by simple rupture; spores smooth, ellipsoidal, 3.0 µm × 2.2 µm; early development intracellular.

*Host*: *Oryzaephilus mercator* (F) [Insecta: Coleoptera]; site of infection: midgut.

*Distribution*: India: West Bengal (North 24-Pargans district).

*Remarks*: Roy (1989) opines that this species also belongs to the genus *Hirmocystis* and is a synonym of *H. minuta*.

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132. *Didymophyes tridactylae* Kundu, Datta and Haldar


*Diagnosis*: Trophozoite vase-shaped, 42.5 - 46.8 µm × 19.1 - 29.8 µm; epimerite hyaline papilla-like; protomerite rectangular, broader than long; deutomerite more or less spherical in shape; nucleus spherical or ovoidal, having a big endosome; sporadins cylindro-conical, biassociative caudo-frontally, measuring 34.0 - 157.0 (81.7) µm × 17.0 - 114.8 (50.1) µm; gametocyst
ovoidal with ectocyst, 116.6 - 233.2 μm × 133.3 - 183.2 μm, simple rupture releasing sproes in mass; spores ovoidal, covered with a rectangular hyaline coat.

**Host**: *Tridactylus* sp. [Insecta: Orthoptera]; site of infection: midgut and hepatic caeca.

**Distribution**: India: West Bengal (Nadia district).

**Genus** *Laterospora* Haldar, Ray and Bose

133. *Laterospora phenacocca* Haldar, Ray and Bose


**Diagnosis**: Trophozoites elongated, 212.3 μm × 89.5 μm in average dimensions; epimerite inverted cap-like on the top of a short stalk, protomerite dome-shaped, deutomerite elongated and cylindrical; nucleus spherical, 24.0 μm × 26.7 μm; cytoplasm almost uniformly granulated; sporadin solitary or biassociative; association caudo-frontal; gametocysts spherical, 211.1 μm in average diameter, dehiscing by simple rupture, releasing spores in long chains; spores dolioform, arranged in sidewise manner; two knob-like projections located at each pole; development intracellular.

**Type host**: *Phenacoccus hirsutus* Cr., a hemipteron jute pest (Insecta); site of infection: midgut.

**Distribution**: India: West Bengal (Nadia district).

**Genus** *Liposcelisus* Sarkar and Haldar

134. *Liposcelisus coronatus* Sarkar and Haldar


**Diagnosis**: Trophozoite 34.5 - 69.0 (51.6) μm in length, obese in shape; epimerite spherical, sucker-like and beset with a corona; protomerite sub-conical; deutomerite hemispherical in shape; sporadin solitary or in loose caudo-frontal association; gametocyst spherical with thick cyst wall; spore smooth, spindle shaped with sharply pointed ends.

**Host**: *Liposcelis* sp. (Insecta: Pscoptera); site of infection: midgut.

**Distribution**: India: West Bengal (North 24-Parganas district).

**Genus** *Quadruhyalodiscus* Kundu and Haldar

135. *Quadruhyalodiscus gallerucidae* Kundu and Haldar


**Diagnosis**: Trophozoite cylindrical 59.5 - 172.1 (126.8) μm in length; epimerite sucker-like, beset with a corona consisting of four hyaline discs; protomerite conical to obese; deutomerite cylindrical. Sporadin 97.7 - 267.7 (200.9) μm in length; solitary or in loose caudo-frontal association; gametocyst spherical or slightly oval; spore smooth, spindle shaped with polar thickenings, liberated in a mass by simple rupture.
Host: *Gallerucita bicolor* (Jope) [Insecta: Coleoptera]; site of infection: midgut.

Distribution: India: west Bengal (Nadia district).

Family: HIRMOCYSTIDAE

Key to the genera

1 (2) Epimerite very labile resembling a conical button, oocysts ovoid, ellipsoidal or cylindrical

2 (1) Epimerite globular, retractile into protomerite; oocysts barrel-shaped, extruded in chains

Genus: *Hirmocystis* Labbe

Key to the species

1(2) Epimerite hyaline with a characteristic oxeate in shape..........................*H. oxeata*

2(1) Epimerite not oxeate in shape............................................................................................

3(8) Epimerite knob-like ..............................................................................................................

4(5) Protomerite hemispherical, deutomerite obese or pitcher-shaped........... *H. theodoridesi*

5(4) Protomerite and deutomerite of different shape............................................................... *H. minuta*

6(7) Protomerite spherical or dome-shaped, deutomerite cylindrical................. *H. haplosomae*

7(6) Protomerite cylindroconical, deutomerite elongated gradually tapering posteriorly........ *H. minuta*

8(3) Epimerite not knob-like........................................................................................................

9(10) Epimerite dome-shaped, protomerite short pea-shaped................................. *H. lophocateri*

10(9) Epimerite papilla-like and protomerite of different shapes.................................

11(12) Protomerite pitcher-like................................................................................................. *H. pitcheris*

12(11) Protomerite not pitcher-like.........................................................................................

13(16) Protomerite hemispherical or dome-shaped..............................................................

14(15) Deutomerite obese, elongated and cylindrical......................................................... *H. bengaliensis*

15(14) Deutomerite somewhat globular................................................................................... *H. triboli*

16(13) Protomerite ovoidal........................................................................................................

17(18) Deutomerite conical widest behind the septum......................................................... *H. lepropi*

18(17) Deutomerite obese sharply constricted at the septum................................. *H. pseudoductis*
136. *Hirmocystis bengalensis* Haldar and Chakraborty


**Diagnosis**: Trophozoites, solitary, elongated, measuring 35.0 - 222.5 μm × 15.0 - 62.5 μm; epimerite hyaline papilla-like with a rounded end; protomerite hemispherical, broadest at the middle; deutomerite obese, elongated and cylindrical; nucleus spherical with distinct nuclear membrane, 7.5 - 20.0 μm in diameter; sporadins solitary, bi or tri associative in an anteroposterior axis; gametocysts white, egg-shaped, 240 - 300 μm × 170 - 190 μm, burst by simple rupture, liberating spores in chain; spores ovoidal, double-walled, 7.5 μm × 5.0 μm, with two knob-like projections at each poles; development intracellular.

*Host*: *Myllocerus* sp. 1 (Insecta : Coleoptera); site of infection : gut epithelium.

*Distribution*: India : West Bengal (Nadia district).

137. *Hirmocystis hoplasmomae* Kundu and Haldar


**Diagnosis**: Trophozoites 93.5 - 293.2 (170.4) μm, cylindrical; epimerite knob-like; protomerite cylindro-conical; deutomerite elongated, gradually tapering posteriorly; sporadin solitary or biassociative; gametocysts spherical to ovoidal; gametocytes equal-sized; spores barrel-shaped; initial development intracellular.

*Host*: *Hoplasoma unicolor* Illiger (Coleoptera : Insecta); site of infection : midgut.

*Distribution*: India : West Bengal (Nadia district).

138. *Hirmocystis lepropi* Haldar and Chakraborty


**Diagnosis**: Trophozoites cylindrical, 77.5 - 580 μm; epimerite subspherical papilla-like, 5 - 10 μm in length; protomerite ovoidal; deutomerite ovoidal; nucleus spherical, 12.5 μm in diameter with a large, slightly eccentric end some; sporadins biassociative caudo-frontally; gametocysts oval, 250 μm × 50 μm - 360 μm × 200 μm; simple rupture releasing spores in chains; spores ovoidal, double-walled, 6 μm × 4 μm, with four knobs, two at each pole; development intracellular.

*Type host*: *Lepropus* sp. (Insecta : Coleoptera); site of infection : midgut.

*Distribution*: India : West Bengal (Nadia district).

139. *Hirmocystis lophocateri* Ghose and Haldar


**Diagnosis**: Trophozoites solitary, elongated, measuring 30.45 - 56.7 μm × 6.07 - 22.1 μm; epimerite dome-shaped; protomerite short, pea-shaped; deutomerite elongated and cylindrical; nucleus rounded with a clear endosome; sporadin solitary or biassociative, ovoidal to elongated, association caudo-frontal; gametocyst ovoidal 96.6 μm × 38.4 μm, dehiscing by simple rupture liberating spores in chains; spores 5.7 μm × 3.3 μm, ovoidal, double-walled; development intracellular.
Host: *Lophocateres pusillus* (K.) [Insecta: Coleoptera]; site of infection: gut.

**Distribution**: India: West Bengal (Nadia district).

140. *Hirmocystis minuta* (Ishii, 1914) emend Roy, 1989


**Diagnosis**: Trophozoite with small, spherical or dome-shaped protomerite (4-12 μm × 4-16 μm) and elongated, cylindrical deutomerite (24-80 μm × 16.24 μm); sporadin bi or rarely triassociative, with caudo-frontal association. Gametocyst spherical (60 μm) with equatorial constriction, devoid of sporoducts; spores 6 μm × 4 μm, extruded in long chains after simple dehiscence of cyst.

**Host**: *Tribolium ferrugineum* F (Tenebrionid beetle).

**Indian host**: *Oryzaephilus mercator* F. [Insecta: Coleoptera]; site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: This species was originally described as *Gregarina minuta* by Ishii (1914). Roy (1989) reviewed, redescribed and emended it as *Hirmocystis minuta*.

141. *Hirmocystis oxeata* Ghose, Sengupta and Haldar


**Diagnosis**: Trophozoite (40.5 μm) elongated, solitary; epimerite characteristically oxeate-shaped; protomerite elongated, broadest at the middle; deutomerite large with rounded posterior end; sporadins (27.0 - 121.5 μm) in caudo-frontal association; gametocysts spherical; spore double walled and barrel-shaped; early development intracellular.

**Host**: *Tribolium castaneum* (Herbst) [Insecta: Coleoptera], from walnuts; site of infection: midgut.

**Distribution**: India: West Bengal (Hugli district).

142. *Hirmocystis pitcharis* Haldar and Chakraborty


**Diagnosis**: Trophozoites 62.5 - 480.0 μm x 17.5 - 180.0 μm in dimension; epimerite broadly papillated with a pointed extremity; protomerite pitcher-like, deutomerite widest behind the septum, narrow posteriorly ending in a blunt proximity; cytoplasm finely granulated; nucleus spherical and located at the middle; sporadin biassociative sometimes solitary; protomerite hemispherical, deutomerite with a rounded end; nucleus anteriorly situated; gametocyst 320.0 μm × 190.0 μm; thin-walled, egg-shaped enclosing two unequal gametocytes; spores 6.0 μm × 4.0 μm, oval, liberated in chains; development intracellular.

**Host**: *Xanthoprochilus* sp. [Insecta: Coleoptera]; site of infection: midgut.

**Distribution**: India: West Bengal (Nadia district).

*Diagnosis:* Trophozoites 65.0-460.0 μm x 50-170 μm, oval in outline and circular in cross-section; epimerite subconical and papilla-like, protomerite ovoidal, deutomerite obese, sharply constricted at the septum; nucleus spherical, 10-40 μm in diameter with a central rounded endosome; sporadin with globular protomerite and an elongated deutomerite, biassociative, primite always smaller than the satellite; gametocyst opaque, egg-shaped, 400 μm x 250 μm, enclosing two unequal gametocytes; spore ovoidal with two knobs at each pole, 7 μm x 6 μm liberating in chains; development intracellular.

*Host:* *Myllocerus* sp. 2 (Insecta : Coleoptera); site of infection: midgut.

*Distribution:* India: West Bengal (Nadia district).


*Diagnosis:* Trophozoites obese in shape at the early stage, later on becoming elongated and cylindrical, 19.3-105.0 (54.0) μm; epimerite knob-like; protomerite hemispherical; deutomerite obese or pitcher-shaped; sporadin solitary or in linear associations of twos and fours. Gametocyst almost spherical; gametocytes of equal size; ectocyst present; spores doliiform or barrel-shaped; development extracellular.

*Host:* *Gryllotalpa africana* [Orthoptera : Insecta]; site of infection: midgut.

*Distribution:* India: West Bengal (Nadia district).


*Diagnosis:* Trophozoites 41.55 ± 18.85 μm x 27.44 ± 16.36 μm, vase-like with tongue or papilla-like epimerite, dome or hat-shaped protomerite and somewhat globular deutomerite; sporadin solitary or biassociative, cylindrical in shape with hat or dome-shaped protomerite, association caudo-fronta; gametocyst 119.7 μm x 76.6 μm, spherical, whitish, double-walled with an ectocyst; burst by simple rupture releasing the spores in masses.

*Host:* *Tribolium casteneum* (Harbst) [Insecta : Coleoptera]; site of infection: gut.

*Distribution:* India: West Bengal (Nadia district).

**Genus Retractocephalus** Haldar and Chakraborty

**Key to the species**

1 (6) Epimerite simple, globular.......................... .......................... ..........................

2 (5) Deutomerite obese with distinct epicyteal striations...................................

3 (4) Protomerite somewhat conical and pointed towards the apex, epimerite retractile into
protomerite.................................................................................................................\textit{R. aulacophorae}

4 (3) Protomerite greatly elongated and somewhat narrower anteriorly, epimerite not retractile into protomerite.................................................................................................................\textit{R. spatulatus}

5 (2) Deutomerite cylindrical with distinct epicyteal striations....................\textit{R. raphidopalpae}

6 (1) Epimerite simple knob-like or ovoidal.................................................................\textit{R. hallieus}

7 (8) Protomerite broader than long having a depression at anterior margin and two pointed projections on two sides of the septum.................................................................\textit{R. haliicus}

8 (7) Protomerite hemispherical with pointed apex.......................................................\textit{R. spinosus}

146. \textit{Retractocephalus aulacophorae} Haldar, Chakraborty and Kundu


\textit{Diagnosis}: Trophozoite elongated 40.0 - 410.0 (155.1) \(\mu\)m; epimerite globular and retractile; protomerite somewhat conical; deutomerite obse in shape with distinct epicyteal striations; sporadin solitary and biassorative; gametocyst nearly spherical; spore barrel-shaped, liberated in chains; trophozoite and sporadin similar in size.

\textit{Host}: \textit{Aulacophora intermedia} Jacoby [Insecta : Coleoptera]; site of infection : midgut.

\textit{Distribution}: India : West Bengal (Nadia district).

147. \textit{Retractocephalus haliicus} Haldar, Chakraborty and Kundu


\textit{Diagnosis}: Trophozoite elongated 210.0 - 440.0 (324.3) \(\mu\)m; epimerite retractile, somewhat ovoidal; protomerite broader than long; deutomerite somewhat cy lindroconical; sporadin solitary, rarely bioassociative; gametocyst spherical; spore barrel-shaped and extruded in chains; development intracellular; trophozoite and sporadin similar in size.

\textit{Host}: \textit{Haliica} sp. [Insecta : Coleoptera]; site of infection : midgut.

\textit{Distribution}: India : West Bengal (Nadia district).

148. \textit{Retractocephalus raphidopalpae} Haldar and Chakraborty


\textit{Diagnosis}: Trophozoite elongated, 57.5 - 135.0 (116.5) \(\mu\)m; epimerite simple, retractile, globular and hyaline; protomerite and deutomerite elongated cylindrical in outline with distinct epicyteal striations; sporadin 87.5 - 360.0 (183.6) \(\mu\)m, solitary and biassiative caudo-frontally; gametocyst oval; spore barrel-shaped, liberating in chains.

\textit{Host}: \textit{Raphidopalpa} (= \textit{Aulacophora} \textit{feveicollis}) Lucas [Insecta : Coleoptera]; site of infection: midgut.

\textit{Distribution}: India : West Bengal (Nadia District).
149. Retractocephalus spatulatus Haldar, Chakraborty and Kundu

Diagnosis: Trophozoite 120.0-220.0 (155.4) μm, elongated; epimerite globular and retractile; protomerite hemispherical. deutomerite elongated, somewhat obese with epicyteal striations; sporadins solitary or biassociative caudo-frontally, primite large than the satellite; gametocyst oval; spore barrel-shaped, liberated in chains; development intracellular.

Host: Lema sp. [Insecta: Coleoptera]; site of infection: midgut.

Distribution: India: West Bengal (Nadia district).

Remarks: The epimerite of the young trophozoite assumes a characteristic spatulated shape from which the specific name is derived.

150. Retractocephalus spinosus Haldar, Chakraborty and Kundu

Diagnosis: Trophozoite 100-300 (196.4) μm, elongated; epimerite knob-like and retractile; protomerite somewhat hemispherical; deutomerite elongated cylindrical with indistinct epicyteal striation; sporadins solitary or biassociative; gametocyst spherical or slightly oval; spore barrel-shaped, liberated in chain, development intracellular.

Host: Monolepta signata Oliv. (Insecta: Coleoptera); site of infection: midgut.

Distribution: India: West Bengal (Nadia district).

Remarks: The epimerite of the young trophozoite is provided with a characteristic blunt spine from which the species named is derived.

Family NEOHIRMOCYSTIDAE
Genus Neohirmocystis Ghosh, Ray and Haldar

Diagnosis: Epimerite lacking, sporadins solitary, biassociative, satellite with septum during association, spores spherical.

Key to the species

1 (2) Mature sporadins with hat-like, tongue-like or globular protomerite, gametocyst blackish-white and round................................................................. N. grassei

2 (1) Mature sporadins with conical protomerite, gametocyst white and spherical...........

................................................................. N. dercetini

151. Neohirmocystis dercetini Ghose, Roy and Haldar

Diagnosis: Sporadins solitary or biassociative, 44.8 - 106.4 (66.0) μm in length; obese-shaped, with conical protomerite and elongated, sometimes ovoidal to elliptical deutomerite; nucleus spherical with an endosome inside; association caudo-frontal; gametocyst almost spherical 79.0 μm × 77.0 μm in average dimensions, simple rupture; spores spherical, double-walled, 4.1 μm in diameter; development extracellular.
Host: *Derectine* sp. [Insecta: Coleoptera] from the potato plants, *Solanum tuberosum*; site of infection: midgut.

*Distribution*: India: West Bengal (Nadia district).

152. *Neohirmocystis grassei* Ghose, Ray and Haldar


*Diagnosis*: Sporadins 25.35-199.8 (74.1) μm, solitary or biosociative with hat-like, tongue-like or blobular protomerite, syzygy caudo-frontal, primitive with fan-shaped protomerite, but protomerite dome-shaped in satellite; gametocyst round with prominent ectocyst; spore spherical, double-walled; development intracellular.

*Type host*: *Tribolium castaneum* (Herbst) from the fruits of *Trachyspermum amor*; site of infection: midgut.

*Distribution*: India: West Bengal (Hugli district).

Family STENOPHORIDAE

**Key to the genera**

1(2) Epimerite small, tongue-shaped, bordered by a collar at its base, sporocysts covering with a surrounding hyaline membrane................................................................. *Hyalosporina*

2 (1) Epimerite lacking or rudimentary, sporocysts ovoidal with equatorial line......................

................................................................. *Stenophora*

Genus *Hyalosporina* Chakraborty

**Key to the species**

1 (2) Gametocysts oval, 292-390 μm × 263-375 μm in dimensions ............... *H. cambolopsisae*

2 (1) Gametocysts spherical, 96-120 μm in diameter............................................... *H. rayii*

153. *Hyalosporina cambolopsisae* Chakrabarty


*Diagnosis*: Trophozoite elongated, dimension 43-150 μm × 14.30 μm, attached to the epithelial cells; epimerite simple consisting of a collar or ring and a tongue-like process; protoelement small and conical; deutomerite elongated, cylindrical with longitudinal epicyteal striations; sporonts 800-111 μm × 80-111 μm in dimensions; gametocysts and sporocysts oval.

*Host*: *Cambolopsis* sp. [Arthropoda: Myriapoda]; site of infection: alimentary canal.

*Distribution*: India: West Bengal (Calcutta district).

154. *Hyalosporina rayi* Chakrabarty and Mitra

Diagnosis: Trophozoite elongated, 130-173 μm × 37-70 μm; epimerite rounded; protomerite small, triangular in shape; deutomerite broader anteriorly, gradually tapering posteriorly, nucleus spherical, tethered to the pellicle by myonemas; gametocysts spherical, 77-116.5 μm in diameter; sporocysts elongate-oval.

Host: Polydesmus sp., Strongylosoma contortipes Alms (Arthropoda: Myriapoda); site of infection: alimentary canal.

Distribution: India: West Bengal (Calcutta district).

Genus Stenophora Labbe

Key to the species

1 (2) Epimerite hyaline and oval, protomerite rectangular or barrel-shaped and broader..............

.......................................................... S. shyamaprashadi

2 (1) Epimerite not hyaline and protomerite of different shape.................................................

3 (4) Epimerite round, protomerite bottle-shaped with a process at its posterior end..............

.......................................................... S. ellipsoidi

4 (3) Epimerite conical or rounded, protomerite rounded anteriorly and flattened at the septum........................................................................................................... S. khagendrae

155. Stenophora ellipsoidi Chakravarty


Diagnosis: Young trophozoite with a round epimerite and a bottle-shaped protomerite; sporonts 250-372 μm × 50-95 μm, ellipsoidal with protomerite posteriorly drawn out into a small blunt process; gametocysts spherical; sporocyst spindle-shaped, octozoic; development intracellular.

Host: Diplopoda sp. (Arthropoda: Myriapoda); site of infection: midgut.

Distribution: India: West Bengal (Calcutta district).

156. Stenophora khagendrae Ray


Diagnosis: Young trophozoite intracullalar, with a conical or rounded epimerite; sporont solitary, 225 μm × 56 μm, parrot-shaped with a deutomerite up to eight times as long as protomerite; gametocyst spherical, 100-123 μm in diameter; sporocysts spindle-shaped.

Host: Unnamed millipede close to Zikadesmus; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

157. Stenophora shyamaprashadi Chakravarty


Diagnosis: Sporonts solitary, elongated, 82-174 μm × 18-42.5 μm, epimerite hyaline, oval;
protomerite rectangular or barrel-shaped, granular and broader than long; deutomerite granular, broadest at little distance behind the septum, tapering with a rounded posterior end, nucleus spherical; gametocyst spherical, thick-walled, 253.5 μm in diameter; dehiscing by simple rupture, liberating oval spore, 8.24 μm × 4.12 μm in dimension.

**Host**: Cormocephalus dentipes Poc. (Arthropoda : Chilopoda); site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district).

Family **LEIDYANIDAE**
Genus **Leidyana** Watson

**Diagnosis**: Epimerite simple, globular, knob-like; oocysts emerging through sporoduct in long chains.

Key to the species

1 (2) Gametocysts with ectocysts, protomerite dome-shaped................................. *L. linguata*
2 (1) Gametocysts without ectocysts, protomerite of different shape..........................
3 (4) Protomerite rectangular, deutomerite elongated................................. *L. guttiventrisa*
4 (3) Protomerite hemispherical with irregular anterior margin, deutomerite triangular....... .................................................................................................................................................................................... *L. oryzaephili*

158. **Leidyana guttiventrisa** Sarkar


**Diagnosis**: Trophozoite 42 μm × 11 μm, with a conical to lance-shaped epimerite, a rectangular protomerite and an elongated deutomerite; sporadin 206.5 μm × 73.5 μm, two segmented, cylindrical and solitary; gametocyst oval to egg-shaped without ectocyst; sporocyst barrel-shaped released singly or in chain through sporoduct.

**Host**: Plebeiogryllus guttiventris (Walker) [Insecta : Orthoptera], site of infection: midgut.

**Distribution**: India: West Bengal (Hugli district).

159. **Leidyana linguata** Haldar and Sarkar


**Diagnosis**: Trophozoite 53.4 μm × 17.3 μm in dimension; with large, tongue-like epimerite, dome-shaped protomerite and subspherical deutomerite; sporodin elongated, 31.4-415.8 (143.8) μm × 12.5 - 71.8 (27.5) μm in dimension, two segmented and solitary; gametocyst small, spherical with ectocyst; spore cylindrical, extruded through short bent sporoduct in short chains.

**Host**: Pteronomobius conclor Walker (Insecta : Orthoptera); site of infection: midgut.

**Distribution**: India: West Bengal (Nadia district).
160. *Leidyana oryzaephili* Roy


*Diagnosis*: Trophozoite 44-70 μm × 35-57 μm, epimerite agranular, 4-13 μm X 22-26 μm, protomerite hemispherical with irregular anterior margin, deutomerite triangular; sporadin solitary, 56-116 μm; gametocyst small, spherical, 55-75 μm in diameter, dehiscing through five sporoducts; spores barrel-shaped, 6 μm × 4 μm, extruded in long chains.

*Host*: *Oryzaephilus mercator* F. [Insecta : Coleoptera]; site of infection : intestine.

*Distribution*: India : West Bengal (Calcutta district).

Family  AMPHIPLATYSPORIDAE

Genus  *Amphiplatyspora* Kundu and Haldar

*Diagnosis*: Trophozoite without epimerite, sporadins solitary, gametocysts ovoidal with a prominent ectocysts, spores cylindrical extruded in chains.

161. *Amphiplatyspora striata* Kundu and Haldar


*Diagnosis*: Trophozoite without an epimerite; sporadins 115.0- 415.0 (277.5) μm, solitary with protomerite and deutomerite characterised by epicyteal striations, both longitudinal and cross striations; gametocysts ovoidal with a prominent gelatinous ectocyst; spores cylindrical with polar thickenings, extruded in chains by simple rupture of the cyst.

*Host*: *Pteronemobius concolor* (Wlk.), [Insecta : Orthoptera], site of infection : midgut.

*Distribution*: India : West Bengal (Nadia district).

Family  MONODUCTIDAE

Key to the genera

1 (2) Epimerite lacking or a hyaline body, sporadins biassociative, gametocysts with ectocysts.................................................................*Phleobum*

2 (1) Epimerite a small elevations with prons attached to its base sporonts solitary or in association, gametocysts without ectocysts ..............................................*Monoductus*

Genus  *Monoductus* Ray and Chakravarty

162. *Monoductus lunatus* Ray and Chakravarty


*Diagnosis*: Trophozoite elongated, 225-445 μm × 33-49 μm; epimerite knob-like with 12-16 stiff radiating processes at its neck; protomerite small, more or less conical; deutomerite elongated cylindrical; sporonts solitary or associative; gametocysts spherical, 225-230 μm in diameter; sporocysts compressed, truncated at one pole; a single spore-duct releasing sporocysts in a long chain.
Host: *Stronglysoma contortipes* Attems [Arthropoda: Diplopoda]; site of infection: alimentary canal.

Distribution: India: West Bengal (Calcutta district).

Genus *Phleobum* Haldar and Chakravarty

Key to species

1 (2) Epimerite absent, deutomerite cylindrical with epicyleal striations ........... *P. gigantinum*

2 (1) Epimerite spherical and hyaline, deutomerite elongated, ovoidal to cylindrical, without any epicyleal striations ................................................. *P. collarum*

163. *Phleobum collarum* Kundu and Haldar


Diagnosis: Trophozoites 147.5-474.8 μm × 50.0 - 133.2 μm in dimensions; epimerite spherical, hyaline and knob-like; protomerite collar-like, subspherical to rectangular; deutomerite elongated; nucleus spherical to elliptical; sporadins cylindrical, associating caudofrontally in pairs; satellite smaller or larger than primite; gametocysthi descing through a pore at one corner of the cyst wall liberating outside encased within a transparent mucoid covering; spores ovoidal, 7.7 μm × 4.4 μm.

Host: *Phleoba infumata* Bruner (Insecta: Orthoptera); site of infection: midgut and hepatic caeca.

Distribution: India: West Bengal (Nadia district).

164. *Phleobum gigantinum* Haldar and Chakravarty


Diagnosis: Trophozoites 230.0 - 620.0 μm in length; epimerite absent, deutomerite cylindrical, pallicle well developed with epicyleal striations; nucleus spherical, 50.0 μm in diameter, with several karyospme. Sporadin biassociative, satellite always larger than primite. Gametocyst spherical, 520-600 μm in diameter, dehiscing through a single enormous-sized sporoduct of 2.7 μm long; spores ovoidal 6 μm × 4 μm.

Host: *Phleoba anttenatta* Bruner. (Insecta: Orthoptera); site of infection: midgut.

Distribution: India: West Bengal (Nadia District).

Family DACTYLOPHORIDAE

Genus *Grebneckiella* Bhatia

Diagnosis: Protomerite spread out transversely with numerous delicate rhizoids, made up of two long narrow horizontal lobes, fused and turned up spirally at one end, peripheral portion with several teeth form long filaments projecting out.
165. *Grebneckiella navilliae* (Mitra and Chakravarty)


**Diagnosis:** Sporonts solitary, 819-975 μm × 97-190 μm; gametocyst oval 125-175 μm × 95-125 μm in dimension; sporocysts spherical to oval, with two envelopes; liberated in chains (detail description lacking).

_Host:_ *Scolopendra S.* [Arthropoda: Chilopoda]; site of infection: Intestine.

_Distribution:_ India: West Bengal (Calcutta District).

**Remarks:** The species was originally described as *Nina navilliae* by Mitra and Chakravarty (1937). The genus *Nina* Grebnecki, 1873 is preoccupied for a molluscan genus *Nina* G.E. gray, 1850. Hence Bhatia (1938) erected the genus *Grebnekiella* and renamed it as *G. navillae*. The species needs redescription.

**Family** STYLOCEPHALIDAE

**Key to genera**

1(2) Epimerite elongated into a neck, swollen posteriorly at its free end, oocysts purse-like... .............................................................. _Stylocephalus_

2(1) Epimerite elongated into a neck but then turning into a simple knob, oocysts void or ellipsoidal............................... _Lepismatophila_

**Genus** _Stylocephalus_ Ellis

166. _Stylocephalus apapillatus_ Haldar and Chakravarty


**Diagnosis:** Trophozoites 60.0 -200.0 μm, elongated; epimerite tube-like; protomerite subconical to quadriangular; deutomerite, elongated, circular in cross section and with epicystal striations; sporadins 95-201 μm, solitary, associated by their anterior ends. Gametocyst round or oval; spores hat-shaped, liberation in chain; sporozoite boat shaped, early development intracellular.

_Host:_ *Gonocephalum* sp. [Insecta: Coleoptera]; site of infection: midgut.

_Distribution:_ India: West Bengal (Nadia district).

**Genus** _Lepismatophila_ Adams and Travis

**Key to the species**

1 (2) Epimerite sub-globular, protomerite elliptical or conical, deutomerite elongated..........

............................................................................................................................................. _L. cruszi_

2 (1) Epimerite rhomboidal, protomerite hemispherical or subconical, broadest at the base, deutomerite cone-shaped................................................................._L. rhombocephala_
167. *Lepismatophila cruszi* Kundu and Haldar


*Diagnosis*: Trophozoite 36.1 - 150.0 (84.8) μm, with subglobular epimerite, elliptical or conical protomerite and an elongated deutomerite; sporadin 95.0 - 290.0 (185.6) μm, solitary, associating side-wise; gametocyst bean-shaped; spore boat-shaped.

*Host*: *Acrotelsa collaris* (Fabricius) [Insecta: Thysanura]; site of infection; midgut and ventricular caeca.

*Distribution*: India: West Bengal (Nadia district).

168. *Lepismatophila rhombocephala* Haldar and Chakravarty


*Diagnosis*: Trophozoites 77.5 - 155.0 μm (125.8) μm × 57.5 - 117.5 (85.5) μm in dimensions; epimerites rhomboidal, apical sides slightly elevated and a notch in the middle; protomerite hemispherical or subconical, broadest at the base; deutomerite cone-shaped, ending in a rounded extremity; nucleus 20-25 μm in diameter, located centrally. sporadins solitary; gametocysts egg-shaped, 160 × 110 μm; delicate cyst wall enclosing two unequal gametocytes; simples rupture liberating spores in spiral chains; spores ellipsoidal, 14 μm × 5 μm.

*Host*: *Ctenolepisma nigra* (Qudamans), [Insecta: Thysanura]; site of infection: ventricular caeca and midgut.

*Distribution*: India: West Bengal (Nadia District).

**Family** ACTINOCEPHALIDAE

**Key to the genera**

1(13) Oocyst with spines or thickening at their poles.................................................................

2(5) Oocyst with 2 spines at each poles........................................................................................

3(4) Oocysts ovoid with 2 very long spines at each pole................................. *Quadruspinospora*

4(3) Oocyst biconical, bent in the middle, with 2 sharp, stout spines at each end..............

............................................................... *Tetractinospora*

5(2) Oocyst with more than 4 spines of various arrangements..............................................

6(9) Oocysts with 6 equatorial bristles........................................................................................

7(8) Epimerite composed of a head furnished with flexible and rigid appendages forming hooks, oocyst biconical with polar tuft and 6 equatorial bristles......... *Ancyrophora*

8(7) Epimerite disc-like, with many upward projecting process at its periphery, oocysts biconical, with one row of polar spines and a row of 6 equatorial spines ..... *Remicephalus*

9(6) Oocysts without 6 equatorial bristles.......................................................................................
10(11) Oocysts diamond-shaped with polar and meridional spines..........................*Mukundaella*

12(11) Oocyst biconical or ellipsoidal, with equatorial spines and terminal tufts .......................................................... *Ichthinospora*

13(1) Oocysts without any spine or thickening at their pole.............................................................

14(20) Epimerite a large cup bordered with hooks...........................................................................

16(17) Epimerite hat-shaped, with petaloid spines on the margin .................. *Odonaticola*

17(16) Epimerite of different shape and without petaloid spines...........................

18(19) Epimerite terminating by a couple bordered by hooks, oocysts bent banana-shaped ......................................................................................................... *Menspora*

19(18) Epimerite terminating in a flattened bulb bordered by digitations anteriorly ........

20(14) Epimerite of different shape........................................................................................................

21(22) Epimerite a sharply pointed process, ordinarily recurved in a long, hyaline point very sharp at its end ................................................................................... *Stylocystis*

22(21) Epimerite not pointed or recurved as above...........................................................................

23(24) Epimerite not pointed dialated into a cauliflower at the top and narrow at the base .

24(23) Epimerite not resembling cauliflower............................................................................................

25(30) Epimerite with simple or digitiform process.............................................................................

26(27) Digitiform epimerite later changing into a flattened structure .................. *Steinina*

27(26) Epimerite not changing into such flattened structures .................................................................

28(29) Epimerite simple or with non-persistent digitiform process, parasitic in Chilopoda .

29(28) Epimerite with 8-16 or more digitiform processes at its apex, but such processes subsequently disappear, parasitic in insects ........................................ *Actinocephalus*

30(25) Epimerite globuler, bowl-shaped or a crenulate crateriform disc........................................

31(32) Epimerite highly complex, bowl-like with a bulb-like round base........ *Harendraia*

32(31) Epimerite not bowl-like................................................................................................................

33(34) Epimerite a crenulate crateriform disc with or without hooks at its periphery, with a style in the centre.............. *Pyxinia*

34(33) Epimerite globular having 6-8 broad vertical ridges set upon a short, thick-walled neck, with a dilated base .............................................................. *Crucocephalus*
Genus *Actinocephalus* Stein

Key to the species

1 (2) Epimerite with 9 slightly backwardly directed pointed process, protomerite conical, deutomerite elongated tapering posteriorly .............................................. *A. ellipsoides*

2 (1) Epimerite with 16 or more laterally directed digitiform processes, protomerite subspherical, broader than long, deutomerite circular in cross-section .... *A. ceriagrionae*

169. *Actinocephalus ceriagrionae* Sarkar and Chakravarty


*Diagnosis*: Trophozoites solitary, elongated, 117-258 μm × 35-100 μm in dimension; epimerite short and stout, with a proximal stout, cylindrical, retractile neck and a distal large, simple, spherical knob possessing 16 or more, laterally directed digitiform processes; protomerite subspherical, broader than long, deutomerite circular in cross-section, broadest at the anterior one-third of the body; sporadins large, elongated, measuring about 1 μm in length; gametocysts, almost spherical, 2.84 μm × 4.28 μm, a button-like hyaline tip at each pole of the longitudinally striated sporocysts.

*Host*: *Ceriagrion coromandelianum* (Fabr.), *Ceriagrion cerinorubellum* (Bauer) [Insecta : Coleoptera]; site of infection : midgut contents.

*Distribution*: India : West Bengal (Calcutta district).

170. *Actinocephalus ellipsoides* Sarkar and Haldar


*Diagnosis*: Trophozoites elongated, 67.8-458.3 (307) μm × 33.3- 50.0 (40.0) μm in dimension; epimerite disc-like with nine slightly backwardly directed pointed processes, neck short, protomerite conical, deutomerite elongated, tapering posteriorly; sporadin solitary, elongated; gametocyst ellipsoidal, covered by thin ectocyst; spore biconical bent in the middle, with 8 filliform sporzoites dehiscing by simple rupture; development extracelluar.

*Host*: *Ischnura delicata* Hagen (Insecta : Odonata); site of infection : midgut.

*Distribution*: India : West Bengal (Nadia district).

Genus *Caulocephalus* Batia and Setna

171. *Caulocephalus crenata* Bhatia and Setna


*Diagnosis*: Trophozoites elongated, cylindrical; epimerite dilated anteriorly, caulifolower-like with crenate surface; protomerite elongated, conical with its anterior end characteristically specialised; deutomerite cylindrical, sporonts 40-142 μm, elongated and associative; gametocysts spherical, 90 μm in diameter; sporocysts ovoid or nearly spherical.
Host: *Aulacophora foveicollis* Kust. [Insecta: Coleoptera]; site of infection: alimentary canal.

*Distribution*: India: West Bengal (Calcutta district), Punjab.

**Genus** *Pyxinia* Hammerschmidt

172. *Pyxinia reneae* Sarkar


*Diagnosis*: Trophozoites almost fusiform, 49.9-133.6 (96.7) μm × 10.8 -29.7 (22.5) μm; epimerite complex, differentiable into a proximal small, smooth hemisphere and a distal long ribbon on the summit; protomerite conical; deutomerite cyllindro-conical; sporadins 40.5 -194.4 (138.7) μm × 10.8 -37.8 (30.7) μm, solitary; gametocysts small, round to ovoid; sporocyst smooth, ellipsoidal released singly and in cluster by simple rupture of the gametocyst’s wall.

*Host*: *Evorinea iota* (Arrow) [Insecta: Coleoptera] from Jackfruit trees; site of infection: midgut.

*Distribution*: India: West Bengal (Murshidabad district).

**Genus** *Steirina* Leger and Duboscq

Key to the species

1 (4) Epimerite superimposed upon protomerite........................... ..............................

2 (3) Epimerite ending in a circular disc which is provided with some concentric ring-like striations.................................................. *S. alphitobiusae*

3 (2) Epimerite possessing a characteristic style.......................... *S. palorusi*

4 (1) Epimerite not superimposed upon protomerite..............................................................

5 (6) Epimerite saucer-shaped with concave surface lying on protomerite ........ *S. microgoni*

6 (5) Epimerite somewhat conical with a short or long projection ............... *S. singhi*

173. *Steinina alphitobii* Sarkar and Chakravarty emend. Levine


*Diagnosis*: Trophozoite biconical, broadest near the septum, 26- 39 μm × 14-24 μm; epimerite broad at the base, a circular disc at the apex with concentric ring-like striations and thread-like processes at the edge, protomerite diutomerite septum thin with slight constriction in this region. sporont one to pyriform; without any epimerite. Gametocysts 190-210 μm in diameter; spores spherical, 12-14 μm in diameter; sporocysts with two button-like hyaline, subconical knobs, one at each pole.

*Host*: *Alphitobius piceus* 01. (Insecta: Coleoptera); site of infection: intestine.
Distribution: India: West Bengal (Calcutta district).

174. Steinina microgoni Sarkar and Chakravarty emend. Levine


Diagnosis: Trophozoites 90-140 μm, broader at the anterior end and narrower posteriorly; epimerite saucer-shaped, furnished with fine thread-like processes at the rim; protomerite dome-shaped; a thick septum and a distinct constriction separating protomerite and deutomerite; deutomerite broader near the septum and tapers posteriorly; nucleus spherical, 22 μm in diameter, located anteriorly in the deutomerite; cysts and spores unknown.

Host: Anoplogenius microgonus Bates [Insecta: Coleoptera]; site of infection: midgut.

Distribution: India: West Bengal (Calcutta district).

175. Steinina palorusi Gupta and Haldar


Diagnosis: Trophozoites solitary, obese, 68.8-106.6 μm in length; epimerite superimposed upon the protomerite and covering more than half of the protomerite’s tip and characterised with a style; protomerite hemispherical or dome-shaped; deutomerite broadest near the septum, septum thin; nucleus ovoidal with a single endosome, located anteriorly. Sporadins solitary, 18.5-99.9 μm in length; gametocysts oval, 91.5 μm × 66.5 μm in dimension; spores, biconical and pot bellied, 12.5 μm × 9.0 μm in dimensions, button-like, hyaline, subconical knobs, one at each pole.

Host: Palorus sp. larva from wheat, [Insecta: Coleoptera]; site of infection: midgut of the host larvae.

Distribution: India: West Bengal (Nadia district).

176. Steinina singhi Ghose and Haldar


Diagnosis: Trophozoites conical; epimerite somewhat conical with a short or long projection, the style, 8.1-29.7 μm × 10.8-7.3 μm in dimension; protomerite flattened or himispherical, 13.5-29.7 μm in length and 29.7-45.9 μm in width, septum thin, deutomerite conical or oval with rounded or pointed ends, 32.4-97.2 μm × 36.5 -56.7 μm; sporadins solitary; gametocyst double walled, ellipsoidal, 39. μm × 24.9 μm in dimension; simple rupture liberating spores in chains; spores double-walled, smooth, biconical, broadest at the middle, 15.7 μm × 9.7 μm; early development intracellular.

Host: Palrous ratzebergii (Wissmann) infecting Coriandrum sativum L. [Insecta: Coleoptera]; site of infection: midgut.

Distribution: India: West Bengal (Hugli district).
Genus *Stylocystis* Leger

177. *Stylocystis chowdhurya* Sarkar and Mazumder.


*Diagnosis*: Trophozoites fusiform to elongate, 70.2-203.4 (104.6) μm × 13.5 - 43.2 (20.1) μm, epimerite long, filamentous, sharply pointed anterior end and a small conical or bulb-like swelling at the base; protomerite dome-shaped; deutomerite elongated and narrowed posteriorly; sporadin solitary, 196.0 - 252.2 (231.0) μm × 32.7 - 63.0 (54.6) μm; gametocyst ovoidal; spore smooth, diamond-shaped with truncated ends, liberated by simple rupture.

*Host*: *Crytophagus* sp. [Insecta : Coleoptera] from Jajube trees (*Ziziphus jujuba*); site of infection: midget and hindgut.

*Distribution*: India : West Bengal (Exact locality not mentioned).

Genus *Chilogregarina* Levine

178. *Chilogregarina bhatiae* Sarkar


*Diagnosis*: Trophozoites flat, leaf-like and elongated, dimension 226 μm × 28 μm; epimerite nonpersistent, discoid with 8 digitiform processes; neck of moderate-size; protomerite ellipsoidal; deutomerite elongated, gradually tapered posteriorly to bluntly pointed end; sporadin 198 μm × 25 μm, solitary, leafy and elongated with inverted cup-like protomerite, highly serrated posteriorly.

*Host*: *Geophius* sp. (Arthropoda : Chilopoda); site of infection: midgut.

*Distribution*: India : West Bengal (Hugli District).

Genus *Crucocephalus* Sarkar

179. *Crucocephalus dufouri* Sarkar


*Diagnosis*: Trophozoites cylindrical, 36.7-88.8 μm × 17.2-31.7 μm in dimension; epimerite globular with 6-8 broad vertical ridges; neck short, thick walled with dialated base; protomerite dome-shaped; deutomerite oblong; sporadin solitary, fusiform to cylindro-conical, 18.7-262.8 μm × 5.6-62.4 μm in dimension; gametocytes spherical, dehiscing by simple rupture; sporocytes biconical with sharply pointed ends.

*Host*: Larvae of *Dermestes* sp. [Insecta : Coleoptera]; site of infection: midgut (anterior portion).

*Distribution*: India : West Bengal (North 24-Parganas district).

Genus *Harendraia* Sarkar

180. *Harendraia intricata* Sarkar


*Diagnosis*: Trophozoites ovoid or almost fusiform, 87.3-246.3 μm × 20.0-83.5 μm, epimerite
long bowl-like round base, elongated neck and truncated apex beset with 4 short, slender, symmetrically arranged filamentous spines; neck between epimerite and protomerite short and broad; protomerite dome-shaped; deutomerite ovoid or cylindrical, sporadins solitary and cylindrical, 31.2-334.0 μm × 12.5-104.4 μm; gametocysts spherical dehiscing by simple rupture; sporocysts ellipsoidal released in lateral chains.

**Host**: *Ptinus* sp. [Insecta: Coleoptera]; site of infection: midgut.

**Distribution**: India: West Bengal (North 24-Parganas district).

**Genus** *Acanthospora* Leger

181. *Acanthospora bengalensis* Sarkar and Haldar


**Diagnosis**: Trophozoites elongated, 176.4-758.5 (410) μm, epimerite bulb-like; protomerite conical; deutomerite long, cylindrical, sporadins large, solitary, 291.4 - 913.7 (546.2) μm; gametocyst spherical; gametocytes equal in size; spore spindle-shaped, hexagonal with polar and meridional spines; development intracellular.

**Host**: *Ceriagrion cerinorubellum* (Braner) [Insecta: Odonata]; site of infection: midgut.

**Distribution**: India: West Bengal (Hugli District).

**Genus** *Ancyrophora* Leger

**Key to the species**

1 (2) Epidermite globular with 12 short digitiform processes, spore with polar and equatorial spines .......................................................... *A. ischnurae*

2 (1) Epidermite disc-like with 10-11 radiating digitiform processes, spore with polar and meridional spines .......................................................... *A. ovoides*

182. *Ancyrophora ischnurae* Sarkar and Haldar


**Diagnosis**: Trophozoite elongated, 63.0 - 218.4 (124.8) μm; epimerite globular with 12 short digitiform processes; protomerite dome-shaped with a long neck; deutomerite cylindro-conical; sporadins solitary, 175.3 - 784.9 (449.5) μm; gametocyst spherical, occasionally with hyaline ectocyst; spore spindle-shaped, hexagonal with polar and equatorial spines.

**Host**: *Ischnura senegalensis* (Rambur) [Insecta: Odonata]; site of infection: midgut.

**Distribution**: India: West Bengal (Hugli district).

183. *Ancyrophora ovoides* Sarkar and Haldar


**Diagnosis**: Trophozoites 183.3-542.7 (309.8) μm, elongated epimerite disc-like with 10
to 11 radiating digitiform processes; protomerite small, conical or tomb-like; deutomerite elongated, cylindro-conical; sporadin 84.8-916.8 (415.3) µm, solitary with a large, almost rectangular protomerite; gametocyst ovoidal; spore small, spindle shaped with polar and meridional spines.

*Host*: *Ischnura delicata* Hagen (*Insecta*: Odonata); site of infection: midgut.

*Distribution*: India: West Bengal (North 24-Paragans district).

**Genus** *Ramicephalus* Obata

184. *Ramicephalus olivacus* Sarkar and Haldar


*Diagnosis*: Trophozoites 58.8 - 411.6 (212.9) µm, elongated epimerite cylindroglobular, differentiated into an upper hyaline, elevated, circular disc with 15 to 20 peripherally arranged sharply pointed spines and a lower cylindrical longitudinally straited part; protomerite hemispherical; deutomerite cylindrical; sporadin 112.0 µm, solitary; gametocyst spherical with two layers of ectocysts; spore spindle shaped with shorter polar and longer equatorial spines.

*Host*: *Ceriagrion olivacum* Laidlow (*Insecta*: Odonata); site of infection: midgut.

*Distribution*: India: West Bengal (Hugli district).

**Genus** *Quadruspinospora* Sarkar and Chakravarty

**Key to species**

1(2) Gametocyst with a distinct ectocyst, epimerite with 25-30 dichotomously branched digitiform processes, spores barrel-shaped .................................................. *Q. dichotoma*

2(1) Gametocyst without ectocyst, epimerite with less than 25 digitiform processes, spores oval.................................................................

3(6) Protomerite rhomboidal.................................................................

4(5) Epimerite with 10-23 digitiform processes, trophozoite 140- 600 µm in length........

5(4) Epimerite with 12-14 digitiform processes, trophozoite 92-290 µm in length........

6(3) Protomerite hemispherical or dome-shaped...................................

7(8) Epimerite with 20-24 digitiform processes .............................*Q. chakravartyi*

8(7) Epimerite with less than 20 digitiform processes........................

9(10) Deutomerite broadest behind septum with epicyteal longitudinal striations........*Q. aelopii*.

10(9) Deutomerite of different shape and without any epicyteal striations....................

11(12) Deutomerite with broad posterior end, epimerite with 13-16 digitiform processes........

 ................................................................. *Q. megaspinosa*
12(11) Deutomerite not with broad posterior end, epimerite with 10-13 digitiform processes, deutomerite elongated gradually narrowed to a rounded end ...............

185. *Quadruspinospora acridae* Haldar and Chakravarty


*Diagnosis*: Trophozoites 70-720 (326.1) μm, elongate, epimerite subspherical knob-like with 10-13 digitiform processes; protomerite hemispherical; deutomerite elongated gradually narrowed to a rounded end; sporadin solitary, larger than the trophozoites; gametocyst spherical to slightly oval; spore oval with four elongated spines.

*Host*: *Acrida exalta* Walker [Insecta : Orthoptera]; site of infection : hepatic caeca and midgut.

*Distribution*: India : West Bengal (Nadia district).

186. *Quadruspinospora aelopii* Sarkar and Chakravarty


*Diagnosis*: Trophozoites elongated, 92.5-290 μm in length; epimerite knob-like, 15-20 μm, with 8-12 digitiform processes; protomerite hemispherical, 15-65 μm in length, broader than long; septum thick forming a distinct constriction; deutomerite 62.5-205 μm in length, broadest behind the septum with epicuteal longitudinal striations; sporont similar to trophozoites, associate sidewise; gametocyst subspherical or spherical, 530-590 μm in diameter; simple rupture; spores oval, 8 μm × 4 μm, with two long polar spines at each pole.

*Host*: *Aelopus* sp. [Insecta : Orthoptera]; site of infection : midgut and caeca.

*Distribution*: India : West Bengal (Haora district).

187. *Quadruspinospora attractomorphae* Haldar and Chakravarty emend. Levine


*Diagnosis*: Trophozoites 92.5-290.0 μm, elongated; epimerite subspherical knob-like with 12-18 digitiform processes; protomerite rhamboidal; deutomerite elongated cylindrical; sporadin solitary; gametocyst spherical; spore oval with four long spines.

*Host*: *Attractomorpha crenulata* (Fabr.) [Insecta : Orthoptera]; site of infection : hepatic caeca and midgut.

*Distribution*: India : West Bengal (Nadia district).

188. *Quadruspinospora chakravartyei* Chakraborty and Haldar emend. Levine


*Diagnosis*: Trophozoites 52.5-457.5 μm, elongated, solitary; epimerite subspherical, knob-like, provided with 20-24 pointed digitiform processes; neck very short; protomerite more or less dome-shaped; deutomerite elongated, bluntly conical towards posterior end; sporadin solitary,
smaller in size than the trophozoite; gametocyst spherical; spore oval with two long spines at each pole.

*Host*: *Spathosternum* sp. [Insecta: Orthoptera]; site of infection: midgut and hepatic-caeca.

*Distribution*: India: West Bengal (Nadia district).

**189. Quadruspinospora dichotoma** Kundu and Haldar


*Diagnosis*: Trophozoites 89.2-250.0 (224.9) μm, elongated; epimerite subspherical, knob-like with 25 to 30 dichotomously branched digitiform processes arranged in a circular fashion; protomerite almost rectangular; deutomerite cylindro-conical in outline; sporadin 85.0-749.7 (394.5) μm, solitary or laterally associated in pairs. gametocyst almost spherical with a distinct ectocyst; spores barrel-shaped with four long spines; development intracellular.

*Host*: *Spathosternum prasiniferum prasiniferum* (Walker), [Insecta: Orthoptera]; site of infection: midgut and hepatic caeca.

*Distribution*: India: West Bengal (Nadia district).

**190. Quadruspinospora indoaiolopii** Haldar and Chakraborty emend. Levine


*Diagnosis*: Trophozoites 140-600 (350) μm, elongated, solitary epimerite sub-spherical knob-like with 10-23 short digitiform processes, protomerite somewhat rhomboidal; deutomerite elongated, circular in cross-section; sporadin solitary; gametocyst spherical; spore oval with two spines attached to each pole.

*Host*: *Aiolopus* sp. (Insecta: Orthoptera); site of infection: midgut and hepatic caeca.

*Distribution*: West Bengal (Nadia district).

**191. Quadruspinospora megaspinosa** Haldar and Chakraborty


*Diagnosis*: Trophozoites 95-630 (314.2) μm, elongated, cylindrical; epimerite spherical knob-like with 13-16 digitiform processes; neck short; protomerite hemispherical; deutomerite cylindricol with somewhat broad posterior end; sporadin solitary, larger in size; gametocyst spherical to subspherical; spore oval with 4 long spines.

*Host*: *Trilophidia annualata* Thunberg [Insecta: Orthoptera]; site of infection: hepatic caeca and midgut.

*Distribution*: India: West Bengal (Nadia district).

**Genus**: *Tetractinospora* Sarkar and Haldar

**192. Tetractinospora victoris** Sarkar and Haldar

**Diagnosis**: Trophozoites 932–312.5 (250.3) μm; elongated; epimerite globular with short neck; protomerite rectangular, deutomerite elongated, conical; sporadin 226.7–466.7 (349.5) μm, solitary; gametocyst spherical with ectocyst; spores biconical bent at the middle, with a pair of short stout spines at each pole.

**Host**: *Ceriagrion coromandelianum* (Fabricius), [Insecta : Odonata]; site of infection: midgut.

**Genus** *Mukundaella* Sarkar

193. *Mukundaella undulatus* Sarkar


**Diagnosis**: Trophozoites 348.6 μm × 50.5 μm, elongated, fusiform or cylindrical; epimerite a broad wide cup with numerous closely-set vertical undulations on its wall; neck short; protomerite conical or rectangular; deutomerite fusiform or cylindroconical sporadin large, cylindroconical, solitary; gametocysts spherical, sporulation by simple rupture; spore diamond-shaped, hexagonal in polar view, with two polar and six meridional spines.

**Host**: *Enallagma* sp. [Insecta : Odonata]; site of infection: midgut.

**Distribution**: India: West Bengal (Hugli and North 24-Parganas districts).

**Genus** *Mensopora* Leger

Key to the species

1 (2) Epimerite bell-shaped, protomerite inverted flask-like, deutomerite elongated cylindrical

.......................................................... .......................................................... *M. coenagrii*

2 (1) Epimerite cup-like, protomerite conical, deutomerite elongated fusiform

.......................................................... .......................................................... *M. enallagmae*

194. *Mensopora coenagrii* Sarkar and Haldar


**Diagnosis**: Trophozoites 194.8 μm × 31.6 μm, elongated; epimerite bell-shaped with many short backwardly directed digitiform processes; neck long; protomerite inverted flask-like, deutomerite elongated cylindrical; sporadin 262.1 μm × 55.2 μm, solitary with dome-shaped protomerite and sharply pointed deutomerite; gametocyst spherical; spore cylindro-biaconical.

**Host**: *Coenagrion dyeri* Fraser [Insecta : Odonata]; site of infection: midgut.

**Distribution**: India: West Bengal (Hugli district).

195. *Mensopora enallagmae* Sarkar and Haldar


**Diagnosis**: Trophozoite 338.9 × 63.7 μm, somewhat fusiform; epimerite cup-like beset with 32 backwardly directed digitiform processes; protomerite conical; deutomerite elongated fusiform, sporadin 321.7 μm × 68.8 μm, large, solitary; gametocysts spherical with gelatinous ectocyst; gametocyte with a triangular transparent region; spore cylindro-biaconical.
**Host**: *Enallagma pravum* Salys [Insecta: Odonata]; site of infection: midgut.

**Distribution**: India: West Bengal (Hugli district).

**Genus** *Hoplorhynchus* Carus

**Key to the species**

1 (2) Epimerite discoid with 10 radially arranged digitiform processes; protomerite tomb-shaped, deutomerite cylindro-conical..........................................................*H. carusi*

2 (1) Epimerite disc-like with 11-14 digitiform processes arranged peripherally, protomerite conical, deutomerite cylindrical..........................................................*H. ramidigitus*

196. *Hoplorhynchus carusi* Sarkar and Mazumder


**Diagnosis**: Trophozoite elongated; epimerite discoid with 10 radially arranged digitiform processes; neck long and narrow; protomerite tomb-shaped; deutomerite very long and cylindroconical; sporadin very elongated.

**Host**: *Pseudagrion decorum* (Rambur) [Insecta: Odonata]; site of infection: midgut.

**Distribution**: India: West Bengal (Darjiling district, Mahananda Reserve Forest).

197. *Hoplorhynchus ramidigitus* Sarkar and Haldar


**Diagnosis**: Trophozoite 75.0-175.0 (131.7) μm; elongated; epimerite disc-like with 11 to 14 short, stumpy, bifid or trifid, digitiform processes arranged peripherally; protomerite conical, connected with epimerite by a neck; deutomerite cylindrical sporadin 87.5-700.1 (302.0) μm, solitary; gametocyst small, spherical; spore crescentic.

**Host**: *Agriocnemis pygmaea* (Rambur) [Insecta: Odonata]; site of infection: midgut.

**Distribution**: India: West Bengal (Hugli district).

**Genus** *Odonaticola* Sarkar and Haldar

**Key to the species**

1(2) Epimerite conical with 9 petaloid spines..............................................................*O. nomacantta*

2(1) Epimerite hat or umbrella-shaped...........................................................................

3(8) Epimerite with many marginal petaloid spines.........................................................

4(7) Protomerite ovoid........................................................................................................

5(6) Deutomerite fusiform, trophozoite in an average 910.7 μm in length..............*O. elliptica*

6(5) Deutomerite oblong, trophozoite in an average 289.3 μm in length..............*O. orthetri*
7(4) Protomerite conical, (deutomerite cylinbroconical, trophozoite in an average 376.0 μm in length)..............................................................O. brachydiplaxi

8(3) Epimerite with 6-8 petaloid spines.................................................................

9(10) Trophozoite considerably long, 604.6-838.1 (743.6) μm; epimerite with 7 petaloid marginal spines...........................................................................O. longicollara

10(9) Trophozoite not so long, epimerite with 6 or 8 petaloid marginal spines.............

11(12) Epimerite with 6 petaloid spines, protomerite cylindrical, trophozoite 31.5-273.1 (88.5) μm in length ......................................................O. hexacantha

12(11) Epimerite with 8 petaloid spines, protomerite conical, trophozoite 268.8 μm in length......................................................................................O. rodgii

198. Odonaticola brachydiplaxi Sarkar and Mazumder


Diagnosis: Trophozoite 376.0 μm × 45.0 μm, elongated; epimerite umbrella-shaped with many marginal petaloid spines; neck long and narrow; protomerite almost conical; deutomerite cylinbroconical; sporadin 237.5 μm × 60.0 μm, small, solitary.

Host: Brachydiplax farinosa Kruger [Insecta: Odonata]; site of infection: midgut.

Distribution: India: West Bengal [Darjiling district], Mahananda Reserve Forest.

199. Odonaticola elliptica Sarkar


Diagnosis: Trophozoite with a small, conical umbrella-like epimerite having many small, curved spines along its margin; an ovoid protomerite and a fusiform deutomerite; neck between epimerite and protomerite broad; sporadin large, solitary; gametocyst spherical, spores boat-shaped, liberated by simple rupture of the cyst wall; trophozoite and sporadins 233.5-1700.3 (910.7) μm × 50.0-383.4 (178.5) μm in dimension.

Host: Crocothemis s. servilia (Drury) [Insecta: Odonata]; site of infection: midgut.

Distribution: India: West Bengal ( Exact locality not mentioned).

200. Odonaticola hexacantha Sarkar and Haldar


Diagnosis: Trophozoite 31.5-273.1 (88.5) μm, elongated with a very long, slender neck; epimerite hat-shaped with six distinct spines; protomerite cylindrical; deutomerite elongated; sporadin 54.2-758.5 (319.8) μm, solitary gametocyst spherical with a gelatinous ectocyst; spore boat-shaped with two short projections.

Host: Brachythemis contaminare (Fabricius) [Insecta: Odonata]; site of infection: midgut.

Distribution: India: West Bengal (Hugli district).
201. *Odonaticola lingicollara* Sarkar and Haldar


**Diagnosis**: Trophozoite exceedingly long, 604.6-838.1 (743.6) μm; epimerite hat-shaped with seven petaloid marginal spines; long neck; protomerite conical; deutomerite elongated; sporadin 146.0-1467.8 (741.8) μm, solitary; gametocyst spherical with thin cyst wall; spore boat-shaped.

**Host**: *Diplacodes trivialis* (Rambur) [Insecta: Odonata]; site of infection: midgut.

**Distribution**: India : West Bengal (Hugli district).

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202. *Odonaticola nonacantha* (Devdhar and Deshpande)


**Diagnosis**: Trophozoite elongated; epimerite conical with nine petaloid spines along its margin and a long neck; protomerite dome-shaped and deutomerite cylindroconical; sporadin solitary; gametocyst spherical with ectocyst; spore boat-shaped released mostly in clusters and a few singly by simple rupture.

**Host**: *Agriocnemis* sp.; (Insecta: Odonata); site of infection : midgut.

**Distribution**: India : West Bengal (Hugli district); Karnataka.

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203. *Odonaticola orthetri* Sarkar and Haldar


**Diagnosis**: Trophozoite 241.6-337.0 (289.3) μm, elongated; epimerite hat-shaped having umbrel-la like peripheral margin with several sharp spines; long neck; protomerite ovoidal and deutomerite oblong; sporadin 75.0-950.2 (564.9) μm, solitary; gametocyst large, spherical with gelatinous hyaline ectocyst; spore boat-shaped; development extracellular.

**Host**: *Orthetrium sabina* (Drury) [Insecta : Odonata]; site of infection : midgut.

**Distribution**: India : West Bengal (Hugli district).

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204. *Odonaticola rodgii* Sarkar and Haldar


**Diagnosis**: Trophozoite 268.8 μm, elongated, fusiform; epimerite hat-shaped with eight petaloid spines; neck long; protomerite conical; deutomerite cylindroconical with pointed posterior end; sporadin 239.9-1624.5 (693.5) μm, solitary, gametocysts spherical with thick hyaline gelatinous ectocyst; spore boat-shaped; development extracellular.

**Host**: *Neurothemis t. tullia* (Drury) (Insecta : Odonata); site of infection : midgut.

**Distribution**: India : West Bengal (Nadia district).

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Family CEPHALOIDOPHORIDAE

Genus *Cephaloidophora* Mavrodiadi

**Diagnosis**: Epimerite small, lenticular, oocysts ellipsoidal or spherical, with an inconspicuous equatorial ring.
205. **Cephaloidophora metaplaxi** (Pearse)


**Diagnosis**: Trophozoite somewhat flattened; epimerite nearly spherical; protomerite wider than long; deutomerite almost rectangular, with rounded angles; nucleus ellipsoidal; Sporonts 40-60 \(\mu m\) \(\times\) 18-20 \(\mu m\) in dimension.

**Host**: *Metaplax dentipes* Heller [Crustacea : Brachyura]; site of infection: intestine.

**Distribution**: India: West Bengal (South 24-Parganas district).

**Family** BRUSTIOSPORIDAE

**Genus** *Brustiospora* Kundu and Haldar

**Diagnosis**: As for the family (see Key to the family).

206. **Brustiospora indicola** Kundu and Haldar


**Diagnosis**: Trophozoites cylindrical, 69.2-131.7 \(\mu m\) \(\times\) 11.7-17.0 \(\mu m\); epimerite a broom-stick or spatulated or bilobed elevation provided with bristles; a short or moderately long neck; protomerite cylindrical, conical or hemispherical; deutomerite cylindrical, broadest just behind the septum; sporadins solitary; gametocysts elliptical or egg-shaped, 106.2 \(\mu m\) \(\times\) 63.7 \(\mu m\) to 131.7 \(\mu m\) \(\times\) 76.5 \(\mu m\); single rupture releasing spores in chains; spores spherical, 3.8 \(\mu m\) in diameter, beset with brushy border.

**Host**: *Stathorus* sp. [Insecta : Coleoptera]; site of infection: midgut.

**Distribution**: India: West Bengal (Nadia district).

**Subclass** COCCIDIA

**Order** EUCOCCIDA

Key to the families

1(2) Heteroxenous producing oocysts following syngamy (oocysts with two sporocysts, each with four sporozoites)........................................................................................................SARCOCYSTIDAE

2(1) Homoxenous or heteroxenous, development without syngamy.................................................................

3(6) Macrogamete and microgamont usually associated in syzygy during development, microgamont producing 1-4 microgametes...................................................

4(5) Zygote inactive, life cycle involving one host, chiefly in invertebrates ..........ADELEIDAE

5(4) Zygote active (ookinete), life cycle involving two hosts, one vertebrate and other in invertebrate (leech).......................................................................................HAEMOGREGARINIDAE

6(3) Macrogamete and microgamont develop independently, syzygy absent, microgamont
Sporozoite typically enclosed in sporocyst within oocyst, zygote non-motile.

Homoxenous, merogony and gamogony within hosts, sporogony typically outside, sporozoites never in blood cells.

Heteroxenous or homoxenous with merogony, gamogony and sporogony in same vertebrate host, sporozoites in blood cells.

Parasite having a sexual phase in the mosquito and asexual cycle in tissue and blood cells of the vertebrate hosts, distinguished by erythrocytic schizogony.

Parasite having a sexual phase in insects other than mosquitoes and asexual cycle in tissue cells of vertebrate host, erythrocytic schizogony lacking.

Pigmented gametocytes in erythrocytes of vertebrate hosts.

Gametocytes in erythrocytes/leucocytes of vertebrate host, usually non-pigmented and occasionally pseudo-pigmented.

Family ADELEIDAE

Genus Adelina Hesse

Diagnosis: Oocysts spherical or subspherical with thick wall, with 3-20 spherical or ellipsoidal sporocysts, each with two sporozoites.

207. Adelina schellacki Ray and Das Gupta


Diagnosis: Oocysts oval, octosporoblastic, without residue; sporoblasts spherical with two sporozoites.

Host: Cormocephalus dentipes Poc. [Arthropoda: Chilopoda]; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

Family HAEMOGREGARINIDAE

Key to the genera

1(2) Oocysts with 8 or more naked sporozoites, infection of vertebrate host by bite of invertebrate, schizogony occurring in erythrocytes of vertebrates...Haemogregarina

2(1) Oocysts enormous with n sporocysts, each with 4 to 16 or more sporozoites, infection of vertebrate host by ingestion of invertebrate host, schizogony occurring in the cells of liver, spleen and other organs of vertebrate...Hepatozoon
Genus *Haemogregarina* Danilewsky

In all 20 species including 6 undertermined ones of the genus *Haemogregarina* have been reported so far from West Bengal. Out of these one species is found from fish host, 10 including one unidentified species from amphibian hosts and 9 including 5 undetermined species from reptilian hosts. Host-wise key to the species of *Haemogregarina* is given below for the convenience of identification.

**A. Key to the species of *Haemogregarina* of fishes**

The key is not given since a single species is known from this state and dealt with under its systematic account.

**B. Key to the species of *haemogregarina* from amphibians**

1(12) Both capsule and polar cap or either of these two present ..............................................

2(7) Both capsule and polar cap present..........................................................................................

3(4) Mature macrogametocyte sausage-shaped; (measuring 14.4 μm × 2.95 μm with an average area of 28.95 μm², occupying about 25.97% of the total host cell-parasite complex) .............................................................. *H. nucleobiscecanes*

4(3) Mature macrogametocyte elongated with both ends, rounded or sometimes posterior end attenuated to form hook-like structure........................................................................ *H. kaloulae*

5(6) Macrogametocyte measuring 15.3 μm × 3.9 μm with an average area of 50.7 μm², occupying 44.2% of the total host cell-parasite complex ........................................ *H. systoma*

6(5) Either capsule or polar cap present.........................................................................................

7(2) Polar cap present but capsule absent (mature macrogametocyte measuring 16.5 μm X 3.3 μm with an area of 40.5 μm² occupying about 38.4% of the total host cell-parasite complex) .................................................. *H. maculatus*

8(9) Mature macrogametocyte measuring 16.0 μm X 3.8 μm with an area of 29.56 μm², occupying about 29% of host cell-parasite complex, cytoplasm homogeneous, scanty granular at anterior end............................................................... *H. berestineffi*

9(8) Capsule present but polar cap absent......................................................................................

10(11) Mature macrogametocyte measuring 16.0 μm X 3.8 μm with an area of 29.0 μm², occupying about 28.7% of total host cell-parasite complex; cytoplasm densely granular in the middle near nucleus and lighter towards the poles................................. *H. pattoni*

11(10) Both capsule and polar cap absent......................................................................................

12(1) Mature macrogametocyte always encircling the host cell-nucleus by it twisted body or sometime super imposed with host cell nucleus......................................................... *H. perinucleophilum*
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14(13) Mature macrogametocyte not encircling the host cell nucleus as above.

15(16) Macrogametocyte measuring 12.4 μm × 4.06 μm with an average area of 44.5 μm², occupying about 42.7% of the total host cell-parasite complex. H. magna

16(15) Macrogametocyte measuring 15.41 μm × 3.0 μm with an average area of 32.53 μm², occupying 33.4% of the total host cell-parasite complex. H. pulchra

C. Key to the species of Haemogregarina from reptiles

1 (2) Parasitic in snakes (macrogametocyte elongated slightly curved, 12 μm in length, nucleus located near anterior pole). H. mirabilis

2 (1) Parasitic in turtles.

3 (6) Macrogametocyte elongated or broadly-elongated.

4 (5) Macrogametocyte elongated, slightly curved with both ends equally blunt, measuring 8.5 μm × 3.5 μm, nucleus oval or rounded and centrally located. H. choudhuryi

5 (4) Macrogametocyte broad-elongated with two ends equally blunt measuring 9.6 μm × 4.8 μm, nucleus ribbon-like, located centrally. H. gangetica

6 (3) Macrogametocyte broadly oval or sometimes reniform, measuring 7.5-13.5 μm × 2.5-6.5 μm. H. xaveri

A. Haemogregarina of fishes

208. Haemogregarina colisa Mandal, Ray, Sarkar and Kahali


Diagnosis: Mature forms broad, bean-shaped with both ends rounded, measuring 8.53 μm × 2.36 μm; nucleus rounded or bean-shaped and located at the middle.

Host: Colisa fasciatus, site of infection: blood

Distribution: India: West Bengal (South 24-Parganas district).

B. Haemogregarina of amphibians

209. Haemogregarina berestneffi Castellani and Willey


Diagnosis: Gametocyte typically elongate and straight, anterior end more or less rounded and narrower and posterior end pointed, measuring 16.5 μm × 2.57 μm with an average 29.56 μm²; cytoplasm homogeneous, scanty granular at the anterior end; nucleus rounded, oval or irregular shaped measuring 2.85 μm × 2.19 μm with an average area about 5.13 μm², situated centrally or a little below towards the posterior end.
Host: *Rana cyanophlyctis* Schneider, *R. limnocharis* Wiegmann and *R. tignina* Daudin; site of infection: blood.

Distribution: India: West Bengal (Bankura, Darjiling and Murshidabad district); Maharashtra, Tamil Nadu.

210. **Haemogregarina kalouiae** Ray and Choudhury


Diagnosis: Gametocyte elongated with both ends rounded, measuring 16.02 μm × 3.65 μm with an area of 43.22 μm²; cytoplasm granular, more dense towards the poles, giving rise to cap-like structure measuring 3.75 μm × 2.87 μm and area of 8.75 μm²; nucleus rounded to oval, triangular or band-shaped, measuring 3.9 μm × 2.06 μm with a mean area of 6.12 μm², usually situated at the anterior end.

Host: *Kaloula pulchra taprobanica* Parker; site of infection: blood.

Distribution: India: West Bengal (Bankura and Murshidabad districts).

211. **Haemogregarina maculatus** Ray and Choudhury


Diagnosis: Gametocyte elongated to club-shaped having broader anterior end with a neck-like constriction and the attenuated end possessing a plug like structure, measuring 16.5 μm × 3.3 μm with an area of 40.5 μm²; cytoplasm granular; nucleus rhomboidal or rounded, situated on the broader anterior half, measuring 2.4 μm × 2.1 μm with an average area of 4.4 μm² and containing chromatin granules.

Host: *Rhacophorus maculatus* (Gray); site of infection: blood.

Distribution: India: West Bengal (Bankura district).

212. **Haemogregarina magna** (Grassi & Feletti)


Diagnosis: Gametocyte elongated having broadly rounded anterior end and narrower posteriorly, measuring 12.4 μm × 4.06 μm with an average area 44.5 μm²; cytoplasm homogeneous, hyaline, a little granular; broad to oval nucleus sometimes rounded or band-shaped, situated centrally or towards the broader end, measuring 4.4 μm × 3.3 μm with an area about 12.1 μm².

Host: *Rana limnocharis* and *R. tigrina*; site of infection: blood.

Distribution: India: West Bengal (Bankura and Jalpaiguri districts).
213. **Haemogregarina nucleobisecans** Shortt


*Diagnosis:* Gametocyte sausage-shaped, slightly curved with anterior end regular, rounded and broad, posterior end slightly bent or hook-like or attenuated, measuring 14.4 μm x 2.95 μm with an average area 28.95 μm²; nucleus rounded, oval, band-shaped or triangular or irregular in outline, measuring 3.25 μm x 1.95 μm with a mean area of 5.18 μm², situated centrally containing a close network of granules and with no karyosome; parasite enveloped in a pink coloured, thick capsule measuring 15.17 μm x 3.7 μm with an area of 31.84 μm²

*Host:* *Bufo melanostictus* and *B. andersoni*; site of infection: blood.

*Distribution:* India: West Bengal (Bankura, Maldah, Puruliya and South 24-Parganas districts); Delhi, Punjab.

214. **Haemogregarina pattoni** Ray and Choudhury


*Diagnosis:* Gametocyte elongated with broader, rounded anterior end and attenuated posterior end; measuring 16 μm x 3.8 μm with an area of 29.0 μm²; cytoplasm densely granular in the middle; nucleus oval to round situated almost in the middle, measuring 3.5 μm x 2.5 μm with an area of 7.0 μm², containing compactly arranged chromatin granules; capped form elongated measuring 9.7 μm x 4.93 μm with an area of 33.05 μm²; capsule in different developmental phases measuring 6.0 μm x 1.25 μm with an area of 5.15 μm²

*Host:* *Rana hexadactyla*; site of infection: blood.

*Distribution:* India: West Bengal (Medinipur district).

215. **Haemogregarina perinucleophilum** Ray


*Diagnosis:* Gametocyte elongated, gregarine form having a broader head, attenuated thin body and hook-like pointed tail; measuring 11.1 μm x 3.1 μm with an average area of 25.7 μm², the larger one measuring 18.5 μm x 4.0 μm with an area of 37.5 μm²; cytoplasm densely granular. Nucleus oval, kidney-shaped, sometimes tubular, situated on the anterior half of the body, measuring 3.4 μm x 2.2 μm with an area of 6.0 μm², containing less compact chromatin granules.

*Host:* *Rana tigrina*; site of infection: blood.

*Distribution:* India: West Bengal (Bankura district).

216. **Haemogregarina pulchara** Ray and Choudhury


Diagnosis: Gametocyte elongated, measuring 15.41 μm × 3.0 μm with an area of 32.53 μm²; anterior end broad and rounded, posterior end attenuated; cytoplasm hyaline, homogeneous, more granulated towards the broader anterior end; nucleus rounded or oval, sometimes elongated measuring 2.3 μm × 1.75 μm with an area of 1.55 μm², situated centrally or subcentrally, chromatin granules compactly arranged; broad form measuring 15.5 μm × 4.0 μm with an area of 44.0 μm².

Host: Kaloula pulchara Gray; site of infection: blood.

Distribution: India: West Bengal (Puruliya district).

217. Haemogregarina systoma Ray and Choudhury


Diagnosis: Gametocyte elongated with both the ends rounded, measuring 15.3 μm × 3.9 μm with an average area of 50.7 μm²; cytoplasm homogeneous and coarsely granular, polar caps visible; nucleus rounded, oval on triangular, measuring 6.2 μm² in area, situated at the centre and containing a large number of chromatin granules.

Host: Uperodon systoma Schneider; site of infection: blood.

Distribution: India: West Bengal (Puruliya district).

218. Haemogregarina sp.

Host: Bufo himalayanus Gunther.

Distribution: India: West Bengal (Darjiling district).

Remarks: Sinha (1979) reported the occurrence of this unnamed species from the blood smear of aforesaid host.

C. Haemogregarina of reptiles

219. Haemogregarina choudhuryi Ray and Bhattacharjee


Diagnosis: Mature gamont bean-shaped, 8.0 μm × 2.5 μm with an average area of 18.7 μm²; microgamonts Kidney or bean-shaped with a few metachromatic granules, measuring 8.5 μm × 2.0 μm with an average area of 15.5 μm²; macrogamont elongated with both ends equally blunt, measuring 8.5 μm × 3.5 μm with an average area of 20.6 μm²; binucleated, tetraneucleated and hexanucleated schizonts in R.B.C. ultimately forming six merozoites; mature schizonts measuring 10.9 μm × 5.5 μm with an area of 38.5 μm²; merozoite elongated, measuring 5.7 μm × 1.0 μm; mature schizonts in the endothelial cells of lung capillaries measuring 16.5 μm × 10.0 μm and containing 20-35 developing merozoites; each merozoite measuring 4.0 μm × 1.2 μm.
Host: *Lissemys punctata punctata*; site of infection: blood.

Intermediate host: *Helobdella nociva* Harding.

Distribution: India: West Bengal (Bankura district).

220. *Haemogregarina gangetica* Misra


*Diagnosis:* Both macro and microgametocyte in R.B.C.; fully developed microgametocyte having nucleus with two band-shaped structures measuring 9.16 μm × 3.2 μm; macrogametocyte broad, elongated with both ends equally blunt, measuring 9.6 μm × 4.8 μm; nucleus ribbon-like, either compact or granular in nature; schizogony in the lung.

Host: *Trionyx gangeticus*; site of infection: blood.

Distribution: India: West Bengal (Calcutta district).

221. *Haemogregarina mirabilis* Castellani and Willey


*Diagnosis:* Macrogametocyte 12 μm in length, elongated thick gregarine-like and bent, cytoplasm staining uniformly blue; nucleus reddish blue in Romanowsky's stain.

Host: *Natrix piscator*; site of infection: blood.

Distribution: India: West Bengal (Koch Bihar district).

222. *Haemogregarina xaveri* de Mello


*Diagnosis:* Marcogametocyte broadly oval or sometimes reniform measuring 7.5-13.5 μm in length and 2.5 - 6.2 μm in width; microgametocyte elongate or vermicular measuring 9-10 μm in length and 4 μm in width; schizogony in the lungs, spleen, liver etc.; cyst sometimes having 2 or 3 schizonts and sometimes 6 or 7 schizonts in organ imprints.

Host: *Lissemys punctata*; site of infection: blood.

Distribution: India: West Bengal (South 24-Parganas) and Goa.

223. *Haemogregarina* sp.

Host: *Enhydris enhydris*; site of infection: blood.

Distribution: India: West Bengal (Nadia district).

224. *Haemogregarina* sp.

*Host*: *Mabuya carinata*; site of infection: blood  
*Distribution*: India: West Bengal (West Dinajpur district).  
*Remarks*: Tiwari and Ray (1981) reported the occurrence of this unnamed species from the blood smear of the aforesaid host.

225. *Haemogregarina* sp.

*Host*: *Hemidactylus flaviviridis*; site of infection: blood  
*Distribution*: India: West Bengal (Jalpaiguri district).  
*Remarks*: As for Sl. No. 224.

226. *Haemogregarina* sp.

*Host*: *Natrix stolata*; site of infection: blood  
*Distribution*: India, West Bengal (Koch Bihar district).  
*Remarks*: As for Sl. No. 224.

227. *Haemogregarina* sp.

*Host*: *Calotes versicolor*; site of infection: blood.  
*Distribution*: India: West Bengal (Darjiling district).  
*Remarks*: As for Sl. No. 224.

Genus *Hapatozoon* Miller

228. *Hapatozoon mucosus* Sinha


*Diagnosis*: Gametocytes exhibiting two morphological types: broad or oval forms measuring 5.5 - 11 μm × 1.6 - 3.8 μm and thin or narrow forms with a broad and tapering ends, 9.7 - 16 μm × 1.4 - 2.5 μm; trophozoites in liver and lungs, 6.4 - 7.7 μm × 4.8 - 6.5 μm; macroschizonts 10 - 13 μm × 8 - 11 μm with mature macromerozoites of 3.5 - 12 μm × 1.6 - 4 μm; microschizonts 7.7 - 11 μm × 6.5 - 8.8 μm.  
*Host*: *Ptymas mucosus*; site of infection: blood.  
*Distribution*: India: West Bengal (North 24-Parganas district).

229. *Hapatozoon* sp.

*Host*: *Petranrissa magnificus*; site of infection: blood.
Distribution: India: West Bengal (Darjiling district).

Remarks: Das Gupta (1965: Trans. R. Soc. trop. Med & Hyg., 659, pp. 716-717) reported the occurrence of this unnamed species from the blood smears of the aforesaid host.

Family EIMERIIDAE

Key to the genera

1(2) Oocysts without sporocyst: ................................................................. *Tyzzeria*

2(1) Oocyst with sporocysts: ...........................................................................

3(4) Oocysts with one sporocyst; (sporocyst with 8 sporozoites): .................. *Caryospora*

4(3) Oocyst with more than one sporocyst: ....................................................

5(10) Oocyst with two sporocysts: .................................................................

6(7) Each sporocyst with four sporozoites: .................................................. *Isospora*

7(6) Each sporocyst with 8 or 16 sporozoites: .............................................

8(9) Each sporocyst with 8 sporozoites, species occurring in vertebrate hosts:  *Dorisa*

9(8) Each sporocyst with 16 sporozoites: ...................................................... *Sivatoshella*

10(5) Oocyst with 4, 8 or 16 sporocysts: .........................................................

11(14) Oocyst with 4 sporocysts: ....................................................................

12(13) Each sporocysts with 2 sporozoites: ................................................... *Eimeria*

13(12) Each sporocysts with 4 sporozoites: .................................................... *Wenyonella*

14(11) Oocyst with 8 or 16 sporocysts: .........................................................

15(16) Oocyst with 8 sporocysts and each sporocyst with 2 sporozoites: ........ *Octosporella*

16(15) Oocyst with 16 sporocysts and each sporocyst with 4 sporozoites: ........ *Pythonella*

Genus *Tyzzeria* Allen

Key to the species

1 (2) Oocyst oval, 14.48 - 17.3 μm × 9.63 - 11.5 μm in dimension: ............... *T. alleni*

2 (1) Oocyst broadly cylindrical, 20.4 - 27.6 μm × 14.0 - 20.0 μm in dimensions: ................................................................. *T chenicusae*
230. *Tyzzeria alleni* Chakravarty and Basu


*Diagnosis*: Oocysts oval with micropyle and oocystic residium, measuring 14.4 - 17.3 (16.5) μm x 9.6 - 11.5 (10.5) μm; shape index 1.56, residual mass 6.4 μm in diameter, sporozoites elongated having rounded posterior and pointed anterior ends, measuring 5.5 - 6.8 μm in length with centrally placed spherical nucleus, 2.4 μm in diameter.


*Distribution*: India: West Bengal (North 24-Parganas district).

231. *Tyzzeria chenicusae* Ray and Sarkar


*Diagnosis*: Oocyst broadly cylindrical, measuring 20.4 - 27.6 μm (24.48) μm x 14.0 - 20.4 (16.8) μm; shape index 1.5; micropyle absent; sporozoites club-shaped, 13.2 μm x 4.2 μm, usually arranged in a circular fashion around a granular mass of residual body, placed at the broader pole of the sporozoites.


*Distribution*: India: West Bengal (North 24 Parganas district).

**Genus Eimeria** Schneider

So far, 71 species of *Eimeria* has been reported from this state out of which 5 are recovered from fishes, 2 from amphibians, 14 from reptiles, 22 from birds and 28 from mammals. A host wise key to the species of *Eimeria* is given below for the convenience of identification.

A. Key to the species of *Eimeria* of fishes

1 (6) Oocyst spherical or round.................................................................

2 (3) Sporocyst elliptical with long protuberance at one end............... *E. harpodoni*

3 (2) Sporocyst pyriform without any protuberance...........................

4 (5) Wall of sporocyst provided with warts................................. *E. zygaene*

5 (4) Wall of the sporocyst not provided with warts............................ *E. glossogobii*

6 (1) Oocyst not spherical...........................................................

7 (8) Sporocyst oval with sausage-shaped sporozoites, 10.1 μm in length........ *E. southwelli*

8 (7) Sporocyst oval with elongated sporozoites, 5.5 μm in length........ *E. notopteri*

B. Key to the species of *Eimeris* of amphibians

1 (2) Oocyst spherical, measuring 8.5 - 11.0 μm in diameter........ *E. laminata*

2 (1) Oocyst oval or spherical, 15.5 - 20.2 μm x 15.5 - 18.3 μm in dimension...........
C. Key to the species of *Eimeria* of reptiles

1 (8) Oocyst spherical............................................................

2 (3) Sporocyst oval or ellipsoidal, oocyst measuring 13-15 μm............*E. bongaonensis*

3 (2) Sporocyst pyriform or spindle shaped...........................................

4 (5) Oocyst without residuum......................................................

5 (4) Oocyst with residuum................................................................

6 (7) Oocyst measuring 20 μm or more.............................................

7 (6) Oocyst below 20 μm in size..................................................

8 (1) Oocyst not spherical..............................................................

9 (1) Oocyst irregular....................................................................

10 (9) Oocyst with regular shape.....................................................

11(16) Oocyst oval, cylindrical, sub-spherical or almond-shaped...........

12(13) Oocyst with residuum............................................................

12 a. Oocyst 36 μm x 18 μm in dimension........................................

12 b. Oocyst 29-31 μm x 22.5 - 24.5 μm in dimension....................

12 c. Oocyst 23-27 μm x 17-18 μm in dimension............................

13(12) Oocyst without residuum....................................................

14(15) Sporocyst ovoid..............................................................

15(14) Sporocyst pyriform...........................................................

16(11) Oocyst of different shape....................................................

17(20) Oocyst elliptical-ellipsoidal.................................................

18(19) Sporocyst ovoid..............................................................

19(18) Sporocyst naviculoid...........................................................

20(17) Oocyst triangular or lemon-shaped........................................

21(22) Oocyst triangular, measuring 9.5 - 14.5 μm in length.............

21(22) Oocyst lemon-shaped, measuring 16.5-21.5 μm in length.........
D. Key to the species of *Eimeria* of birds

1(2) Oocyst pyriform, (19.8 - 20.9 μm in length)......................................................... *E. gallinagoi*
2(1) Oocyst not pyriform

3(26) Oocyst spherical or sub-spherical

4(11) Oocystic residuum present

5(6) Sporocyst ellipsoidal................................................................. *E. tropicalis*
6(5) Sporocyst pyriform or bean-shaped

7(10) Size of oocyst below 20 μm

8(9) Sporocyst pyriform, residual mass present at the centre........... *E. mandali*
9(8) Sporocyst bean-shaped, scantly residual mass at one end........ *E. bhutanensis*

10(7) Size of oocyst above 20 μm......................................................... *E. numeni*

11(4) Oocystic residuum absent

12(17) Sporocyst oval, ovoidal or elliptical

13(16) Sporocyst 10-13 μm in length

14(15) Oocyst 26.5-30.5 μm in length..................................................... *E. malaccae*
15(14) Oocyst 12-19.5 μm in length.................................................... *E. labbeana*

16(13) Sporocyst 22.2 - 34.2 μm in length........................................ *E. barbetta*

17(12) Sporocyst pyriform

18(19) Oocyst large, 26.5 - 38.5 in length................................................ *E. coturnicis*
19(18) Oocyst comparatively small, 13-22 μm in length

20(21) Wall of oocyst provided with warts........................................... *E. vanelli*
21(20) Wall of oocyst smooth

22(23) Oocyst with knob at micropylar end........................................ *E. dauki*
23(22) Oocyst without any micropylar knob

24(25) Oocyst subspherical, 21.2 μm x 18.3 μm in dimensions......... *E. gennaeuscus*
25(24) Oocyst spherical to sub-spherical, 15.44 μm x 13.59 μm in dimensions..... *E. gallusae*

26 (3) Oocyst elliptical or ovoidal

27(40) Oocyst oval or ovoidal

28(37) Sporocyst pyriform
29(34) Oocystic residuum present, sporocyst pyriform
30(33) Sporocyst above 10 \( \mu m \) in length
31(32) Micropyle present \( \Rightarrow \) E. tennella
32(31) Micropyle absent \( \Rightarrow \) E. roscoviensis
33(30) Sporocyst below 10 \( \mu m \) in length (7.8 - 9.8 \( \mu m \)) \( \Rightarrow \) E. charadrii
34(29) Oocystic residuum lacking
35(36) Sporocyst boat-shaped \( \Rightarrow \) E. anili
36(35) Sporocyst pyriform \( \Rightarrow \) E. bengalensis
37(26) Sporocyst ovoid or ellipsoidal
38(39) Oocyst large, 24-30 \( \mu m \) in length \( \Rightarrow \) E. kapotei
39(38) Oocyst comparatively small, 14.5 - 17.5 \( \mu m \) in length \( \Rightarrow \) E. columbae
40(27) Oocyst elliptical or ellipsoidal
41(42) Sporocyst pear-shaped, sporozoite banana-shaped \( \Rightarrow \) E. alectorae
42(41) Sporocyst boat-shaped, sporozoite elongated \( \Rightarrow \) E. pavonina

E. Key to the species of Eimeria of mammals

1(12) Oocyst spherical or subspherical
2(3) Sporocyst spherical (10 \( \mu m \) in diameter) \( \Rightarrow \) E. cluperum
3(2) Sporocyst not spherical
4(11) Sporocyst ovoid/ovoidal
5(8) Micropyle absent
6(7) Oocyst measuring 15-18.7 \( \mu m \) x 13.2 - 17.4 \( \mu m \) in dimension, sporocyst 7.1-8.9 \( \mu m \) x 5.5 - 7.0 \( \mu m \) in dimension \( \Rightarrow \) E. darjeelingensis
7(6) Oocyst measuring 15-21 \( \mu m \) x 14-16.5 \( \mu m \) in dimension and sporocyst 8.5 - 13.5 \( \mu m \) x 6.5 - 8 \( \mu m \) in dimension \( \Rightarrow \) E. murinus
8(5) Micropyle present
9(10) Oocyst measuring 24-28 \( \mu m \) x 21.5-23 \( \mu m \) in dimension \( \Rightarrow \) E. bandicota
10(9) Oocyst measuring 17.25 - 20.25 \( \mu m \) x 16.5 - 19.25 \( \mu m \) in dimension \( \Rightarrow \) E. gorumarana
11(4) Sporocyst not ovoid/ovoidal
11a Sporocyst pear-shaped \( \Rightarrow \) E. bandiurensis
<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Species</th>
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<tr>
<td>11b</td>
<td>Sporocyst lemon-shaped</td>
<td>E. suncus</td>
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<tr>
<td>11c</td>
<td>Sporocyst cylindrical</td>
<td>E. cervis</td>
</tr>
<tr>
<td>12(1)</td>
<td>Oocyst not spherical or subspherical</td>
<td></td>
</tr>
<tr>
<td>13(28)</td>
<td>Oocyst ellipsoidal or ovoidal or vice versa</td>
<td></td>
</tr>
<tr>
<td>14(27)</td>
<td>Oocyst ellipsoidal</td>
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<tr>
<td>15(16)</td>
<td>Oocystic residuum present</td>
<td>E. oryctolagi</td>
</tr>
<tr>
<td>16(15)</td>
<td>Oocystic residuum absent</td>
<td></td>
</tr>
<tr>
<td>17(26)</td>
<td>Sporocyst oval or ellipsoidal</td>
<td></td>
</tr>
<tr>
<td>18(21)</td>
<td>Sporocyst ellipsoidal</td>
<td></td>
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<tr>
<td>19(20)</td>
<td>Stieda body present, sporocyst 9.1-11.7 µm x 5.2 - 6.5 µm in dimension</td>
<td>E. spinosa</td>
</tr>
<tr>
<td>20(19)</td>
<td>Stieda body absent, sporocyst measuring 11-14.3 µm x 8-9.5 µm in dimension</td>
<td>E. comminispora</td>
</tr>
<tr>
<td>21(18)</td>
<td>Sporocyst oval</td>
<td></td>
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<tr>
<td>22(23)</td>
<td>Stieda body absent or vestigial</td>
<td>E. arloingi</td>
</tr>
<tr>
<td>23(22)</td>
<td>Stieda body present</td>
<td></td>
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<tr>
<td>24(25)</td>
<td>Sporocyst 17-20.5 µm x 10.2 - 11.9 µm in dimension</td>
<td>E. intricata</td>
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<td>25(24)</td>
<td>Sporocyst 9-14 µm x 4-10 µm in dimension</td>
<td>E. ninakholyakimovi</td>
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<td>26(17)</td>
<td>Sporocyst spindle-shaped</td>
<td>E. crandalis</td>
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<td>27(14)</td>
<td>Oocyst ellipsoidal-ovoidal</td>
<td></td>
</tr>
<tr>
<td>27a</td>
<td>Sporocyst ovoid, 8.25 10.5 µm in length</td>
<td>E. biswapatii</td>
</tr>
<tr>
<td>27b</td>
<td>Sporocyst spindle-shaped, 14-15 µm in length</td>
<td>E. nasuta</td>
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<tr>
<td>27c</td>
<td>Sporocyst naviculoid, 17-18 µm in length</td>
<td>E. micropylifera</td>
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<tr>
<td>27d</td>
<td>Sporocyst ellongate-ovoid, 16-21 µm in length</td>
<td>E. ahsata</td>
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<tr>
<td>27e</td>
<td>Sporocyst oval, 14-16 µm x 8-9 µm in dimension</td>
<td>E. ovoidalis</td>
</tr>
<tr>
<td>27f</td>
<td>Sporocyst broad-ovoid, 9-13 µm x 6-8 µm in dimension</td>
<td>E. neodebliecki</td>
</tr>
<tr>
<td>28(13)</td>
<td>Oocyst not ellipsoidal or ellipsoidal-ovoidal</td>
<td></td>
</tr>
<tr>
<td>28a</td>
<td>Oocyst cylindrical, 28-34 µm x 12-16 µm in dimension</td>
<td>E. antilocervi</td>
</tr>
<tr>
<td>28b</td>
<td>Oocyst pyriform, 22-35 µm x 17-25 µm in dimension</td>
<td>E. granulosa</td>
</tr>
<tr>
<td>28c</td>
<td>Oocyst egg-shaped, 23.8-38.34 µm x 18.8-23.8 µm in dimension</td>
<td>E. faurei</td>
</tr>
</tbody>
</table>
28d  Oocyst subspherical to spherical, 22-43 \( \mu m \times 24-30 \mu m \) in dimension

\( \ldots \) \( E. \) christenseni

28e  Oocyst ellipsoid or subspherical, 13.6-18.7 \( \mu m \times 11.9-15.3 \mu m \) in dimension

\( \ldots \) \( E. \) parva

28f  Oocyst subspherical to ellipsoidal, 14-15 \( \mu m \times 10.5-13.5 \mu m \) in dimension

\( \ldots \) \( E. \) sibporensis

28g  Oocyst subspherical to ovoid, 21-22.5 \( \mu m \times 18-21 \mu m \) in dimension

\( \ldots \) \( E. \) jalpaiguriensis

**A. Eimeria of fishes**

232. Eimeria glossogobii Mukherjee and Haldar


*Diagnosis*: Oocyst spherical, with delicate and smooth wall having faintly yellowish tinge, measuring 7.1-12.2 \( \mu m \times 7.1-11.0 \mu m \) in dimension; pyriform to oval, measuring 3.0-9.1 \( \mu m \times 2.0-5.1 \mu m \); stieda body present as a small knob at the pointed end of each sporocyst, oocystic and sporocystic residuum absent; sporozoites sickle-shaped.

*Host*: Bar eyed Goby, *Glossogobius giuris* (Hamilton); site of infection: small intestine.

*Distribution*: India: West Bengal (Nadia district).

*Remarks*: The specific name should be *E. glossogobia* instead of *E. glossogobii* as per International Code of Zoological Nomenclature (Mandal, 1989).

233. Eimeria harpodoni Setna and Bana


*Diagnosis*: Oocyst spherical with two transparent membrane, the outer one is thinner than the inner one; 12.3-17.5 \( \mu m \) in diameter; cytoplasm granular with centrally placed nucleus; four rounded sporoblasts, each 3.5-4.4 \( \mu m \) in diameter, without any micropyle; thin granular oocystic residuum; sporocyst elliptical with a long protuberance at one end; a broad inverted V-shaped appendage present at the edge of this protuberance or neck; sporocyst measuring 8.5-10.8 (9.7) \( \mu m \times 3.6-5.7 (4.8) \mu m \), sporocystic residual compact mass present at one end of the sporocyst; elongated sporozoite 7.3 \( \mu m \) in length, slightly curved at middle region with one pointed end.


*Distribution*: India: West Bengal (South 24-Parganas district) and Bombay.

234. Eimeria notopteri Chakravarty and Kar


*Diagnosis*: Oocyst irregular in shape, measuring 23.5-25.2 (24.3) \( \mu m \times 21.4-22.5 (22.2) \mu m \); oocystic wall double layered of equal thickness, micropyle and oocystic residuum absent; sporocyst oval with both ends bluntly pointed, measuring 10.5-11.5 (11.0) \( \mu m \), x 5.5-7.3 (6.8) \( \mu m \); shape
index 1.5; sporocystic residuum absent, sporozoite elongated, 5.5 \( \mu m \) in length, with one pointed and the other rounded ends.

*Host*: Feather back, *Notopterus notopterus* (Pallas), and Chital, *Notopterus chitala* (Gunthar); site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district) and Meghalaya.

235. *Eimeria southwelli* Halawani


*Diagnosis*: Mature oocyst cylindrical or sausage-shaped provided with a single outer transparent wall, measuring 1-3 \( \mu m \) in thickness; oocyst 30.5-53.5 (39.5) \( \mu m \) x 10.5-15.4 (13.1) \( \mu m \), shape index 3.02, sporocyst oval, measuring 10 \( \mu m \)-12 \( \mu m \) in length and 6.5 \( \mu m \) in width, sporocystic residuum absent, sporozoite sausage shaped 10.1 \( \mu m \) in length and arranged irregularly.

*Host*: Eagle Ray (Devil fish), *Aetobatis narinari* [=*Aetobatus flagellum* (Schn.)] and Light Tip Shark, *Scoliodon sorrakowah* (Cuvier); site of infection: alimentary canal.

*Distribution*: India: West Bengal (South 24-Parganas district) and Maharashtra.

*Remarks*: *E. southwelli* interestingly occurs in the embryo of Eagle Ray as noted by Halwani (1930).

236. *Eimeria zygaenae* Mandal and Chakravarty


*Diagnosis*: Oocyst round, 12.1-14.3 (31.2) \( \mu m \) in diameter, having two transparent oocystic envelop, outer is thinner than the inner one; oocystic residuum absent and micropyle seen after complete development of the oocyst; sporocyst pyriform, anterior end bluntly pointed and the posterior end rounded, wall of the sporocyst warty and yellowish in colour, sporocyst measuring 7.7 - 8.9 (8.8) \( \mu m \) x 4.5 - 6.6 (5.5) \( \mu m \), shape index is 1.6, sporocytic residuum present as globular mass; sporozoite elongated, 6.6 \( \mu m \) in length.

*Host*: Hammer headed shark *Sphyrna (=Zygena) blochii* Cuvier; site of infection: intestine.

*Distribution*: India: West Bengal (Medinipur and South 24-Parganas districts).

B. *Eimeria of amphibians*

237. *Eimeria cyanophlyctis* Chakravarty and Kar


*Diagnosis*: Mature oocyst oval or sub-spherical transparent, single walled, 15.5-20.2 (17.9) \( \mu m \) x 15.5-18.3 (16.7) \( \mu m \) in dimension; shape index 1.07; oocystic residuum in the form of and irregular mass; micropyle absent; sporocyst spindle-shaped, single layered, measuring 10.5-12.5 (11.5) \( \mu m \) x 4.5-6.5 (5.5) \( \mu m \), shape index 2.09, sporocystic residuum scattered. Sporozoite elongated with pointed anterior end.

*Host*: Skipping Frog, *Rana cyanophlyctis* Schneider; site of infection: intestine.
Distribution: India: West Bengal (Calcutta district).

238. *Eimeria laminata* Ray


*Diagnosis*: Oocyst spherical, measuring 8.5-11.0 (9.8) \( \mu \text{m} \) in diameter, oocystic wall double layered, outer one thicker than the inner one, with oocystic residuum; sporocyst spindle-shaped pointed at both ends and without any knob, 5.2-6.5 \( \mu \text{m} \times 3.0 \, \mu \text{m} \) in dimensions, shape index 1.96, sporocystic residuum present; sporozoite elongated bodies pointed at one end.

*Host*: Indian common Toad, *Bufo melanostictus* Schneider; site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district).

C. *Eimeria* of reptiles

239. *Eimeria bongaonensis* Sinha and Sinha


*Diagnosis*: Oocyst circular, 13-15 (13.8) \( \mu \text{m} \) in diameter, oocystic wall greenish, smooth and bilayered; micropyle, oocystic residuum and polar granule absent; sporocysts ellipsoidal, 8.4-9.3 (8.8) \( \mu \text{m} \times 5.1-5.7 \, (5.2) \, \mu \text{m} \), without stieda body and containing scattered residue; 3.9-4.3 \( \mu \text{m} \times 1.4-1.9 \, \mu \text{m} \) in dimensions.

*Host*: Takkhak or Indian Gekko, *Gekko gecko* (Linn.); site of infection: intestine.

*Distribution*: India: West Bengal (North 24 Parganas district).

240. *Eimeria fibrilosa* Mandal


*Diagnosis*: Oocyst ellipsoidal, 25-27 (25.5) \( \mu \text{m} \times 13.5-22.5 \, (18.0) \, \mu \text{m} \), shape index 1.36, with double-layered wall, outer thinner than the inner one, micropyle absent; oocystic residuum refractile and globular, sporocyst 10-15 (12.5) \( \mu \text{m} \times 5-6 \, (5.5) \, \mu \text{m} \), shape index 2.09; sporozoite bean-shaped, 10.5-14.4 (12.2) \( \mu \text{m} \times 7.5-8.5 \, (8) \, \mu \text{m} \), shape index 1.56, sporocystic residuum as beaded mass.

*Host*: Common water snake, *Enhydris enhydris*, (Schneider); site of infection: intestine.

*Distribution*: India: West Bengal (Nadia district).

241. *Eimeria flaviviridis* Setna and Bana


*Diagnosis*: Oocyst elliptical, colourless, measuring 18.5-35.4 (25.5) \( \mu \text{m} \times 10.5-15.5 \, (12.5) \, \mu \text{m} \), shape index 2; micropyle and oocystic residuum absent; sporocyst ovoid, 6.5-6.4 (8.3) \( \mu \text{m} \times 5.3-8.3 \, (6.9) \, \mu \text{m} \), shape index 1.2, sporocystic residuum present; sporozoite 9.5 \( \mu \text{m} \times 1 \, \mu \text{m} \) in dimension. Schizonts round 12 \( \mu \text{m} \) in diameter or sometimes irregular, containing 16 to 140 elongated merozoites, each measuring 8-10 \( \mu \text{m} \times 1.3-1.5 \, \mu \text{m} \), microgametocytes ovoid measuring 17 \( \mu \text{m} \times 16 \, \mu \text{m} \) in dimension.
Host : House Lizard, *Hemidactylus flaviviridis* (Ruppell); site of infection: intestine.

Distribution: India: West Bengal (Calcutta and North 24-Parganas districts) and Maharashtra.

242. *Eimeria gupti* Bhatia


Diagnosis: Oocyst cylindrical, measuring 36 μm x 18 μm oocystic residuum present.

Host: Checkered Keelback (Water snake), *Natrix piscator* (Schneider); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

Remarks: The species is incompletely described and requires redescription.

243. *Eimeria hemidactyli* Knowles and Das Gupta


Diagnosis: Oocyst lemon-shaped with two layers of equal thickness; measuring 16.5-21.5 (18.5) μm x 12.5-16.2 (14.4) μm, shape index 1.3; oocyst residuum and micropyle absent; ovoid sporocyst 9.5-11.3 (10.4) μm x 7.5-8.5 (8.0) μm, shape index 1.3, sporocyst residuum scattered inside the sporocyst; sporozoite elongated, pointed at one end, 6.5 μm in length.

Host: House Lizard, *Hemidactylus flaviviridis* (Ruppell); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

244. *Eimeria irregularis* Kar


Diagnosis: The oocyst irregular, 14.5-16.5 (15.5) μm in diameter, without micropyle or oocystic residuum; sporocyst elongately oval, 11.5-13.5 912.5) μm x 6.5-7.5 (6.9) μm, with rounded posterior end and somewhat pointed anterior end characterised in having a little knob, sporocyst residuum mass present; sporozoite sausage-shaped, 8.5 μm x 2.5 μm, with both the ends rounded.

Host: Pond Turtle, *Lissemys punctata* (Bonnaterre); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

245. *Eimeria innominata* Kar


Diagnosis: Oocyst subspherical, double walled, outer one thinner than the inner, measuring 16.5-18.8 (17.7) μm x 11.5-14.3 (13.5) μm, shape index 1.3, micropyle and oocyst residuum absent; sporocyst pyriform with an irregular shaped knob at the pointed end, 10.5-12.3 (11.3) μm x 5.5-7.5 (6.5) μm, shape index 1.7, sporocyst residuum mass present; sporozoites elongated 6.5-7.5 μm x 4.1-4.6 μm, with one sharply pointed end.
Host: Pond turtle, *Lissemys punctata* (Bonnaterre); site of infection: liver and bile.

Distribution: India: West Bengal (Calcutta district).

246. *Eimeria koormae* Das Gupta


Diagnosis: Oocyst spherical with two layers, the inner layer thicker than the outer, 13.5-15.8 (14.6) μm in diameter, micropyle present, oocystic residuum absent; sporocyst spindle-shaped, tapering at both ends, 9.3-11.3 (10.3) μm × 3.5 - 5.6 (4.6) μm, shape index 2.24; sporocystic residual mass granular and situated between the two sporozoites; sporozoite elongated, one end rounded and stouter than the other; mature schizont 12 μm in diameter with 8 merozoites; macrogamete spherical, 12.36 μm in diameter.

Host: Pond turtle, *Lissemys punctata* (Bonnaterre); site of infection: small intestine.

Distribution: India: West Bengal (Calcutta and North 24-Parganas districts) and Bangladesh.

247. *Eimeria knowlesi* Bhatia


Diagnosis: Oocyst spherical or oval, double-layered, without any micropyle and residuum, 16.5-20.5 (18.5) μm × 14.5-18.5 (16.5) μm; sporocysts ovoid, 9.00-11.00 (10.0) μm × 7.5-8.5 (7.9) μm; sporocystic residual mass in between the sporozoites; sporozoite elongated, 7.2 μm in length.

Host: House Lizard, *Hemidactylus flaviviridis* (Ruppe11); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

248. *Eimeria najae* Ray and Das Gupta


Diagnosis: Oocyst ovoidal, double walled, outer wall thinner, 23.5-27.5 (25.5) μm × 15.5-18.5 (16.9) μm, shape index 1.5, micropyle visible in immature oocysts, oocystic residual mass compact; sporocyst spindle-shaped, 11.5-13.5 (12.5) μm × 5.9-7.8 (6.9) μm, shape index 1.8 sporozoite elongated, tapering at both ends, 10.5-11.5 μm in length; schizont with 8 merozoites, each of 7 μm × 2 μm; microgametocyte 20-24 μm in diameter.

Host: Cobra, *Naja naja* Linnaeus; site of infection: intestine.

Distribution: India: West Bengal (South 24-parganas district).

249. *Eimeria piscatori* Ray and Das Gupta


Diagnosis: Oocyst oval, 29-31 μm × 22.5-24.5 μm, with oocystic residuum; sporocyst spindle shaped, 14 μm × 4.5 μm in dimension.

Host: Checkered Keelback (Water snake) *Natrix piscator*; site of infection: intestine.
Distribution: India: West Bengal (Calcutta district).

Remarks: This species is incompletely described.

250. *Eimeria stolatae* Ray and Das Gupta


Diagnosis: Oocyst spherical, double walled, the outer thinner than the inner, 19.5 - 21.5 (20.5) μm in diameter; micropyle and oocystic residuum absent; sporocyst spindle-shaped with both ends tapering, 11.5 - 13.4 (12.5) μm × 5.5 - 7.5 (6.5) μm, shape index 2.0 sporocystic residuum present; sporozoite 8.5 × 2.3 μm in dimension; schizont 8.2 μm × 4.1 μm, with 8 merozoites; macrogamete round 18-20 μm in diameter.

Host: Striped Keelback (Grass snake), *Natrix stolata* (Linnaeus), site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

251. *Eimeria trionyxae* Chakravarty and Kar


Diagnosis: Oocyst spherical, double layered, outer thinner, 14.45 - 19.5 (16.5) μm in diameter, micropyle absent, oocystic residuum present; sporocyst pyriform, 11.5 - 13.40 (12.5) μm × 5.7 - 7.9 (6.3) μm, shape index 2.00, sporocystic residuum present; sporozoites elongated, 9.5 - 10.5 μm in length; schizont round, 8- 14 μm in diameter.


Distribution: India: West Bengal (Calcutta district).

252. *Eimeria triangularis* Chakravarty and Kar


Diagnosis: Oocyst triangular, 9.5 - 14.5 (12.5) μm in length, oocystic residuum and micropyle absent; sporocyst oval or spindle-shaped with both the ends bluntly rounded, 9.5 - 11.5 (10.5) μm X 3.4 - 5.4 (4.14) μm, shape index 3.02; sporozoites elongated, 9.5 μm in length, with tapering ends.


Distribution: India: West Bengal (Calcutta district).

D. *Eimeria* of birds

253. *Eimeria alectorae* Ray and Hiregaudar


Diagnosis: Oocyst ellipsoidal with a few ovoidal and very few spherical forms; oocystic wall pale yellowish-brown with a micropyle; oocyst measuring 23.6-26.4 μm × 15.6 -19.5 μm, shape index 1.43; sporocyst pear-shaped, 8 - 9.5 μm × 5-5.6 μm, with sporocystic residuum and stieda body at the pointed end; sporozoites banana-shaped.
Host: Chukar Partridge, *Alectoris graeca* (Meisner); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).


Diagnosis: Oocyst ovoidal, measuring 14.1 - 17.4 μm × 12.3 - 13.3 μm; distinct micropyle present, oocystic residuum absent; sporocyst boat shaped, bilayered, measuring 7.3 - 9.2 μm × 5.8 - 5.5 μm, stieda body and sporocystic residuum present; elongated sporozoites measuring 7.0 μm × 1.7 μm.

Host: *Sturnus contra contra* Linnaeus; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).


Diagnosis: Oocystic oval, double walled, the outer thinner, 22.2 - 34.2 (32.2) μm × 17.5 - 19.5 (18.5) μm, shape index 1.2; micropyle present and oocystic residuum absent, sporocyst oval, anterior portion narrower and provided with an ill developed knob, 14.5 - 16.5 (15.5) μm × 7.5 - 9.5 (8.5) μm, shape index 1.8, sporocystic residuum present as compact mass; Sporozoites sickle shaped, 10.5 - 12.5 μm × 2.2 μm, shape index 5.2.


Distribution: India: West Bengal (Calcutta district).


Host: Common Domestic Fowl, *Gallus domesticus*; site of infection: intestine.

Distribution: India: West Bengal (Barddhaman district).


Diagnosis: Oocysts spherical to subspherical in shape, endocytic wall thicker and slightly yellowish in colour, 15.5 - 16.8 μm × 14.6 - 16.6 μm; sporocyst bean-shaped, 6.7 μm × 3.4 μm, with a stieda body at one end and having scanty residual matter; sporozoites sickle-shaped.
Host: Bhutan Peacock pheasant, *Polyplectron bicoloratum* (= *Polyplectron bicoloratum bakeri* (Linn.)); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

258. *Eimeria charadrii* Mandal


Diagnosis: Oocyst oval with double wall, outer wall thinner, anterior end drawn out as a small neck, 14.3 - 17.6 (15.8) \(\mu m\) \(\times\) 11.0 - 12.0 (11.5) \(\mu m\), shape index 1.3, micropyle present; oocystic residuum absent; sporocyst pyriform, 7.8 - 9.8 (8.8) \(\mu m\) \(\times\) 5.5 - 7.6 (6.6) \(\mu m\), shape index 1.3, anterior end narrow, posterior end round, sporocystic residuum present as scattered mass; sporozoites elongated with both ends bluntly pointed, 4.4 \(\mu m\) \(\times\) 2.2 \(\mu m\); schizont spherical, 8.8 \(\mu m\) in diameter; microgametocyte oval, 7.7 \(\mu m\) \(\times\) 5.5 \(\mu m\); macrogamete 6.6 \(\mu m\) in diameter.


Distribution: India: West Bengal (South 24-Parganas district).

259. *Eimeria columbae* Mitra and Das Gupta


Diagnosis: Oocyst subspherical, double walled, outer thinner and membranous, 14.5 - 17.5 (16.5) \(\mu m\) \(\times\) 13.5 - 15.5 (14.5) \(\mu m\), shape index 1.14; micropyle absent, oocystic residuum present; sporocyst ellipsoidal without any knob, 6.5 - 8.5 (7.3) \(\mu m\) \(\times\) 3.5 5.8 (4.6) \(\mu m\), shape index 1.6 sporocystic residuum present as scattered mass; sporozoites curved with one end pointed and the other end rounded; schizont 4.1 \(\mu m\) in diameter; macrogamete 6.1 \(\mu m\) in diameter.

Host: Domestic Pigeon, *Columba intermedia* (= *Columba livia intermedia* Strickland) *Columba* sp.; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district) and Orissa.

260. *Eimeria coturnicis* Chakravarty and Kar


Diagnosis: Oocyst oval, with double envelops, 26.5 - 38.5 (31.5) \(\mu m\) \(\times\) 19.4 26.4 (22.8) \(\mu m\), shape index 1.3, micropyle end and oocystic residuum absent; sporocyst pyriform, anterior end pointed and provided with a knob, 13.4 - 17.4 (15.4) \(\mu m\) \(\times\) 8.5 - 11.5 (9.5) \(\mu m\), shape index 1.6, sporocystic residuum present as a compact mass; sporozoites spherical or slightly oval in shape.

Host: Common Quail, *Coturnix c. coturnix* (Linn.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).
261. *Eimeria dauki* Bhatia and Pande


*Diagnosis*: Oocyst ovoidal, with a knob at narrow micropylar end and double walled, 14-20 (17.8) \(\mu\)m \(\times\) 11-13.5 (12.5) \(\mu\)m, shape index 1.4, oocystic residuum absent; sporocyst elongated with narrow anterior end, 10.5 - 12.5 (10.5) \(\mu\)m \(\times\) 5.5 - 7.8 (5.8) \(\mu\)m, stieda body prominent plug-like, sporocystic residuum present as dark granules; sporozoites elongated, 8.5 \(\mu\)m \(\times\) 2.5 \(\mu\)m.


*Distribution*: India: West Bengal (North 24-Parganas district) and Uttar Pradesh.

262. *Eimeria gallinagoi* Mandal


*Diagnosis*: Oocyst pyriform, double walled with uniform thickness and yellowish in colour, 19.8 - 20.9(20.2) \(\mu\)m \(\times\) 13.2 - 14.3 (13.8) \(\mu\)m, shape index 1.4; micropyle present but oocystic residuum absent; sporocyst pyriform, anterior narrower end with a small knob, 6.7 - 8.7 (7.7) \(\mu\)m \(\times\) 4.5 - 6.5 (5.5) \(\mu\)m, shape index 1.4, sporocystic residuum present as concentrated mass; sporozoite 5.5 \(\mu\)m \(\times\) 2.5 \(\mu\)m.

*Host*: Fantail snipe, *Gallinago gallinago* (Linnaeus); site of infection: intestine.

*Distribution*: India: West Bengal (South 24-Parganas district).

263. *Eimeria gallusae* Paul, Ghosh and Haldar


*Diagnosis*: Oocyst spherical to subspherical, 13.28 - 17.49 (15.44) \(\mu\)m \(\times\) 11.42 - 14.94 (13.59) \(\mu\)m, double layered, oocystic residuum, micropyle and polar granules absent; sporocyst pyriform, 6.64 - 9.13 (7.87) \(\mu\)m \(\times\) 4.98 - 6.94 (5.81) \(\mu\)m, shape index 1.4, sporocystic residuum present; sporozoite elongated, 4.15 - 6.30 (5.62) \(\mu\)m \(\times\) 1.66 - 2.98 (2.26) \(\mu\)m.

*Host*: Common Domestic Fowl, *Gallus domesticus*; site of infection: intestine.

*Distribution*: India: West Bengal (North 24-Parganas).
Distribution: India: West Bengal (Calcutta district).

265. Eimeria kapotei Chatterjee and Ray

Diagnosis: Oocyst oval, 24-30 (26.1) \(\mu m\) \(x\) 22-26 (23.5) \(\mu m\), double walled inner one being thicker, micropyle present; sporocyst ovoid, 8.5 - 9.5 \(\mu m\) in length, sporocystic residuum and steida body present; sporozoite bean-shaped, 5.6 \(\mu m\) in length.

Host: Domestic Pigeon, Columba livia intermedia Strickl. (=Columba sp.); site of infection: small intestine

Distribution: India: West Bengal (Calcutta district).

266. Eimeria labbeana (Labbe)


Diagnosis: Oocysts oval or spherical, oval form measuring 19.5 - 21.2 (20.1) \(\mu m\) \(x\) 16.5 - 17.5 (16.9) \(\mu m\), shape index 1.1; spherical form measuring 17.5 - 18.5 (17.9) \(\mu m\) in diameter, double walled, outer one thinner; micropyle present, oocystic residuum absent; sporocyst oval 11.00-13.5 (12.4) \(\mu m\) \(x\) 5.5 - 6.8 (6.4) \(\mu m\), shape index 1.4, sporocystic residuum compact; sporozoites elongated, 6.5 \(\mu m\) \(x\) 2.3 \(\mu m\); schizonts of two types, small and large; macrogametocyte 3.4 - 15.8 \(\mu m\) \(x\) 2.3 - 12.2 \(\mu m\).

Host: Domestic Pigeon, Columba livia intermedia Strickl. (=Columba sp.); Ring necked Dove, Streptopelia orientalis; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

267. Eimeria malaccae Chakravarty and Kar

Diagnosis: Oocysts broadly oval, 26.5 - 30.5 (28.5) \(\mu m\) \(x\) 16.5 - 18.5 (17.5) \(\mu m\), shape index 1.6 double walled outer one thinner; micropyle present, oocystic residuum absent; sporocyst oval, anterior end pointed and with a small knob, 11.5 - 13.5 (12.5) \(\mu m\) \(x\) 9.5 - 11.5 (10.5) \(\mu m\), shape index 1.1, sporocystic residuum coarsely granular, sporozoite 8.5 \(\mu m\) \(x\) 2.3 \(\mu m\), with anterior end tapering.

Host: Black headed Munia, Munia (Lonchura) malacca malacca Linn; site of infection: intestine

Distribution: India: West Bengal (Calcutta district).

268. Eimeria mandali Banik and Ray

Diagnosis: Oocyst round, double layered, measuring 14.5 - 20.6 (17.6) \(\mu m\) \(x\) 14.2 - 18.8
(16.5) μm, shape index 1 : 1, micropyle and oocystic residuum present; sporocyst pyriform, 6.5 - 12.0 μm × 4.5 - 8.5 μm, sporocyst residual mass present at the centre; sporozoite banana-shaped, measuring 6.5 μm in length.

**Host**: Common Pea Fowl,*Pavo cristatus* Linnaeus; site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district), and Uttar Pradesh.

### 269. *Eimeria numeni* Mandal


**Diagnosis**: Oocyst spherical, double layered, 20.9 - 23.1 μm in diameter, micropyle and oocystic residuum absent; sporocyst pyriform, 5.6 - 7.6 (6.6) μm × 4.5 - 6.5 (5.5) μm, shape index 1.2, sporocystic residuum present as scattered mass; sporozoites elongated, 5.9 μm × 2.5 μm; Schizont spherical, 5.5 μm in diameter, microgametocyte 7.7 μm × 4.4 μm; macrogametes oval, 6.6 μm × 4.4 μm.

**Host**: Curlew,*Numenius arquata* (Linnaeus); site of infection: intestine.

**Distribution**: India: West Bengal (South 24-Parganas district).

### 270. *Eimeria pavonina* Banik and Ray


**Diagnosis**: Oocyst egg-shaped, double layered, 20 - 28 (26.5)μm × 16 - 20 (18.5)μm, micropyle and oocystic residuum present; sporocyst boat-shaped, 6 - 16 μm × 4 - 8 μm, stieda body present at the pointed end, sporocystic residuum present as a scattered granules, sporozoites elongated, 10 - 12 μm in length.

**Host**: Common Pea Fowl,*Pavo cristatus* Linnaeus; site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district).

### 271. *Eimeria roscoviensis pluvialina* Mandal


**Material examined**: Sev. exs., Narayantala, South 24-Parganas, 12.v.1974, A.K. Mandal.

**Diagnosis**: Oocyst pyriform or ovoidal, double layered, 17.7 - 19.7 μm × 13.3-15.3 μm, shape index 1.3, micropyle absent, oocystic residuum present; sporocysts pyriform, 11.1 - 13.1 μm × 5.6 - 7.6 μm, shape index 1.7, sporocystic residuum present as scattered mass; sporozoites elongated, 8.8μm × 2.5 μm; schizonts 6.6 μm in diameter; merozoites sphindle-shaped, 7.7 -8 μm in length; macrogametocyte 9.9 μm × 7.7 μm; macrogamete measuring 8.8 μm × 5.5 μm.

**Host**: Golden Plover,*Pluvialis appricaria* (Linnaeus); site of infection: intestine.

**Distribution**: India: West Bengal (South 24-Parganas district).
Remarks: Pellerdy (1974) treated this subspecies as a distinct species but herein its subspecies status is retained.

272. *Eimeria tenella* (Railliet and Lucet)


*Diagnosis*: Oocyst broad-oviod, 19.2 - 26 μm × 16-22 μm, oocystic wall striated, micropyle present; sporocyst measuring 11 μm × 7 μm, stieda body present; sporozoites elongated banana-shaped, 5 - 8 μm in length; mature schizont 42.5 μm × 37.5 μm, merozoite 6.5 μm in length.

*Host*: Domestic Fowl, *Gallus domesticus* (= *Gallus* sp.); site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district), Madhya Pradesh, Uttar Pradesh, Orissa; Tamil Nadu. Elsewhere: Bangladesh; cosmopolitan.

273. *Eimeria tropicalis* Malhotra and Ray


*Diagnosis*: Oocyst spherical or sub-spherical, 19 - 24 μm × 18 - 23 μm, oocystic residuum present; sporocyst ellipsoidal, 10 μm × 6 μm, stieda body and sporocystic residuum present; sporozoites globular in shape.

*Host*: Blue rock Pigeon, *Columba livia intermedia* (Strickland); site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district), Uttar Pradesh.

274. *Eimeria vanelli* Mandal


*Diagnosis*: Oocyst oval or pyriform, double layered, provided with warts, 19.19 - 21.9 μm × 13.3 - 15.3 μm, shape index 1.4, micropyle present, oocystic residuum absent; sporocyst Pyriform, 11.1 - 13 μm × 5.6 - 7.6 μm; index 1.8, sporocystic residuum present as scattered mass; sporozoites elongated tapering at both ends, 8.7 μm in length; young schizont 5.5 μm in diameter become elongated producing 6 - 10 merozoites, each measuring 9.9 μm in length and arranged symmetrically; microgametocytes oval, 11 μm × 7.7 μm; macrogametocytes oval, 12.1 μm × 9.9 μm.

*Host*: Yellow-wattled Lapwing, *Vanellus malabaricus* (Boddaert); site of infection: intestine.

*Distribution*: India: West Bengal, (South 24-Parganas district).

E. *Eimeria of mammals*

275. *Eimeria ahsata* Honess


Diagnosis: Oocyst ellipsoidal to ovoid, 37 - 45 μm × 22 - 29 μm, oocystic residuum absent, micropylar cap present; sporocyst elongate ovoid, 16 - 21 μm × 7 - 10 μm, stieda body absent, sporocystic residuum present as scattered granules; sporozoite banana-shaped; microgametocyte 36.5 μm × 23 μm; macrogametocyte 35-45 μm in diameter.

Host: Rocky mountain bighorn sheep, Ovis canadensis; Domestic sheep, Ovis sp., and domestic goat, Capra hircus (= Capra sp.); site of infection: small intestine.


276. Eimeria antilocervi Ray and Mandal


Diagnosis: Oocyst cylindrical, 28 - 34 μm × 12 - 16 μm, with a distinct micropyle, oocystic wall single layered, oocyst residuum absent; sporocyst pyriform, 11 μm × 7 μm, sporocystic residuum present.

Host: Black buck, Antelope cervicapra [ = Antelope cervicapra (Linn.) ]; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

277. Eimeria arloingi (Marotel)


Diagnosis: Oocyst ellipsoidal, 24.65 - 37.4 (30.3) μm in length, with crescent-shaped polar cap lying above the micropyle, shape index 0.16 - 0.62, oocystic residuum absent; sporocyst elongate ovoid, 11 - 17 μm × 6 -10 μm, stieda body absent or vestigial, sporocystic residuum present; sporozoite elongated; schizont 146 μm × 122 μm, merozoite 9 μm × 2 μm microgametocyte 11 - 26 μm × 8 - 16 μm.

Host: Domestic goat, Capra hircus (= Capra sp.) Domestic sheep, Ovis sp.; Ladakh goat, Capra ibex Linn.; Rocky mountain bighorn sheep, Ovis canadensis Shaw; Mouflon, Ovis musimon Linn., Ovis ammon Linn.; site of infection: small intestine.

Distribution: India: West Bengal (Calcutta, North & South 24- Parganas district), Orissa, Andhra Pradesh, Bihar, Madhya Pradesh, Punjab, Maharashtra and Uttar Pradesh.

278. Eimeria bandicota Bandyopadhyay and Das Gupta


Diagnosis: Oocysts subspherical measuring 24 - 28.5 μm × 21.5 - 23 μm (mean 26 μm × 22.5 μm), micropyle present but polar granule and oocystic residuum absent; sporocyst ovoid.
10.5 - 13.5 μm × 6 - 9 μm (mean 11.7 μm × 7.6 μm), stieda body small, sporocystic residuum present; sporozoites measuring 9 - 12 μm × 3.5 - 4.5 μm (mean 10.1 μm × 4 μm).

Host: Bandicota bengalensis (Gray); site of infection: intestine.

Distribution: India: West Bengal (Darjiling district).


Diagnosis: Oocyst spherical or egg-shaped, measuring 16 - 18 μm in diameter or 16 - 20 μm × 14 - 18 μm, double layered, micropyle and oocystic residuum absent; sporocyst broadly pear-shaped with a stieda body at the narrow end, 6 -10 (8) μm × 6 - 8 (6.5) μm, sporocystic residuum present; sporozoites banana-shaped.

Host: Indian Palm Squirrel, Funambulus palmarum (Linnaeus); site of infection: intestine.

Distribution: India: West Bengal (Hugli District) and Kerala.


Diagnosis: Oocyst ovoid, measuring 16.5 - 19.5 μm × 12-15 μm micropyle present, polar granules and oocystic residuum absent; sporocyst ovoid, devoid of stieda body, measuring 8.25 - 10.5 μm × 5.5 - 6.5 μm, sporocystic residuum present; sporozoites comma-shaped, 6-7.5 μm × 2.25 - 3 μm.

Host: Bandicota indica (Bechstein); site of infection: intestine.

Distribution: India: West Bengal (Haora district).


Diagnosis: Oocyst subspherical, measuring 12.65 - 14.57 (13.62) μm × 9.90 - 11.50 (10.82)μm, micropyle, oocystic residuum absent; sporocyst cylindrical, slightly curved with one end narrower than the other, 6.60 - 8.25 μm × 2.20 - 3.30 μm, sporocystic residuum absent; sporozoite club-shaped with a blunt posterior and a tapering anterior end, measuring 3.30 - 6.05 μm in length.

Host: Spotted deer, Axis axis Erxleben; site of infection: intestine.

Distribution: India: West Bengal (South 24-Parganas district).


Diagnosis: Oocyst ovoid, rarely ellipsoidal, and slightly flattened at the micropylar end, 32...
- 43 μm × 24 - 30 μm with a mean of 39 μm × 26 μm, micropyle present, micropylar cap prominent, colourless round-shaped, oocystic residuum absent; sporocysts broadly ovoid, stieda body absent, 14 - 18 μm × 8 - 11 μm with a mean of 15 μm × 10 μm, sporocystic residuum present; sporozoites arranged head to tail order.

Host : Domestic goat, Capra hircus (= Capra sp.); site of infection : intestine.

Distribution : India : West Bengal (Calcutta district), Madhya Pradesh and Uttar Pradesh.

283. Eimeria clupearum (Thelohan)


Diagnosis : Oocyst spherical, 18 - 21 (19.5) μm in diameter; sporocyst spherical 10 μm in diameter, sporocystic residuum present; sporozoite with rounded anterior end and pointed posterior end.

Host : Herring, Alosa sardina; Clupea harengus, Sardine, Saradina (= Clupea) pilchardus; Spart, Sprattus (=Clupea) sprattus; Ancovy, Engraulis encrosicholus; Round herring, Etrumeus micropus; Sardine, Sardina melanostictal; Mackerel, Scomber scomber and also from Man; site of infection : intestine.

Distribution : India : West Bengal (Calcutta district).

Remarks : Knowles (1924) recorded this species from facial sample of man. However, the species was originally found in large numbers in the intestine of herrings, mackerel and sprats, consumption of which might be the possible reason that the oocysts were found in the faeces of man (Mandal, 1987).

284. Eimeria comminispora Bandyopadhyay and Das Gupta


Diagnosis : Oocysts ellipsoid, 32 - 38 μm × 25 - 27 μm (mean 34.5 μm × 26.75 μm), double walled, with no micropyle, polar granule and oocystic residuum; sporocyst ellipsoid, devoid of stieda body, 11 - 14.3 μm × 8.9.5 μm (mean 13.4 μm × 8.82 μm); sporozite 9.5 - 11.5 μm × 3.5 - 4.5 μm (mean 10.5 μm × 4.2 μm); sporocytic residuum globular.

Host : Petaurista magnificus (Helgson); site of infection : intestine.

Distribution : India : West Bengal (Darjiling district).

285. Eimeria crandallis Honess


Diagnosis : Oocyst more or less spherical to oval or ellipsoidal, measuring 17 - 23.8 μm × 17 - 22.1 μm (mean 20.4 μm × 18.4 μm), shapre index 0.74 - 0.93, micropyle with a very
small polar cap, oocystic residuum absent; sporocyst ovoid, 13.6 \( \mu m \times 3.6 \mu m \), with no stieda body, sporocystic residuum usually present; sporozoite with one or two clear globules.


*Distribution*: India: West Bengal (Calcutta district), Bihar, Jammu and Kashmir, Madhya Pradesh, Maharshtra, Orissa and Tamil Nadu.

### 286. *Eimeria darjeelingensis* Sinha and Sinha


*Diagnosis*: Oocyst subspherical, 15.0 - 18.7 \( \mu m \times 13.2 - 17.4 \) (mean 16.7 \( \mu m \times 14.9 \mu m \)), oocystic wall smooth, bilayered of uniform thickness, oocystic residuum, micropyle and polar granule absent; sporocyst ovoid, single layered, 7.1 - 8.9 \( \mu m \times 5.5 - 7.0 \mu m \) (mean 8.0 \( \mu m \times 5.6 \mu m \)), stieda body and sporocystic residuum present; sporozoites 4.0 - 5.5 \( \mu m \times 1.4 - 1.8 \); trophozoite subspherical to ovoid 5.6 - 7.7 \( \mu m \times 5.2 - 6.3 \mu m \); multinucleated schizont with 12 nuclei, measuring 13.9 \( \mu m \times 11.9 \mu m \); macrogamete 14.8 \( \mu m \times 11.0 \mu m \); microgamete 5.6 - 11.0 \( \mu m \times 5.6 - 9.0 \mu m \).


*Distribution*: India: West Bengal (Darjiling district).

### 287. *Eimeria faurei* (Moussu and Marotol)


*Diagnosis*: Oocyst egg-shaped, 23.8 - 38.34 (29.53) \( \mu m \times 18.8 - 23.8 (22.36) \mu m \), micropyle at the narrower and with no cap, oocystic residuum absent, polar granules present; sporocyst elipsoidal, 15 - 17 \( \mu m \times 8 - 10 \mu m \), sporocystic residuum scattered, stieda body absent; sporozoite elongated; schizont 100 \( \mu m \) in diameter.


*Distribution*: India: West Bengal (Calcutta district), Madhya Pradesh, Maharshtra, Orissa, Punjab and Uttar Pradesh.

### 288. *Eimeria garumarana* Bandhyopadhyay and Das Gupta

Diagnosis: Oocyst subspherical measuring 17.25 - 20.25 μm × 16.5 - 19.25 μm (mean 18.45 × 17.85 μm), prominent micropyle but with no polar granule or oocystic residuum; sporocyst ovoid 9-11.25 μm × 6 - 8.25 μm with a mean 9.78 × 7.45 μm, stieda body present; sporozoites comma-shaped measuring 6 - 8.25 (7.12) μm × 2.25 - 3.75 (3) μm; sporocystic residuum in the form of globules.

Host: Rattus rattus brunneusculus (Hodgson); site of infection: intestine.

Distribution: India: West Bengal (Jalpaiguri district).

289. Eimeria granulosa Christensen


Diagnosis: Oocyst pyriform, egg or urn-shaped, measuring 22 - 35 μm × 17 - 25 μm (mean 29.4 μm × 20.9 μm), micropyle 3-5 μm in diameter with a polar cap, oocystic residuum or polar granule absent; sporocyst ovoid or elongate ovoid, rounded at both ends 13 - 16 μm × 8 - 9 μm, stieda body faintly present; sporocystic residuum present; sporozoite elongated with one end narrower than the other.

Host: Domestic sheep, Ovis aries (= Ovis sp.); Rocky mountain bighorn sheep, Ovis canadensis Shaw; Domestic sheep, Ovis sp.; Domestic goat, Capra hircus (Linn.) (= Capra sp.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district), Haryana, Orissa, Madhya Pradesh and Uttar Pradesh.

290. Eimeria intricata Spiegel


Diagnosis: Oocyst 37.4 - 51.0 μm × 28.9 - 37.4 μm (mean 45.5 μm × 32.7 μm), ellipsoidal to ovoid, shape-index 0.65 - 0.83, exocystic wall of the oocyst very thick, large micropyle 3.4 - 8.5 μm in size having a crescent-shaped polar cap; sporocyst pyramidal, 17 - 20.4 μm × 10.2 - 11.9 μm, stieda body and sporocystic residuum present; sporozoite elongated; schizont 32 - 37 μm × 21 - 25 μm containing 25 - 40 merozoites; macrogamete 36 - 54 μm × 25 - 36 μm.

Host: Domestic sheep, Ovis aries (= Ovis sp.); Rocky mountain bighorn sheep, Ovis ammon (Linnaeus); Domestic goat, Capra hircus (= Capra sp.); Roe deer, Capreolus capreolus (Linn.); Fallow Deer, Dama dama (Linnaeus); site of infection: small intestine.

Distribution: India (Calcutta district), Bihar, Madhya Pradesh, Maharashtra, Orissa, Punjab and Uttar Pradesh.

291. Eimeria jalpaiguriensis Bandyopadhyay


Diagnosis: Oocyst subspherical to ovoid measuring 21 - 22.5 μm (mean 21.6 μm) × 18 - 21 μm (mean 19 μm), micropyle, polar granule and oocystic residuum absent; sporocyst ovoid with
small stieda body, 9 - 11 μm × 6 - 7.5 μm; sporozoites broad and elongated, 6 - 9 μm × 2 - 3.5 μm; 8 - 10 globules in the sporocystic residual bodies.

**Host**: Herpestes edwardsi (Geoffroy); site of infection: Intestine.

**Distribution**: India: West Bengal (Jalpaiguri district).

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**292. Eimeria micropyli/era** Bandyopadhyay and Das Gupta


**Diagnosis**: Oocyst ovoid tapering at the micropylar end assuming bottle-neck shape, 32 - 35 μm × 22.5 - 25 μm (mean 33.16 μm × 23.66 μm), double walled, micropyle somewhat sunken in the bottle-neck; sporocyst naviculoid, 17 - 18 μm × 7 - 8.5 μm (mean 17.75 μm × 7.75 μm), stieda body present; sporozoites head to tail oriented, 12 - 13 μm × 3 - 4 μm (mean 12.62 μm × 3.37 μm); 6 - 8 globules in sporozoitic residuum.

**Host**: Petaurista magnificus (Hodgson); site of infection: intestine.

**Distribution**: India: West Bengal (Darjiling district).

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**293. Eimeria murinus** Bandyopadhyay and Das Gupta


**Diagnosis**: Oocyst subspherical, 15 - 21 (18.8 ) μm × 14 - 16.5 (16.1) μm, micropyle, polar granule and oocyst residuum absent; sporocyst ovoid, 8.5 - 13.5 (12.6) μm × 6.5 8 (5.1) μm, stieda body small; sporozoites comma-shaped 4.5 - 7 (5.1) × 2 - 3.5 (3.2) μm; sporocystic residuum in the form of scattered globules.

**Host**: Suncus murinus murinus (Linnaeus); site of infection: intestine.

**Distribution**: India: West Bengal (exact locality not mentioned).

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**294. Eimeria nausta** Bandyopadhyay and Dasgupta


**Diagnosis**: Oocyst ovoid tapering at one end to a bottle-neck shape, 23 - 26 μm × 17 - 21 μm (mean 25.12 μm × 19.5 μm), micropyle, polar granule, oocyst residuum absent; sporocysts spindle-shaped without stieda body, 14 - 15 μm × 6 - 7 μm (mean 14.5 μm × 6.5 μm); sporozoites comma-shaped, head to tail oriented, measuring 11 - 12.5 μm × 3.5 - 4.5 μm (mean 1.2 μm × 4.1 μm); sporocystic residuum granular.

**Host**: Petaurista magnificus (Hodgson); site of infection: intestine.

**Distribution**: India: West Bengal (Darjiling district).

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**295. Eimeria neodebliecki** Vetterling


**Diagnosis**: Oocyst ellipsoidal, occasionally ovoid in shape, 17 - 26 μm × 14 19 μm (mean...
22.1 μm x 16 μm), length-width ratio 1.2 to 1.3 to 1.3 (1.25), oocystic wall double-layered, micropyle and oocystic residuum absent, one or two polar granules occasional present: sporocyst broadly ovoid, 9 - 13 μm x 6 - 8 μm (mean of 10.4 μm x 6.6 μm), stieda body and oocystic residuum present; sporozoite banana-shaped, usually lying length wise head position.

Host: Domestic pig, Sus scrofa scrofa (=Sus scrofa Linn.) and Wild boar, Sus scrofa scrofa (Lin.n.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta and South 24- Parganas districts), Madhya Pradesh and Uttar Pradesh.

296. Eimeria ninakholyakimovi Yakimoff and Rastegaieff


Diagnosis: Oocyst ovoid to sub-spherical, 20.4-26.8 (22.2) μm x 17.0-20.4 (18.08) μm, shape index 0.83-0.91 (0.04), oocystic wall very thin, micropyle and oocystic residuum absent; sporocyst elongate ovoid, 9-14 μm x 4-10 μm, stieda body and sporocystic residuum present; sporozoite elongate, lying length wise and head to tail orientation; schizont 290 μm in diameter; macrogamete 9-18 μm x 7-13 μm.

Host: Domestic goat, Capra hircus (Linn.) (= Capra sp.); domestic sheep, Ovis sp.; Wild goat; Capra aegagrus (Erxleben); Siberian Wild goat, C. Siberica (Pallas); Alpine ibex, C. ibex Linn. and Rocky mountain bighorn sheep, O. canadensis Shaw; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district), Haryana, Madhya Pradesh, Maharashtra, Orissa, Punjab and Uttar Pradesh.

297. Eimeria oryctolagi Ray and Banik


Diagnosis: Oocyst ellipsoidal, 28.5-46.8 (38.7) μm x 12.5-28.5 (19.1) μm, shape index 1 : 2, double walled, micropyle and oocystic residuum present; sporocyst pyriform, 8.5-14.5 (10.0) μm x 4.5-8.5 (6.0) μm, stieda body and sporocystic residuum present; sporozoite elongated, tapering at one end, 10.5 μm in length.

Host: Domestic rabbit, Oryctolagus cuniculus Linn. (= Oryctolagus sp.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

298. Eimeria ovoidalis Ray and Mandal


Diagnosis: Oocyst ovoidal, 32.0-40.0 (35.5) μm x 20-28 (23.8) μm, micropyle present, oocystic residuum absent; sporocyst oval, 14-16 μm x 8-9 μm, sporocystic residual mass coarsely granular, stieda body present; sporozoite ovoidal, 8-9 μm x 4-6 μm.

Host: Buffalo calf, Bubalus bubalis Linn.; site of infection: intestine.
Distribution: India: West Bengal (Calcutta district).

299. Eimeria parva Kotlan, Mocsy and Vajda


Diagnosis: Oocyst 13.6-18.7 μm x 11.9-15.3 μm (mean 16.2 μm x 13.4 μm), shape index 0.72-0.95 (0.81), oocyst ovoidal or subspherical in shape, double layered with no micropyle and polar cap; sporocyst ellipsoidal, stieda body and sporocystic residuum present; schizont 185-258 μm x 128-179 μm; macrogametocyte 15-19 μm in diameter.

Host: Domestic sheep, Ovis aries (= Ovis sp.); Domestic goat, Capra hircus (= Capra sp.); Asiatic Mouflon, Ovis orientalis Gmelin; Muflon, O. musimon Linnaeus; Argali, O. ammon (Linnaeus); Rocky mountain bighorn sheep, O. canadensis Shaw; Siberian wild goat, Capra siberica (= Capra ibex siberica (Pallas) and Alpine ibex, C. ibex Linnaeus; site of infection: intestine.

Distribution: India: West Bengal (Calcutta, North and South 24- Parganas districts), Bihar, Haryana, Madhya Pradesh, Punjab, Maharashtra, Orissa, and Uttar Pradesh.

300. Eimeria sibporensis Bandyopadhyay and Das Gupta


Diagnosis: Oocyst subspherical to ellipsoid, 14-15 μm x 10.5-13.5 μm (mean 14.7 μm x 11.7 μm), micropyle present but no polar granule or oocystic residuum; sporocyst ovoid with no stieda body, 7.5-9 μm x 6 μm, (mean 8 μm x 5 μm); sporozoite comma-shaped 6-7.5 μm x 2-3 μm (mean 6.3 μm x 2.6 μm); sporocytic residuum present.

Host: Rattus rattus arboreus (Horsfield); site of infection: intestine.

Distribution: India: West Bengal (Haora district).

301. Eimeria spinosa Henry


Diagnosis: Oocysts ellipsoidal measuring 16-22.4 μm x 12.8-16 μm, entire surface with 1 μm high spines; sporocyst 9.1-11.7 μm x 5.2- 6.5 μm, stieda body and sporocystic residuum present; schizont 8- 10 μm with about 20 merozoites; macrogametocytes 7-9 μm in diameter.

Host: Domestic pig, Sus scrofa (Linn.); site of infection: small intestine.

Distribution: India: West Bengal (Calcutta district), Haryana, Madhya Pradesh and Orissa.


Diagnosis: Oocyst almost subspherical, 18.2-21.8 (19.5) µm x 15.5-16.8 (15.2) µm, bilayered wall with a micropyle cap, oocystic residuum and polar granules absent; sporocyst lemon-shaped, 9.5-11.2 (10.5) µm x 6.5-8.8 (7.8) µm, with a nipple like protuberance at one end, sporocystic residuum beaded globular mass scattered within the sporocyst; sporozoites comma-shaped, 4.0-5.5 (4.5) µm x 3.2-3.8 (3.5); µm macrogametocyte 14 µm x 12.56 µm.

Host: House-shrew, Suncus murinus murinus Linn. and S. murinus soccatus Hodgson; site of infection: small intestine.

Distribution: India: West Bengal (Calcutta and Darjili districts).

Genus Caryospora Leger

Key to the species

1 (2) Oocyst spherical, sporocyst spherical............................................................C. gekkonis
2 (1) Oocyst spherical to subspherical, sporocyst pear-shaped............................
3 (4) Sporocyst measuring 18-20 µm x 12-14 µm..................................................C. bengalensis
4 (3) Sporocyst measuring 12-16.5 µm x 9-12.8 µm...............................................C. cobrae

303. Caryospora bengalensis Mandal


Diagnosis: Oocysts spherical, 20-22.5 (21.5) µm in diameter, shape index 1.07, double layered, micropyle present, oocystic residuum absent; sporocyst double-layered, pear-shaped, 18-20 (19) µm x 12-14 913.5) µm, shape index 1.4, stieda body with a shiny plug at the pointed end, sporocystic residuum present; sporozoites bean-shaped 10-12 (11.0) µm in length and 2.5µm at its broadest width.

Host: Common water snake, Enhydris enhydris (Schneider); site of infection: intestine.

Distribution: India: West Bengal (Nadia district).

304. Caryospora cobrae Nandi


Diagnosis: Oocyst subspherical to spherical, 16.5-19.5 (18.5) µm x 16.5-18.5 (17.2) µm, L/W ratio 1.02-1.10; 2-layered, micropyle with a micropylar cap, polar granule and residuum absent; sporocyst pyriform, 12.0-16.5 (14.2) µm x 9.0-12.8 (11.8) µm, stieda body distinct, substieda body present, residuum present; sporozoite sausage-shaped to narrowly ovoid, 4.6-6.5 (5.4) µm x 1.2-3.0 (2.0) µm.

Host: Naja naja Linnaeus; site of infection: intestine.

Distribution: India: West Bengal (Baridhama district).
305. Caryospora gekkonis Chakravarty and Kar


Diagnosis: Oocyst spherical, 18.5-20.5 (19.7) µm, double walled, no oocystic residuum, micropyle present; sporocyst almost spherical, thin-walled, 10.5-12.5 (11.5) µm in diameter, one end knob-like, sporocystic residuum present; sporozoites almost spherical, 2.5 µm in diameter.

Host: Takkhak or Indian Gekko, Gekko gecko (Linn.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

Genus Isospora Scheneider

In all 34 species of Isospora have been reported so far from West Bengal out of which 2 are recovered from amphibian host, 3 from reptilian hosts, 20 from avian hosts and 9 from mammalian hosts. Host-wise key of this genus is as follows:

A. Key to the species of Isospora of amphibians

1 (2) Oocyst subcylindrical, 15.3-20.5 µm x 13.5-15.5 µm in dimensions.............I. wenyoni

2 (1) Oocyst broadly oval, 24.5-26.5 µm x 15.5-19.5 µm in dimensions.............I. stomatica

B. Key to the species of Isospora of reptiles

1 (4) Oocyst spherical or subspherical, sporocyst elliptical.................................................................

2 (3) Oocyst 17.5-23.14 µm in diameter.................................................................I. knowlesi

3 (2) Oocyst 25-37 µm in diameter.................................................................I. calotesi

4 (1) Oocyst cylindrical, sporocyst spherical.............................................................I. minuta

C. Key to the species of Isospora of birds

1(12) Oocyst oval......................................................................................................................

2(7) Oocyst with residuum.............................................................................................................

3(6) Sporocyst pyriform or spindle-shaped............................................................................

4(5) Sporozoite elongated with tapering anterior end, 13.5-15.5 µm in length..............................I. emberizae

5(4) Sporozoite elongated-bluntly pointed at both ends, 9.2-10.4 µm in length..............................I. lorchurae

6(3) Sporocyst somewhat oval with narrow anterior end.........................................................I. psittaculae

7(2) Oocyst without residuum............................................................................................................

8(11) Sporocyst pyriform..................................................................................................................
9(10) Sporozoite elongated, 11.1-13.1 \( \mu \text{m} \) in length..................................................\( I. \) pycnonotae
10(9) Sporozoite sickle-shaped, 6.5 \( \mu \text{m} \) in length..................................................\( I. \) muniae
11(8) Sporocyst oval..........................................................\( I. \) zosteropis
12(1) Oocyst spherical or subspherical..........................................................
13(16) Oocyst with micropyle..........................................................
14(15) Oocyst spherical, 18.7-23.3 \( \mu \text{m} \) in diameter, sporocysts pyriform.............\( I. \) bengalensis
15(14) Oocyst subspherical, 22.5-24.5 \( \mu \text{m} \times 19.5-21.5 \mu \text{m} \) in dimensions, sporocysts elongately oval..........................................................
16(13) Oocyst without micropyle..........................................................
17(26) Sporocyst pyriform..........................................................
18(25) Sporozoite elongated..........................................................
19(20) Oocystic wall with bulbous thickening at broader pole.............................\( I. \) bellaricae
20(19) Oocystic wall without any bulbous thickening..........................................................
21(22) Sporozoite more than 10 \( \mu \text{m} \) in length, oocyst spherical, 20.3-24.5 \( \mu \text{m} \) in diameter..........................................................
22(21) Sporozoite less than 10 \( \mu \text{m} \) in length..........................................................
23(24) Oocyst spherical, (23.2-25.4 \( \mu \text{m} \) in diameter).....................................\( I. \) megalaimae
24(23) Oocyst subspherical..........................................................
24a Oocyst, 19.09-24.94 \( \mu \text{m} \) x 16.60-23.22 \( \mu \text{m} \), sporocyst 11.62-19.92 \( \mu \text{m} \) x 8.32-12.45 \( \mu \text{m} \)..................................................\( I. \) estrildi
24b Oocyst 16.65-23.31 \( \mu \text{m} \) x 15.54-21.09 \( \mu \text{m} \), sporocyst 10.54-14.95 \( \mu \text{m} \) x 7.75-1054 \( \mu \text{m} \) ..................................................\( I. \) copsychi
24c Oocyst, 20.75-24.09 \( \mu \text{m} \) x 19.92-22.49 \( \mu \text{m} \), sporocyst, 13.28-16.60 \( \mu \text{m} \) x 9.32-11.62 \( \mu \text{m} \)..................................................\( I. \) mandali
25(18) Sporozoite not elongated..........................................................
25a Sporozoite banana-shaped, 6-7 \( \mu \text{m} \) x 1.5-2.0 \( \mu \text{m} \)..................................................\( I. \) mayuri
25b Sporozoite bean-shaped, 8.5 \( \mu \text{m} \) x 2.3 \( \mu \text{m} \)..................................................\( I. \) lacazei
25c Sporozoite sausage-shaped with pointed anterior end, 6 \( \mu \text{m} \) x 1.6 \( \mu \text{m} \)..................\( I. \) gypsi
25d Sporozoite club-shaped, 7.5-10.2 \( \mu \text{m} \) x 10.8-2.5 \( \mu \text{m} \)..................................................\( I. \) capistrata
26(17) Sporocyst not pyriform..........................................................
27(28) Sporocyst conical, (16-18 \( \mu \text{m} \) x 11-12.5 \( \mu \text{m} \))..................................................\( I. \) concinus
28(27) Sporocyst oval, (17.5 μm x 18.5 μm).................................I. ceylonensis

D. Key to the species of Isospora of mammals

1(6) Oocyst with micropyle.................................................................

2(3) Oocyst elongated, egg-shaped with one end more constricted that other forming neck .................................I. belli

3(2) Oocyst ovoid or spherical to subspherical without any constriction as above.................

4(5) Oocyst ovoidal, 19.5 μm x 12 μm, sporocyst 7.5 μm x 6 μm...........I. sundarbanensis

5(4) Oocyst spherical to subspherical, 21-24.7 μm x 19.5-22.5 μm, sporocyst ovoid, 12-15.75 μm x 9-11.25 μm.................................I. sibporensis

6(1) Oocyst without any micropyle..............................................................

7(8) Oocyst not elongated, not parasitic in man.................................I. hominis

8(7) Oocyst not elongated, not parasitic in man........................................

9(10) Oocyst spherical, ovoid or egg-shaped...........................................

9a Oocyst subspherical, 36-40 μm x 32 μm; sporozoite bean-shaped...............I. canis

9b Oocyst spherical, 16 μm in diameter; sporozoite banana-shaped...............I. tropicalis

9c Oocyst ovoid or egg-shaped, 39-48 μm x 26-37 μm; sporozoite comma-shaped.................I. felis

9d Oocyst ovoid, 27-30 μm x 20-25 μm; sporozoite elongated with one end pointed......

...............................................................I. rivolta

10(9) Oocyst rhomboidal, (30-32 μm x 28-31 μm)..................................I. leonina

A. Isospora of amphibians

306. Isospora stomaticae Chakravarty and Kar


Diagnosis: Oocyst oval or spherical, double layered, both the walls thin, without any residuum and micropyle, 24.5-26.5 (25.5) μm x 15.5-19.5 (17.5) μm, shape index 1.5; sporocyst egg-shaped, with a stieda body, at the anterior end, 15.5-17.5 (16.5) μm x 10.5-11.5 (10.9) μm, shape index 1.5, sporocystic residuum present; sporozoite elongated, 12.5-14.5 μm x 2.5-4.5 μm; schizonts with 8.12 elongated merozoites, 6.6 μm x 3.2 μm; macrogametocyte round or oval, 15 μm in diameter.

Host: Marbled Toad, Bufo stomaticus Lutken; site of infection: small intestine.

Distribution: India: West Bengal (Calcutta district).
307. *Isospora wenyonii* Ray and Das Gupta


Diagnosis: Oocyst subcylindrical, double layered, 15.3-20.5 (17.5) μm x 15.5 (14.5) μm, shape index 1.2, oocystic residuum present, micropyle absent; sporocyst naviculoid, 10.0-13.3 (11.8) μm x 7.5-9.5 (8.5) μm, shape index 1.3, sporocystic residuum present; sporozoite elongated tapering at one end, mature schizont 15 μm in diameter; macrogametocyte 16-20 μm x 11-14 μm.


*Distribution*: India: West Bengal (Calcutta district).

B. *Isospora* of reptiles

308. *Isospora calotesi* Bhatia


Diagnosis: Oocyst spherical or subspherical, double-layered, with a micropyle but without any oocystic residuum, 25.0-3.70 (32.5) μm in diameter; sporocyst ellipsoidal, 12.5-17.5 (14.5) μm x 9.5-10.5 (9.8) μm, shape index 1.5, with a stieda body at the anterior end, sporocystic residuum present; sporozoites elongated 12.0 μm x 2.5 μm; schizont 22 μm x 17 μm, producing small vermiform merozoites about 100 in number.

*Host*: Garden lizard, *Calotes versicolor* (Daudin); site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district) and Maharashtra.

309. *Isospora knowlesi* Ray and Das Gupta


Diagnosis: Oocyst spherical, double layered, 17.5-23.14 (21.7) μm in diameter, residuum and micropyle absent; sporocyst ellipsoidal, 12.0-15.5 (14.3) μm x 7.3-10.5 (8.5) μm, shape index 1.7; sporozoite elongated tapering at one end, 10.5 μm-12.5 μm in length.

*Host*: House lizard, *Hemidactylus flaviviridis* (Ruppell); site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district).

310. *Isospora minuta* Mitra and Das Gupta


Diagnosis: Oocyst cylindrical, 14.5-16.5 (15.5) μm x 6.8-8.5 (7.7) μm, shape index 2.01, oocyst residuum and micropyle absent; sporocyst spherical, 6.5-9.9 (7.7) μm in diameter, residuum present as compact mass; sporozoites elongated tapering at one end, 3.5 - 4.6 μm in length.


*Distribution*: India: West Bengal (Calcutta district) and Meghalaya.
C. *Isopora* of birds

311. *Isopora bellericae* Banik and Ray


*Diagnosis*: Oocyst round or slightly oval, 18.7-24.5 (22.5) µm × 18.5 -22.5 (21.5) µm, double walled, with a bulbous thickening at one of the broader poles, residuum and micropyle absent; sporocyst pear-shaped with a prominent stieda body, 9.5 -15.00 µm × 7.5 - 9.5 µm, sporocystic residuum present; sporozoites elongated.

*Host*: Crowned Crane, *Bellerica (=Bellearica) pavonina regulorum*; site of infection: Intestine.

*Distribution*: India: West Bengal (Calcutta district).

312. *Isopora bengalensis* Mandal and Chakravarty


*Diagnosis*: Oocyst spherical, double walled, 18.7-23.3 (20.5) µm in diameter, micropyle present, oocystic residuum absent; sporocyst pyriform 14.4-16.4 (15.4) µm × 6.7 - 8.7 (7.7) µm, shape index 2.0 with a knob at the pointed anterior end, sporocystic residuum present; sporozoite elongated, 8.8 µm × 3.8 µm with shape index 2.6.

*Host*: House crow, *Corvus splendens* Vieillot; site of infection: Intestine.

*Distribution*: India: West Bengal (Calcutta district).

313. *Isopora capistrata* Sinha and Sinha


*Diagnosis*: Oocyst spherical 18.2 -24.6 (21.6) µm in diameter, double layered, oocystic residuum, micropyle, micropylar cap and polar body absent; sporocyst pyriform with a knob at the anterior end, 11.00-16.9 (14.6) µm × 8.8 -10.4 (9.6) µm, sporocystic residuum present; sporozoite club-shaped, 7.5-10.2 (9.0) µm × 1.8 - 2.5 (2.2) µm; schizont 7.9 µm × 7.6 µm; macrogamete 12 µm × 10 µm.


*Distribution*: India: West Bengal (Darjiling distrrict).

314. *Isopora ceylonensis* Sinha, Sinha, Chattoraj, Bandyopadhyay and Ghosh


*Diagnosis*: Oocyst oval or roudish, 20.5 -26.5 (24.8) µm × 18 - 23 (21.5), double layered, micropyle and oocystic residuum absent; sporocyst 17.5 µm × 18.5 µm, residuum present as clusterous mass; sporozoite elongated, 10 µm × 3 µm; trrophozoite 5.7 µm × 3.0 µm; schizont 9.6 × 4.6 µm; macrogametocyte 12 µm × 9.8 µm.

**Distribution**: India: West Bengal (Darjiling district).

**315. Isopora concinna** Sinha and Sinha


**Diagnosis**: Oocyst spherical, 23.5 - 29.0 (27.0) \(\mu m \times 21 - 25 (23) \mu m\), double layered, micropyle and oocystic residuum absent; sporocyst conical, 16.0 - 18.0 (17.8) \(\mu m \times 11.0 - 12.5 (12.0) \mu m\); sporozoite elongated, 11.8 \(\mu m \times \mu m\); trophozoite oval, 7.0 \(\mu m \times 4.2 \mu m\); schizont round or oval, 13.8 \(\mu m\) in diameter; macrogametocyte 16.3 \(\mu m \times 15.4 \mu m\).

**Host**: Sikkim Red-headed Tit, *Aegithalos concinna rubricapillus* (Tristehurrst); site of infection: small intestine.

**Distribution**: India: West Bengal (Darjiling district).

**316. Isopora copsychi** Paul, Ghosh and Haldar


**Diagnosis**: Oocyst subspherical, 16.65 - 23.31 (22.41) \(\mu m \times 15.54 - 21.09 (21.13) \mu m\), double layered, residuum, micropyle and polar granule absent; sporocyst pyriform, 10.54 - 14.98 (14.77) \(\mu m \times 7.7 - 10.54 (10.12) \mu m\), stieda body and residuum present; sporozoite elongated, 2.22 - 5.55 \(\mu m \times 1.66 - 2.77 \mu m\).

**Host**: Copsychus saularis (Linn.); site of infection: intestine.

**Distribution**: India: West Bengal.

**317. Isospora emberizeae** Mandal and Chakravarty


**Diagnosis**: Oocyst oval with three layers, middle one thicker than the other two layers, 22.2 - 24.2 (23.2) \(\mu m \times 18.8 - 20.8 (19.8) \mu m\), shape index 1.1, micropyle and residuum present, sporocyst pyriform with a small knob at the anterior end, 18.8 - 20.8 (19.8) \(\mu m \times 14.4 - 16.4 (15.4) \mu m\), shape index 1.2, sporocystic residuum present; sporozoite elongated, 13.5 - 15.5 (14.5) \(\mu m \times 2.5 - 3.5 (3.0) \mu m\).

**Host**: Red headed bunting, *Emberiza bruniceps* Brandt; site of infection: intestine.

**Distribution**: India: West Bengal (South 24 Parganas district).

**318. Isospora estrildi** Paul, Ghosh and Haldar


**Diagnosis**: Oocyst subspherical, 19.9 - 24.94 (22.13) \(\mu m \times 16.60 - 23.24 (20.80) \mu m\), double layered, residuum and micropyle absent, polar granules present; residuum and micropyle absent, polar granule present; sporocyst pyriform, 11.62 - 19.92 (14.50) \(\mu m \times 8.3 - 12.45 (9.40) \mu m\), stieda body and residuum present; sporozoite elongated, irregularly arranged, 4.15 - 8.3 \(\mu m \times 2.49 - 4.15 \mu m\).
Host: *Estrilda amandava* (L.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

319. *Isospora ginginiana* Chakravarty and Kar


Diagnosis: Oocyst round, double layered, 22.3 - 24.5 (23.4) μm, in diameter, micropyle and residuum absent; sporocyst pyriform with a refractile knob at anterior pointed end, 15.5 - 17.5 (16.5) μm × 10.5-11.5 (11) μm, shape index 1.5, residuum present; sporozoite elongated, 10.5 μm × 4.2 μm; schizont 8.8 μm in diameter; macrogametocyte 11 μm in diameter.


Distribution: India: West Bengal (Calcutta district).

319a. *Isospora ginginiana tristis* Chakravarty and Kar


Diagnosis: Oocyst subspherical or slightly oval, 24.0-30.0 (26.0) μm × 19.5 - 24.5 (21.9) μm, shape index 1.18; sporocyst pyriform, 15.5 - 17.5 (16.5) μm × 8.5 - 11.5 (10.5) μm, shape index 1.5; sporozoite elongated, 15.4 μm × 2.2 μm; other characters as for *I. ginginiana*.


Distribution: India: West Bengal (Calcutta district).

Remarks: Pellerdy (1974) treated this subspecies as separate species *I. tristis*.

320. *Isospora gypsi* Patnaik and Mohanty


Diagnosis: Oocyst spherical to sub-spherical, double layered, 17.0 - 23.5 (20.4) μm, × 14.5 - 19.5 (17.5) μm, shape index 1.5, residuum and micropyle absent, one or more polar granules present; sporocysts pyriform or ellipsoidal, 11.5 - 16.5 (13.2) μm × 8.2 - 8.5 (8.5) μm with a refractile plug like stieda body at the narrow anterior end, residuum present; sporozoite sausage-shaped, 6.0 μm × 1.6 μm, with pointed anterior end.

Host: Indian White-backed Vulture, *Gyps bengalensis* (Gmelin); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district), Orissa and Uttar Pradesh.

321. *Isospora lacazei* (Labbe)


**Diagnosis**: Oocyst spherical or sub-spherical, double walled, 24.0 - 32.0 (26.8) μm × 20.0 - 30.0 (27.4) μm, shape index is 1.09, macropyle and oocystic residuum absent; sporocyst ovoid to pyriform with a button-shaped plug at the narrow anterior end, 14 - 22 (17.2) μm, × 10.0 - 11.0 (10.3) μm, shape index 1.56, sporocystic residuum present; sporozoite bean-shaped, 8.5 μm 2.3 μm; schizont 14 μm × 10 μm, with 12-15 sickle-shaped merozoites; macrogamete 11-16 μm, in diameter.


**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Pellerdy (1974) gave a detail account of this common and cosmopolitan parasite having world wide distribution.

322. *Isospora lonchurae* Mandal and Chakravarty


**Material examined**: Sev. exs., Calcutta, 12.3. 1963, A.K. Mandal.

**Diagnosis**: Oocyst oval, double layered, 24.3 - 26.4 (25.4) μm × 20.9 - 23.1 (21.8) μm, shape index 1.1, micropyle absent and oocystic residuum present; sporocyst pyriform with a small knob at the anterior end, 18.7 - 20.9 (19.5) μm, × 11.13.2 (12.1) μm, shape index 1.6 sporocystic residium present; sporozoite elongated bluntly pointed at both ends, 9.2 - 1.4 (9.6) μm, × 2.5-3.5 (2.8) μm; macrogemetocyte 8.8 - 11.0 μm in diameter.


**Distribution**: India West Bengal (Calcutta district).

323. *Isospora mandali* Paul, Ghosh and Haldar


**Diagnosis**: Oocyst spherical or subspherical, 20.75 - 24.09 (22.41) μm × 19.92 - 22.41 (21.13) μm, double layered, micropyle absent, polar granules present; sporocyst pyriform, 13.28 - 16.66 (14.77) μm × 9.13 - 11.62 (10.12) μm, stieda body and sporocystic residuum present; sporozoite elongated, 4.89 - 6.64 μm × 1.66 - 2.66 μm.

**Host**: *Lonchura striata* (L.); site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district).

324. *Isospora mayuri* Patnaik,


**Diagnosis**: Oocyst sub-spherical, double walled, 20 - 27.4 (23.3) μm, × 18-24.1 (21.36) μm,
shape index 1.0-1.21 (1.09), oocystic residuum and micropyle absent; sporocyst pyriform, 14.5 - 16.1 (15.9) \( \mu m \times 9.6 - 11.23 (10.17) \mu m \), stieda body at the pointed end; sporozoites banana-shaped, 6-7 \( \mu m \times 1.5 - 2 \mu m \).

**Host**: Indian Pea fowl, *Pavo cristatus* Linn.; site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district), Delhi, Orissa and Uttar Pradesh.

325. *Isospora megalaimae* Mandal and Chakravarty


**Material examined**: Sev. exs., Calcutta, 10.iii.1962, A.K. Mandal.

**Diagnosis**: Oocysts round, 23.2 - 25.4 \( \mu m \) in diameter, double layered, micropyle and oocystic residuum absent; sporocyst pyriform, 17.6 \( \mu m \times 9.9 \mu m \), sporocystic residuum present; sporozoite elongated, 7.7 \( \mu m \) in length and arranged irregularly; schizont round, 6.6 \( \mu m \) in diameter; macrogametocyte round, 15.5 \( \mu m \) in diameter;

**Host**: Crimson-breasted Barbet, *Magalaima haemocephala* (P.L.S. Muller); site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district).

326. *Isospora muniae* Chakravarty and Kar


**Diagnosis**: Oocyst broadly or elongately oval, 24.5 31.5 (28.3) \( \mu m \times 15.5 - 19.5 (17.5) \mu m \), shape index 1.6, double layered, micropyle present, oocystic residuum absent; sporocyst pyriform, 14.5 - 16.5 (15.5) \( \mu m \times 10.2 - 11.2 (10.7) \mu m \), shape index 1.4, double layered with a refractile knob at the pointed anterior end, sporocystic residuum present; sporozoites sickle-shaped, 6.5 \( \mu m \), x 2.00 \( \mu m \); elongately oval, schizont, 10-13.2 \( \mu m \times 6.6-8.8 \mu m \), producing 16 sickle-shaped merozoites; macrogamete oval, 18.8 \( \mu m \times 13.2 \mu m \).

**Host**: Black-headed Munia (=Loicnura) malacca malacca Linn.; site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district).

327. *Isospora psittaculakae* Chakravarty and Kar


**Diagnosis**: Oocyst broadly oval, double layered, 28.5 - 32.6 (30.5) \( \mu m \times 24.4 - 28.4 (25.4) \mu m \), shape index 1.16, oocystic residuum present, micropyle absent; sporocyst somewhat oval with narrow anterior end and with a well developed knob of 2.2 \( \mu m \) in length, sporocyst 22.0 - 26.4 (24.5) \( \mu m \times 12.5 - 14.5 (13.50) \mu m \), shape index 1.8, sporocystic residuum present; sporozoite elongated 11.5 -15.5 (13.5) \( \mu m \times 4.4 -6.4 (5.4) \mu m \).

**Host**: Large Indian Parakeet, *Psittacula eupatria, nipalensis* (Hodgson), and Red whiskered Bulbul, *Pycnonotus (=Elathea) jocosus emeria* (Linn.); site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district).
328. *Isospora pycnonotae* Mandal and Chakravarty.


*Diagnosis*: Oocyst oval, double walled, 23.2 - 24.5 (24.2) μm × 18.8 - 20.8 (19.8) μm, shape index 1.2, micropyle present, oocystic residuum absent; sporocyst pyriform, provided with a small knob at the pointed end, 18.8 - 20.8 (19.8) μm × 7.8 - 9.8 (8.8) μm, shape index 2.1, sporocystic residuum present; sporozoite elongated, 11.1 - 13.1 (12.1) μm × 2.1 - 3.4 (2.8) μm; schizont 4.4 μm in diameter with 8-12 merozoites; macrogamete 22 μm × 15.4 μm.


*Distribution*: India: West Bengal (Calcutta district) and Uttar Pradesh.

329. *Isospora temenuchii* Chakravarty and Kar


*Diagnosis*: Oocyst subspherical or slightly ovoid, 22.5 - 24.5 (23.5) μm × 19.5 - 21.5 (20.5) μm, shape index 1.14, double layered, micropyle present, oocystic residuum absent; sporocyst elongately oval with a well developed knob at the anterior end, 15.5 - 17 (16.5) μm × 10.2 - 11.5 (10.6) μm, sporocystic residuum present; sporozoite elongated, 8.5 μm × 3.3 μm.

*Host*: Black headed or Brahminy Mayna, *Temenuchus (= Sturnus) pagodarum* (Gmelin); *Megalaima (= Thereiceryx) zeylanica*; site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district).

330. *Isospora zosteropis* Chakravarty and Kar


*Diagnosis*: Oocyst oval, double layered, 17.5 - 22.5 (19.8) μm × 13.5 - 19.5 (16.5) μm, shape index 1.2, micropyle and oocystic residuum absent; sporocyst oval with a knob at the anterior end, 15.3 - 17.5 (16.5) μm × 10.5 - 11.5 (11.1) μm, shape index 1.4, sporocystic residuum present; sporozoites club-shaped, 14.5 - 16.5 (15.5) μm × 2.1 - 3.5 (2.5) μm.

*Host*: White eye, *Zosterops palpebrosa palpebrosa* (Temm, & Schiegal); *Megalaima (= Thereiceryx) zeylanica*; site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district).

*Isospora of Mammals*

331. *Isospora belli* Wenyon


*Diagnosis*: Oocyst elongated, egg-shaped, with one end more constricted than the other, forming neck, 25-23 (29) μm × 12.5 - 16 (14.25) μm, double layered, micropyle present; sporocyst 12- 14 μm × 7-9 μm, sporocystic residuum present; sporozoites elongated with rounded anterior end and tapering at the posterior
Host: Man, Homo sapiens Linnaeus.

Distribution: India: West Bengal (Calcutta district) and Maharashtra.

Remarks: Das Gupta (1934), Mukherjee and Ray (1965) and Ray, Mukherjea and Chakrabarty (1959) reported this species from man while working at the School of Tropical Medicine, Calcutta.

332. Isospora canis Nemesis


Diagnosis: Oocyst subspherical, 38 μm × 32 μm, micropyle and oocystic residuum absent, sporocyst spherical 20 μm × 16 μm, stieda body absent, sporocystic residuum present; sporozoites bean-shaped, 11.5 μm in length.

Host: Domestic dog, Canis familiaris Linn. (= Canis sp.).

Distribution: India: West Bengal (Calcutta district).

Remarks: Mandal (1976) has synonymised Isospora canis as a homonym, described by Ray and Banik with T. canis Nemesis.

333. Isospora felis (Wasielewsky)


Diagnosis: Oocysts ovoid to egg-shaped, tapering at one end, ovoid form 39-48 μm × 26-37 μm (mean 43.5 μm × 31.5 μm) and the egg-shaped one measuring 35-45 μm × 23-35 μm (mean 40 μm × 29 μm), oocystic wall smooth and pinkish in colour, micropyle absent; sporocyst elongated, 20-24 μm × 18-21 μm (mean 22 μm × 19.5 μm), sporocystic residuum present; sporozoites comma-shaped, schizor.: 4-6.2 μm producing 8-16 merozoites; macrogametocyte 16-12 μm × 8-12 μm.

Host: Domestic cat, Felis catus [= F. domestica Linn. (= Felis sp.)]; White Tiger, Panthera sp., Alsatian pup., Canis sp.; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district), Tamil Nadu and Uttar Pradesh.

334. Isospora hominis (Railliet and Lucet)


Diagnosis: Oocysts elongated, 22-32 μm × 10-15 μm, transparent, colourless, with a thin outer and a thick inner membrane, micropyle and oocystic residuum absent; sporocyst oval, 9-16 μm × 7-11 μm, sporocystic residuum present; sporozoite elongated with one end rounded and the other pointed.
Host: Man, Homo sapiens Linn.

Distribution: India: West Bengal (Calcutta district).

Remarks: Ray, Mukherjee and Chakrabarty (1959) and Haldar and Chakravarty (1969) reported this species from India. The present knowledge on coccidia and subsequent description of certain genera like Sarcocystis, Besnoitia, Frenkelia etc., indicates that this human coccidium, Isospora hominis may be treated as Sarcocystis hominis and S. suihominis. The authors like Zaman (1963), Tardos and Laarman (1976), Dubey (1976) and Long (1982) have contributed much on the subject (see Mandal, 1988).

335. Isospora leonina Mandal and Ray


Diagnosis: Oocyst rhomboidal, 30-32 (31.8) μm x 28.00-31 (28.2) μm, micropyle and oocystic residuum absent; sporocyst subspherical, 16-20 μm x 13.5 - 15 μm, sporocystic residuum present; sporozoite sausage shaped, 9.5 μm in length.

Host: Lion, Panthera leo (Linn.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district) and Nandankanan Biological Park, Barang, Orissa (Patnaik and Acharjya, 1970).

336. Isospora rivolta (Grassi)


Diagnosis: Oocyst ovoid, 27-30 μm x 20-25 μm (mean 28 μm x 23 μm), shape index 1.17-1.22, double layered, micropyle, polar cap, polar granules and oocystic residuum absent; sporocyst ellipsoidal, 17-19 μm x 12-14 μm (mean 18 μm x 12 μm), steida body absent, sporocystic residuum present; sporozoite elongated, 13-15 μm x 2-3 μm; schizont, 17-24 μm x 12-15 μm, 4-20 merozoites.

Host: Domestic dog, Canis familiaris Linn. (= Canis sp.); Dingo, Canis dingo Linn.; Domestic cat, Felis catus (= Felis domestica Linn.) (= Felis sp.), Jungle cat, Felis chaus Guldensteadt, Herpestes auropunctata; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district), Tamil Nadu and Uttar Pradesh.

337. Isospora sibporensis Bandyopadhyay, Nandi and Das


Diagnosis: Oocyst subspherical to spherical, 21-24.75 μm x 19.5-22.5 μm (mean 22.05 μm x 20.75 μm), yellowish, bilayered, micropyle with micropylar cap and polar body, oocystic residuum absent; sporocyst ovoid, 12-15.75 (14.1) μm x 9-11.25 (10.5) μm, steida body and residuum present; sporozoite elongated, 4.5-6 (5.4) μm x 2.45-3 (2.85) μm.

Host: Rattus rattus arboreus (Horsefield); site of infection: intestine.
Distribution: India: West Bengal (Haora district).

338. Isospora sundarbanensis Ray and Sarkar


Diagnosis: Oocyst ovoidal, 18.5-20.0 (19.5) μm × 10.5-13.5 (12.0) μm, bilayered, yellowish brown, micropyle present, residuum and polar granule absent; sporocyst ovoidal with cap-like stieda body, 7-8 (7.5) μm × 5.5-6.5 (6.0) μm, residuum present; sporozoite round, 3.5-4.0 μm in diameter.

Host: Sus scrofa (Linn.); site of infection: intestine.

Distribution: India: West Bengal (South 24-Parganas district).

339. Isospora tropicalis Mukherjee and Krassner

Diagnosis: Oocyst spherical, 16 μm in diameter, micropyle and oocystic residuum absent; sporocyst oval, 15.5-16 μm × 10.0-10.5 μm, sporocystic residuum present; sporozoites banana-shaped, 8-10 μm × 3.2-4 μm.

Host: Asiatic Jackal, Canis aureus Linn.; site of infection: intestine.

Distribution: India: West Bengal (Hugli district).

Genus Dorisa Levine

In all 10 species of Dorisa have been reported so far from the state. Out of these 7 species are known from birds and 3 from mammals.

A. Key to the species of Dorisa of birds

1(8) Oocyst spherical..........................................................................................................................
2(3) Oocystic residuum present........................................................................................................
3(2) Oocystic residuum absent...........................................................................................................
4(7) Sporocyst ellipsoidal.................................................................................................................
5(6) Stieda body present, oocyst 27.5-30.0 μm. .................................................................D. chakravartyi
6(5) Stieda body absent, oocyst 16.80-20.16 μm. .................................................................D. graculae
7(4) Sporocyst pyriform..............................................................................................................D. hareni
8(1) Oocyst oval..............................................................................................................................
9(12) Oocystic residuum present....................................................................................................
10(11) Sporocyst oval.....................................................................................................................D. vagabundae
A. Dorisa of birds

340. Dorisa aethiopsaris (Chakravarty and Kar)

Diagnosis: Oocyst subspherical or oval, double walled, subspherical form 28.5-30.5 (29.5) \( \mu m \times 24.4-25.4 \) (25.4) \( \mu m \), shape index 1.16, oval form 33.5-38.5 (35.8) \( \mu m \times 24.2-26.4 \) (25.4) \( \mu m \), shape index 1.4, micropyle and oocystic residuum absent; sporocyst oval, with a well developed knob at the pointed anterior end, 19.5-22.5 (20.9) \( \mu m \times 11.2-13.2 \) (12.2) \( \mu m \), shape index 1.5, sporocystic residuum present; sporozoite elongated, 12.2-14.2 (13.2) \( \mu m \times 1.5-2.5 \) (2.1) \( \mu m \); schizont spherical 8.8 \( \mu m \) in diameter, macrogamets 11 \( \mu m \) in diameter.

Host: Jungle Myna, (= Acridotheres Aethiopsar) fuscus fuscus (Wagler); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

341. Dorisa chakravartyi (Ray and Sarkar)

Diagnosis: Oocyst spherical, 27.5-30.00 (28.45) \( \mu m \), double layered, oocystic residuum and micropyle absent; sporocyst ellipsoidal, 22.5 \( \mu m \times 15.0-17.5 \) \( \mu m \), with stieda and substiedal body, sporocystic residuum present; sporozoite elongated, club-shaped, 13.2 \( \mu m \times 3.6 \) \( \mu m \).

Host: White-throated Munia, Lonchura malabarica (Linn.) and Spotted Munia, L. punctulata (Linn.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

342. Dorisa graculæ (Mandal, Mandal, Chakraborty, Bhowmik, Sarkar and Ray)
Diagnosis: Oocyst spherical, double walled, 16.80-20.16 μm in diameter, micropyle, refractile granule, oocystic residuum absent; sporocyst ellipsoidal, bilayered, without stieda body, 10.08-13.44 (11.17) μm × 5.04-6.72 (6.52) μm, sporocystic residuum present; sporozoite elongated, 6.72-10.08 (8.56) μm × 3.36-5.04 (4.87) μm.

Host: Gracula religiosa Linn.; site of infection: intestine.

Distribution: India: West Bengal (Darjiling district).

343. Dorisa hareni (Chakravarty and Kar)


Diagnosis: Oocyst spherical, 18.5-22.5 (20.5) μm in diameter, double walled; micropyle and oocystic residuum absent; sporocyst single layered, pyriform, 14.5-18.5 (16.5) μm × 9.5-10.5 (9.9) μm, shape index 1.5, residuum present; sporozoite club-shaped with bluntly pointed anterior end, 8.2 μm × 2.5 μm; trophozoite spherical, 5.6 μm in diameter, schizonts 19.5 × 16.36 μm; macrogametocyte 16.6 μm × 12.8 μm.

Host: Black-headed Munia, Munia (= Lonchura) malacc malacca Linn.; Chestnet-bellied Munia (= Nepal Black headed Munia), Munia atricapilla (= Lonchura malacca) rubroniger (Hodgson); Red Munia, Amandava amandava (= Estrilda amandava (Linn.)); Whitethroated Munia, Uroloncha (= Lonchura) malabarica (Linn.) and Spotted Munia, Uroloncha (= Lonchura) punctulata (Linn.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

344. Dorisa mandali (Ray and Sarkar)


Diagnosis: Oocyst oval, 27.5-33.7 μm × 25.0-30.0 μm (average 30.73 μm × 26.7 μm), wall transparent greenish yellow in colour, oocystic residuum present, micropyle absent; sporocyst vial-shaped with prominent plug-like “stieda body” at the pointed anterior end, sporocystic residuum present; sporozoite 12.2 μm × 4.5 μm.

Host: Indian white eye, Zosterops palpebrosa (Temm.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

345. Dorisa passeris (Ray and Sarkar)


Diagnosis: Oocyst spherical, 30-32.5 (31.17) μm in diameter, outer wall pale yellowish green, oocystic residuum present, micropyle absent; sporocyst vial-shaped 22.5 μm × 15.2 μm, sporocystic residuum present; sporozoite curved, sausage-like, 9.7 μm × 3.0 μm, blunt at both ends.

Host: House Sparrow, Passer domesticus (Linn.); site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).
346. *Dorisa vagabundae* (Mandal and Chakravarty)


*Diagnosis*: Oocyst oval, double walled, outer thinner, micropyle and oocystic residuum present, 24.0-26.4 μm × 22.0 μm; sporocyst with a less prominent stieda body, 17.6-19.8 μm × 12.1 μm; sporozoite club-shaped, pointed at one end.

*Host*: *Dendrocitta vagabunda* (Latham); site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district).

B. *Dorisa* of mammals

347. *Dorisa bengalensis* Bandyopadhyay and Ray


*Diagnosis*: Oocyst subspherical to ovoid, bilayered, 18-19.5 μm × 16.5-18 μm, micropyle absent; sporocyst ellipsoid with a prominent stieda body, 13.5-14 μm × 9-10 μm, sporocystic residuum present; sporozoite rounded, 3 μm in diameter.

*Host*: Indian Palm Squirrel, *Funambulus pennanti* Wroughton; site of infection: intestine.

*Distribution*: India: West Bengal (Haora district).

348. *Dorisa harpia* (Sinha and Das Gupta)


*Diagnosis*: Oocysts subspherical to ellipsoidal 21.5-24.2 (22.6) μm × 17-19 (17.8) μm, double layered, oocystic residuum absent, micropyle present; sporocyst 16.8 μm × 10.8 μm with compact sporocystic residuum; sporozoite elongated, 8.4 μm × 3.2 μm; trophozoite oval, 6.6 μm × 5.5 μm; schizont spherical, 5.5 μm in diameter, macrogamete 15.5 μm × 14.0 μm.

*Host*: Hairywinged Bat, *Harpiocephalus harpia lasyurus* (Hodgeson); site of infection: intestine.

*Distribution*: India: West Bengal (Darjiling district).

349. *Dorisa indica* Bandyopadhyay, Ray and Bhattacharjee


*Diagnosis*: Oocyst subspherical, 19.5-22.5 (20.8) μm × 18-19.5 (18.6) μm, smooth, colourless and bilayered wall, micropyle and polar body present, residuum absent; sporocyst ovoid, bimembranous, with a knob-like stieda body, residuum abundant, 14.25-16.5 (15.4) μm × 8.25-9.3 (8.5) μm; sporozoite ellipsoid, 4.2-4.5 (4.4) μm × 2.7-3.0 (2.9) μm.

*Host*: *Rattus rattus arboreus* (Horsefield); site of infection: Intestine.

*Distribution*: India: West Bengal (Haora district).
Genus *Wenyonella* Hoare

Four species of this genus, 2 from birds and 2 from mammals, are reported so far from this state.

A. Key to the species of *Wenyonella* of birds

1 (2) Oocyst bilayered, spherical or slightly oval, measuring 21.3-26.5 μm x 20.6-25.8 μm ................................................................. *W. columbae*

2 (1) Oocyst trilayered, pitcher-shaped, measuring 22.8-26.4 μm x 16.8-19.2 μm .......................... *W. gagari*

B. Key to the species of *Wenyonella* of mammals

1 (2) Oocyst spherical, measuring 14.5-18.5 μm in diameter, micropyle present........ *W. hoarei*

2 (1) Oocyst ellipsoid to slightly ovoid, measuring 16.5-21.75 μm x 13.5-15.0 μm, micropyle absent................................................................. *W. levinei*

A. *Wenyonella* of birds

350. *Wenyonella columbae* Haldar and Ray Chaudhury


*Diagnosis*: Oocyst spherical or slightly oval, 21.3-26.5 (23.8) μm x 20.6-25.8 (23.0) μm, bilayered, micropyle and oocystic residuum absent; sporocyst 10.5-12.8 (11.6) μm x 6.4-8.6 (7.5) μm, sporocystic residuum and stieda body absent; sporozoite elongated, 4.5 μm in length.

*Host*: Domestic pigeon, *Columba livia intermedia* Strickland

*Distribution*: India: West Bengal (Calcutta and Nadia districts).

351. *Wenyonella gagari* Sarkar and Ray


*Diagnosis*: Oocyst pitcher-shaped having three layers of 1.8 μm in thickness, outer layer yellow, middle greenish and the inner yellowish pink, a prominent micropyle of 4.8 μm in diameter at narrow pole with flunted 4-6 ridges at its outer boarder, 22.8-26.4 (24.0) μm x 16.8-19.2 (18.5) μm, oocystic residuum absent; sporocyst vial-shaped, 13.2 (13.8) μm x 7.2-9.6 (8.4) μm, sporocystic residuum and stieda body present; sporozoite club-shaped 9.6 μm x 3.6 μm.


*Distribution*: India: West Bengal (North 24-Parganas district).

B. *Wenyonella* of mammals

352. *Wenyonella hoarei* Ray and Das Gupta

**Diagnosis**: Oocyst spherical, double layered, 14.5-18.5 (16.8) μm in diameter, oocystic residuum absent, micropyle present; sporocyst ovoid, with a lens-shaped knob at the pointed anterior end, 9.5-11.5 (10.5) μm × 7.5-9.3 (8.4) μm, shape index 1.2, sporocystic residuum present; sporozoite elongated, 7.4 μm × 1.5 μm; schizonts with two types of merozoites measuring 6 μm × 2 μm and 8 μm × 2 μm.

**Host**: Indian squirrel, *Sciurus* sp.; site of infection: intestine.

**Distribution**: India: West Bengal (Haora district).

353. *Wenyonella levinei* Bandyopadhyay, Ray and Das Gupta


**Diagnosis**: Oocyst ellipsoid to ovoid, 16.5-21.75 (19.95) μm × 13.5-15 (14.25) μm, double layered, micropyle, polar granule and oocystic residuum absent; sporocyst ovoid, 7.5-9.75 (8.55) μm × 5.22-6.0 (5.4) μm, sporocystic residuum present, stieda body absent; sporozoite ellipsoid, 4.5-5.25 (4.95) μm × 3.0-4.5 (3.3) μm.

**Host**: *Rattus rattus arboreus* (Horsfield); site of infection: intestine.

**Distribution**: India: West Bengal (Haora district).

354. *Octosporella mabuiae* Ray and Raghavachari


**Diagnosis**: Oocyst octosporocystid, sporocyst dioic; spherical oocyst 14-16 μm in diameter with no oocystic residuum; sporocyst spindle-shaped, 8.4 μm × 4.2 μm, sporocystic residuum present; sporozoite sickle-shaped.

**Host**: *Mabuya* sp.; site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district).

Genus *Octosporella* Ray and Raghavachari

355. *Sivatoshella lonchurae* Ray and Sarkar


**Diagnosis**: Oocyst spherical, 36.0-38.0 (37.62) μm in diameter, oocystic wall 4 layered of 3.6 μm in thickness, oocystic residuum and micropyle absent; sporocyst pear-shaped, 28.00-29.00 μm × 18.0 μm, stieda body and substiedal body present at the narrow pole, sporocystic residuum present; sporozoite broad, comma-shaped, peripherally arranged; schizont 24-26 μm in diameter containing nearly 100 merozoites; macrogametocyte 30-35 μm in diameter.

**Host**: Spotted Munia, *Lonchura punctulata* (Linn.); Whitethroated Munia, *L. malabarica* (Linn.); site of infection: intestine.

**Distribution**: India: West Bengal (Calcutta district).
Genus *Pythonella* Ray and Das Gupta

356. *Pythonella bengalensis* Ray and Das Gupta


*Diagnosis*: Oocyst with sixteen sporocysts (hecaidecasporocystid), each containing four sporozoites (tetrazoic sporocyst); oocyst spherical, 25-30 µm in diameter; sporocyst 8-10 µm × 6.7 µm, with a central residuum.

*Host*: Indian Python, *Python* sp., site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district).

Family LANKESTERELLIDAE

Genus *Lankesterella* Labbe

*Diagnosis*: Heteroxenous, oocyst producing 32 or more sporozoites, sporozoites occurring in vertebrate erythrocytes, with about 30 subpellicular microtubules.

So far 3 species of *Lankesterella* including one undetermined species have been recovered from amphibians and 3 undetermined species from avian hosts. In this connection mention is to be made here that Levine (1988) listed two species of *Lankesterella* viz., *L. ranae* and *L. rhacophorae* both dealt with by R. Ray (1979) in his unpublished Ph.D. Thesis. Since these 2 species are not published tile to date these are to be treated as ‘nomen nudum’ and, therefore, excluded from the present systematic account.

A. Key to the species of *Lankesterella* of amphibians

1 (2) Sporozoite vermiform with anterior extremity tapering, 10-15 µm in length....... *L. minima*

2 (1) Sporozoite slender, crescent-shaped, measuring 9.0-11.5 µm in length............. *L. bufonis*

A. *Lankesterella* of amphibians

357. *Lankesterella bufonis* Mansour and Mohammed


*Diagnosis*: Sporozoite very small, slender, crescent-shaped, 9-11.5 (10.6) µm × 1.0-2.5 (1.45) µm; nucleus terminal or subterminal with few chromatin granules; vacuole single and centrally located.

*Host*: *Bufo melanostictus* Schneinder; site of infection: blood.

*Distribution*: India: West Bengal (Bankura district).

358. *Lankesterella minima* (Chaussat)


**Diagnosis**: Sporozoite vermicular with anterior extremity tapering, 10-15 μm in length, schizont 7.5-8.5 μm in diameter producing 16-25 merozoites; merozoites 6.0 μm × 1.5 μm in dimensions, finally invade endothelial cells of blood vessels and develop into micro and macrogametocytes; microgamete and macrogamete (7-9 μm in diameter) fertilizing to form zygote which develops into an oocyst containing 10-20 sporozoites but no sporocyst; leech acting as mechanical transmitter.


*Distribution*: India: West Bengal (Bankura, Jalpaiguri, Murshidabad and South 24-Parganas districts).

359. *Lankesterella* sp.

*Host*: *Bufo himalayanus* Boulenger; site of infection: blood.

*Distribution*: India: West Bengal (Darjiling district).

*Remarks*: Sinha (1979) recorded this unnamed species from the above mentioned host.

360. *Lankesterella* sp.

*Host*: *Placopus philippinus* (Linnaeus): blood

*Distribution*: India: West Bengal (Nadia district).

*Remarks*: Nandi et al. (1984) reported this unnamed species from the above mentioned host.

361. *Lankesterella* sp.

*Host*: *Passer domesticus* (Linnaeus); site of infection: blood.

*Distribution*: India: West Bengal (Nadia district).

*Remarks*: Nandi et al. (1984) reported this unnamed species from the above mentioned host.

362. *Lankesterella* sp.

*Host*: *Sturnus malabaricus* (Gmelin); site of infection: blood.

*Distribution*: India: West Bengal (Nadia district).

*Remarks*: Nandi et al. (1984) reported this unnamed species from the above mentioned host.

*Family*: SARCOCYSTIDAE

*Genus*: *Sarcocystis* Lankester

*Diagnosis*: Last generation meronts typically in striated muscles; merozoites elongate.

363. *Sarcocystis blanchardi* Doflein


**Diagnosis**: Cysts measuring up to 30 mm × 5 mm × 3 mm, usually 1 cm long, compartmented when mature, cyst wall smooth, peripheral polyhedral chambers filled with fine granulations, central chambers empty or containing spores (cytophaneres); trophozoites about 10 μm long.

**Host**: *Bubalus bubalis* and *Bos indicus* Linnaeus; site of infection: striated and heart muscle.

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Chatterjee (1907) found the cysts and spores of *Sarcocystis* sp. in the heart-muscle of a cow which was later referred to by Bhatia (1938) as *S. blanchardi*. This species is extremely common throughout the world and in very heavy infections there may be lameness, weakness, emaciation, paralysis and even death (Levine, 1967).

**Family** TOXOPLASMATIDAE

**Genus** Toxoplasma Nicolle and Manceaux

**Diagnosis**: Meronts in many types of cell; host cell nucleus outside meront wall; euryxenous, producing pseudocyst and reproducing by endodyogeny.

364. *Toxoplasma gondii* (Nicolle and Manceaux)


**Diagnosis**: Trophozoite crescentic or banana-shaped, with one end pointed and the other 2bd rounded, 4-8 μm × 2-4 μm, with more or less central and vesicular nucleus; occurring in host cells either singly or in groups; schizont growing up to 20 μm in diameter, producing 20-30 nuclei by a process of internal budding known as endodyogeny, in this process 2 daughter cells produced, growing until they destroy the parent cell and become released from the host cell.

**Host**: Mammals and brids, common in rodents; *Rattus rattus*; *Lepus* sp.; site of infection: blood and in many types of cells, epithelial, endotelhial, skeletal, neurons, microglia etc.

**Distribution**: India: West Bengal (Calcutta and Haora districts). Worldwide.

**Remarks**: Toxoplasmosis is apparently extremely common in man and also in many domestic animals and has many different manifestations (Livine, 1967). Krishnan and Lal (1933) reported *Toxoplasma cuniculi* Splendore infection in smear preparation from liver, spleen, bone-marrow and heart blood of rabbits, *Lepus* sp. from Calcutta. This species *T. cuniculi* is considered as a synonym of *T. gondii* (see Levine, 1967).
Family PLASMODIIDAE

Key to the genera

1 (2) Parasitic in mammals, birds and reptiles, pigment granules present in gametocytes and schizonts

Plasmodium

2 (1) Parasitic in fishes, pigment granules present in gametocytes only

Mesnilium

Genus Plasmodium Marchiafava and Celli

Seven species of Plasmodium, 4 from birds and 3 from man have been reported from this State. In addition 10 unidentified species of Plasmodium are also known from birds. In this connection, mention is to be made that 2 species of Plasmodium viz., P. cynomolgi and P. knowlesi are not dealt with here since the place of origin of infection of these species is doubtful. (see Napier and Campbell, 1932, Sinton and Mulligan, 1932, Knowles and Das Gupta, 1932).

A. Key to the species of Plasmodium of birds

1 (6) Elongate gametocyte

2 (3) Erythrocytic schizonts with plentiful cytoplasm, (mature gametocytes and a sexual forms tending to encircle the host cell- nucleus without displacing it, mature segmenters with 13-30 merozoites)

P. circumflexum

3 (2) Erythrocytic schizonts with scanty cytoplasm

4 (5) Erythrocytic schizonts small with 4-9 merozoites

P. nucleophilum

5 (4) Erythrocytic schizonts large with 10-14 merozoites

P. coturnixae

6 (1) Round gametocytes, (mature segmenters with 8-32 merozoites)

P. relictum

B. Key to the species of Plasmodium of Mammals

1 (2) Full grown schizonts rounded, nearly filling erythrocytes, 6-12 merozoites, typically arranged in circle, schizogony in 72 hours

P. malariae

2 (1) Full grown schizonts irregular in form, filling half to two- third the erythrocyte and irregularly arranged, schizogony in about 48 hours

3 (4) Gametocytes crescent-shaped, infected erythrocytes normal or atrophied

P. falciparum

4 (3) Gametocytes rounded or oval, infected erythrocytes hypertrophied

P. vivax

A. Plasmodium of birds

365. Plasmodium circumflexum Kikuth


**Diagnosis**: Mature gametocytes and asexual forms tending to encircle the host-cell nucleus without displacing it; mature segmenters with 13-30 merozoites; pigment localized at the extremity in asexual forms; 48 hour periodicity; elongated gametocytes; sporogony in *Theobaldia* mosquitoes; usually occurring in passerine birds, also found in grouse and eider duck.

**Host**: *Dendrocitta vagabunda*, *Ardeola grayi* and in a number of sparrows, thrushes and other passeriform species (Garnham, 1966); site of infection: blood, lungs, liver, spleen, bone-marrow, heart, capillary endothelium of brain etc. of vertebrate hosts (birds).

**Distribution**: India: West Bengal (Calcutta and Nadia districts), widely distributed being a cosmopolitan species.

**Remarks**: Basu (1938) reported a malarial parasite viz. *Plasmodium heroni* in pond heron, *Ardeola grayi* with elongated schizonts and gametocytes. According to Garnham (1966) *P. heroni* should be regarded as a synonym of *P. circumflexum* or of *P. fallax*. *P. heroni* is considered herein as a possible synonym of *P. circumflexum*.

366. *Plasmodium coturnixae* Sarkar and Ray


**Diagnosis**: Elongated gametocytes with one pole narrower than the other, margins irregular or slightly crenated, 15 - 20 small black pigment granules usually aggregated at either pole of the female gametocyte; erythrocytic schizonts with 10 -14 merozoites, round, 7.6 μm in diameter with pigments in the centre or peripherally located; exoerythrocytic schizont in macrophage cells of bone marrow, liver, spleen, kidney and in lungs; experimental vector *Aedes aegypti* and *Culex f. fatigans*; ookinete sausage-shaped, 13 -17 μm × 3 -4 μm in dimension; oocysts 36 μm in diameter.

**Host**: Grey Quail, *Coturnix coromandelica* (Gmelin); site of infection: blood.

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Bennett et al. (1982) consider this species as *incertaesedis*.

367. *Plasmodium nucleophylum* Manwell


**Diagnosis**: Gametocyte elongate often closely applied to hostcell nucleus; mature segmenters rarely seen in peripheral blood with 4-9 merozoites; non-pathogenic to canaries, 24 hour periodicity.

**Host**: *Sturnus malabarica* from West Bengal (Nandi et al., 1984) and in a variety of passeriform species (vide Graham, 1966; Bennett et al., 1982).

**Distribution**: India: West Bengal (Nadia district), Andhra Pradesh, a cosmopolitan species.

368. *Plasmodium relictum* (Grassi and Feletti)


Diagnosis: Gametocytes round or oval, erythrocytic stages in the peripheral blood, pigment of mature gametocytes relatively fine and dot-like, host-cell nucleus markedly displaced or expelled by mature forms; ring-stages common in immature red cells; mature segments with 8-32 merozoites; periodicity variable, usually 24-36 hours; usually with high parasitemia and relatively high mortality.

Host: From West Bengal as for systematic list (please vide supra) - a very common bird malarial parasite occurring in a wide range of hosts (vide Garnham, 1966; Bennett et al., 1982).

Intermediate host: Anopheles subpictus.

Distribution: India: West Bengal (Calcutta, Darjiling, Nadia, South 24-Parganas districts) - a cosmopolitan species occurring throughout.

Remarks: Both the species of Plasmodium viz., P. ploceii and P. pericrocoti reported by Chakravarty and Kar (1945a, b) and P. praecox var. muniae reported by Das Gupta and Siddons (1941) are considered as synonyms of P. relictum.

369. Plasmodium sp.


Host: Dendrocitta vagabunda (Latham); site of infection: blood.

Distribution: India: West Bengal (Nadia district).

Remarks: Nandi et al. (1984) reported this unnamed species from the aforesaid host.

370. Plasmodium sp.


Host: Magalaima haemacephala (Muller); site of infection: blood.

Distribution: India: West Bengal (Calcutta and Nadia districts).

Remarks: As for 51. No. 369.

371. Plasmodium sp.


Host: Otus scops (Linnaeus); site of infection: blood.

Distribution: India: West Bengal (Nadia district).

Remarks: As for Sl. No. 369.
372. *Plasmodium* sp.

**Host**: *Heterophasia capistrata* (Vigors); site of infection: blood.

**Distribution**: India: West Bengal (Darjiling district).

**Remarks**: Pal and Dasgupta (1980) reported this unnamed species from the aforesaid host.

373. *Plasmodium* sp.

**Host**: *Ploceus philippinus* (Linnaeus); site of infection: blood.

**Distribution**: India: West Bengal (Nadia district)

**Remarks**: As for Sl. No. 369.

374. *Plasmodium* sp.

**Host**: *Muscicapa sundra* (Hodgson); site of infection: blood.

**Distribution**: India: West Bengal (Darjiling district).

**Remarks**: As for Sl. No. 372.

375. *Plasmodium* sp.

**Host**: *Sturnus contra* Linnaeus; site of infection: blood.

**Distribution**: India: West Bengal (Nadia district and Gangetic West Bengal).

**Remarks**: As for Sl. No. 369.

376. *Plasmodium* sp.

**Host**: *Accipiter virgatus affinis* (Hodgson); site of infection: blood.

**Distribution**: India: West Bengal (Darjiling district).

**Remarks**: Sinha and Sinha (1980) recorded this unnamed species from the aforesaid host.

377. *Plasmodium* sp.

**Host**: *Centropus sinensis* (Stephens); site of infection: blood.

**Distribution**: India: West Bengal (North 24-Parganas district).

**Remarks**: Ghosh and Das Gupta (1980) recorded this unnamed species from the aforesaid host.

378. *Plasmodium* sp.

**Host**: *Sturnus malabaricus* (Gmelin); site of infection: blood.
**379. Plasmodium falciparum** (Welch)


*Diagnosis*: Relatively small ring forms with double dots of chromatin, some apparently on edge (accolé forms); usually with crescentic gametocytes, macrogametocyte 12-14 μm long; trophozoite compact, rarely seen in peripheral blood; schizont irregular in form, 5 μm in diameter, 8-32 merozoites, irregularly arranged filling half to two-third the erythrocyte, with early clumping of coarse dark pigments, rarely occur in peripheral circulation; host erythrocyte not hypertrophied, but accompanied by reddish clefts known as Maurer's clefts; erythrocytic schizogony at 48 hours interval; paroxysms of chills and fever occur every other day; [for exoerythrocytic schizogony and sporogony, Garnham (1966) may be consulted].


*Distribution*: India : West Bengal (exact locality not mentioned).

*Remarks*: Bandyopadhyay and Haldar (1987) recorded this unnamed species of the aforesaid host.

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**380. Plasmodium malariae** (Grassi and Feletti)


*Diagnosis*: ‘Ring’ form about one-third diameter of erythrocyte, one in each red cells; trophozoite compact, often band-like, schizont rounded, 7 μm in diameter, nearly filling the erythrocyte, 6-12 merozoites, typically arranged in circle; schizogony in 72 hours; gametocyte round or ovoid, 9 μm in diameter, with brown-black pigments; host erythrocyte not enlarged, very faint stippling (Ziemann’s) after prolonged staining only paroxysms occurring every 3 days; for other stages see Garnham, 1966.

*Host*: Man, *Homo sapiens* Linn., and Chimpanzees in West Africa (Garnham, 1966); site of infection: blood, liver.

*Intermediate host*: *Anopheles annularis*, *A. culicifacies* and *A. maculatus*.

*Distribution*: India : West Bengal (almost all districts) and apparently all over India (vide Knowles, Senior White and Das Gupta, 1930); worldwide occurring tropical, subtropical and warmer temperate regions.
Remarks: This species is known to cause quartan malaria in man and is less common in occurrence than *P. vivax*. However, like *P. vivax* it is not a very pathogenic organism, although chronic infection may lead to a lethal kidney condition.

381. *Plasmodium vivax* (Grassi and Feletti)


Diagnosis: Relatively large ring forms about one-third diameter of erythrocyte, round or oval, usually one in each red cells, a round chromatin dot in thin part of ring; trophozoite amoeboid; schizont irregular, filling half to two-third the erythrocyte; schizogony usually at interval of 48 hours, 12-24 merozoites in irregular grape-like cluster, with small brown pigment granules usually collected in a single mass; gametocyte large, round or ovoid, 10 μm in diameter; host erythrocyte enlarged, stippled with red dots known as Schüffner’s dots; all erythrocytic stages occurring in peripheral blood, multiple infection in R.B.C. not uncommon; paroxysms at every other day as in *falciparum* malaria; also see Garnham (1966) for other life-cycle stages.


Intermediate host: *Anopheles culicifacies*, *A. maculatus* and *A. varuna*.

Distribution: India: West Bengal (all districts); all over India; worldwide, in tropics, subtropics and warmer temperate regions (Knowles et al., 1930; Garnham, 1966).

Remarks: This species is the most widespread of the human malaria parasites and is known to cause benign tertian malaria in man.

Genus *Mesnilium* Misra, Haldar and Chakravarty

382. *Mesnilium malariae* Misra, Haldar and Chakravarty


Diagnosis: Ring form small, with pin-head like chromatin mass and a narrow ring enclosing a vacuole; schizont about half the host erythrocyte in size, polar, lateral or tangentially located. 6-8 merozoites, unpigmented; gametocyte in peripheral blood, filling three-fourth the erythrocyte, with coarse pigment granules, host cell nucleus unaltered, exoerythrocytic cycle in R.E. cells of liver, spleen or kidney.

Host: *Channa punctatus* (Bloch) [= *Ophicephalus punctatus*]; site of infection: blood, liver, spleen & kidney.

Distribution: India: West Bengal (Calcutta district).

Remarks: It is a pathogenic species which causes the host fish succumbed to infection after 72 hours (Misra et al., 1972).
Family HAEMOPROTEIDAE

Key to the genera

1 (2) Merogony in endothelial cells of blood vessels especially the lungs, parasitic in vertebrates other than mammals .......................................................... Haemoproteus

2 (1) Merogony in mesodermal cells of various organs especially liver, parasitic in mammals

3 (6) Merogony in liver parenchyma with the formation of giant macroscopic meronts (merocysts)

4 (5) Merocyst in cluster in liver ................................................................. Rayella

5 (4) Merocyst not in cluster in liver ......................................................... Hepatocystis

6 (3) Merogony finally occurring in Kupffer cells of liver (macromeronts in liver and lungs, micromeronts in reticulo-endothelial cells), meronts tiny ......................... Polychromophilus

Genus Haemoproteus Kruse

In all 17 named and 13 unnamed species of Haemoproteus have been recorded from this state. Out of these, 14 species are recovered from birds and one each from fish, amphibia and reptile respectively. All the 13 unnamed species are reported from birds only. Key to the species of this genus from birds is presented since single species of Haemoproteus from other host groups is reported.

Key to the species of Haemoproteus of birds

1 (20) Macrogametocyte halteridial in shape ..............................................

2 (3) Inner lateral margins of macrogametocytes forming a pair of horns (parasitic in Capitonidae) ............................................................................. H. cornuata

3 (2) Such “horns” not present ........................................................................

4 (5) Cytoplasm with volutin granules at poles, (parasitic in Strigidae) .......... H. syrnii

5 (4) Cytoplasm without any volutin granules .............................................

6 (11) Parasite causing marked displacement of host cell nucleus ..................

7 (8) Mean number of pigment granules more than thirty (parasitic in Capitonidae) .......... H. thereicercyris

8 (7) Mean number of pigment granules less than twenty ..........................

9 (10) Mean number of pigment granules 17, macrogametocytes 14.4 μm × 3.6 μm and 53.5 μm² in area ................................................................. H. oryxivorae

10 (9) Mean number of pigment granules 11.1, macrogametocyte 13.5 μm × 2.8 μm and 41.32 μm² in area ................................................................. H. pastoris
Parasite not causing marked displacement of host cell nucleus

Mean number of pigment granules more than twenty

Mean number of pigment granules 33, parasitic in Columbidae. H. columbae

Mean number of pigment granules 23, parasitic in Corvidae. H. danilewskyi

Mean number of pigment granules 15 or less

Pigment granules less than 10, parasitic in Muscicapidae. H. himalayanus

Pigment granules 15 (average)

Parasitic in Dicruridae, macrogametocyte 12.6 \( \mu m \times 2.5 \mu m \) and 36.0 \( \mu m^2 \) in area. H. dicruri

Parasitic in Zosteropidae, macrogametocyte 15.8 \( \mu m \times 3.0 \mu m \) and 50.5 \( \mu m^2 \) in area. H. zosteropis

Macrogametocyte not halteridial in shape

Shape of macrogametocyte microhalteridial

Macrogametocyte bilobed, mean number of pigment granules 12, parasitic in Fringillidae and other small passerine birds (Muscicapidae). H. fringillae

Macrogametocyte not bilobed, mean number of pigment granules 15, parasitic in Pycnonotidae. H. sanguinis

Shape of macrogametocyte not microhalteridial

Macrogametocyte rhabdosomal, causing marked displacement of host cell, nucleus, parasitic in Picidae. H. bennetti

Macrogametocyte circumnuclear not causing any marked displacement of host cell nucleus, parasitic in Psittacidae. H. handai

Genus Haemoproteus Kruse

A. Haemoproteus of fish


Diagnosis: Gametocytes mostly in red cells and rarely in leucocytes; macrogametocyte, slightly curved and elongate, 3-4.5 (3.9) \( \mu m \times 1.5 \times 2.5 \) (1.95) \( \mu m \), and 6-12.25 (8.47)\( \mu m^2 \) in area; microgametocyte oval, 3.5-6 (4.3) \( \mu m \times 2-3.5 \) (2.4) \( \mu m \), and 3.5-10.5 (6.68) \( \mu m^2 \) in area; pigment, black, finely granular and peripherally located.

Host: Noemacheilus rupicola rupicola (McClelland); site of infection: blood.

Distribution: India: West Bengal (Darjiling district).
B. *Haemoproteus* of amphibia

384. *Haemoproteus ovalis* Ray and Choudhury


*Diagnosis*: Microgametocyte elongated pyriform, 8 µm × 4 µm and 22.0 µm² in area, occupying 16.76% of the total host cell parasite complex; macrogametocyte bean or kidney shaped, 9 µm × 4 µm and 23.5 µm² in area, occupying 20.6% of the host cell-parasite complex; pigment yellowish black granules, 7-10 in number; infected erythrocyte slightly hypertrophied, host cell nucleus distorted or displaced at one pole.

*Host*: *Rana limnocharis* Wiegmann; site of infection: blood.

*Distribution*: India: West Bengal (Bankura district).

C. *Haemoproteus* of reptile

385. *Haemoproteus trionyxii* Misra and Choudhury


*Diagnosis*: Microgametocyte typically round, cytoplasm negative to stain excepting the peripheral part, 6.4-9.6 (8.2) µm × 6.4-8.0 (7.8) µm, polar in location, without any displacement of host cell nucleus, pigment rod-shaped, 6-8 in number, either separate or clumped together into a large round mass at the periphery; macrogametocyte round, oval or elongate, polar or tangential but never lateral in location, 7.2-12.8 (10.2) µm × 5.6-8.8 (7.5) µm, pigment rod-shaped, many and scattered, host cell nucleus not displaced.

*Host*: *Trionyx gangeticus* Cuvier; site of infection: blood.

*Distribution*: India: West Bengal (Calcutta district).

D. *Haemoproteus* of birds

386. *Haemoproteus bennetti* Greiner, Mandal and Nandi


*Diagnosis*: Macrogametocyte rhabdosomal, margin entire, 12.7 (1.1) µm × 4.4 (0.4) µm and 45.8 (6.6) µm² in area, occupying about 50% of the host cell-parasite complex; pigment granules discrete, yellow-brown, scattered and averaging 20 (2.5) granules; volutin granules absent; nucleus median, round to oval, 3.3 (0.4) µm × 2.7 (0.4) µm and 6.9 (1.4) µm² in area; erythrocyte nucleus displaced laterally or to one pole, and occasionally enuncleated; host cell hypertrophied in length (9.5%), in width (5.3%) and in area (15.1%); and host cell nucleus atrophied (15.5%) in area.

*Host*: *Picus flavinucha* Gould; site of infection: blood

*Distribution*: India: West Bengal (Darjiling district).
387. *Haemoproteus columbae* Kruse


*Diagnosis*: Macrogametocyte halteridial, inner and polar margin amoeboid, outer margin entire, 12.6 (0.4) μm × 3.4 (0.4) μm and 34.3 (3.9) μm² in area, occupying about 60% of the host cell-parasite complex; pigment yellowish-black, discrete, round, scattered, 30 (4.2) granules per parasite, nucleus round-oval, median to submedian, 2.5 (0.2) μm × 1.8 (0.2) μm and 3.2 (0.7) μm² in area, host cell relatively unchanged, host cell nucleus atrophied 25.8% in area.

*Host*: *Columba livia*, *Columba livia domestica*, *Columba livia intermedia* Strickland and *Streptopalia chinensis* (Scopoli); site of infection: blood.

*Intermediate host*: *Pseudolynchia canariensis*.

*Distribution*: India: West Bengal (Calcutta, Nadia and South 24-Parganas districts), Delhi, Maharashtra - a cosmopolitan species with worldwide distribution.

388. *Haemoproteus cornuata* Bennett and Nandi


*Diagnosis*: Macrogametocyte broadly sausage-shaped and halteridial, margins entire, inner lateral margins with a deep invagination forming a pair of 'cornua' of 'horns', 21.9 (2.3) μm × 4.3 (0.6) μm and 73.1 (9.1) μm² in area, occupying 67% of the host cell-parasite complex; nucleus median or submedian, 3.5 (0.8) μm × 2.3 (0.4) μm and 6.6 (2.1) μm² in area; pigment granules small, scattered, 28.2 (6.4) in number; host cell hypertrophied (19.7) in area, host cell nucleus atrophied (11.5%) in area.

*Host*: *Megalaima haemocephala* (Muller) and other species of the genus *Megalaima* (see Bennett and Nandi, 1981); site of infection: blood.

*Distribution*: India: West Bengal (Nadia district) and Maharashtra. Elsewhere: Bhutan and Thailand.

389. *Haemoproteus danilewskyi* Kruse


*Diagnosis*: Macrogametocyte slender, halteridial, margin entire, 11.9 (1.1) μm × 2.6 (0.4) μm and 32.0 (4.6) μm² in area, occupying about 58.4% of the host cell-parasite complex; nucleus round-oval, submedian to terminal, 2.1 μm² in area; pigment granules yellowish-black, 9-23 scattered granules; host cell hypertrophied (28.8%) in area.

*Host*: *Corvus splendens* Vieillot, *Dendrocitta vagabunda* (Latham) and other corvid species (see Bennett et al., 1982); site of infection: blood.
**Distribution**: India: West Bengal (Calcutta and Nadia districts). Worldwide.

390. *Haemoproteus dicruri* de Mello


*Diagnosis*: Macrogametocyte hateridial, margins entire, 12.6 (0.3) μm × 2.5 (0.2) μm and 36.0 μm² in area, occupying about 60% of the host cell-parasite complex, nucleus submedian, round-oval, 3.7 (0.8) μm² in area, pigments yellowish-brown, averaging 15 granules; host cell hypertrophied (19.2%) in area and host cell nucleus atrophied (3.4%) in area.

*Host*: *Dicrurus adsimilis* (Bechstein), *D. macrocerus* Vieillot; site of infection: blood.


391. *Haemoproteus fringillae* Labbe


*Diagnosis*: Macrogametocyte microhalteridial in shape, bilobed, margins entire, with a marked constriction at the middle of the convex margin, 14.0 (0.8) μm × 2.5 (0.3) μm and 42.4 (3.6) μm² in area; nucleus round or semi-round, central or sub-central, occasionally terminal but usually peripheral, 2.17 μm in diameter, pigments dark-yellow, elongated, boat-shaped or round, 13.8 (3.0) granules, randomly scattered; host cell nucleus rarely displaced to periphery; no multiple invasion of erythrocyte.

*Host*: *Copsychus saularis* (Linnaeus); site of infection: blood.

*Distribution*: India: West Bengal (Calcutta and Nadia districts), Andhra Pradesh, Goa, Orissa. Worldwide.

392. *Haemoproteus handai* Maqsood


*Diagnosis*: Macrogametocyte large, circumnuclear, margins amoeboid in immature forms, entire in mature forms, 25.3 (1.8) μm × 3.1 (0.6) μm and 78.0 (11.7)μm² in area, occupying 88% of the erythrocyte-parasite complex; nucleus small, compact, ovoid to rectangular, central, 6.1 (1.5) μm² in area; pigment randomly scattered, 20.8 (1.8) granules; host cell nucleus central, slightly displaced laterally and atrophied (15.9%) in area; host cell hypertrophied (5.4%) in area. Voluntin granules small, deep violet, 6 (3.2) granules per parasite.

*Host*: *Psittacula krameri manillensis* (Bechstein) and other psittaciform birds; site of infection: blood.

*Distribution*: India: West Bengal (Calcutta district); South-east Asia and Australia.
393. Haemoproteus himalayanus Pal and Das Gupta


Diagnosis: Gametocyte halteridial, scanty pigment grains, tissue schizonts occuring in lung, schizont measuring 35 µm in average.

Host: Heterophasia capistrata (Vigors); site of infection: blood.

Distribution: India: West Bengal (Darjiling district).

Remarks: Bennett et al. (1991) declared H. himalayanus a species incertae sedis: since, as they (op. cit.) opined, the description of this species “is based on mixed infection of Plasmodium and Haemoproteus) in post-mortem material for which no quantitative values are presented for any morphological characters and makes this "species" an organism of uncertain taxonomic status."

394. Haemoproteus oryzivorae Anschütz


Diagnosis: Macrogametocyte hateridial, rarely broadly sausage-shaped, margins entire, 13.3 (0.8) µm × 3.8 (0.3) µm and 48.1 (2.2) µm² in area, occupying about 70% of the host cell-parasite complex; nucleus round, ovoid or broadly triangular, median to subterminal, usually located on the outer margin of the parasite, occupying about 9% of the area of the macrogametocyte; pigment granules small, ovoid, yellow to dark-yellow brown, scattered, averaging 12 (2) granules; host cell hypertrophied in area (34.6%), host cell nucleus atrophied (10.4%) in area and markedly displaced to periphery.

Host: Copsychus saularis (Linnaeus), Ploceus philippinus (Linnaeus), Turdoides striatius (Dumont), Lonchura malabarica, Lonchura malacca, Lonchura punctulata and other smaller passeriform birds; site of infection: blood.

Distribution: India: West Bengal (Calcutta, Nadia and South 24- Parganas districts), Andhra Pradesh, Goa, Orissa. Elsewhere: South-eastern Asia to Philippine islands.

Remarks: Haemoproteus garnhami described by Grewal (1964) from Lonchura malabarica and Haemoproteus lonchuri described by Bandyopadhyay and Haldar (1988) from Lonchura malacca are considered as synonyms of H. oryzivorae Anschütz (see also Bennett and Peirce, 1991). The records of H. garnhami from munias (Lonchura spp.) by Nandi et al. (1984) and Nandi (1984) may also be considered to belong to this species.

395. Haemoproteus pastoris de Mello


**Diagnosis**: Macrogametocyte halteridial, margins usually entire, sometimes end margins amoeboid, medium sized, 11.6 (0.6) µm × 2.6 (0.2) µm and 31.5 (3.4) µm² in area, occupying about 50% of the host cell-parasite complex; nucleus round to ovoid, submedian, 1.9 (0.2) µm² in area; pigment yellowish-brown, scattered, averaging 8 (0.7) granules; host cell hypertrophied (13.1%) and host cell nucleus atrophied (4.5%) in area.

*Host*: *Sturnus contra* Linnaeus, *Sturnus malabaricus* (Gmelin) and other mynas and starlings (Family Sturnidae); site of infection: blood.

**Distribution**: India: West Bengal (Nadia and South 24-Parganas district), Andhra Pradesh, Goa, Jammu and Kashmir, Maharashtra. Elsewhere: Africa, Asia east to Philippine Islands.

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396. *Haemoproteus sanguinis* Chakravarty and Kar


**Diagnosis**: Macrogametocyte microhalteridial, margins entire, not bilobed, 13.8 (91.3) µm × 2.4 (0.3) µm and 35.5 (5.2) µm², occupying 53.7% of the erythrocyte-parasite complex; nucleus roughly ovoid, median to subterminal, 3.5 (1.3) µm² in area; pigment yellow-brown, discrete, scattered 15.4 (5.4) granules; host cell hypertrophied (11.3%) and host cell nucleus atrophied (13.9%) in area.

*Host*: *Pycnonotus jocosus emeria* (Linnaeus) and other pycnonotid birds (see Bennett et al., 1982); site of infection: blood.


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397. *Haemoproteus syrni* (Mayer)


**Diagnosis**: Macrogametocyte halteridial, margins entire with volutin granules at poles, inner margin usually not touching the host cell nucleus, 15.6 (0.7) µm × 2.3 (0.3) µm and 39.8 (4.0) µm² in area; nucleus round-oval, median to submedian 3.6 (0.9) µm² in area, pigment yellow-brown, 13 (2.3) scattered granules; volutin averaging 14 (4.2) granules; host cell hypertrophied (8%) and host cell nucleus sometimes slightly hypertrophied in area, macrogametocyte occupying 53.1% of the erythrocyte-parasite complex.

*Host*: *Otus scops* (Linnaeus) and other strigid birds (see Bennett et al., 1982); site of infection: blood.

**Distribution**: India: West Bengal (Nadia district). Worldwide.

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398. *Haemoproteus thereicerycis* de Mello


**Diagnosis**: Macrogametocyte halteridial, sometimes broadly sausage-shaped, margins entire,
16.3 (1.8) \( \mu m \times 4.9 (0.9) \mu m \) and 80.2 (9.4) \( \mu m^2 \) in area, occupying 75\% of the erythrocyte-parasite complex; nucleus ovoid, usually median, 8.5 (1.9) \( \mu m^2 \) in area; pigment yellow-brown or black, averaging 31.3 (2.9) granules, randomly scattered; host cell hypertrophied (20\%) in area; host cell nucleus atrophied (4\%) in area and markedly displaced laterally.

*Host*: Megalaima asiatica asiatica (Latham), Megalaima heamacephala (Muller) and other capitonid species (see Bennett and Nandi, 1981).


399. *Haemoproteus zosteropis* Chakravarty and Kar


*Diagnosis*: Macrogametocyte halteridial, margins entire, 15.8 (1.8) \( \mu m \times 3.0 (0.6) \mu m \) and 50.5 (7.9) \( \mu m^2 \) in area, occupying 66\% of the erythrocyte-parasite complex; nucleus ovoid, median to submedian, 2.7 (0.1) \( \mu m^2 \) in area; pigment 15 (2.0) granules, usually scattered, occasionally clumping in various parts of the cytoplasm; host cell hypertrophied (12\%) and host cell nucleus slightly atrophied (2\%) in area.

*Host*: Zosterops palpebrosa palpebrosa (Temminck) and other zosteropid birds (see Bennett et al., 1982).


400. *Haemoproteus* sp.

*Host*: Acrocephalus arundinaceus Linnaeus; site of infection: blood.

*Distribution*: India: West Bengal (exact locality not mentioned).

*Remarks*: McClure et al. (1978) reported this unnamed species from the aforesaid host.

401. *Haemoproteus* sp.

*Host*: Acrocephalus stentioreus (Hemprich and Ehrenber); site of infection: blood.

*Distribution and Remarks*: As for Sl. No. 400.

402. *Haemoproteus* sp.

*Host*: Acrocephalus dumetorum Blyth; site of infection: blood.

*Distribution*: India: West Bengal (Calcutta and South 24- Parganas district).

*Remarks*: Nandi et al. (1984) recorded this unnamed species from the aforesaid host.

403. *Haemoproteus* sp.

*Host*: Copsychus malabaricus (Scopoli); site of infection: blood.
Distribution and Remarks: As for Sl. No. 400.

404. *Haemoproteus* sp.

*Host*: *Dicrurus adsimilis* (Bechstein); site of infection: blood.

*Distribution and Remarks*: As for Sl. No. 400.

405. *Haemoproteus* sp.

*Host*: *Muscicapa parva* Bechstein; site of infection: blood.

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: As for Sl. No. 402.

406. *Haemoproteus* sp.

*Host*: *Ploceus manyar* (Horsfield); site of infection: blood.

*Distribution and Remarks*: As for Sl. No. 400.

407. *Haemoproteus* sp.

*Host*: *Ithopygia saturata*; site of infection: blood.

*Distribution*: India: West Bengal (Darjiling district)

*Remarks*: Pal and Das Gupta (1980) recorded this unnamed species from the aforesaid host.

408. *Haemoproteus* sp.

*Host*: *Estrilda amandava* (L.); site of infection: blood.

*Distribution*: India: West Bengal (exact locality not mentioned).

*Remarks*: Bandyopadhyay and Haldar (1987) reported this unnamed species from the aforesaid host from Gangetic West Bengal.

409. *Haemoproteus* sp.

*Host*: *Lanius schach tricolor* (Hodgson); site of infection: blood.

*Distribution*: India: West Bengal (Purchased from local dealer in Calcutta).

*Remarks*: Choudhury and Misra (1976) recorded this unnamed species from the aforesaid host.

410. *Haemoproteus* sp.

*Host*: *Lonchura malabarica* (L.); site of infection: blood.
Distribution and Remarks: As for Sl. No. 400.

411. Haemoproteus sp.

Host: Lonchura malacca (L.); site of infection: blood.
Distribution and Remarks: As for Sl. No. 408.

412. Haemoproteus sp.

Host: Sturnus contra (L.); site of infection: blood.
Distribution and Remarks: As for Sl. No. 408.

Genus Polychromophilus Dionisi

413. Polychromophilus murinus Dionisi


Diagnosis: Gametocytes round-oval, 6-8 μm in diameter, cytoplasm finely granular, usually a little denser towards the periphery, nucleus of macrogametocyte compact, round, central or subcentral, 1-1.5 μm in diameter, numerous dark-brown pigment granules scattered throughout the cytoplasm, in smaller grains, host cell hypertrophied.

Host: Hipposideros lankadiva Kelart, vespertilionid bats (see Garnham, 1986); site of infection: blood.

Distribution: India: West Bengal (Jalpaiguri district).

Remarks: Nandi and Mandal (1976) recorded this species from the aforesaid host with some differences in gametocyte morphology suggesting of its being a local strain.

414. Polychromophilus sp.

Host: Rhinolophus rouxi rouxi (Temminck); site of infection: blood.
Distribution: India: West Bengal (Darjiling district).

Remarks: Palo and Das Gupta (1982) reported this unnamed species from the aforesaid host.

Genus Hepatoeystis Levaditi and Sechoen

415. Hepatoeystis ravi wui Dasgupta, Chatterjee and Ray

**Diagnosis**: Pigmented haemoproteid parasite with gametocytes occurring in red blood cells; tissue stages occur in clusters of cystic bodies, associated with finer blood vessels of liver forming characteristic foci of infection; mature merocyst about 1.5 μm in diameter.

**Host**: *Petaurista magnificus* Hodgson; site of infection: blood, lung and spleen.

**Distribution**: India: West Bengal (Darjiling district).

416. *Hepatocystis* sp.

**Host**: *Petaurista elegans caniceps* Gray; site of infection: blood, lung and spleen.

**Distribution**: India: West Bengal (Darjiling district).

**Remarks**: Pal and Dasgupta (1984) reported this unnamed species from the aforesaid host.

**Genus** *Rayella* Das Gupta

**Key to the species**

1 (2) Gametocytes having haemozoin pigments as black granules, (parasitic in *Hylopetes alboniger*) .............................................................. *R. hylopetei*

2 (1) Gametocytes without such black pigments..........................................................

3 (4) Schizont of large size, measuring up to 225 μm, in diameter, parasitic in *Petaurista elegans caniceps* .............................................................. *R. gigantica*

4 (3) Schizont not so large, growing up to 150 μm in diameter, parasitic in *Petaurista magnificus* .............................................................. *R. rayi*

417. *Rayella gigantica* Pal and Das Gupta


**Diagnosis**: Only gametocytes occurring in the red blood cells without any haemozoin pigments; exoerythrocytic stages found both in liver and lungs; cystic schizonts occurring in large clusters in the liver, few in number in the lung; mature schizonts, large measuring 100 - 225 μm in diameter.

**Host**: *Petaurista elegans caniceps* Gray; site of infection: R.B.C., liver and lungs.

**Distribution**: India: West Bengal (Darjiling district).

418. *Rayella hylopetei* Das Gupta, Pal, Chatterjee & Chatterjee


**Diagnosis**: Gametocytes occurring in red blood cells having haemozoin pigments in black granules, male gametocytes with pale cytoplasm and diffuse chromatin, infected red blood cells hypertrophied and showed no stippling; tissue stages in the form of cystic bodies in characteristic foci of infection occurring in association with blood vessels of the liver.
Host: *Hylopetes alboniger* Hodgson; site of infection: R.B.C. and liver.

*Distribution*: India: West Bengal (Darjiling district).

419. **Rayella rayi** Das Gupta


**Diagnosis**: Gametocytes without any black pigments occurring in the red blood cells; absence of erythrocytic schizogony; exoerythrocytic schizogony occurring in liver; schizonts measuring 150 μm in diameter representing small cystic bodies; occurring in clusters in close association with blood vessels of the liver and often forming definite foci of infection.

Host: *Petaurista magnificus* Hodgson; site of infection: R.B.C., liver.

*Distribution*: India: West Bengal (Darjiling district).

**Family**: LEUCOCYTOZOIDAE  
**Genus**: *Leucocytozoon* Sambon

**Diagnosis**: Unpigmented gametocytes occurring in R.B.C. and rarely in W.B.C. of birds; host cell grossly hypertrophied, host cell nucleus distorted and displaced peripherally; schizogony in liver and other tissues, schizonts with cytomeres; sporogony in Simuliidae and Ceratopogonidae; oocysts small, unpigmented with fewer than 100 sporozoites.

420. **Leucocytozoon sabrazesi** Mathis and Leger


**Diagnosis**: Immature gametocyte ring-like, 2-3 μm in diameter, mature macrogametocyte round ovoid and elongate, occurring in fusiform host-cell, nucleus round-oval centrally or eccentrically placed; oval ones 15.6 μm x 11.6 μm and elongated ones measuring 21.0 μm x 8.5 μm, occupying 122.6 μm² and 123.1 μm² in area respectively; microgametocyte slightly smaller than macrogametocyte with defused nucleus; host cell and host cell nucleus highly hypertrophied.

Host: *Gallus* sp. and *G. gallus murghi* Robinson and Kloss site of infection: blood.

*Distribution*: India: West Bengal (Darjiling district), Madhya Pradesh, Orissa. Elsewhere: Indochina, Malaya, Java and Sumatra.

**Subclass**: PIROPLASMIA  
**Order**: PIROPLASMIDA

**Key to the families**

1 (2) Schizogony in the endothelial cells of the blood vessels of vertebrate (finally parasites invading the erythrocytes in which occurring round, ovoid, irregular or bacilliform forms).................................................................THEILERIIDAE

2 (1) Schizogony in the erythrocytes of vertebrates.................................................................
3 (4) Pear-shaped arranged in pairs, ticks acting as vectors.......................... BABESIIDAE
4 (3) Parasites of different shapes and showing no tendency towards paired arrangements, vectors unknown.................................................................
5 (6) Nucleus with endosome, 4-16 merozoites formed.............................. DACTYLOSOMATIDAE
6 (5) Nucleus without endosome or nucleolus, 4 merozoite formed........ HAEMOHORMIDIIIDAE

**Family** BABESIIDAE  
**Genus** Babesia Starcovici

*Diagnosis*: Apical complex reduced to a polar ring, rhoptries and subpellicular microtubules, filaments not present on parasitized erythrocytes.

**Key to the species**

1 (4) Trophozoites rounded and appearing as small ring-like forms somewhat resembling the ring form of malarial parasite.................................................................

2 (3) Ring form generally having two compact chromatins - one larger and other smaller, parasitic in jackal and dog....................................................... B. gibsoni

3 (2) Ring form with a single chromatin, parasitic in bat, Scotophilus kuhli khuli.............. ........................................ B. vesperuginis

4 (1) Trophozoites without having any ring form......................................................

5 (6) Parasite multiplying by a characteristic budding process, buds remaining attached by their pointed ends, parasitic in Bos indicus........................................ B. bigemina

6 (5) Such characteristic budding lacking in parasite......................................................

6a Frequently pear-shaped, occasionally ovoid, round or irregular, dimension 2.5 - 4.0 μm x 1.2 - 3.0 μm, parasitic in sheep, Ovis sp....................................................... B. motasi

6b Round oval or amoeboid, dimension 1.33 - 3.69 μm x 1.23 - 2.49 μm, parasitic in rat, Rattus rattus........................................................ B. muris

6c Pyriform, dimension 3.5 μm x 1.8 μm, parasitic in mongoose, Herpestes edwardsi........ B. bengalensis

421. Babesia bengalensis Bandyopadhyay and Ray

*Diagnosis*: Trophozoite intraerythrocytic, immature forms pyriform or oval, 2 μm x 1.5 μm and 2 μm² in area; mature forms forms pyriform 3.5 μm x 1.8 μm and 4.5 μm² in area; multiplication by binary fission and schizogony; product of schizogony occurring in tetrad, arranged cross-wise or in the form of a fan.

*Host*: Common Indian Mongoose, Herpestes edwardsi (Geoffroy); site of infection: blood.

*Distribution*: India: West Bengal (North 24-Parganas district).
422. *Babesia bigemina* (Smith and Kilborne)


**Diagnosis**: Parasite large intraerythrocytic, round, oval, irregular, or pyriform, occurring in pairs, individuals of each pair lying closely together; round forms 2-3 µm in diameter, pear-shaped forms 2-4 µm × 1.5 - 2 µm, occasionally 5-6 µm in length, extending across the R.B.C.; multiplication by characteristic budding process, buds remaining attached by their pointed ends.

**Host**: *Bos indicus* Linnaeus, occurring in cattle and deer; site of infection: blood.

**Distribution**: India: West Bengal (Calcutta district), Tamil Nadu, Uttar Pradesh. Elsewhere: Central and South America, Europe, Africa and Australia.

**Remarks**: This species is highly pathogenic for adult animals and causing a disease commonly known as 'Red-water fever.'

423. *Babesia gibsoni* (Patton)


**Material examined**: Sev. exs., Calcutta, 12,iii.1976, A.K. Mandal.

**Diagnosis**: Trophozoites small, rounded, not having characteristic paired, formation pear shaped forms, appearing as small ring-like forms, occupying about one-eighth of the infected corpuscle, generally with two compact chromatins, one larger and other smaller; sometimes larger ovoid or elongate forms present; host cell usually unaltered, parasite often excentrically located in the corpuscle, usually one, occasionally as many as 5 parasites occurring in a single host cell; schizogony in spleen.


**Distribution**: India: West Bengal (Calcutta district), Tamil Nadu, Sri Lanka and China.

**Remarks**: This species is highly pathogenic in domestic dogs (Levine, 1967). The disease is usually referred to as 'Tick fever.'

424. *Babesia motasi* Wenyon


**Diagnosis**: Parasites large, mostly pear-shaped, occasionally round or irregular, occurring singly or in pairs and the pairs always lying at an acute angle at their narrower ends, 2.5 - 4 µm × 1.2 - 3 µm; chromatin often appeared as double; host cell hypertrophied.
Host: Sheep, Ovis sp. and goats; site of infection: blood.


Remarks: This species is not so pathogenic and may either cause an acute or chronic disease.

425. Babesia muria (Fantham)


Diagnosis: Trophozoite round, oval, amoeboid or pyriform, unpigmented, intracorporeal, 1.23 - 3.69 μm × 1.23 - 2.49 μm and 4.7 μm² in area, occurring singly or in pairs, with a single chromatin at one side of the parasite; multiplication typically by binary fission, host cell unaltered.

Host: Rat, Rattus rattus arboreus; site of infection: blood.

Distribution: India: West Bengal (South 24-Parganas district).

426. Babesia vesperuginis (Dionisi)


Diagnosis: Trophozoite intraerythrocytic, unpigmented, round or irregular amoeboid, 0.82 - 2.46 μm × 0.82 - 2.05 μm and 0.5 - 2.01 μm² in area; round-oval forms resembling a ring stage with single chromatin; amoeboid forms rarely with six chromatin as if branching out in various direction and connected with each other by thread-like structures; cross-appearance during division; no change in infected red cells.

Host: Bat, Scotophilus kuhli kuhli; site of infection: blood.

Distribution: India: West Bengal (South 24-Parganas district).

Family: Theileriidae

Genus: Theileria Bettencourt, Franca and Borgess

Diagnosis: Elements of apical complex much reduced, always including only rhoptries; polar ring or conoid lacking, usually without subpellicular microtubules, vectors ixodid ticks, parasitic in mammals.

Key to the species

1 (2) Transmissible by direct blood inoculation, non-pathogenic, persistence of parasites in blood for long periods..............................................................T. mutans

2 (1) Not transmissible by direct blood inoculation, highly pathogenic, no persistence of parasites after recovery..............................................................T. parva
427. Theileria mutans (Theiler)


Diagnosis : Intraerythrocytic forms minute, comma-shaped bacilliform or coccal; sometimes dumbbell-shaped, ring or even cross-shaped forms; the largest one about 1 μm in diameter; schizonts larger than T parva with ovoid nuclei; non pathogenic; transmissible by direct blood inoculation; blood forms persisted for longer periods.

Host : Cattle, Bos indicus Linnaeus and buffalo; site of infection : blood.


Remarks : This species is known to cause benign bovine theileriosis with a mortality rate less than 1% in cattle. Levine (1967), however, referred this species as Gonderia mutans (Theiler).

428. Theileria parva (Theiler)


Diagnosis : Erythrocytic forms resembling small babesiiids, occuring in ring-, comma-, pear- or rod-shaped forms; nucleus located at one end in rod-like forms; blood forms non-infective and with no multiplication, growing to form gametocytes; male gametocytes long, slender rod-like and the female ones rounded or pear-shaped; rod-like gametocytes 2.5 μm x 1.2 μm; schizonts large, multinucleate resembling Koch’s "blue bodies" with a varying number of red chromatin dots; schizonts of two kinds, some with a smaller number of larger nuclei and others with a larger number of smaller nuclei, giving rise to merozoites capable of reproducing by schizogony.

Host : Cattle, Bos indicus Linnaeus, and buffalo; site of infection : blood.


Remarks : This species is most highly pathogenic (mortality rate up to 100%) in domestic cattle (Baker, 1969). It causes theileriosis commonly known as East Coast fever.

Family HAEMOHORMIDIIDAE
Genus Haemohormidium Henry

Diagnosis : As for the family.

Key to the species

1 (2) Full grown trophozoite and schizont measuring 2.5 μm and 3.5 μm in length respectively
.................................................................................................................................H. hareni

2 (1) Full grown trophozoite and schizonts measuring 3.5-6.0 μm and 4 μm respectively........
3 (4) Macrogametocyte oval, 3.5 µm x 2.5 µm, parasitic in *Ophicephalus punctatus*........................
................................................................................................................................................................. *H. ophicephali*

4 (3) Macrogametocyte round, 1.7 µm in diameter, parasitic in *Clarias batrachus*.........................
..................................................................................................................................................................... *H. batrachi*

429. *Haemohormidium batrachi* (Ray Chaudhuri and Choudhury)


**Diagnosis**: Trophozoites usually elongated, sometimes ovoidal, vacuolated and non-pigmented, 5.0 µm x 3.0 µm, nucleus occupying the broader end of the parasite; schizont with 4 crescent-shaped nuclei arranged in the form of a rosette or cross, 5.0 µm x 4.5 µm; microgametocyte elongated or spindle shaped with two nuclei connected by a chromatic thread; macrogametocyte round or slightly oval 1.7 µm in diameter.

**Host**: *Clarias batrachus* (L.); site of infection : blood.

**Distribution**: India : West Bengal (North 24-Parganas district).

430. *Haemohormidium hareni* (Haldar, Misra and Chakraborty)


**Diagnosis**: Schizogony found in the erythrocyte, the youngest form measuring 2.0 µm x 1.5 µm; trophozoite measuring 2.5 µm x 1.5 µm; schizont 3.5 µm x 3.0 µm, having 4 merozoite; microgametocyte 5.0-6.5 µm x 1.5-2.5 µm and macrogametocyte round, 2.5 µm in diameter.

**Host**: *Channa punctatus* Bloch; site of infection : blood.

**Distribution**: India : West Bengal (Calcutta district).

431. *Haemohormidium ophicephali* Misra, Haldar and Chakravarty


**Diagnosis**: Schizogony occurring in erythrocyte with the formation of 4 merozoite, youngest form, slightly triangular measuring 3.0 µm x 2.0 µm; trophozoite ovoid, 3.5-6.0 µm x 2.0-2.5 µm; schizont elongated, 4.0 µm x 2.5 µm; microgametocytes slender, elongated, 5.0 µm x 1.5 µm; macrogametocyte oval, 3.5 µm x 2.5 µm.

**Host**: *Channa punctatus* Bloch; site of infection : blood.

**Distribution**: India : West Bengal (Calcutta district).
432. *Haemohormidium* sp.
 (= Babesiosoma sp.)

*Host:* *Muraenesox* sp.; site of infection: blood.

*Distribution:* India: West Bengal (South 24-Parganas district).

*Remarks:* Mandal (1984) reported this unnamed species from the aforesaid host. The trophozoite of this parasite is ovoid, 2-2.5 μm × 1.5-2 μm, with vacuolated cytoplasm, and schizonts with 4 distinct nuclei arranged cross-wise inside the erythrocyte.

**Family** DACTYLOSOMATIDAE

**Genus** Dactylosoma Labbe

*Diagnosis:* Merogony present, more than 4 merozoites formed, parasitic in cold blooded vertebrates.

**Key to the species**

1 (2) Trophozoite oval to spherical, 3.1 μm × 2.26 μm; mature schizont elongated, triangular, elliptical or oval with nuclei arranged in 4 clusters of 2 each or vice versa...................

..................................................\*D. notopterae\*

2 (1) Trophozoite stumpy, triangular with one end broad and other end tapering gradually, 2.3 μm × 1.4 μm; mature schizont ovoid to quadrilateral, nuclei arranged in 2 clusters of 4 each.................................................................\*D. striata\*

433. *Dactylosoma notopterae* Kundu and Haldar


*Diagnosis:* Youngest form ovoidal, nucleus triangular stained pinkish red; trophozoite oval to spherical measuring 3.1 μm × 2.6 μm; schizogony in R.B.C. forming 8 merozoites arranged in a fashion of four clusters; gametocyte of 2 types, microgamete cylindrical having two nuclei, measuring 7.1 μm × 3.0 μm and the macrogametocyte almost round, measuring 4.5 μm × 4.4 μm.

*Host:* *Notopterus notopterus* (Pallas); site of infection: blood.

*Distribution:* India: West Bengal (Nadia district).

434. *Dactylosoma striata* Sarkar and Haldar


*Diagnosis:* Youngest trophozoite stumpy and triangular, measuring 3.2 μm × 1.4 μm; schizogony completed with the formation of 8 merozoites; schizont ovoid with 8 merozoites arranged in two clusters of four; microgametocyte spindle-shaped, 4.6 μm × 1.0 μm and macrogametocyte 2.0 μm × 1.7 μm, almost round.

*Host:* *Ophicephalus striatus* Bloch; site of infection: blood.
**Distribution**: India: West Bengal (Hugli district).

435. *Dactylosoma* sp.

*Host*: *Mystus vittatus* (Bloch); site of infection: blood.

*Distribution*: India: West Bengal (South 24-Parganas district).

*Remarks*: Mandal (1979) reported this unnamed species from the aforesaid host. The parasite is intraerythrocytic and produces 5 merozoites arranged in the form of a fan.

*Incetae Sedis to Order Piroplasmida*

**Genus**: *Anaplasma* Theiler

*Diagnosis*: Spherical body of chromatin, less than 0.5 μm in diameter, occurring in erythrocytes, tick acting as vectors, parasitic in mammals.

*Remarks*: Although Levine (1988) has not included this genus under piroplasms still this is included in the present communication as this parasite is reported several times from India even in recent times (see Bhatia, 1938; Sinha, 1985).

**Key to the species**

1(2) Appeared as spherical, chromatin granule, lying at the margin of host erythrocyte...........

...................................................*A. marginale*

2(1) Morphologically similar to above, but lying in the central position in host erythrocyte

...................................................*A. centrale*

436. *Anaplasma centrale* Theiler


*Diagnosis*: Spherical chromatin granules with no cytoplasm, 0.2-0.5 μm in diameter, located centrally inside the erythrocyte, a parasitophorous vacuole present.

*Host*: *Hylopetes alboniger* Hodgson; site of infection: blood.

*Distribution*: India: West Bengal (Darjiling district).

437. *Anaplasma marginale* Theiler


*Diagnosis*: Spherical chromatin granular, measuring 0.2-0.40 μm in diameter; apparently with no cytoplasm, parasitophorous vacuole present, usually formed at the margin of the red cells.

*Host*: *Hylopetes alboniger* Hodgson; site of infection: blood.

*Distribution*: India: West Bengal (Darjiling district).
438. *Anaplasma* sp.

*Host*: Indian bats; site of infection: blood.

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Knowles (1928), see Bhatia, 1938) reported this unnamed species from blood of Indian bats.

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*Diagnosis*: Each sporont developing into 8 (in one case upto 12) sporoblasts and ultimately into 8 (in one case upto 12) spores, sporont membrane may degenerate at different times during spore formation.

Key to the species

1 (4) Spores oval with equally rounded extremities

2 (3) Spore measuring 4.5-5.2 μm × 2.4-2.8 μm

3 (2) Spore measuring 4.75-6.0 μm × 3-4 μm

4 (1) Spores broadly oblong or pyriform with dissimilar extremities

5 (6) Spore pyriform, polar end tapered, 5.1-6.1 μm × 2-2.1 μm, sporont dividing to form 8-12 sporoblasts

6 (5) Spore broadly oblong showing a small knob at one end and showing a clear oblong space at the other, 4.5-5.0 μm × 3-3.5 μm, sporont dividing to form 8 sporoblasts

439. *Thelohania anomala* Sen


*Diagnosis*: Spore pyriform, 5.1-6.1 μm × 2.0-2.1 μm, polar end tapered; daughter schizont uninucleated; four nucleated schizont dividing into two binucleated parasites; nuclear fusion taken place to become sporont; sporont divide to form 8-12 sporoblasts; each sporoblast giving rise to mature spore.

*Host*: Larvae of *Anopheles ramsayi* Covell (Insecta: Diptera); site of infection: adipose tissue (Fat body) of the larvae.

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: This species differs from an allied species *Thelohania legari* by its narrower dimension of the spores and greater number of the sporoblasts.
440. *Thelohania indica* Kudo


*Diagnosis*: Spore ellipsoidal, 4-5.2 μm × 2.4-2.8 μm, with equally rounded extremities, thick spore membrane, a comparatively large nucleus at one end and a polar capsule at the other; schizonts elongated with 4-8 nuclei arranged in pairs; sporont octosporoblastic.

*Host*: Larvae of *Anopheles hyrcanus* (Giles); and *A. ramsayi* Covell; site of infection: adipose tissue.

*Distribution*: India: West Bengal (Calcutta district and also from other non-specific locality of the state).

441. *Thelohania legari* Hesse


*Diagnosis*: Spore oval, 4.75-6.0 μm × 3.4 μm; daughter schizont uninucleated, large schizont with four nuclei giving rise to binucleated forms to become sporonts; sporonts, 9-10 μm × 4-6 μm, transforming into pansporoblast with eight spores.


*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: This is perhaps the commonest microsporidians occurring in anopheline larvae (see Sen, 1941).


*Diagnosis*: Spore 4.5-5.0 μm × 3.0-3.5 μm, broadly oblong with thin membrane, a small knob-like mass at one end and a clear oblong space at the other; sporont octosporoblastic.

*Host*: Larva of *Anopheles varuna* Iyengar (Insecta: Diptera); site of infection: thorax and anterior abdominal segments of the larvae.

*Distribution*: India: West Bengal.

*Remarks*: This species was described by Kudo (1929) based on material sent by M.O.T. Iyengar from Bengal.

*Family* NOSEMATIDAE

*Diagnosis*: Pansporoblastic membrane usually absent, sporoblast mono or dinucleated.

*Genus* Nosema Nageli

*Diagnosis*: Each sporont becoming a single sporoblast forming a single spore.
443. *Nosema bombycis* Nageli


*Diagnosis*: Spore egg-shaped, anterior end somewhat narrower than the posterior end, 3-4 \( \mu \text{m} \times 1-2 \mu \text{m} \), with two vacuoles, one at each end; polar capsule single, located axially in spore, 1.5-2 \( \mu \text{m} \times 0.8-1 \mu \text{m} \); polar filament long, 57-72 \( \mu \text{m} \), occasionally up to 98 \( \mu \text{m} \); sporoplasm forming a cytoplasmic girdle round the polar capsule.

*Host*: *Bombyx mori* Fabricius; site of infection: all tissues of eggs, larvae, pupae and imago.

*Distribution*: India: West Bengal (Maldah and Murshidabad districts) - cosmopolitan occurring throughout the world.

*Remarks*: This species is pathogenic in silk-worm causing a disease known as pebrine disease. The disease often causes epidemic among larval silk-worms and spreads to the offspring through the ova. The outbreak usually entails huge economic loss to the silk industry.

### Phylum MYSOZOA

### Class MYXOSPOREA

### Order BIVALVULIDA

#### Key to the families

1 (2) Spore with polar capsule at opposite ends of spore or with widely divergent polar capsule located in sutural plane or sutural zone.........................................................MYXIDIIDAE

2 (1) Spore with polar capsule at one pole in sutural plane or in plane perpendicular to sutural plane.................................................................................................................................

3 (4) Spore with 2-4 polar capsule at one pole located at perpendicular to sutural plane ...............................................................................................................CERATOMYXIDAE

4 (3) Spore with 2-4 polar capsule at one located at sutural plane........MYXOBOLLIDAE

#### Family MYXIDIIDAE

#### Key to the genera

1 (2) Polar filament short, ribbon-like, (trophozoite large and discoid, spore fusiform with truncated ends)................................................................................................. *Sphaeromyxa*

2 (1) Polar filament long and fine........................................................................................................

3 (4) Spore fusiform with pointed or rounded ends, sutural line typically straight..... *Myxidium*

4 (3) Spore fusiform usually with truncated ends, sutural line obliquely directed, usually ‘S’ form...................................................................................................................... *Zschokkela*
Genus *Myxidium* Butschli

Sixteen species of *Myxidium* have been known so far from this state. Out of these, 15 including 4 unidentified species are reported from fish and one species from Amphibia.

*Key to the species of Myxidium of fishes*

1(12) Shell valve non-striated.................................................................

2 (3) Both extremities of spore drawn out into transparent needle-like structures........................................... M. boddaerti

3 (2) Spore not drawn out into needle-like structures as above.................................................................

4 (5) Spores large, over 30 μm in length (30.7-38.7 μm)................................................ M. apocryptae

5 (4) Spores small, less than 20 μm in length..............................................................................................

6 (7) Sutural ridge of shell value ‘S’-shaped................................................................................ M. fasciatum

7 (6) Sutural ridge of shell value not ‘S’-shaped...........................................................................................

8 (9) Spore elongate oval with both extremities rounded, shell slightly elevated in front of filament openings................................................................................ M. glossogobi

9 (8) Spore fusiform with pointed ends, shell not elevated in front of the filament openings......

10(11) Polar capsule spherical to ovoidal, spore, spore 11 - 16.5 μm × 5 - 7.49 μm................................. M. mystusium

12 (1) Shell valve striated..............................................................................................................

13(14) Spore of large dimensions, measuring 23 -27 μm in length................................................ M. calcariferi

14(13) Spore measuring upto 20 μm in length..........................................................................................

15(16) Suture of shell valve finely curved and nearly S-shaped................................................ M. sciaenae

16(15) Suture of shell valve not as above..........................................................................................

17(18) Spore cylindrobiconical in sutural view and bilobate in valvular view........ M. striatusi

18(17) Spore fusiform with both extremities pointed..............................................................................

19(20) Spores narrow three times as long as broad.............................................................................. M. lieberkunhni

20(19) Spores broad about twice as long as broad.............................................................................. M. heteropneustsi

**A. Myxidium of fishes**

444. *Myxidium apocryptae* Bajpai and Haldar

**Diagnosis**: Mature spore more or less spindle-shaped with pointed extremities, 30.7 - 32.2 µm × 4.2 - 6.6 µm; shell valve thin without any striations; polar capsule elongated, pyriform, 9.1 - 12.5 µm × 2.5 - 3.0 µm. Polar filament in some 9.1 - 15.8 µm long and in others 66.4 - 87.1 µm long; sporoplasm granular and located in between the two polar capsule, iodinophilous vacuole absent.

**Host**: *Apocryptes bato* Ham.; site of infection: gall bladder.

**Distribution**: India: West Bengal (Nadia district).

445. *Myxidium boddaerti* Choudhury and Nandi


**Material examined**: Sev. exs., Port Canning, South 24-Parganas, 18.vii.1971, N.C. Nandi.

**Diagnosis**: Spore fusiform with both the extremities drawn out into transparent needle-like structures, 133.3 - 166.8 µm in length with extension and 6.4 - 8.3 µm in breadth; shell valve thick and smooth, sutural line indistinct; polar capsules equal in size, pyriform, 7.4 - 10.3 µm × 3.0 - 4.0 µm; sporoplasm granular and filling the extracapsular space.

**Host**: *Boleophthalmus boddaerti* Palbs; site of infection: gut.

**Distribution**: India: West Bengal (South 24 Parganas district).

446. *Myxidium calcariferi* Chakravarty


**Diagnosis**: Spore elongated and fusiform with pointed terminal ends, 23-27 µm × 6.18 µm; shell valves equal and marked with striations, sutural line absent; polar capsules pyriform, equal in size 8.24 µm × 4.12 µm, polar filament 25-30 µm; sporoplasm occupying the entire space between the polar capsules.

**Host**: *Lates calcarifer* (Bloch); site of infection: gall bladder.

**Distribution**: India: West Bengal (exactly locality not mentioned).

447. *Myxidium fasciatum* Sarkar


**Diagnosis**: Vegetative form hyaline oval (17.6 µm × 12.8 µm - 22.5 µm × 19.0 µm) to spherical (19.0 - 21.0 µm in diameter), disporous; spore cylindrobiconical, 14.4 - 17.6 µm × 5.6 - 6.9 µm; polar capsule pear-shaped, 4.0 - 4.8 µm, polar filament having 2-3 coils, short and ribbon-like; iodonophilous vacuole absent.

**Host**: *Trichogaster fasciatus* Bl. & Schn.; site of infection: gall bladder.

**Distribution**: India: West Bengal (North 24-Parganas district).

448. *Myxidium glossogobi* Chakravarty

Diagnosis: Spore elongately oval with rounded extremities 12-15 μm × 8.5 - 10 μm; shell valve nonstriated, sutural plane indistinct; polar capsules pyriform, one at each end of spore, 3.1 - 4.1 μm long, shell slightly elevated in front of filament openings, polar filament 40 -50 μm long; sporoplasm uniformly granular and located at the middle portion of the spore.

Host: Glossobogobius giuris (Ham); site of infection: gall bladder.

Distribution: India: West Bengal (Calcutta district).

449. Myxidium heteropneustesi Chakravarty

Diagnosis: Spores more or less spindle-shaped with bluntly pointed extremities, 14.42 μm × 6.18 μm, shell valve provided with striations, sutural line indistinguished among striations; polar capsule equal, slightly ovoidal with pointed anterior ends, 4.12 - 6.18 μm × 4.12 μm; sporoplasm granular, rectangular and located in the space between the polar capsules.

Host: Heteropneustes fossilis (Bloch); site of infection: gall bladder.

Distribution: India: West Bengal (Calcutta district).

450. Myxidium islampurium Sarkar, Mazumdar and Pramanik

Diagnosis: Spore almost fusiform in valvular view and more arched on the upper side, cylindribiconical in sutural view, suture thin and straight, shell valve thin and smooth; iodinophilous vacuole absent; spore measuring 8.5 - 12 μm × 3.0 - 6.0 μm; polar capsule conical having 3-4 coil, measuring 3.0 - 4.5 μm × 2.0 - 3.0 μm.

Host: Channa marulius Ham.; site of infection: gall bladder.

Distribution: India: West Bengal (Murshidabad district).

451. Myxidium leiberkuhni Butschli


Diagnosis: Spores fusiform with both extremities pointed, 12.4 - 15 μm × 4.12 - 5 μm; shell valves thin, striated; sutural line very faint; polar capsule pyriform, equal in size, 4.12 μm × 2.06 μm, polar filament 15 μm in length.

Host: Anabas testudineus (Bloch), Boleophthalmus boddaerti Palbs from India and Esox lucinus Linn., Lota loita etc. from abroad.

Distribution: India; West Bengal (Calcutta and South 24- Parganas districts).

Remarks: Butschli (1881) originally described this species from the urinary bladder of a freshwater fish Esox lucinus. But, Chakravarty (1943) recorded the same species from the gall bladder of an anabantid fish, Anabas testudineus. Subsequently Choudhury and Nandi (1973) reported this species from the gall bladder of a gobiid fish, Boleophthalmus boddaerti. It is worth mentioning here that Sarkar (1985) proposed Chakravarty’s species as new to science and named
it *M. mukundae* in view of the fact that: (i) it is smaller in size (12.4 - 15 μm vs. 18-20 μm) and (ii) its site of infection is different (gall bladder vs. urinary bladder).

However *M. leiberkuhni* is retained for Indian forms until further study after obtaining the material from the Indian hosts are made.

452. *Myxidium mystusium* Sarkar and Ray Choudhury


*Diagnosis*: Spore fusiform with pointed end, 11.0 - 16.65 μm × 5.0 - 7.49 μm, shell valve smooth, suture slightly curved, ridged and very distinct; polar capsule spherical to ovoidal, 3.33-7.49 μm in diameter; polar filament having 4-5 coils, extended one measuring 36.0 μm in length; extracapsular cavity filled with biconcave, granular mass of sporoplasm, iodinophilous vacuole absent.

*Host*: *Mystus vittatus* Day; site of infection: gall bladder.

*Distribution*: India: West Bengal (Hugli district).

453. *Myxidium sciaenae* Sarkar


*Diagnosis*: Spore fusiform in valvular view, more fusiform in sutural view, 19.36 (± 0.47) μm × 5.32 (± 0.28) μm; shell valve two each having 5-6 longitudinal striations; suture distinct, finely pyriform having 6-7 coils of polar filament, 5.2 (± 0.13) μm × 2.50 (± 0.12) μm; sporoplasm filling the entire extracapsular biconcave cavity; iodinophilous vacuole absent.

*Host*: *Sciaena bleekeri* Day; site of infection: gall bladder.

*Distribution*: India: West Bengal (Medinipur district).

454. *Myxidium striatusi* Sarkar


*Diagnosis*: Spore, cylindro-biconical in sutural view, bilobate in valvular view due to depression around the intercapsular region, 11.1 - 18.7 μm × 4.7 - 7.0 μm; shell valve with fine longitudinal striations, suture straight; polar capsule two, pyriform, open almost vertically to the sutural line, 3.7 - 5.6 μm × 2.8 - 3.7 μm; sporoplasm uninucleated, finely granulated, completely filling the extra-capsular cavity.

*Host*: *Ophicephalus striatus* Bloch; site of infection: gall bladder.

*Distribution*: India: West Bengal (Hugli district).

455. *Myxidium* sp.

*Host*: *Ophicephalus punctatus* Bloch; site of infection: gall bladder

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Ray (1933) reported this unnamed species from the aforesaid host.
456. *Myxidium* sp.

*Host*: *Clarias batrachus* (Linnaeus); site of infection: gall bladder.

*Distribution and Remarks*: As for Sl. No. 455.

457. *Myxidium* sp.

*Host*: *Heteropneustes fossilis* (Bloch); site of infection: gall bladder.

*Distribution and Remarks*: As for Sl. No. 455.

458. *Myxidium* sp.

*Host*: *Ophicephalus punctatus* Bloch; site of infection: gall bladder.

*Distribution*: India: West Bengal (Nadia district).

*Remarks*: Haldar and Mukherjee (1978) reported this unnamed species from the aforesaid host.

**B. Myxidium of amphibians**

459. *Myxidium haldari* Sarkar


*Diagnosis*: Trophozoite large, oval to ellipsoidal, disporoblastic, polysporous; spore fusiform or cylindrobiconical in sutural view, circular in polar view, slightly bent in the middle, 10-12 μm × 6.5-7.0 μm; shell with 8-10 longitudinal striations, suture almost straight; polar capsule two, round, one at each end, opening vertically to the sutural line, 3-4 μm in diameter, polar filament 38-65 μm in length.

*Host*: *Hyla arborea*; site of infection: gall bladder.

*Distribution*: India: West Bengal (Nadia district).

**Genus Sphaeromyxa Thelohan**

Key to the species

1 (4) Spore slightly arched in front and sutural view..........................................................

2 (3) Sutural line more or less parallel to the long axis of the spore, polar capsule long, pyriform and with truncate ends................................................................. *S. pulitai*

3 (2) Sutural line curved and not parallel to the long axis of the spore, polar capsule ellipsoid ........................................................................................................... *S. dighae*

4 (1) Spore more or less S-shaped in sutural view..........................................................

5 (6) Polar capsule oval to ellipsoidal, spore measuring 27.55 μm × 7.80 μm........ *S. harenii*

6 (5) Polar capsule pyriform, spore measuring 19.8 μm × 5.4 μm................................. *S. theraponii*
460. Sphaeromyxa dighae Sarkar and Mazumdar


Diagnosis: Spore large, broad and bent in the middle forming an angle 140 degrees in valvular view, arched in sutural view, measuring 22.22 μm × 3.23 μm; shell valve smooth, elongated and curved, suture curved; polar capsule two, one on each end, subterminal and ellipsoidal, 2.43 μm × 2.32 μm; polar filament ribbon-like, 4-5 coils in each capsule.

Host: Hilsa ilisha (Ham.); site of infection : gall bladder.

Distribution: India : West Bengal (Medinipur district).

461. Sphaeromyxa hareni Sarkar


Diagnosis: Spore fusiform in valvular view, sometimes slightly curved with round ends and almost 'S'-shaped in sutural view, 23.35-28.95 μm × 5.6-8.87 μm; shell valve smooth, thin-walled with 'S'-shaped sutural line; polar capsule ovoid to ellipsoidal, 8.87-10.27 μm × 3.0-5.1 μm, polar filament 34.5 μm in length; sporoplasm filling the extracapsular space.

Host: Tachysurus platystomus (Day); site of infection : gall bladder.

Distribution: India : West Bengal (Medinipur district).

462. Sphaeromyxa pultai Tripathi


Diagnosis: Young trophozoite circular 4.5 μm in diameter, mature trophozoite mone or disporous, measuring 12.6-13.9 μm, and 19-27.3 μm respectively, spore long with truncated ends, two sides slightly curved in front and sutural view, 28.8-30.0 μm × 5-5.5 μm, shell thin and smooth; sutural line more or less parallel to the long axis of the spore, sutural ridge absent; polar capsule long, pyriform with truncated ends; sporoplasm granular, not filling the whole of the extra-capsular cavity.

Host: Odontamblyopus rubicundus (Ham.); site of infection : gall bladder.

Distribution: India : West Bengal (North 24-Parganas district).

463. Sphaeromyxa theraponi Tripathi


Diagnosis: Spore arched in front view measuring 19.8 μm × 5.9 μm, one side more arched than the other; sutural view appearing as 'S' shaped; sutural line also 'S' shaped, thin and distinct; sutural ridge absent, shell valve thin and smooth; polar capsule small, pyriform, 7.2 μm × 2.7 μm with truncated ends; sporoplasm filling most of the extracapsular cavity.

Host: Therapon jarbua (Forsk.) site of infection : gall bladder.

Distribution: India : West Bengal (South 24-Parganas district).
Genus *Zschokkella* Auerbach

Five species of this genus, 3 from fishes and one each from amphibians and reptiles have been known so far from this state.

Key to the species

A. *Zschokkella* of fishes

1 (4) Valve of the shell thin and not provided with any striation, suture thin and ‘S’ shaped

2 (3) Spore broader, 10.50-12.25 μm × 6.50-7.35 μm, parasitic in marine fish *Tachysurus platystomus* ......................................................... *Z. platystomusi*

3 (2) Spore narrower, 10.3 μm × 4.12-5.18 μm, parasitic in freshwater fish, *Heteropneustes fossilis* ............................................................... *Z. fossilae*

4 (1) Valve of the shell thin and provided with longitudinal striation, suture not ‘S’ shaped, (Spore 12.36 μm × 6.18 μm) .......................................................... *Z. ilishae*

A. *Zschokkella* of fishes

464. *Zschokkella fossilae* Chakravarty


*Diagnosis*: Trophozoite roughly circular, 12.36-16.48 μm in diameter, disporous; spore more or less semi-circular, 10.3 μm × 4.12-5.18 μm; shell valves thin, non-striated, sutural line ‘S’-shaped; polar capsules spherical, equal in size, 3.1 μm in diameter, located at each end of the spore and having distinct coiled filaments.

*Host*: *Heteropneustes fossilis* (Bloch); site of infection: gall bladder.

*Distribution*: India: West Bengal (Calcutta district).

465. *Zschokkella ilishae* Chakravarty


*Diagnosis*: Trophozoite disc-shaped, non-motile, 14.5-22.6 μm in longest diameter; spore more or less semi-circular, 12.36 μm × 6.18 μm; shell valve thin with longitudinal striations; polar capsules equal, spherical, 4.26 μm in diameter; sporoplasm located in between the polar capsules but dorsally extended over the capsules.

*Host*: *Hilsa ilisha* (Ham.); site of infection: gall bladder.

*Distribution*: India: West Bengal (exact locality not mentioned).

466. *Zschokkella platystomusi* Sarkar


*Diagnosis*: Spores ellipsoidal in valvular view with one edge view highly convex and the other slightly concave, dumbbell to nearly fusiform in sutural view, 10.50-12.25 μm × 6.50-7.35 μm; shell valve thin walled, hyaline and smooth; suture thin, not ridged and S-shaped;
Polar capsule two, spherical to ovoidal, 2.80-3.50 μm in diameter; polar filament when extruded measuring 84.0 μm; sporoplasm granular and filling the extracapsular cavity.

**Host**: *Tachysaurus platystomus* (Day); site of infection: gall bladder.

**Distribution**: India: West Bengal (Medinipur district).

### B. *Zschokkella* of amphibians

467. *Zschokkella auberbachii* (Weill)


**Diagnosis**: Mature trophozoite irregular oval, disc-shaped or elongated amoeboid in shape, diameter varying from 1.07-1.7 μm in oval or circular form and in elongated form 1.0-1.75 μm × 0.39-0.5 μm; spore semicircular and ovoidal in side view with angles rounded but one end slightly tapering, 10.3 μm × 6.18 μm and 12.36-14.44 μm × 6.78-8.24 μm; polar capsule spherical, 4.12 μm in diameter, polar filament 40-50 μm long.

**Host**: *Bufo melanostictus* Schneider, *Rana tigrina* Daudin, and *Rana limnocharis* Wiegman; site of infection: gall bladder.

**Distribution**: India: West Bengal (Calcutta district), Uttar Pradesh.

### C. *Zschokkella* of reptile

468. *Zschokkella lissemysi* Chakravarty


**Diagnosis**: Young trophozoite measuring 12.36-14.42 μm × 8.24-9.33 μm; spore semicircular in front view with one end slightly tapering, and ovoidal in lateral view, 18.5-22.6 μm × 14.4-16.4 μm; shell valves thick and striated, sutural line and ridge absent; polar capsule spherical and equal, 7.2-9.2 μm in diameter, each capsule with a fine duct, opening exterior by the side of the lid; polar filament 100 μm in length. Sporoplasm occupying the entire extra-capsular cavity.

**Host**: *Lissemys punctata* (Bonnaterre); site of infection: gall bladder.

**Distribution**: India: West Bengal (Calcutta district).

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**Family** CERATOMYXIDAE

**Key to the genera**

1 (4) Spore with two polar capsules.................................................................................................................................

2 (3) Shell valve conical and hollow, breadth of spore more than twice the sutural diameter .......................................................... *Ceratomyxa*

3 (2) Shell valve hemispherical, breadth of spore less than twice the sutural diameter........
..................................................................................................................... *Leptotheca*
4 (1) Spore with four polar capsules.......................................................... *Chioromyxum*

Genus *Ceratomyxa* Thelohan

1 (2) Shell valve with 2-5 hollow appendages, sutural diameter of spore 14-19 µm.............. *C. tartuori*

2 (1) Shell valve without such appendages, sutural diameter 3.5-10 µm...................................

3 (4) Breadth of the spore about 9 times the length of sutural diameter ................... *C. sagarica*

4 (3) Breadth of the spore 3-4 times the length of sutural diameter...................................

5 (6) Extra capsular cavity filled with finely granular sporoplasm (breadth of the spore 14-15 µm, sutural diameter 4.5 µm)................................................................. *C. gobiodesi*

6 (5) Sporoplasm not filling entirely extracapsular cavity ...........................................

7 (8) Breadth of the spore 25-40 µm, sutural diameter 10 µm, parasitic in *Hilsa ilisha*........ *C. hilsae*

8 (7) Breadth of the spore 16-26 µm, sutural diameter 4.2-7.2 µm, parasitic in *Scatophagus argus* .......................................................... *C. scatophagi*

469. *Ceratomyxa gobioidesi* Chakravarty


*Diagnosis*: Trophozoite circular or disc-shaped, 55-650 µm in diameter, disporous; spore crescent shaped, 14-15 µm in width, shell valve symmetrical with terminal end blunt, sutural plane distinct, sutural diameter 4-5 µm; polar capsules spherical and equal, one on each side of the sutural plane, polar filament 15 µm long, extracapsular cavity filled with granular sporoplasm.

*Host*: *Odantoamblypus (Gobioides) rubicundus* (Ham.); site of infection: gall bladder.

*Distribution*: India: West Bengal (Calcutta district).

470. *Ceratomyxa hilsae* Chakravarty


*Diagnosis*: Trophozoite spherical and usually disporous; spore elliptical in front view, anteriorly arched in lateral view, posteriorly almost straight, 25-40 µm in width; shell valve tapering with rounded or blunt extremities, sutural plane prominent, sutural diameter 10 µm; polar capsules spherical, equal in size, 5 µm in diameter, polar filament 35-40 µm long; sporoplasm asymmetrically placed and not filling the entire extra-capsular cavity.

*Host*: *Hilsa ilisha* (Ham.); site of infection: gall bladder.

*Distribution*: India: West Bengal (Calcutta district).

471. *Ceratomyxa sagarica* Choudhury and Nandi

Material examined: Sev. exs., Port Canning, South 24-Parganas, 10.i.1971.

Diagnosis: Spore crescentic to flat-base arched form with two lateral prolongations ending almost in needle point, breadth of spore (26.5-36.3) μm about nine times the length of sutural diameter (3.3-4.1) μm; shell valve thin and asymmetrical, sutural ridge vertically curved; polar capsule pyriform, one on each side of sutural plane, unequal in size, 2-3 μm x 1.6-2.5 μm, sporoplasm not filling the entire extracapsular cavity.

Host: Boloephthalmus boddaerti Palbs; site of infection: gall bladder.

Distribution: India: West Bengal (South 24-Parganas district).

472. Ceratomyxa scatophagi Chakravarty


Diagnosis: Trophozoite irregular in shape measuring 50-120 μm x 40-85 μm; spore crescent shaped in lateral view, 16-26 μm in breadth; shell valves alike, cylindrical with terminal extremities rounded, sutural line indistinct, sutural diameter 4.2-7.2 μm; polar capsules equal, spherical, 2.5-3.1 μm in diameter, polar filament 30-50 μm in length.

Host: Scatophagus argus (Bloch); site of infection: gall bladder.

Distribution: India: West Bengal (exact locality not mentioned).

473. Ceratomyxa tartoori Sarkar


Diagnosis: Spore hemispherical in sutural view with highly convex, round anterior surface and almost flat posterior surface, 167-234 μm in breadth, 14-19 μm in sutural diameter; shell valve two, thin and smooth, each valve with an appendage or prolongation forming about 45° angle with the sutural axis, sometimes spores with 3-5 hollow appendages; polar capsules two, occasionally 3-4, spherical or nearly ovoidal with a very short neck, 6-7 μm in diameter or 5-7 (6.29) μm x 5-7 (5.5) μm; polar filament 20-28 μm in length.

Host: Opisthopterus tartoor Day; site of infection: gall bladder.

Distribution: India: West Bengal (Medinipur district).

474. Ceratomyxa sp.

Host: Gobioides rubicudus Ham.; site of infection: liver, gall bladder, kidney, ovary etc.

Distribution: India: West Bengal (Calcutta district).

Remarks: Ray (1933a, b) reported this unnamed species from the aforesaid host.

475. Ceratomyxa sp.

Host: Trichogaster fasciatus Schneider; site of infection: gall bladder.

Distribution and Remarks: As for Sl. No. 474.
476. *Ceratomyxa* sp.

*Host*: *Macrones gulio* (Ham.); site of infection: gall bladder.

*Distribution and Remarks*: As for Sl. No. 474.

**Genus* Leptotheca* Thelohan

1 (2) Spore bean-shaped with both extremities rounded, spore valve smooth and symmetrical, sporoplasm not occupying entire extracapsular cavity of the spore..................*L. latesi*

2 (1) Spore elliptical, spore valve smooth and unequal, sporoplasm occupying entire extracapsular cavity of the spore.................................................................*L. macronesi*

477. *Leptotheca latesi* Chakravarty


*Diagnosis*: Trophozoites circular, 10-14 μm in diameter, disporous; spore bean-shaped in lateral view with both extremities rounded, 10.3012.4 μm in breadth; shell valves smooth and symmetrical, sutural line prominent, sutural diameter 6.2 μm, sutural ridge absent; polar capsule spherical, equal in size, one on each side of the sutural line, 3.1 μm in diameter, polar filament 50-80 μm in long; sporoplasm not filling the entire extracapsular cavity.

*Host*: *Lates calcarifer* (Bloch); site of infection: gall bladder.

*Distribution*: India: West Bengal (exact locality not mentioned).

478. *Leptotheca macronesi* Chakravarty


*Diagnosis*: Trophozoites circular, 10.3 μm in diameter, monosporous; spore elliptical with ventral side more or less flattened, extremities rounded, 10-14.4 μm in breadth; shell valves smooth, unequal and thin, sutural line distinct, sutural diameter 6.18-7.2 μm; polar capsules equal, spherical, one on each side of sutural line, 3.1 μm in diameter; sporoplasm filling the entire extracapsular cavity.

*Host*: *Macrones gulio* (Ham.); site of infection: gall bladder.

*Distribution*: India: West Bengal (exact locality not mentioned).

**Genus* Chloromyxum* Mingazzini

**Key to the species**

1 (4) Spore spherical..................................................................................................................................................

2 (3) Spore 8.24-10.3 μm in diameter, shell valve striated, polar capsule oval, 4.1-5.2 μm × 3.1-4.0 μm...........................................................................................................*C. amphipnoui*

3 (2) Spore 9-10 μm in diameter, shell valve without any striations, polar capsule spherical,
2.7-3.6 \mu m \text{ in diameter} \dots \dots 
\text{C. mrigalae}

4 (1) Spore ovoidal, (7-8.5 \mu m \times 6-8 \mu m, shell valve without any striations, polar capsule ovoid to pyriform, 2-3.5 \mu m \times 2-2.5 \mu m \dots \dots 
\text{C. meglitschi}

479. \textbf{Chloromyxum amphipnoui} Ray


\textbf{Diagnosis:} Trophozoites oval or spherical in outline, measuring 14.4 \mu m \times 16.5 \mu m - 35 \mu m \times 40 \mu m; spore almost spherical in front view, ovoidal in side view, 8.24-10.3 \mu m \text{ in breadth}; shell valve smooth, sutural line slightly curved; polar capsules equal in size, oval with attenuated anterior end, 4.1-5.2 \mu m \times 3.1-4.0 \mu m, polar filament 35-40 \mu m long; sporoplasm filling the entire extracapsular space.

\textbf{Host:} Amphipnous cuchia (Ham.), Heteropneustes fossilis (Bloch) and Amblypharyngodon mola (Ham.); site of infection: gall bladder.

\textbf{Distribution:} India: West Bengal (Calcutta and North 24-Parganas districts).

\textbf{Remarks:} Chakravarty and Basu (1948) reported this species from the gall bladder of Amblypharyngodon mola.

480. \textbf{Chloromyxum meglitschi} Sarkar


\textbf{Diagnosis:} Trophozoite coelozoic, ellipsoidal, disporous; spore small, ovoidal with truncated narrower end, 11-16.5 \mu m \times 9-13 \mu m, shell valve smooth, suture slightly curved; polar capsule 4, ovoid to pyriform, 2-3.5 \mu m \times 2-2.5 \mu m, located towards the broader end of the spore, opening through small duct.

\textbf{Host:} Ophicephalus punctatus punctatus Bloch; site of infection: gall bladder.

\textbf{Distribution:} India: West Bengal (North 24-Parganas district).

481. \textbf{Chloromyxum mrigalae} Tripathi


\textbf{Diagnosis:} Trophozoite globular, 19.8-23 \mu m \text{ in diameter}; spore spherical, 7-10 \mu m \text{ in diameter}, with thin and smooth shell valves, sutural line distinct and slightly curved; polar capsules 4 in number, spherical and equal in size, 2.7-3.6 \mu m \text{ in diameter}, sporoplasm filling half of the extracapsular cavity.

\textbf{Host:} Cirrhinus reba (Ham.) and C. mrigala (Ham.); site of infection: gall bladder.

\textbf{Distribution:} India: West Bengal (North 24-Parganas district).

482. \textbf{Chloromyxum} sp.

\textbf{Host:} Xenentodon cancila (Ham.); site of infection: gall bladder.
**Distribution**: India: West Bengal (North 24-Parganas district).

**Remarks**: Tripathi (1952) reported this unnamed species from the gall bladder of the aforesaid host from Belgharia fish farm. The spore is spherical, 7.2 μm in diameter, with smooth shell, slightly raised sutural line and spherical polar capsule of 2.7 μm in diameter.

**Family** MYXOBOLIDAE

**Key to the genera**

1(6) Shell-valve of spore prolonged into long processes.  
2(5) Shell-valve prolonged only posteriorly as caudal appendage.  
3(4) Caudal appendages being the extension of the shell-valve and composed of same material as the shell-valve.  
4(3) Caudal appendage not an extension of the shell-valve and composed of materials different from those of shell-valve.  
5(2) Shell valve with two equally long prolongations at both anterior and posterior ends.  
6(1) Shell valve without any prolonged process.  
7(10) Spore with two polar capsules.  
8(9) Sporoplasm with a conspicuous iodinophile vacuole.  
9(8) Sporoplasm without iodinophile vacuole.  
10(7) Spore with one polar capsule.  
11(12) Spore flattened, pyriform, polar capsule present at anterior end parallel to the longitudinal axis of the spore.  
12(11) Spore oval to ellipsoidal, polar capsule present at broad end, either perpendicular or at longitudinal axis of the spore.

**Genus** Myxobolus Thelohan

Sixteen species of *Myxobolus* have so far been reported from this state.

**Key to the species**

1(16) Polar capsule equal sized.  
2(3) Spore elongately pyriform, shell of spore thin, (spore 14.5-16.5 μm × 6.18 μm, polar capsule elongated pyriform).  
3(2) Spore oval, ellipsoidal, or subspherical, shell of spore thick or moderately thick.  
4(5) Anterior end of spore possessing a small knob.
5(4) Anterior end of spore without any distinct knob .............................................................

6(9) A small intercapsular ridge present between opening of two capsules..........................

7(8) Polar capsule spherical, 2.8-3.6 μm in diameter, sutural ridge distinct, having four
thickenings along its posterior margin ................................................................................. M. sphericum

8(7) Polar capsule pyriform, 3.6-4.5 μm × 2.7 μm, sutural ridge distinct but without having
four thickenings as above ................................................................................................... M. barbi

9(6) Small intercapsular ridge between opening of two capsules lacking............................

10(13) Spore oval or ovoidal ....................................................................................................

11(12) Shell valve bearing a triangular notch-like depression at its anterior extremity, polar
capsule pear-shaped, 6.6 μm × 3.3 μm ........................................................................... M. rohitae

12(11) Shell valve without any triangular notch, polar capsule broadly pyriform, 4.74-5.05
μm × 2.48-3.18 μm ........................................................................................................... M. anili

13(10) Spore subspherical ......................................................................................................

14(15) Polar capsule 6.18 μm × 3.09 μm, parasitic in Clarias batrachus .................. M. clarii

15(14) Polar capsule 4.5-5.5 μm × 2.5-3.0 μm, parasitic in Mastacembelus armatus ... M. eeli

16(1) Polar capsule unequal ..................................................................................................

17(26) Both the polar capsule are of same shape ....................................................................

18(23) Spore more than 10 μm in length ..............................................................................

19(22) Spore pyriform in shape ............................................................................................

20(21) Spore broadly pyriform, 12.22-13.96 μm × 8.73-10.74 μm, shell valves thin-walled,
polar filament of large polar capsule ribbon-like .............................................................. M. mystusius

21(20) Spore pyriform, narrower, 12-14 μm × 6-7.5 μm, shell valves quite thick, polar filament
thread-like .......................................................................................................................... M. aligarhensis

22(19) Spore oval or ovoidal in shape ...................................................................................

22a Spore 12.4-15.0 μm × 8.2-10.0 μm, larger polar capsule 6.18 μm × 4.12 μm and
smaller one 4.12 μm × 3.09 μm ....................................................................................... M. calbasui

22b Spore 11.5-13.96 μm × 9.77-10.47 μm, larger polar capsule 6.28-7.35 μm × 3.49-4.19
μm, small one 4.19-6.98 μm × 3.14-3.49 μm ................................................................ M. mahendrae

22c Spore 12.14-14.3 μm × 7.7-10.5 μm, large polar capsule 5.6 μm × 4.3 μm and smaller
one 4.5 μm × 3.2 μm ......................................................................................................... M. chakravartyi

23(18) Spore less than 10 μm in length .................................................................................

24(25) Shell valves exhibit several triangular markings, both polar capsule pyriform...........
........................................................................................................................................... M. mrigalae
25(24) Shell valve lacking any triangular markings, both polar capsule oval.....M. branchialis
26(17) Larger polar capsule pyriform, smaller one more or less spherical.............M. indicum

483. Myxobolus aligarhensis Bhatt and Siddiqui


Diagnosis: Cyst rounded, milky-white, 0.190-0.628 μm × 0.192-0.531 μm; spore pyriform, gradually tapering, bluntly pointed anterior end and rounded posterior end, 12-14 μm × 6-7.5 μm; shell valves thick, symmetrical, sutural line and sutural ridge straight; polar capsules two, pyriform, equal (excepting those parasitic in heart muscle, Mukherjee and Haldar, 1981), 6.5-8 μm × 2-2.5 μm and 6-7 μm × 2-2.5 μm, polar filament thread-like, unequal, 38-45 μm and 32 μm in length; sporoplasm filling the extracapsular cavity, an iodinophilous vacuole present.

Host: Ophicephalus (= Channa) punctatus Bloch; site of infection: accessory respiratory membrane, pharyngeal epithelium and fins.

Distribution: India: West Bengal (Calcutta, Nadia and North 24- Parganas districts), Punjab and Uttar Pradesh.

Remarks: Mukherjee and Haldar (1981) described M. punctatus from different organs of fish, Ophicephalus punctatus collected from fish ponds around Kalyani University Campus, Nadia. Gupta and Khera (1988) treated this species as synonym of M. aligarhensis as both the species have been collected from the same fish host and size of spores and polar capsules in both is almost the same. The present authors agree with this proposition.

484. Myxobolus anili Sarkar


Diagnosis: Spore broadly ellipsoidal with slightly acuminate anterior end in valvular view and broadly lenticular in sutural view, 9.48-11.06 (10.74) μm × 7.92-9.84 (8.69) μm; shell valves thick-walled, smooth and symmetrical, suture straight, thick-walled and ridged; polar capsule two, equal, broadly pyriform with short neck converging anteriorly, 4.74-5.05 (4.82) μm × 2.48-3.16 (3.05) μm; polar filament thread-like, 20 μm in length; sporoplasm dikaryotic, iodinophilous vacuole and intercapsular ridge absent.

Host: Rhinomugil corsula Ham.; site of infection: mesentry.

Distribution: India: West Bengal (coast of Bay of Bengal).

485. Myxobolus barbi Tripathi


Diagnosis: Spore 12.6-13.5 μm × 9.0 μm, perfectly oval in front view, lenticular in side and anterior view; shell valves thick, sutural ridge prominent, sutural line indistinct; polar capsules pyriform, equal and convergent, 3.6-4.5 μm × 2.7 μm, small intracapsular ridge present, iodinophilous vacuole round; capsulogenous nuclei small, located at the posterior end of the capsule; sporoplasm filling most of the extracapsular cavity.
Host: *Barbus ticto* (Ham.); site of infection: skin.

Distribution: India: West Bengal (North 24-Parganas district).

486. *Myxobolus bengalensis* Chakravarty and Basu


Diagnosis: Cyst oval, 2-4.1 μm in diameter; spore more or less oval in front view with anterior end bluntly pointed and posterior end rounded, spindle-shaped in side view, 8.56-9.36 μm × 6.42-6.80 μm, anterior end with a small knob; shell valve smooth, sutural ridge prominent, sutural line indistinct; polar capsule oval, 4.28-5.40 μm × 2.5-3.2 μm, polar filament 50-125 μm long, a spherical iodinophilous vacuole present.

Host: *Calla calla* (Ham.); site of infection: gills.

Distribution: India: West Bengal (North 24-Parganas district).

487. *Myxobolus branchialis* Tripathi


Diagnosis: Spore oval in front view fusiform in side view; 6.4-7 μm × 4.5-5 μm; shell valves smooth, symmetrical and moderately thick, sutural ridge prominent; polar capsule unequal, convergent, oval-shaped, 3.5 μm × 1.5 μm and 1.5 μm × 1.0 μm; polar filament unequal; iodinophilous vacuole oval, 1.7 μm × 2.3 μm; trophozoite 13.5 μm in diameter; cyst 0.27-0.45 μm.

Host: *Barbus sarana* (Ham.); site of infection: gills.

Distribution: India: West Bengal (North 24-Parganas district).

488. *Myxobolus calbasui* Chakravarty


Diagnosis: Cyst almost spherical, 300-350 μm in diameter, young trophozoites spherical or slightly oval, 30 μm in diameter; spore roughly oval in front view with anterior extremity pointed and the posterior rounded and lenticular in lateral view, 12.4-15 μm × 8.2-10 μm; shell somewhat thick with symmetrical shell valves, sutural ridge distinct, sutural line indistinct; polar capsules pyriform, unequal, 6.18 μm × 4.12 μm and 4.12 μm × 3.09 μm; polar filament unequal in size, 125 μm and 60 μm; single spherical, 4.1 μm in diameter, iodinophilous vacuole present.

Host: *Labeo calbasu* (Ham.), *L rohita* (Ham.) and *Cirrhina mrigala* (Ham.); site of infection: gall bladder.

Distribution: India: West Bengal (Calcutta district).

489. *Myxobolus catiae* chakravarty


Diagnosis: Cyst opaque white, spherical or oval, 45-150 μm in largest diameter; spore
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elongately pyriform in front view with sharply pointed anterior and rounded posterior extremities, spindle-shaped in lateral view, 14.5-16.5 \( \mu m \times 6.18 \mu m \); shell thin, sutural ridge and line indistinct; polar capsule elongated pyriform, equal, 10.3-12.36 \( \mu m \times 2.06-3.01 \mu m \), polar filament 150 \( \mu m \) long.

**Host**: *Catla catla* (Ham.), *Labeo rohita* (Ham.) and *Cirrhinus mrigala* (Ham.); site of infection: gills.

**Distribution**: India: West Bengal (Calcutta district).

490. *Myxobolus chakravartyi* Haldar, Das and Sharma


**Diagnosis**: Cyst creamy-white, oblongate to rounded, 390-440 \( \mu m \times 220-280 \mu m \); spore ovoidal, anterior end flat-like in between the two openings of the polar capsules, posterior end broadly rounded, 12.4-14.3 \( \mu m \times 7.7-10.5 \mu m \); shell valve symmetrical, sutural ridge prominent; polar capsule unequal, pyriform, 5.5-6.6 \( \mu m \times 3.3-5 \mu m \) and 4.4-5.0 \( \mu m \times 2.2-4.4 \mu m \), polar filament 37.4-40.5 \( \mu m \) in length.

**Host**: *Catla catla* (Ham.); site of infection: internal eye musculature.

**Distribution**: India: West Bengal (Nadia district).

491. *Myxobolus clarii* Chakravarty


**Diagnosis**: Cysts broadly oval, opaque white, measuring 780-775 \( \mu m \times 604-877 \mu m \); spore subspherical in front view, lenticular in lateral view, 11.3-12.4 \( \mu m \times 10.3 \mu m \); shell comparatively thick with equal valves, sutural ridge distinct; polar capsules pyriform with their ends drawn into a short narrow tube, 6.18 \( \mu m \times 3.09 \mu m \), polar filament 50 \( \mu m \) long; iodinophilous vacuole single, spherical, 3 \( \mu m \) in diameter.

**Host**: *Clarias batrachus* (Linn.); site of infection: gall bladder, liver, testes, ovary and fat bodies.

**Distribution**: India: West Bengal (Calcutta district).

492. *Myxobolus eeli* Mandal and Nair


**Material examined**: Sev. exs., Champahati, South 24-Parganas, 28.ii.1972, A.K. Mandal.

**Diagnosis**: Spore subspherical in front view, lenticular in lateral view, 10.5-14 \( \mu m \times 8.2-11.5 \mu m \), smooth-walled with 2-3 triangular folds; suture distinct and ridged; polar capsule two, equal, pyriform, convergent, 4.5-5.5 \( \mu m \times 2.5-3.0 \mu m \), polar filament with 6 coils, extruded one 28-32 \( \mu m \) in length; sporoplasm hemispherical 7 \( \mu m \) in diameter, and with a spherical iodinophilous vacuole.

**Host**: *Mastacembelus armatus* (Lacepede); site of infection: inner wall of intestine.

**Distribution**: India: West Bengal (South 24-Parganas district).
493. *Myxobolus indicum* Tripathi


*Diagnosis*: Spore oval in front view, lenticular in side view, 9.5-10.8 \( \mu \text{m} \times 7.5-8.2 \mu \text{m} \), shell valves moderately thick, smooth and symmetrical; polar capsules unequal and divergent, longer one pyriform, 2.7 \( \mu \text{m} \) - 3.6 \( \mu \text{m} \times 1.8 \mu \text{m} \), and the smaller one more or less spherical, 1.8 \( \mu \text{m} \times 1.0 \mu \text{m} \); iodinophilous vacuole round to oval, 2.5 \( \mu \text{m} \) in diameter.

*Host*: *Cirrhinus mrigala* (Ham.); site of infection: muscles, liver and intestinal wall.

*Distribution*: India: West Bengal (North 24-Parganas district).

494. *Myxobolus mahendrae* Sarkar


*Diagnosis*: Spore histozoic, almost cylindrobiconical with thin, slightly curved suture in sutural view and ovoidal with truncate anterior end in valvular view, 11.52-13.96 (12.70) \( \mu \text{m} \times 9.77-10.47 \) (10.37) \( \mu \text{m} \); shell valve two, symmetrical, smooth and thick-walled with 5-6 triangular markings on the wall; polar capsule broadly pyriform, unequal, slightly convergent, open side by side, 6.28-7.33 \( \mu \text{m} \times 3.49-4.19 \mu \text{m} \) and 4.19 - 6.98 \( \mu \text{m} \times 3.14-3.49 \mu \text{m} \); iodinophilous vacuole present.

*Host*: *Catla catla* (Ham.); site of infection: gill arch epithelium.

*Distribution*: India: West Bengal (Hugli district).

495. *Myxobolus mrigalae* Chakravarty


*Diagnosis*: Cysts oval, opaque white in colour, 0.75-1.5 \( \mu \text{m} \times 0.75-1.0 \mu \text{m} \), polysporous; spore spherical or slightly oval in front view, lenticular in lateral view, 7.21-8.24 \( \mu \text{m} \) in length; shell somewhat thick, valves symmetrical with several triangular markings; sutural ridge prominent, sutural line indistinct; polar capsules pyriform, unequal in size, 5.15 \( \mu \text{m} \times 3.09 \mu \text{m} \) and 3.09 \( \mu \text{m} \times 2.06 \mu \text{m} \); sporoplasm located posteriorly, iodinophilous vacuole 3.1 \( \mu \text{m} \) in diameter, polar filament unequal.

*Host*: *Cirrhinus mrigala* (Ham.); site of infection: scales.

*Distribution*: India: West Bengal (Calcutta district).

496. *Myxobolus mustusius* Sarkar


*Diagnosis*: Spore histozoic, almost lenticular with straight thin suture in sutural view and broadly pyriform with rounded posterior and sharply-pointed anterior tip in valvular view, 12.22-13.96 \( \mu \text{m} \times 8.73-10.47 \mu \text{m} \); shell valves two, symmetrical and thin-walled; polar capsules two, convergent, unequal, pyriform, 6.28-7.68 \( \mu \text{m} \times 2.79-4.19 \mu \text{m} \) and 3.49-4.19 \( \mu \text{m} \times 1.40-1.75 \mu \text{m} \); polar filament 16-20 \( \mu \text{m} \) in length in larger polar capsule; a small iodinophilons vacuole present.
Host: *Mystus vittatus* Day; site of infection: gill filaments.

Distribution: India: West Bengal (Hugli district).


Diagnosis: Cyst rounded, 220-300 μm in diameter; spore ovoidal to rounded, 9.9-12.1 μm x 8.8-9.9 μm; shell valves two, meeting along the straight longitudinal sutural line, a triangular notch-like depression at the anterior extremity; polar capsule pear-shaped, equal 6.6 μm x 3.3 μm; polar filament 33-45.1 μm in length; a small iodinophilous vacuole present.

Host: *Labeo rohita* (Ham.); site of infection: scale.

Distribution: India: West Bengal (Nadia district).


Diagnosis: Spore oval in front view, lenticular in side view, anterior end wider than the posterior end, 9.9.5 μm x 7.2 μm; shell valves moderately thick, smooth and symmetrical, sutural ridge prominent and with four thickenings along its posterior margin, sutural line indistinct; polar capsules spherical, equal and convergent, 2.8-3.6 μm in diameter; iodinophilous vacuole oval, prominent, 2.0-2.7 μm in diameter.

Host: *Cirrhina mrigala* (Ham.); site of infection: inner side of the scales.

Distribution: India: West Bengal (North 24-Parganas district).

Genus *Myxosoma* Thelohan

Key to the species

1(2) Both polar capsules elongated and tubular (spore nearly pyriform, 12-17.5 μm x 2.5-5.0 μm).................................................................*M. marulius*

2(1) Both polar capsule pyriform..........................................................*M. magauddi*

3(4) Polar capsules unequal, a knob-like swelling present at the base of each polar filament ............................................................................*M. noblei*

4(3) Polar capsules equal, polar filament without any knob-like swelling as above........

5(6) Spore cyldroconical shell valve with 6-8 long striations.....................*M. cylindrica*

6(5) Spore oval or elliptical, shell valve smooth and without any striation ..................

7(8) Spore with short posterior extension of shell valve, suture thick, ridged and almost ‘S’ shaped..............................................................*M. noblei*

8(7) Spore without any posterior extension of shell valve, suture not S-shaped..............
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9(10) Spore broadly pyriform, (polar capsules 9.00-10.47 μm × 3.38 μm, arranged parallel to each other) .......................................................... M. trichogasteri

10(9) Spore oval ...............................................................................................................................................................................

10a Spore broadly oval to spherical, 11-14 μm x 9-11 μm, polar capsule 4-6 μm x 2-2.5 μm .......................................................... M. indirae

10b Spore broadly oval, sometimes elongated, 9-11 μm x 8-10 μm, polar capsule 4-5 μm x 2-3 μm .......................................................... M. dermitis

10c Spore broadly oval or slightly elongated, 11.2-17.3 μm x 8.1-12.2 μm, polar capsule 4-7.1 μm x 2-4 μm .......................................................... M. filamentosa

499. Myxosoma cylindrica Sarkar, Mazumdar and Pramanik


Diagnosis: Spore histozoic lenticular in sutural view with thick, almost straight suture, cylindroconical in valvular view with 6-8 longitudinal striations on each valve, 12.8-16.32 μm x 4.48-6.4 μm; polar capsules two pyriform, small and equal with very short neck at the conical end of the spore, opening side by side, 4.0-5.2 μm x 1.12-2.24 μm, extended polar filament 8.0-16.0 μm in length; iodinophilous vacuole absent.

Host: Channa gachua Bloch; site of infection: kidney.

Distribution: India: West Bengal (Murshidabad district).

500. Myxosoma dermitis Haldar, Mukherjee and Kundu


Diagnosis: Cyst creamy-white, 0.5 to 1 mm in diameter; spore usually broadly oval, sometimes elongated and rarely circular in outline, shell valve relatively thick and smooth; 9-11 μm x 8-10 μm; polar capsule equal, pyriform with 6 coils, 4-5 μm x 2-3 μm, extruded polar filament 10-25 μm in length; iodinophilous vacuole absent.

Host: Labeo rohita Ham.; site of infection: scale

Distribution: India: West Bengal (Nadia district).

501. Myxosoma filamentosa Haldar, Mukherjee and Kundu


Diagnosis: Spore broadly oval, slightly elongated but never thick circular in outline in front view, lenticular in side view, 11.2-17.3 (13.7) μm x 8.1-12.2 (9.5) μm, shell valve considerably elevated with prominent sutural ridge; polar capsule pyriform, measuring 4-7.1 μm x 2.0-4.0μm, polar filament with 5 or 6 coils extruded one 23.4-34.6 μm long; polar capsule unequal in about 25% of the spore.

Host: Puntius filamentosus Cuvier; site of infection: brain meninges.

Distribution: India: West Bengal (Nadia district).
502. *Myxosoma indirae* Kundu


**Diagnosis:** Cyst egg-shaped to spherical (0.5 to 1.00 μm); spore broadly oval to spherical in front view, lenticular in side and posterior end view, 11-14 μm × 9-11 μm; shell valve thick and smooth, suture thick, ridged and slightly oblique; polar capsule pyriform and convergent having 8 to 10 coils of filament in each, 4-5 μm × 2-2.5 μm, polar filament 28-37 μm in length; iodinophilous vacuole absent.

*Host:* *Cirrhinus mrigala* (Ham.); site of infection: head cartilage, scale and tail fin.

*Distribution:* India: West Bengal (Nadia district).

503. *Myxosoma magauddi* Bajpai, Kundu and Haldar


**Diagnosis:** Cyst 1.0 mm in diameter; spore oval, measuring 10.8-11.7 μm × 8.3-10.0 μm; shell valve two, meeting along the longitudinal straight sutural line, inner wall of shell valve with a triangular projection at the anterior end; polar capsule pear-shaped, unequal (large) 3.3-5.0 μm × 2.5-3.3 μm, and (small) 2.5-3.3 μm × 1.7-2.5 μm; polar filament having six or several loose coils, length (longer) 18.2-42.5 μm and (smaller) 8.3-10.8 μm, with a knob-like swelling at the base of each filament.

*Host:* *Trichogaster fasciatus* Bloch; site of infection: branchial filament.

*Distribution:* India: West Bengal (Nadia district).

504. *Myxosoma maruliensis* Sarkar, Mazumdar and Pramanik


**Diagnosis:** Spore histozoic, hyaline and nearly pyriform and planoconvex, anterior end pointed, posterior end truncated or rarely rounded, 12.0-17.5 μm × 2.5-5.0 μm, shell valve thin walled and smooth, suture thin, slightly bent with anterior minute orifice; polar capsule elongated and tubular, with 9-11 coils, 7.5-13.0 μm × 1.0-2.0 μm; about 8.1% spores with unequal polar capsule, opening separately unlike the spores with equal polar capsule, measuring 8-13 μm × 1.2-1.8 μm and 8.13 μm × 1.0-1.8 μm with 7-9 coils of polar filament; iodinophilous vacuole absent.

*Host:* *Channa marulius* Ham.; site of infection: kidney.

*Distribution:* India: West Bengal (Murshidabad district).

505. *Myxosoma noblei* Sarkar


**Diagnosis:** Cyst oval, 121 μm × 98 μm; spore nearly lenticular in sutural view, suture thick, ridged and almost S-shaped, broadly elliptical in valvular view with short blunt, round or slightly pointed posterior extension of the shell valve; spore thick-walled, shell valve horizontally striated; polar capsule 5.8-8.5 μm or 3.0-4.5 μm, pyriform, equal and convergent with 7-8 coils of polar filament in each, polar filament 76 μm in length; iodinophilous vacuole absent.
Host: Ophicephalus striatus Bloch; site of infection: gall bladder.

Distribution: India: West Bengal (Hugli district).

506. Myxosoma trichogasteri Sarkar


Diagnosis: Spore lenticular in sutural view and pyriform in valvular view with pointed anterior end and round posterior end, 14-17 µm × 8.70-9.85 µm; shell valve thin-walled, smooth and symmetrical, suture thick and slightly bent; polar capsule two, pyriform and equal having 5-6 coils; 9.00-10.47 µm × 3.0-3.84 µm; polar filament (extruded one) 55-60 µm in length; iodonophilous vacuole absent.

Host: Trichogaster fasciatus Bloch; site of infection: gall bladder.

Distribution: India: West Bengal (North 24-Parganas district).

Genus Thelohanellus Kudo

1(2) Two distinct types of spores present, microspores 15.5-17.1 µm × 6.1-8.3 µm and macrospores 31-36.1 µm × 11.1-13.8 µm.........................................................T. jiroveci

2(1) One type of spores present..........................................................T. jiroveci

3(4) Spore large, more than 30 µm or more in length...........................

3a Spore 30-33 µm × 10-13 µm, parasitic in Labeo rohita......................T. rohitae

3b Spore 31-41 µm × 10-15 µm, parasitic in Labeo calbasu.....................T. rodgii

4(3) Spore comparatively small in dimensions, less than 20 µm in length...........................

5(12) Spore more or less pyriform in shape........................................

6(7) Spore with flat and ridged surface and bent neck..........................T. coeli

7(6) Spore with different configuration..................................................

8(11) Suture with prominent sutural ridge............................................

9(10) Suture S-shaped, spore 10-12 µm × 5.5-7.5 µm, polar capsule 3.75-7.0 µm × 3-4.5 µm..............................................................T. bengalensis

10(9) Suture not S-shaped, spore 12.1-13.2 µm × 6.6-7.7 µm, polar capsule 5.5-6.6 µm × 2.8-3.3 µm..............................................................T. opthalmicus

11(8) Suture not distinct and not ridged, (spore 14-15.75 µm × 4.53-7.00 µm)..........................

..............................................................T. auerbachii

13(14) Spore elongated thin, with two lateral lines almost straight.........T. gangeticus

14(13) Spore more or less oval or elongately ellipsoidal........................

15(16) Spore elongately ellipsoidal, slightly acuminate at anterior pole and round at posterior
pole (spore 13.0-15.0 µm × 5.0-6.5 µm)......................................................\(T. \) sud\(\text{evi}\)

16(15) Spore oval.........................................................................................................................

17(22) Spore small, less than 15 µm in length..............................................................................

18(19) Spore oval with lateral sides more or less parallel, and a slight knob-like projection at anterior end (spore 10.8-12 µm in length).........................................................\(T. \) mrigala\(\text{e}\)

19(18) Spore oval, anterior end less broad than posterior end and without any knob like projection.............................................................................................................................

20(21) Shell with distinct sutural ridge...........................................................................................

20a Spore 12.48-14.94 µm in length, parasitic in cyprinid fish..................................\(T. \) sen\(\text{i}\)

20b Spore 12.0-13.0 µm in length, parasitic in silurid fish......................................\(T. \) sanjib\(i\)l

21(22) Shell without any sutural ridge, (Spore 9-10.8 µm in length)...................\(T. \) calbasu\(i\)

22(17) Spore large 19.26-21.4 µm × 10.7-12.48 µm in dimension..............................\(T. \) ca\(\text{ili}\)

507. Thelohanellus auerbachi Sarkar


\textit{Diagnosis} : Spore broadly pyriform to elongately pyriform with pointed anterior and rounded posterior ends, 14.00-15.75 µm × 4.53-7.00 µm; shell valve smooth, curved at the apical region, suture indistinct; polar capsule also broadly pyriform 7.00-8.75 µm × 2.80-4.20 µm, polar filament with 5-6 coils, extended one 51.00-85.00 µm in length.

\textit{Host} : Tachysurus platystomus (Day); site of infection : gall bladder.

\textit{Distribution} : India : West Bengal (Medinipur district).

508. Thelohanellus bengalensis Sarkar and Raychoudhury


\textit{Diagnosis} : Spore coelozoic, broadly pyriform to cylindroconical in valvular and almost S-shaped in sutural view measuring 10.0- 12.0 µm × 5.5-7.5 µm; shell valve thick-walled, usually smooth having 3-4 longitudinal striations, suture S-shaped and ridged; polar capsule one, broadly pyriform measuring 3.75-7.0 µm × 3.0- 4.5 µm; polar filament having 3-4 coils, extruded filament 52.5 µm in length; extracapsular cavity filled with sickle-shaped mass of sporoplasm with two nuclei and an iodinophilous vacuole.

\textit{Host} : Catla catla Ham.; site of infection : gall bladder.

\textit{Distribution} : India : West Bengal (Hugli district).

509. Thelohanellus calbasui Tripathi


\textit{Diagnosis} : Cysts 1.5-2.0 mm in diameter; spore more or less oval, pyriform in side view, 9-10.8 µm × 7.2 µm; shell thin and smooth, sutural valves equal, sutural line distinct, sutural
ridge absent; polar capsule oval with anterior end drawn into a small duct, 5.4 μm × 3.4 μm in dimension.

**Host**: *Labeo calbasu* (Ham.); site of infection: scale.

**Distribution**: India: West Bengal (Hugli district).

510. **Thelohanellus callae** Chakravarty and Basu


**Diagnosis**: Cysts oval or circular in outline, 7.5 mm in diameter; spore more or less oval, 19.26-21.40 μm × 10.70-12.48 μm, with anterior end bluntly pointed and posterior end rounded, more or less spindle-shaped in lateral view; shell valve thick, sutural ridge and line prominent; polar capsule occupying two-thirds of the spore having 9-10 threads of polar filament, 10.71-13.90 μm × 9.63-11.77 μm; iodinophile vacuole present.

**Host**: *Catla catla* (Ham.); site of infection: branchiae.

**Distribution**: India: West Bengal (North 24-Parganas district).

511. **Thelohanellus coeli** Sarkar and Mazumder


**Diagnosis**: Spores pyriform, thick-walled, posterior end round and anterior end with a narrow slightly angled neck, 12.0-13.5 μm × 6-8 μm; upper surface with a median longitudinal ridge; polar capsule single, pyriform, 6-8 μm × 3.3-3.8 μm, situated at the centre and having 6-8 coils of polar filaments, maximum length 50.00 μm.

**Host**: *Tachysurus tenuispinis* (Day); site of infection: gall bladder.

**Distribution**: India: West Bengal (Bay of Bengal).

512. **Thelohanellus gangeticus** Tripathi


**Diagnosis**: Spore elongated, thin anterior end truncated, posterior end slightly flattened with rounded ends, pyriform in side view, 16.2-17.5 μm × 5.4 μm; sutural ridge present, sutural line indistinct; polar capsule pyriform with thin neck, 7.2 μm × 2.5 μm; sporoplasm filling nearly half of the extra-capsular cavity, iodinophilous vacuole small.

**Host**: *Chela bacaila* (Ham.); site of infection: muscles.

**Distribution**: India: West Bengal (North 24-Parganas district).

513. **Thelohanellus jiroveci** Kundu and Haldar


**Diagnosis**: Cyst large, oval, creamy-white, 1.5-2.0 mm × 0.5 mm; spores two types, namely, macrospores and microspores occurring simultaneously within the single cyst; macrospores pyriform, with gradually pointed anterior and rounded posterior extremities, spindle shaped in lateral view, 31-36.1 (3.50) μm × 11.1-13.8 (13.0) μm; shell valve moderately thick, sutural line distinct;
polar capsule single, pyriform, 15.5-19.9 (18.4) μm × 5.5-7.7 (7.0) μm, 10-12 coils of polar filament extruded filament exceedingly long, 194.2-222.0 μm in length; sporoplasm crescentic, binucleate, and with a large, more or less round iodinophilous vacuole; microspores measuring 15.5-17.7 (16.3) μm × 6.1-8.3 (6.8) μm with a polar capsule of 7.2-7.7 μm × 3.8-4.4 μm dimensions and polar filament of 66.6-77.7 (74.1) μm in length.

**Host**: *Labeo bata* (Ham.); site of infection: branchiae.

**Distribution**: India: West Bengal (Nadia district).

514. *Thelohanellus mrigalae* Tripathi


**Diagnosis**: Cyst 0.75 mm in diameter having mature spore; spore oval in front view, with lateral sides more or less parallel, and a slight knob-like projection at the anterior end, pyriform in sutural view, 10.8-12 μm × 6.3-7.2 μm; shell valve thick symmetrical and smooth, sutural line prominent; polar capsule oval, 5.4-7.2 μm × 3.6-5.0 μm, occupying nearly half of the spore cavity; sporoplasm filling nearly the whole of the extracapsular cavity, iodinophilous vacuole present.

**Host**: *Cirrhinus mrigala* (Ham.); site of infection: skin on the head.

**Distribution**: India: West Bengal (exact locality not mentioned).

515. *Thelohanellus opthalmicus* Haldar, Das and Sharma


**Diagnosis**: Cyst rounded, white-coloured, 310-390 μm in diameter; spore pyriform with tapering anterior end and rounded posterior end, 12.1-13.2 μm × 6.6-7.7 μm; shell valve symmetrical, uniformly thick with prominent sutural ridge; polar capsule, single, pyriform with 6-7 coils of polar filament, 5.5-6.6 μm × 2.8-3.3 μm, extruded polar filament 27.5-50.6 μm in length; sporoplasm cup-shaped having a spherical iodinophilous vacuole.

**Host**: *Catla catla* (Ham.); site of infection: internal musculature and scerla of eye.

**Distribution**: India: West Bengal (Nadia district).

516. *Thelohanellus rodgi* Hagargi, Kundu and Haldar


**Diagnosis**: Spore ranging from 31.0-41.0 μm × 10.0-15.0 μm, almost pyriform; polar capsule ranging from 15.0-20.0 μm × 7.0-8.0 μm having polar filament; sporoplasm binucleate and with iodinophilous vacuole of 4-5 μm in diameter.

**Host**: *Labeo calbasu* (Ham.); site of infection: gills.

**Distribution**: India: West Bengal (exact locality not known).

**Remarks**: Diagnosis of this species is based on comparative measurements of 14 species of *Thelohanellus* described from different Indian carps provided by Haldar, Das and Sharma (1983).
517. Thelohanellus rohitae (Southwell and Prasad)


1943. Thelohanellus rohitae (Southwell and Prasad); Chakravarty, Proc. Indian Acad Sci., 18(2)B, p. 33.

Diagnosis: Cysts opaque white, spherical or oval, 45-150 μm in largest diameter; spore elongately pyriform in front view with acutely pointed anterior and rounded posterior extremities, 30-33 μm × 10-13 μm; shell valve thick, sutural ridge very prominent; polar capsule having the same form as the spore, 16-20 μm × 7.8-24 μm, provided with a highly coiled filament; a spherical iodinophilous vacuole present; polar filament 206 μm in length.

Host: Labeo rohita, (Ham.) Labeo bata; site of infection: gills.

Distribution: India: West Bengal (North 24-Parganas district) and Bangladesh.

518. Thelohanellus sanjibi Sarkar and Ghosh


Diagnosis: Cyst small, oval to spherical, 100-200 μm in diameter; spore histozoic, egg-shaped to ovoidal in valvular view, lenticular in sutural view with anterior pole more pointed than the posterior pole, 12-13 μm × 8.5 μm; shell valve smooth, symmetrical and thick-walled, suture slightly curved and ridged; polar capsule single, broadly ovoidal to almost spherical, opening anteriorly through a very short neck, 4-5 μm × 3.5 μm, with 4-5 coils of polar filament; extracapsular cavity large filled with homogeneous mass of sporoplasm and a spherical iodinophilous vacuole.

Host: Mystus guleo (Ham.); site of infection: kidney.

Distribution: India: West Bengal (Hugli district).

519. Thelohanellus seni (Southwell and Prasad)


Diagnosis: Cysts roughly oval or lenticular, upto 1.1 mm; spore 12.48-14.94 μm × 8.56 μm, with two polar capsules, 6.42 μm × 4.52 μm and a short tail-like process, iodinophilous vacuole present.

Host: Catla catla (Ham.); site of infection: branchiae.

Distribution: India: West Bengal (Calcutta and North 24-Parganas district).

520. Thelohanellus sudevi Sarkar and Ghosh


Diagnosis: Cyst small oval to spherical, 100-200 μm; spore histozoic, elongately ellipsoidal in valvular view and lenticular in sutural view, 13-15 μm × 5-6.5 μm, anterior pole slightly acuminate and posterior pole rounded; shell valves two, smooth, symmetrical and thick-walled, suture broad, thick and almost straight with no ridge; polar capsule single, pyriform, 4.75-6 μm
x 2-3 μm, with 4-5 coils of polar filament; extracapsular cavity large, filled with homogenous binucleate mass of sporoplasm and a small iodinophilous vacuole.

Host: Amblypharyngodon mola Ham.; site of infection: kidney.

Distribution: India: West Bengal (Hugli district).

Genus: Neothelohanellus Das and Haldar

Key to the species

1 (2) Spore rounded to ellipsoidal, 8.2-8.8 μm × 7.7 μm, polar capsule 4.4 μm × 3.3 μm, length of polar filament 77.0-90.2 μm............................................N. callae

2 (1) Spore oblongate to ellipsoidal, 11.0-12.1 μm × 7.1-8.2 μm, polar capsule 5.5 μm × 4.4 μm, length of polar filament 22.0-42.9 μm........................................N. krishnagarensis

521. Neothelohanellus callae Das and Haldar


Diagnosis: Cyst small rounded, 100-160 μm in diameter; spore rounded to ellipsoidal, 8.2-8.8 μm × 7.7 μm; shell valves two, symmetrical, uniformly thick and meeting along the longitudinal sutural line; polar capsule single, pyriform, 4.4 μm × 3.3 μm, located angularly to the longitudinal axis and having 8-9 coils of polar filaments inside, extuded filament thread-like, 77-90.2 μm in length; sporoplasm crescentic, binucleate, and with a round iodinophilous vacuole.

Host: Catla calla (Ham.); site of infection: kidney.

Distribution: India: West Bengal (Nadia district).

522. Neothelohanellus krishnagarensis Das and Haldar


Diagnosis: Cyst oblongate, creamy-white, 300-380 μm × 240-280 μm; spore oblongate to ellipsoidal, 11.0-12.1 μm × 7.1-8.2 μm; shell valves symmetrical, uniformly thick and meeting along the longitudinal sutural line; polar capsule single, pyriform, located perpendicular to the longitudinal axis of the spore, 5.5 μm × 4.4 μm, with 5-6 coils of polar filaments, extruded polar filament 22-42.9 μm in length, sporoplasm hemispherical, binucleate, and with a small spherical iodinophilous vacuole.

Host: Labeo calbasu (Ham.); site of infection: fatty matrix of brain.

Distribution: India: West Bengal (Nadia district).

Genus Henneguya Thelohan

In all 11 species of Henneguya have been dealt with in the present paper. Out of these 4 species, namely, H. bengalensis, H. bicornuta, H. chaudhuryi and H. ritae have been described under the genus Unicauda Davis (1970), the former two by Raychaudhuri and Chakravarty (1970) and the latter two by Bajpai and Haldar (1982). But, spores of Henneguya and Unicauda resemble very closely excepting that caudal appendage of the latter is not an extension of the shell valve and composed of material different from those of shell valve (Kudo, 1966). From
the description of the aforesaid 4 species it is evident that the caudal prolongation of these species is the extension of the 'main spore body' Hence, these are placed under the genus *Henneguya* which is in conformity with the opinion of Gupta and Khera (1987).

In this connection mention is to be made here that Tripathi (1952) described *Unicauda ophicephali* which, in the present circumstances, becomes the synonym of *Henneguya ophicephali* described by Chakravarty (1939) (see Gupta and Khera, 1987).

1(16) Caudal prolongation bifurcated

2(5) Two polar capsules unequal in size

3(4) Spore ovoidal or oblongate, total length 41.5-52.5 µm; polar capsule pyriform, larger one 6.18-9.25 µm × 2.06-3.0 µm

   *H. ophicephali*

4(3) Spores oblongate, total length 35.2-38.0 µm; polar capsule elongated pyriform, larger one 5.5-6.0 µm × 1.1 µm

   *H. namae*

5(2) Two polar capsules equal in size

6(9) Spore oval in shape

7(8) Spore elongately oval, average total length 31.2 µm, polar capsule pyriform without any tubular neck, caudal prolongation long, 19.7 µm in average

   *H. rubicundii*

8(7) Spore broadly oval, average total length 16.83 µm; polar capsule subspherical to broadly pyriform with short narrow tubular neck; caudal prolongation short and slender, 7.9 µm in average

   *H. renalis*

9(6) Spore not oval in shape

10(13) Spore oblongate

11(12) Bifurcation of caudal process characteristically at their distal and in the form of two unequal arm of 'U'

   *H. bleekeri*

12(11) Caudal prolongations characteristically forked at distal end with two equal sized arms

   *H. bicornuata*

13(10) Spore pyriform or fusiform, caudal process of different configuration

14(15) Spore pyriform, polar capsule also pyriform 3.6 µm × 2 µm in dimension

   *H. latesi*

15(14) Spore fusiform, polar capsule tubular, 5-6 µm × 1-1.3 µm in dimension

   *H. mystusia*

16(1) Caudal prolongation undivided throughout the length

17(18) Spore small, 26.3-33.2 m in length, caudal prolongation 17.7 µm in average

   *U. chaudhuryi*

18(17) Spore comparatively large, more than 35 µm in length

18a Spore 35.73-45.73 µm in length, caudal prolongation 21.54 µm in average

   *U. bengalensis*
18b Spore 39.9-44.8 μm in length, caudal prolongation 29.4 μm in average. . . . . . . . . U. rita

523. Henneguya bengalensis (Chaudhury and Chakravarty)


Diagnosis: Cysts oval, whitish in colour, 1.0 to 1.25 mm in diameter; spore body oblongate, 26.4-29.15 μm × 2.75-3.89 μm, with gradually pointed anterior end and posteriorly continued into a long caudal prolongation; sporoplasm granular filling the extracapsular region having two sporoplasm and a rounded iodinophilous vacuole; polar capsules, two, pyriform, equal and situated at the anterior end of the spore body with a distinct coiled polar filament in each capsule.

Host: Ophicephalus punctatus (Bloch.); site of infection: buccal cavity.

Distribution: India: West Bengal (North 24-Parganas district).

524. Henneguya bicornuata (Chaudhuri and Chakravarty)


Diagnosis: Cyst oval milky white, 1.2 to 1.5 mm in diameter; spore body oblongate, anterior end extremely rounded, posterior portion gradually tapering and continued into a long caudal prolongation of 11.55-13.75 μm in length, undivided for a distance but forked at its extreme end, 26.4-29.15 μm × 2.75-3.85 μm; sporoplasm rounded and having a rounded iodinophilous vacuole; polar capsules two, equal, pyriform and situated at the anterior end, 3.3-3.56 μm × 1.1-1.38 μm, polar filament distinct in each capsule.

Host: Ophicephalus punctatus (Bloch.); site of infection: branchial epithelium

Distribution: India: West Bengal (Calcutta district).

525. Henneguya bleekeri Haldar and Mukherjee


Diagnosis: Cyst white, oval to rounded, 1.5 mm × 1.0 mm; spore elongated, main body of the spore oblongate with rounded anterior end, 20-25.5 μm in length with caudal prolongation and 3.3-5.0 μm in breadth; caudal prolongation bifurcated after some distance and curved characteristically at their distal end in the form of two unequal arms of the 'U', lenticular in side view, sutural line straight; polar capsules, two, equal, 3.6 μm × 1.7 μm, with 6-8 coils of polar filament; sporoplasm filling the entire extracapsular cavity, iodinophilous vacuole present.

Host: Mystus bleekeri (Day); site of infection: kidney.

Distribution: India: West Bengal (Nadia district).

526. Henneguya chaudhuryi (Bajpai and Haldar)


Diagnosis: Spore oblongate, anterior extremity more or less rounded, posterior end extended as an undivided caudal appendage, 26.3-33.2 μm × 3.3-4.4 μm, caudal prolongation 14.5-20.0 μm in length; sporoplasm with a single iodinophilous vacuole; polar capsules two, pyriform, identical and convergent anteriorly, 5-7.5 μm × 1.6 μm, with 6-7 coils of polar filament.
Host: *Ophicephalus punctatus* Bloch.; site of infection: gill filaments.

Distribution: India: West Bengal (Nadia district).

527. Henneguya *latesi* Tripathi


Diagnosis: Cyst small with mature spore; spore pyriform in front view, fusiform in sutural view, 9.0-10.8 μm × 6.3-8.2 μm; shell valve thin and symmetrical, with two very thin prolongations (17.2-25.4 μm) posteriorly; polar capsule pyriform 3.6 μm × 2 μm, slightly convergent; sporoplasm granular and filling most of the extracapsular cavity; iodinophilous vacuole present.

Host: *Lates calcarifer* (Bloch.); site of infection: gills.

Distribution: India: West Bengal (North 24-Parganas district).

528. Henneguya *mystusia* Sarkar


Diagnosis: Cyst ovoidal, opaque white, 0.2 mm × 0.1 mm, polysporous; spine fusiform in valvular view, widest just posterior to polar capsule and obovate in sutural view, anterior end very slightly curved and blunt, 12.0-15.0 μm × 3.0-4.0 μm, caudal prolongation 17.0-25.0 μm; shell valves two, thin, smooth, symmetrical, each tapering posteriorly into a very long and fine caudal prolongation, suture thin, straight to slightly curved; polar capsule tubular, almost equal, 5.0-6.0 μm × 1.0-1.3 μm, polar filament not distinct, iodinophilous vacuole present.

Host: *Mystus* sp.; site of infection: gill filament.

Distribution: India: West Bengal (Hugli district).

529. Henneguya *namee* Haldar, Das and Sharma


Diagnosis: Cyst small, creamy-white, oval, 180-220 μm × 150-190 μm, polysporous; spore oblongate, anterior end broader and rounded, posterior end tapering and prolonged as a tail, 17.6-19.3 μm × 5.5-6.6 μm, excluding tail measuring 17.6-18.7 μm in length, tail bifurcated and divaricated; shell valve uniformly thick and symmetrical, sutural ridge prominent; polar capsule two, elongated, pyriform, unequal, measuring 5.5-6 μm × 1.1 μm and 4.4-5 μm × 1.1 μm, with 9-10 coils and 8-9 coils of polar filament of 23.1-55(48.2) μm and 27.5-48.4(38.6) μm; sporoplasm oblong, occasionally extending into the caudal prolongation, binucleate and with a spherical iodinophilous vacuole.

Host: *Ambassis name* (Ham.); site of infection: gill filaments.

Distribution: India: West Bengal (Nadia district).

530. Henneguya *ophicephali* Chakravarty


Diagnosis: Cysts spherical or oval, 2 mm in diameter, polysporous; spore more or less ovoidal or oblongate, anterior end broader and rounded, posterior end tapering and prolonged as the tail, measuring 41.5-52.5 μm in length including the tail, 6.18-7.27 μm in breadth, tail bifurcated and divaricated in spores from the gills and relatively approximate in those from the muscles; shell valve symmetrical, sutural ridge prominent; polar capsules pyriform, unequal, 6.18-9.27 μm × 2.06-3.0 μm and 5.15-8.24 μm × 2.06-3.0 μm; polar filament 26-32 μm in length; iodinophilous vacuole 2.06 μm in diameter.

Host: Ophicephalus punctatus (Bloch) and Ophicephalus gachua (Ham); site of infection: gills and muscles.

Distribution: India: West Bengal (Calcutta and North 24-Parganas districts).

Remarks: Unicauda ophicephali described by Tripathi (1952) is considered to be a synonym of this species.

531. Henneguya renalis Sarkar, Mazumdar and Pramanik

Diagnosis: Spore histozoic and hyaline, almost pyriform in sutural view, broadly oval in valvular view, 14.4-19.2 μm × 8.0-11.2 μm, caudal appendage short and fine, 4.8-12.8 μm in length; shell valve smooth and thin walled, suture slightly bent and thin; polar capsule two, equal, oval or pyriform with short neck and with 3-4 coils of polar filament, 4.6-7.36 μm × 2.5-5.06 μm.

Host: Channa marulius Ham.; site of infection: kidney.

Distribution: India: West Bengal (Murshidabad district).

532. Henneguya ritaia (Bajpai and Haldar)
1952. Unicauda ritaia Bajpai and Haldar, Arch. Protistenk., 125, p. 79.

Diagnosis: Spore oblongate with pointed anterior end, posterior end prolonged undividedly, lenticular in front as well as side view, 39.9-44.8 μm × 5.0-5.8 μm, caudal prolongation 27.2-31.5 μm; sutural line distinct; polar capsule two, pyriform, 5.0-5.8 μm × 1.7-2.5 μm, polar filament having 6 to 7 coils, extruded filament 16.7-23.2 μm in length; sporoplasm lanceolate, almost filling the extracapsular space, and with an iodinophilous vacuole.

Host: Rota rita Ham.; site of infection: branchial filament.

Distribution: India: West Bengal (Hugli district).

533. Henneguya rubicundi Haldar and Mukherjee

Diagnosis: Cyst creamy-yellowish, oval, tumour-like, 2 mm × 1.5 mm; spore body elongate oval in front view, anterior extremity bluntly rounded, posterior extremity narrow and prolonged as the caudal appendage, 24.4-36.7 μm × 3.3-8.1 μm, caudal appendage 13.3-24.5 μm in length; shell valve smooth and uniform, sutural ridge distinct and straight, sutural line indistinct; polar capsules, two, equal, pyriform, 3.3-5.1 μm × 2.2-3.0 μm with 6-8 coils of polar filament, sporoplasm almost filling the entire extracapsular space, binucleate and with a distinct iodinophilous vacuole.
Host: *Gobioides rubicundus* (Bloch); site of infection: dorsal and ventral fins.

Distribution: India: West Bengal (Nadia district).

Genus *Neohenneguya* Tripathi

534. *Neohenneguya tetraradiata* Tripathi


Diagnosis: Cyst 0.5 mm in diameter; trophozoite irregular in shape; spore fusiform with two long thin prolongations at either end, 16.2-21.6 μm × 5.4 μm; sutural line thin, sutural ridge not distinct, shell valve thin, smooth and slightly unequal in size, polar capsule spherical, 2-2.7 μm in diameter, polar filament long and thin; iodinophilous vacuole present.

Host: *Odontamblyopus rubicundus* (Ham.); site of infection: gills.

Distribution: India: West Bengal (Hugli river).

Order MULTIVALVULIDA

Family ?

Genus *Kudoa* Meglitsch

Diagnosis: Spore quadriate or stellate in anterior end view, shell delicate, sutural line usually indistinct, polar capsule 4 in number.

Key to the species

1 (2) Spore large, 7.87 μm × 8.44 μm in average with 4 lateral inflations from the capsular surface giving it a stellate shape, polar capsule tubular and convergent, infecting skeletal muscles near anal fin. .................................................. *K. bengalensis*

2 (1) Spore ‘small’, 4.87 μm × 7.75 μm in average, not forming any stellate shape, polar capsule pyriform and convergent, found in the bile of gall bladder. ........... *K. tachysurae*

535. *Kudoa bengalensis* Sarkar and Mazumder


Diagnosis: Spore ovoid, thin-walled and with four lateral inflations from the capsular surface giving it a stellate shape, 7-8.5 μm × 7.0-11.0 μm; sutural line two, indistinct, dividing the spore into four quadrants; each quadrant with a polar capsule and a lateral inflation extending as median, bluntly pointed edge, meeting with the other quadrant at the sutural lines through small notches; polar capsules four, almost tubular and convergent, axes coinciding with axes of the lateral inflations, 3.0-4.8 μm × 1.8-2.0 μm in dimensions.

Host: *Tachysurus platystomus* (Day); site of infection: skeletal muscle.

Distribution: India: West Bengal (Bay of Bengal)

536. *Kudoa tachysurae* Sarkar and Mazumdar

**Diagnosis**: Spore coelozoic, small, thin-walled, tetracapsulated, comprising four indistinct quadrants, 4.5-6.0 μm × 7.0-9.0 μm; two quadrants longitudinally arranged having larger polar capsules than the other two horizontal ones, edges highly convex or almost round unlike flat and parallel edges of the horizontal quadrants forming four notches at their meeting points; polar capsule pyriform, 3-4 μm × 2-3 μm and 1-1.5 μm × 1-1.5 μm, with coils of polar filament inside.

**Host**: Tachysurus tenuispinis (Day); site of infection: gall bladder.

**Distribution**: India: West Bengal (Bay of Bengal).

Phylum CILIOPHORA
Class KINETOFRAGMINOPHOREA
Subclass VESTIBULIFERA
Order TRICHOSTOMATINA
Family BALANTIDIIDAE

**Diagnosis**: Vestibulum anteriorly located, cytostome located at the base of vestibulum, somatic ciliation uniform, parasitic in invertebrate and vertebrate hosts.

Genus Balantidium Claparede and Lachmann

**Diagnosis**: Body oval, ellipsoid to subcylindrical, uniformly ciliated; peristome starting at or near anterior end, cytopharynx not well developed, contractile vacuole and cytopyge terminal; parasitic in the gut of both vertebrate and invertebrate.

In all 15 species of Balantidium have been reported from West Bengal. Out of these, 4 species are recovered from invertebrate hosts (3 from insects and 1 from freshwater snail) and 11 from vertebrate hosts belonging to fishes, amphibians, reptiles and mammals.

In this connection mention is to be made here that Ghosh (1921) described a new genus Parabursaria to accommodate his species *P. pheretima* collected from earthworm, *Pheretima posthuma*. This genus is not sufficiently characterised. Therefore, Bhatia (1936) did not consider this genus as valid. However, Corliss (1979) synonymised it under *Balantidium*. Since the host *Pheretima posthuma* is well studied for their protozoan parasites by many workers in different parts of India for many years and none of them is able to observe *Parabursaria* or *Balantidium* from this host, the species *P. pheretima* appears to be a doubtful record and, therefore, is not dealt with or listed in the present communication.

**Key to the species of Balantidium**

1(8) Commensal in the gut of invertebrates

2(3) Peristome large reaching the middle of the body or further, occupying the entire ventral surface

3(2) Peristome not reaching the middle of the body

4(5) Body irregularly pyriform, peristome extending about one-third the length of the body

5(4) Body elongately oval, peristome extending about one-fifth the length of the body
6(7) Contractile vacuole large, posterior, with an anal canal opening in front of posterior end, parasitic in *Periplaneta americana*................................................................. *B. ovatum*

7(6) Contractile vacuole medium sized, posterior and lateral, without any anal canal, parasitic in *Pila globosa*........................................................................................................... *B. depressium*

8(1) Commensal in the gut of vertebrates.................................................................

9(12) Inhabiting the gut of mammals........................................................................

10(11) Body egg-shaped, narrowed and tapering anteriorly and rounded posteriorly, macronucleus ribbon-like, folded at each end..................................................... *B. rhesum*

11(10) Body ovate, anteriorly tapering and blunt, posteriorly broad and rounded, macronucleus round, disc-shaped.................................................................

12 (9) Inhabiting the gut of cold blooded vertebrates..............................................

13(16) Commensal in the gut of freshwater fishes................................................

14(15) Body ovate, 44.6-116.3 μm × 33.2-91.4 μm in dimensions, peristome short, obliquely placed................................................................. *B. pangasi*

15(14) Body elongated, more or less rounded at both ends, 136-233.3 μm × 55.6-89.3 μm, peristome not oblique, ending deep into cytostome.................................................... *B. mrigali*

16(13) Commensal in the gut of amphibians and turtle...........................................

17(24) Peristome not reaching the middle of the body............................................

18(19) Body torpedo-shaped, contractile vacuole three in number, macronucleus broadly oval ........................................................................................................... *B. sushillae*

19(18) Body oval or elongated egg-shaped, contractile vacuole less than three, macronucleus elongated or kidney-shaped.................................................................

20(23) Macronucleus kidney-shaped........................................................................

21(22) Body oval, macronucleus with many vacuolated structure, contractile vacuole two.... ........................................................................................................... *B. tylototritonis*

22(21) Body elongated egg-shaped, macronucleus without any vacuolated structure, contractile vacuole one or two................................................................. *B. helena*

23(20) Macronucleus elongated, body oval, peristome with slantingly directed cleft and having 'siderophile' lip possessing a strong affinity for basic stains........................................... *B. dogieli*

24(17) Peristome reaching below the middle of the body........................................

25(26) Body roughly pyriform, commensal in the gut of salamandar..................... *B. rayi*

26(25) Body round or broadly oval, commensal in the gut of anurans.....................

27(28) Body flattend, peristome slit-like, contractile vacuole single....................... *B. rotundum*
28(27) Body rounded in transverse section, peristome not slit-like, contractile vacuole two.

537. Balantidium blattarum Ghosh

1922. Balantidium blattarum Ghosh, Parasitology, 14, p. 15.

Diagnosis: Body irregularly pyriform, 90 μm in length, slightly less than twice as long as its greatest transverse diameter, circular in transverse section; anterior end tapering and rounded, posterior end obliquely truncate; peristome small extending about one-third the length of the body, with a large undulating membrane; contractile vacuole large, posteriorly located; macronucleus spherical, centrally located.

Host: Periplaneta americana; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district) and Punjab.

538. Balantidium coli (Malmsten)


Diagnosis: Body egg-shaped, posterior end slightly broader, anterior end somewhat narrowed and pointed, 30-200 μm x 20-70 μm; body cilia arranged in longitudinal rows with a slightly spiral course; peristome ventral, at the anterior end, somewhat obliquely placed, with adoral zone of cilia passing through the cytostome into the short cytopharynx; contractile vacuole two, one at the posterior and the other near the middle of the body; macronucleus sausage or bean-shaped, lying transversely at the middle of the body, with a small micronucleus close to it; cyst 50-60 μm in length.

Host: Homo sapiens, Sus scrofa, Chimpanzee and other primates, rarely in dog and rat; site of infection: caecum and colon.

Distribution: India: West Bengal (Calcutta district) - a cosmopolitan species having worldwide distribution.

Remarks: B. coli extremely common in swine. It is pathogenic in man and other primates. It causes diarrhoea or balantidial dysentery in man (Levine, 1967).

539. Balantidium depressum (Ghosh)


Diagnosis: Body elongately oval, slightly narrowed and rounded anteriorly, wide and tapering posteriorly, 57-63 μm x 37 μm; a deep concavity on ventral, posterior third part of the body; longitudinal ciliary striae distinct; peristome small fusiform, about one-fifth of the body length; macronucleus oval central, micronucleus spherical and placed at the side of macronucleus; contractile vacuole posterior and lateral.
Host: *Pila globosa* (Swainson); site of infection: rectum.
Distribution: India: West Bengal (Calcutta Haora and North and South 24-Parganas districts).

540. *Balantidium dogieli* Das and Mukherjee
Diagnosis: Body oval, 56.3-93.8 (79.4) μm × 45-67.5 (55.3) μm; cilia long and regularly arranged, peristomal cilia longer and thickly grown; peristome anteriorly placed, slantingly directed, not reaching up to the anterior third of the body; contractile vacuole single, located below the middle region; macronucleus elongated, 22.5-37.5 μm × 5.6-7.5 μm, located near the middle region; micronucleus very small, placed adjacent to the macronucleus.
Host: *Lissemys punctata punctata* (Bonnaterre); site of infection: rectum.
Distribution: India: West Bengal (Calcutta district).

541. *Balantidium helenae* Bezzenberger
Diagnosis: Body ovoid, anterior end narrower than the posterior, 45-175 μm × 30-62 μm; peristome not reaching up to the middle; contractile vacuole single or variable in number; macronucleus kidney-shaped, 31-37 μm × 10-18 μm; micronucleus rounded, 5 μm × 2.5 μm, lying at the notch of macronucleus.
Distribution: India: West Bengal (Puruliya district).

542. *Balantidium knowlesi* Ghosh
Diagnosis: Body broadly ovate, posterior end wider than anterior, length slightly less than twice the width, 40 μm × 25 μm, dorsal surface convex, ventral surface flattened; peristome large, cup-like, ovate, occupying the ventral surface, adoral row of cilia not well developed, no distinct undulating membrane; ciliation throughout the body, anteriorly with long cilia; contractile vacuole single, posterior; macronucleus rounded or broadly oval, located centrally; micronucleus single, lodged in a depression of the macronucleus.
Host: *Culicoides peregrinus*; site of infection: coelomic cavity.
Distribution: India: West Bengal (Calcutta district).

543. *Balantidium mrigalae* Mukherjee and Haldar
Diagnosis: Body elongated with a more or less rounded anterior and posterior extremities, 136-233.3 (180.9) μm × 55.6 - 89.3 (65.1) μm; peristome at the anterior end; body cilia short, closely set in parallel rows; cytoplasm divisible into a thin, hyaline ectoplasm and granular endoplasm; macronucleus more or less bean-shaped, 22.2 - 44.4 (33.2) μm × 11-17 (13.7) μm, situated at the posterior end in most cases; micronucleus 4.2 μm in diameter, lying in the concavity of the macronucleus; contractile vacuole obscured.

Host: Cirrhina mrigala (Hamilton); site of infection: intestine.

Distribution: India: West Bengal (Nadia district).

544. Balantidium ovatum Ghosh


Diagnosis: Body elongately oval, wider posteriorly than anteriorly, slightly less than twice as long as its greatest diameter, 85 μm in length; anterior end rounded, posterior end abruptly tapering; cilia long, an anterior row of long cilia present; peristome small, tubuliform, with an undulating membrane having a row of stouter cilia; contractile vacuole large, posteriorly placed; macronucleus broadly oval, central.

Host: Periplaneta americana; site of infection: intestine.

Distribution: India: West Bengal (Calcutta district).

545. Balantidium pangasi Mukherjee and Haldar


Diagnosis: Body ovate, 44.6 - 116.3 (76.7) μm × 33.2 - 91.4 (50.3) μm, with thick pellicle and uniformly covered with short and closely set cilia arranged in rows, 27 rows of dorsal kineties present; peristome at the anterior end, very short and ending in pocket-like cytostome; cytoplasm with distinct ecto and endoplasm; macronucleus bean-shaped, situated in the posterior half of the body, 14.8 - 26.7 (17.9) μm × 6.6 - 12.8 (9.3) μm; micronucleus very small, round to oval, placed in the concavity of the macronucleus; contractile vacuole single.

Host: Pangasius pangasius (Hamilton); site of infection: intestine.

Distribution: India: West Bengal (Nadia district).

546. Balantidium ranarum Ghosh


Diagnosis: Body elongately to broadly oval, tapering anteriorly, truncate or rounded posteriorly, 65 μm × 40 μm; peristome extending beyond the middle of the body, porvided with a distinct adoral row of long and stout cilia; body cilia long and uniformly arranged in meridional rows; contractile vacuole two, postero- lateral, one on each side; macronucleus oval with micronucleus adjacent to it.

Host: Rana tigrina Daudin; site of infection: rectum.

Distribution: India: West Bengal (Calcutta district)
547. *Balantidium rayi* Pal and Das Gupta,


*Diagnosis*: Body roughly pyriform, 59-69 \( \mu m \times 45-55 \mu m \), anterior end more pointed than the posterior end; peristome at the anterior end with specialised cilia, stouter, and longer than the others; cytostome leading into the tubular cytopharynx extending beyond the middle region; contractile vacuole single; macronucleus oval, 23 \( \mu m \times 18 \mu m \); micronucleus 2.5 \( \mu m \) in diameter, lying close to the macronucleus.

*Host*: *Tylotriton verrucossus* Anders; site of infection: rectum.

*Distribution*: India: West Bengal (Darjiling district).

548. *Balantidium rhesum* Ghosh


*Diagnosis*: Body ovate, nearly or less than twice as long as broad, anteriorly tapering and blunt, posteriorly broad and rounded, 10-11 \( \mu m \times 5 \mu m \); peristome triangular, extending one-fourth the length of body; contractile vacuole single, posteroterminal; macronucleus circular, disc-like, located about the middle.

*Host*: *Macaca mulatta* Zimmerman; site of infection: intestine.

*Distribution*: India: West Bengal (Calcutta district).

549. *Balantidium rotundum* Bezzenberger


*Diagnosis*: Body round or compactly egg-shaped, strongly compressed dorso-ventrally, with a marked bulging on the ventral surface, 56 \( \mu m \times 44 \mu m \); cilia very long and fine; peristome slit-like, anteriorly located, extending along the right margin, a little in front of the middle, with long and thick adoral cilia on the left; contractile vacuole single, lying at the lower right quadrant of the body; macronucleus oval or slightly kidney-shaped, lying in left lower quadrant of the body; micronucleus distinct and located at the notch, middle or near at one end of macronucleus.

*Host*: *Rana tigrina* Daudin *Rana hexadactyla*; site of infection: small intestine.

*Distribution*: India: West Bengal (North 24-Parganas and Puruliya districts).

550. *Balantidium sushilae* Ray


*Diagnosis*: Body torpedo-shaped, 150-319.44 \( \mu m \times 35.65 \mu m \); peristome narrow groove-like, not reaching the middle of the body, with long cilia on the left and an undulating membrane; contractile vacuoles three, two lateral and one terminal; macronucleus broadly oval, variable in position; micronucleus lateral to macronucleus; a boring apparatus present.
Host: *Rana tigrina* Daudin; site of infection: intestine.

Distribution: India: West Bengal (Calcutta and Puruliya districts).


Diagnosis: Body oval, 90.5 - 109.5 μm x 60 - 79.5 μm, anterior end tapering; peristomeal depression at the anterior end, cytostome circular, cytopharynx short, not reaching middle region, peristomeal cilia stouter and longer than cytopharyngeal cilia; contractile vacuole two in number; macronucleus containing a number of vacuoles, micronucleus sheathed, closely adherent to the macronucleus.

Host: *Tylotriton verrucosus* Andes.; site of infection: rectum.

Distribution: India: West Bengal (Darjiling district).

Order RHYNCHODIDA
Family ANCISTROCOMIDAE

Diagnosis: Body pear or banana shaped, somatic ciliature confined to anterior half only, sucking tube sometimes clearly protruding from anterior end, parasitic in both freshwater and marine invertebrates.

Key to the genera

1 (2) Strongly elongated banana-shaped body, slightly depressed in thigmotactic area, kinetics generally arranged in three complexes-middle and left and right lateral complexes, two lateral complexes making a parenthetical system..........................*Ancistrocoma*

2 (1) Pear shaped, feebly elongated body with moderately flattened thigmotactic area, thigmotactic ciliature consisting of two complexes, on right side two arc-like bent present, not forming any parenthetical system..........................................................*Raabella*

Genus *Ancistrocoma* Chatton and Lwoff

Key to the species

1 (2) Central thigmotactic complex consisting of relatively short kinetics reaching two-third of body length.................................................................*A. pelseneeri*

2 (1) Central thigmotactic complex consisting of relatively long kinetic reaching three-fifth of body length.................................................................

3 (4) Thigmotactic complex consisting of eleven kinetics, a complex of seven kinetics lying on the left from it.................................................................*A. thorsoni*

4 (3) Central thigmotactic complex comprising five kinetics, on the left usually three to four kinetics present.................................................................*A. dissimilis*
552. Ancistrocoma dissimilis Kozloff


**Diagnosis**: Body elongated; 27.2 - 44.2 µm × 8.5 - 11.9 µm; macronucleus more or less round, located above the posterior third of the body, 5.1 - 10.2 µm × 5.1 - 8.5 µm; micronucleus 1.7 µm in diameter, lying posterior to the macronucleus; kineties 12-14 in number, central thigmotactic complex with 5 kineties; contractile vacuole at the posterior third of the body.

**Host**: Pholadidea penita (Conrad), Mactra luzonica (Deshayes); site of infection: gills and labial palps.

**Distribution**: India: West Bengal (Medinipur district). Elsewhere: U.S.A.

553. Ancistrocoma pelseneeri Chatton and Lwoff


**Diagnosis**: Body elongated, somewhat buckled, 27.2 - 42.5 µm × 8.5 - 13.6 µm; anterior terminal more or less attenuated banana-shaped with incurved ventral surface; macronucleus oblong, centrally located; micronucleus spherical, lying anterior to the macronucleus; kineties 14-16 in number; contractile vacuole in the middle.

**Host**: Macoma balthica, Mactra luzonica (Deshayes); site of infection: gills and palps.

**Distribution**: India: West Bengal (Medinipur district). Elsewhere: Baltic sea.

554. Ancistrocoma thorsoni Fenchel


**Diagnosis**: Body elongated, slightly buckled, 28.9 - 47.6 µm × 8.5 - 13.6 µm; macronucleus elongated, 15.3 - 27.2 µm in length, nearly half of the body length; micronucleus spindle-shaped or spherical; kineties 18-20 in number forming two systems, a left thigmotactic system of 11 kineties and a right system of 7-9 kineties; contractile vacuole located in the posterior half of the body.

**Host**: Abra nitida (Muller), Mactra luzonica (Deshayes; site of infection: gills and labial palps.

**Distribution**: India: West Bengal (Medinipur district). Elsewhere: Scandinavian water.

Genus Raabella Chatton and Lwoff

555. Raabella helensis Chatton and Lwoff


**Diagnosis**: Body pyriform, 25.5 - 35.7 µm × 13.6 - 18.7 µm, pointed anteriorly and rounded
posteriorly; anterior end with suctorial tentacles; macronucleus ovoid or spherical, 6.8 - 11.05 μm × 5.1-7.65 μm, situated nearly at the centre; micronucleus spherical, 2.55 μm in diameter, anterior to macronucleus; contractile vacuole single, spherical, close to macronucleus; cilia restricted at the anterior half of the body; thigmotactic zone formed of 3 ciliary rows, central complex of 5 kineties, running meridionally, left complex of 5-6 kineties and right system with 2 long, archly buckled, parallelly running kineties.

Host: *Mytilus edulis, Modiolus (Modiolus) striatulus* (Hanley); site of infection; gills.

Distribution: India: West Bengal (Calcutta district); Andhra Pradesh (Kaakinada Bay). Elsewhere: California, U.S.A.; Helsinger, Kristineberg and Asko; Baltic sea (vide Jamadar and Choudhury, 1988).

Class OLIGOHYMENOPHOREA
Subclass HYMENOSTOMATIA
Order HYMENOSTOMATIDA
Family ICHTHYOPHTHIRIIDAE

Diagnosis: Encysted tomont of large size, producing hundreds of tomites, trophonts invading epithelial tissues of marine and freshwater fishes, causing white spot disease.

Genus *Ichthyophthirius* Fouquet

Diagnosis: Body ovoid, with uniform ciliation, vestibule inconspicuous, cytostome located at anterior end, macronucleus horse-shoe shaped, parasitic in the integument of freshwater fishes.

556. *Ichthyophthirius multifilis* Fouquet


Diagnosis: Body ovoid, length greatly variable, 100-1000 μm; cytostome large, macronucleus horse-shoe shaped, cytoplasm with various inclusions.

Host: *Labeo bata, Cirrhinus mrigala, Xiphophorus hellerii*, site of infection: skin

Distribution: India: West Bengal (Experimental).

Remarks: It produces pustules in the epidermis and gills of fishes.

557. *Ichthyophthirius* sp.

Host: Indian Carps, site of infection: skin.

Distribution: India, West Bengal (Experimental)

Remarks: Tripathi (1955) reported this unnamed species from Indian carps.

Order SCUTICOCILIATIDA

Key to the families

1 (4) Buccal ciliation mostly subequatorial in location, scutico- vestige (segment ‘C’ of
paroral membrane) usually indistinct, strongly developed thigmotactic ciliature and/or distinct sucker or adhesive disc characteristically present at apical pole.

2 (3) Body somewhat flattened laterally, prominent thigmotactic sucker, essentially at apical end of the body, buccal apparatus reduced or even rudimentary at antapical pole.

3 (2) Body occasionally elongate, not laterally flattened, anterior thigmotactic ciliature present but not any thigmotactic sucker, buccal ciliature conspicuous, winding in arc of 360° around antapical pole in some species.

4 (1) Buccal ciliature equatorial or subequatorial, a permanent scutico-vestige present, thigmotactic ciliature, sucker or adhesive disc absent.

5 (6) Body laterally compressed, ellipsoidal to broadly reniform with dense and uniform ciliation.

Family CYCLIDIIDAE
Genus Cristigera Roux

Diagnosis: Body ovoid, much compressed with a post oral depression and with a long caudal cilium, peristome closer to midventral line. Corliss (1979) considers this genus as incertae sedis under the family Cyclidiidae.


Diagnosis: Body ovoid, much compressed, 25.5 - 42.5 μm x 8.5 - 13.6 μm, anterior end pointed and posterior end slightly broad; dorsal surface convex and ventral surface somewhat flattened; macronucleus usually round, 5.1 - 10.2 μm x 3.4 - 8.5 μm; micronucleus 1.7 - 2.55 μm in diameter, lying in front of macronucleus; cytostome at anterior 1/3 of the body, buccal cavity occupying a conspicuous position on the ventral surface just above the macronucleus; somatic cilia throughout, anterior ones longer than the posterior; kinetics 8-12 in number; contractile vacuole, single, found, located at the posterior middle, caudal cilium long.

Host: Crassostrea cucullata (Born); site of infection: gills and labial palps.

Distribution: India: West Bengal (South 24-Parganas district).

Family CONCHOPHTHIRIDAE
Genus Conchopthirius Stein

Diagnosis: Body oval to ellipsoid, flattened; cytostome on right side, near middle in a depression with an undulating membrane,

Key to the species

1 (2) Form very broad, cytopharynx ciliated, very long, extending across almost close to the dorsal border, macronucleus oval, subcentral...C. curtus
2 (1) Form ovate or elongate, cytopharynx lacking; macronucleus oval, posterior.

3 (4) Body elongate, two and a half times as long as broad; dorsal border nearly straight; ventral border not dentate and with a shallow notch just behind the anterior third of the body.

4 (3) Body ovate, one and a half times as long as broad; dorsal border convex and minutely dentate in anterior and slightly notched in posterior half.

559. *Conchophthirius curtus* Engleman


*Diagnosis*: Body oval with equally rounded ends; dorsally convex and ventrally flattened; 120 μm in length; peristomial depression in front of the middle; cytopharynx long, tubular and recurved; ciliary lines longitudinal, throughout; a tuft of strong cilia at the posterior end; contractile vacuole behind the middle surrounded by subsidiary vacuole; macronucleus oval, subcentral; micronucleus one or two in number.

*Host*: *Lamellidens marginallis*; site of infection: mantle chamber.

*Distribution*: India: West Bengal Calcutta Hugli, Medinipur, North and South 24-Parganas districts).


560. *Conchophthirius elongatus* Ghosh


*Material examined*: Sev. exs., India, West Bengal, Calcutta, 17.v.1964, K.N. Nair.

*Diagnosis*: Body elongated, nearly two and a half times as long as broad, 50 μm in length, anterior end broad and rounded, posterior end narrow and bluntly pointed; peristome small, conical, ventrally located just behind the anterior third length of the body; cytopharynx absent; ciliary lines anteriorly well marked; contractile vacuole single, behind the middle of the body macronucleus, oval, posteriorly placed.

*Host*: *Lamellidens marginallis*; site of infection: mantle chamber.

*Distribution*: India: West Bengal: (Calcutta, Hugli, Medinipur, North and South 24-Parganas districts).

*Remarks*: As for Sl. No. 559.

561. *Conchophthirius lamellidens* Ghosh

1918. *Conchophthirius lamellidens* Ghosh, Rec. Indian Mus., 15, 0. 132.

*Material examined*: Sev. exs., India, West Bengal, Calcutta, 12.x.1963, K.N. Nair.

*Diagnosis*: Body ovate, 90 μm in length, about 1/2 times as long as broad, bluntly pointed at both ends; dorso-ventrally convex, minutely dentate at the anterior ventral border; peristomial
notch in the posterior half; longitudinal ciliary lines distinct; contractile vacuole single, subcentral.
macronucleus oval or triangular, posterior and subterminal.

Host: Lamellidens marginalis (Lamarck); site of infection: mantle chamber.

Distribution: India: West Bengal (Calcutta, Hugli, Medinipur, North and South 24-Parganas districts).

Remarks: As for Sl. No. 559.

Family ANCISTRIDAE

Key to the genera

1 (2) Body oval, strongly flattened, ciliature dense, number of kineties of the range of 65
.................................................................................................................................Protophrya

2 (1) Body of diverse shape, not strongly flattened number of kineties 12-30..............

3 (4) Two adoral kineties starting in the vicinity of the enlarged posterior pole and making
around it a large involutive spiral........................................................................Boveria

4 (3) Two adoral kineties starting from anterior pole without forming any spiral as above......

5 (6) Body elongated with a cone-shaped prolongation at posterior end, two adoral kineties
starting about one-third the body length from anterior pole.........................Fenchelia

6 (5) Body ovoid, anterior end attenuated, posterior end without any cone, two adoral kineties
beginning at a small distance of the apical suture........................................Ancistrumina

Genus Ancistrumina Raabe

Key to the species

1 (2) Body ovoid, margins convex, posterior end almost rounded, 35.08 \( \mu \text{m} \times 27.88 \mu \text{m} \) in
dimensions, macronucleus oval located in the anterior part of the body..............A. obtusae

2 (1) Body elongately oval with almost parallel margins, 34.61 \( \mu \text{m} \times 19.92 \mu \text{m} \) in dimensions,
macronucleus round, oval or elongated, location as above..............................A. barbata

562. Ancistrumina barbata (Issel)


Diagnosis: Body elongated, with almost parallel margins and truncated posterior end, 28.9
- 42.5 \( \mu \text{m} \times 17.0 - 23.8 \mu \text{m} \); kineties 20-24 in number; peristome 22.1 - 28.9 \( \mu \text{m} \), extending
four-fifth length of the body from the apical part; undulating membrane forms a big loop;
macronucleus oval or elongated, 8.5 - 17.0 \( \mu \text{m} \times 5.8 - 11.9 \), centrally placed, anteriorly indented
to accommodate the spherical micronucleus; 1.2 - 3.4 \( \mu \text{m} \) in diameter contractile vacuole in the
posterior part of the body; with three distinct ciliary regions consisting of thigmotactic, adoral
and somatic ciliature.
Host: *Fusus syracusanus* Lamarck, *Certithidea obtusa* (Lamarck); site of infection: mantle cavity and buccal mass.

Distribution: India: West Bengal (South 24-Parganas district). Elsewhere: Neapolitanian Bay.

563. *Ancistrumina obtusae* Jamadar and Choudhury


*Diagnosis:* Body ovoid, 30.2 - 40.8 μm × 20.4 - 34.0 μm almost rounded at its posterior part, somatic kinetics more or less meridional, 19-22 in number; peristome elongated, extending from anterior one-third part to the posterior extremity; cytostome at the posterior end with two long lashing cilia; macronucleus elongated, or oval, 14.29 μm × 9.45 μm, situated in the anterior part of the body; micronucleus spherical, 1.7 - 3.4 μm in diameter, juxtaposed to the macronucleus; contractile vacuole posteriorly located; somatic cilia 4-5 μm long, adoral cilia 9-15 μm long and thigmotactic cilia 5-6 μm long.

Host: *Certithidea obtusa* (Lamarck); site of infection: buccal cavity.

Distribution: India: West Bengal (South 24-Pargans district.)

Genus *Boveria* Stevens

564. *Boveria teredinidi* Nelson,


*Diagnosis:* Body somewhat conical, 34.0 - 57.8 μm × 15.3 - 22.1 μm, anterior end slightly tapering; kinetics 20-22 in number; oval apparatus broad disc-like; cytostome a temporary structure, only visible during active feeding; macronucleus large, oval centrally placed, 10.2 - 15.3 μm × 6.8 - 8.5 μm; micronucleus spherical, 2.5 - 3.4 μm in diameter, located at the anterior one-third part of the body; contractile vacuole single; at the anterior one-third part of the body; contractile vacuole single; food vacuole 7-12 in number.

Host: *Teredo navalis* L.; site of infection: labial palps and gills.


Genus *Fenchelia* Raabe

Key to the species

1 (2) Body ovoid or pear-shaped with a short distinct prolongation on posterior body pole, 39.1 - 51.0 μm × 22.1 - 37.4 μm in dimensions........................................... *F. sagarica*

2 (1) Body ovoid with a conspicuous cone-shaped prolongation on posterior body pole, 25.5 - 40.8 μm × 13.6 - 30.6 μm in dimensions........................................... *F. kapili*

565. *Fenchelia kapili* Jamadar and Choudhury

**Diagnosis**: Body ovoid, 25.5 - 40.8 \(\mu m\) × 13.6 - 30.6 \(\mu m\), dorso-ventrally flattened with a cone-shaped prolongation at the posterior end; kineties 21-25 in number, anterior thigmotactic cilia longer; peristome starts behind the anterior one-third of the body; undulating membrane forms a big loop posteriorly; cytostome situated posteriorly; macronucleus ovoid or oblong 8.5 - 15.3 \(\mu m\) × 5.1 - 10.2 \(\mu m\); micronucleus spherical, 1.7 - 3.4 \(\mu m\) in diameter, single, anterior to the macronucleus; contractile vacuole large, located posteriorly near the cytostome.

**Host**: Cerithidea obtusa (Lamarck); site of infection: ctenidium and mantle cavity.

**Distribution**: India: West Bengal (South 24-Parganas district) and Andhra Pradesh (Kakinada Bay).

566. **Fenchelia sagarica** Jamadar and Choudhury


**Diagnosis**: Body dorso-ventrally flattened, 39.1 - 51.0 \(\mu m\) × 22.1 - 37.4 \(\mu m\), ovoid or pear-shaped with a small protrusion at the posterior end; kineties 30-32 in number; peristome starts considerably posteriorly from the anterior tip; cytostome situated posteriorly from the anterior tip; cytostome situated posteriorly in a depression; macronucleus variable in shape, 8.5 - 17.0 \(\mu m\) × 6.8 - 17.0 \(\mu m\), located at the anterior half of the body, micronucleus spherical or oval, 3.4 - 5.1 \(\mu m\) in diameter, shadowed by the macronucleus and not readily visible; contractile vacuole single, large, located posteriorly, 25.5 - 42.5 \(\mu m\) in diameter.

**Host**: Cerithidea obtusa (Lamarck); site of infection: mantle cavity.

**Distribution**: India: West Bengal (South 24-Parganas district) and Andhra Pradesh (Kakinada Bay).

**Genus** *Protophrya* Kofoid

567. **Protophrya indica** Jamadar and Choudhury


**Diagnosis**: Body pyriform, laterally flattened, 59.5 - 89.9 \(\mu m\) × 35.7 59.5 \(\mu m\); kineties 60-77 in number; peristome naked and narrow, starts from the mid region of the body; cytostome situated close to the posterior end; undulating membrane formed of adoral cilia and a long caudal cilium of 11.9 - 17.0 \(\mu m\) in length; macronucleus oval or round located at the anterior part; micronucleus spherical, lying above the macronucleus; contractile vacuole single, located adjacent to the cytostome.

**Host**: Littorina melanostoma Gray Littorina scabra seabra site of infection: mantle cavity and buccal mass.

**Distribution**: India: West Bengal (Medinipur and South 24- Parganas, districts); Andhra Pradesh (Waltair) and Goa (Dona Paula).

**Family** HYSTEROCLINETIDAE

**Genus** *Drilocineta* Raabe

**Diagnosis**: Prominent thigmotactic sucker at apical end of the body, short ciliary rows
between the arms of the sucker, small congregation of food vacuoles in the posterior part of
the body, macronucleus elongated.

568. *Drilocineta perionyxi* Nair and Chakrabarti


A. Chakrabarti.

*Diagnosis*: Body elongated, anterior end bluntly pointed and slightly curved, and posterior
end truncated, 85-195 μm × 43-85 μm in dimensions; an inverted ‘U’ shaped sucker of unequal
arms at antero-ventral region, 5-6 ciliary rows in between arms of sucker; macronucleus elongated
with rounded posterior and acuminated anterior ends; contractile vacuole single with 3-4 accessory
vacuoles below macronucleus; food vacuoles congregated at posterior part of the body.

*Host*: *Perioryx excavatus*; location: intestine (posterior part).

*Distribution*: India: West Bengal (North 24-parganas district).

**Order** ASTOMATIDA

**Key to the families**

1 (2) Body ovoid to elongate ovoid, no endoskeleton, apical hooks or suckers .................
............................................................................................................................................ANOPLOPHRYIDAE

2 (1) Body cylindrical, rounded at both ends, skeletal fibres short, small anterior spines
fixed or mobile.........................................................................................................................MAUPASELLIDAE

**Family** ANOPLOPHRYIDAE

**Genus** Anoplophrya de Putorac and Dragesco

*Diagnosis*: Shape as for the family, macronucleus ovoid to cylindrical, contractile vacuole
one to several.

**Key to the species**

1(4) Contractile vacuole single................................................................................................

2(3) Body oval, twice as long as broad, posterior end considerably pointed, macronucleus
band-shaped, straight or curved.........................................................................................*A. aelosomatis*

3(2) Body band-like, about three to four times as long as broad, posterior end with a
minute notch, macronucleus club-shaped with pointed anterior end....................*A. variabilis*

4(1) Contractile vacuole more than one.................................................................................

5(6) Contractile vacuoles numerous arranged in two longitudinal rows, mostly non-contractile,
(body elongated, band-like, sometimes twisted in posterior region)................*A. elongata*
6(5) Contractile vacuoles few and scattered
7(11) Contractile vacuoles three in number
8(9) Body elongated, human foot-shaped, 100 μm × 60 μm, in dimensions, (macronucleus irregularly band-shaped exhibiting three-fourth length of body)..............A. chauhani
9(8) Body oval or elongately oval
10(12) Body oval, subtruncate posteriorly.................................A. lloydii
11(10) Body elongately oval with rounded ends
12(13) Comparatively large, 180-250 μm × 50-70 μm, macronucleus ribbon-shaped extending almost entire length of the body........................................A. lumbrici
13(12) Smaller in size, 85 μm × 48 μm, macronucleus band-shaped, extending two-third the length of the body..................................................A. anili
14(7) Contractile vacuoles four in number, (body elongated cylindrical about six times as long as broad)..................................................A. cylindrca

569. Anoplophrya aelosomatis Anderson
Diagnosis: Body oval, twice as long as broad, tapering at both ends, 62-63 μm in length; densely ciliated with fine longitudinal striations; macronucleus axial, band-shaped and extending almost the whole length of the body; contractile vacuole single, close to the macronucleus.

Host: Aelosoma chlorosticum Wood-Mason Metaphire; posthum; site of infection: alimentary canal.

Distribution: India: West Bengal (Calcutta district).

570. Anoplophrya anili Mukherjee and Chakrabarti
Diagnosis: Body 85 μm × 48 μm, elongately oval with rounded ends; anterior end broadly rounded, gradually narrower towards posterior end; ciliation thick and uniform; contractile vacuole three in living condition; macronucleus 58 μm in length, band-shaped, two-third the length of the body; micronucleus small, spherical; endoplasmic zonation distinct.

Host: Perionyx excavatus Perrier; site of infection: alimentary tract.

Distribution: India: West Bengal (North 24-parganas district).

571. Anoplophrya chauhani Mukherjee and Chakraborty
Diagnosis: Body elongated, human foot-shaped, 100 μm × 60 μm; anterior end broader; posterior end rounded; ciliation thick and uniform; macronucleus 74 μm in length, irregularly band-shaped with broader anterior anterior and gradually narrower posterior end, extending
three-fourth the length of the body; micronucleus small, spherical; three contractile vacuoles in living condition.

*Host*: *Perionyx excavatus* Perrier; *site of infection*: digestive tract.

*Distribution*: India: West Bengal (North 24-Parganas district).

572. *Anoplophrya cylindrica* Ghosh


*Diagnosis*: Body elongated and cylindrical, 230 μm in length, about six times as long as broad with rounded ends; ectoplasm thin and endoplasm finely granular; contractile vacuoles four and irregularly arranged; macronucleus elongated, extending almost the whole length of the body.

*Host*: *Belamya (=Vivipera) bengalensis*; *site of infection*: intestine.

*Distribution*: India: West Bengal (Calcutta district).

573. *Anoplophrya elongata* Ghosh


*Diagnosis*: Body elongated, band-like, 150 μm × 30 μm, occasionally twisted, with bluntly tapering ends; anterior end broader; numerous small vacuoles arranged in longitudinal rows; cilia small and uniform; macronucleus flattened and board-like, extending almost the whole length of the body.

*Host*: Small freshwater gastropods (unnamed); *site of infection*: rectum.

*Distribution*: India: West Bengal (Calcutta district).

574. *Anoplophrya lloydii* Ghosh


*Diagnosis*: Body elongately oval with subtruncate posterior end; macronucleus irregularly ribbon-shaped, extending nearly the whole length of the body; micronucleus small, spherical located close to macronucleus, contractile vacuoles three, on the right side.

*Host*: *Pheretima posthuma* (L. Vaill); *site of infection*: seminal vesicles.

*Distribution*: India: West Bengal (Calcutta district).

575. *Anoplophrya lumbrici* (Schrank)


*Diagnosis*: Body elongate oval with posterior end subtruncate, 180-250 μm × 50-70 μm, dorsalside convex and ventral side concave; macronucleus more or less ribbon-shaped, 100-120 μm in length, extending almost entire length of body; micronucleus spherical.

*Host*: *Pheretima peguyana* (Rosa); *site of infection*: seminal vesicle.

*Distribution*: India: West Bengal (Calcutta district).
576. *Anoplophrya pheretimii* Raychaudhuri, Haldar and Chakravarty


*Host*: *Metaphire* : (*Pheretima*) *posthuma*.

*Distribution*: India : West Bengal (Calcutta district); site of infection: gut.

*Remarks*: Diagnostic characters and exact place of occurrence of this species could not be incorporated in the present work due to nonavailability of concerned literature. Ghosh, Haldar and Chakravarty (1970) however, studied some cytochemical localisation of this species wherein no diagnostic feature of this ciliate is available.

577. *Anoplophrya variabilis* Ghosh


*Diagnosis*: Body band-like, 84-174 μm in length, 3 to 4 times as long as broad, with a minute notch at the posterior end, rounded anterior end and almost parallel sides; ciliation uniform in longitudinal rows; with two hook-like caudal cirri; contractile vacuole single, posterior; macronuclei club-shaped.

*Host*: Small freshwater gastropods (unnamed); site of infection : intestine.

*Distribution*: India : West Bengal (Calcutta district).

578. *Manpasella nova* Cepede


*Diagnosis*: Body ovoidal, 48-66 μm × 15-17 μm, dorsoventrally flattened with bluntly rounded anterior end and tapering posterior end; ciliary line longitudinal, cilia fine and densely arranged; macronucleus elongated, ribbon-shaped, granular, located at four-fifth of the body; micronucleus fusiform, almost centrally placed; contractile vacuoles 8-10 in numbers, arranged in two rows.

*Host*: *Perionyx excavatus*; site of infection : digestive tract.

*Distribution*: India : West Bengal (North 24-Parganas district, Barrackpore) cited from Mukherjee and Chakrabarti (1985); Paris, France; Lahore, Pakistan.

*Remarks*: Mukherjee and Chakrabarti (1987) described a subspecies *M. nova anili* from *Perionyx excavatus* from Barrackpur, North 24-Parganas district. This form is ellipsoidal in shape and 55-58 μm × 15-17 μm in dimensions.
Order PERITRICIDDA

Key to the families

1 (2) Stalkless, yet sessile, attached to substrata by scopulary organellae forming flattened disc often prominently distinct from rest of the body..........................SCYPHIDIDAE

2 (1) Mobile, body cylindrical, adoral spiral ranges from turn of 180° to 2-3 nearly full circles, always with wide radius.............................................................TRICHODINIDAE

Family SCYPHIDIIDAE

Genus Scyphidia Dujardin

Diagnosis: Body cylindrical, posterior end attached to submerged objects or aquatic animals, body usually cross-striated.

Key to the species

1 (4) Body vase-shaped, cylindrical, distinctly sculptured by regular or transverse striations, macronucleus elongated or sausage-shaped.................................................................

2 (3) Scopular disc small, peristomeal disc inconspicuous, macronucleus considerably large, sometimes its length surpassing total length of animal..........................S. bengalensis

3 (2) Scopular disc comparative large, peristomeal disc conspicuous, expanded peristomeal disc resembling a pointed snout, macronucleus not very large........................S. ubiquita

4 (1) Body urn-shaped or conical, not sculptured by any striation, macronucleus pyriform pointed posteriorly.................................................................S. pyriformis

579. Scyphidia (Gerda) bengalensis Jamadar and Choudhury


Diagnosis: Body cylindrical, contractile and vase-shaped with concentric pellicular ridges, 40.8 - 71.4 µm x 25.5 - 61.2 µm; scopular disc very small; peristomeal disc conspicuous with the circlet of long cilia; macronucleus cylindrical, variable in shape and size, 28.9 - 81.9 µm x 5.1 - 8.5 µm; contractile vacuole prominent, located near the gullet.

Host: Cerithidea cingulata (Gmelin); site of infection: mantle cavity and buccal mass.

Distribution: India: West Bengal (Sagar Island, South 24-Parganas district).

580. Scyphidia pyriformis Tripathi


Diagnosis: Body urn-shaped or conical, anterior end round, posterior end elongated and truncate broad, frill-like scopula, 38.5 -46.9 µm x - 18.0 -20.36 µm in dimensions, peristome arched, with ciliated circular oral groov descending obliquely to form vestibule, macronucleus pyriform, pointing posteriorly, contractile vacuole single, located at the anterior part of the body and connected with vestibule by a small duct.
Host: *Labeo rohita, Catla catla, Cirrhinus mrigala, Cirrhinus reba*; location: skin, fins and gills.

Distribution: India, West Bengal (Hugli district).

Remarks: Fish fry infected with this parasite become weak and sluggish.


Diagnosis: Body cylindrical, vase-shaped 40.8 - 96.9 μm × 23.8 - 64.6 μm, with transverse striae; peristomial disc snout-like; gullet long with two rows of cilia; macronucleus elongated or sausage-shaped, centrally located; micronucleus small, spherical to oval, located at the anterior proximity of the macronucleus; contractile vacuole located near the peristomial disc.

Host: *Littorina melanostoma* Gray and *L. (Littorinopsis) scabra scabra* (Linnaeus); site of infection: mantle cavity and buccal mass.

Distribution: India: West Bengal (South 24-Parganas district) and European coast.

Family TRICHODINIDAE

Key to the genera

1 (2) Adoral spiral making one to three...............................*Trichodina*

2 (1) Adoral spiral making incomplete turn of 180° to 290°...............................*Tripartiella*

Genus *Trichodina* Ehrenberg

Key to the species

1 (2) Body bell-shaped to hemispherical, parasitic in invertebrate host (estuarine bivalve) (diameter 40.8 - 52.7 μm, height 6.8 - 15.3 μm, number of denticles 21-24).........................*T. gangetica*

2 (1) Body disc-shaped or ellipsoid, parasitic in vertebrate hosts..............................

3 (4) Body ellipsoid, often with a median constriction, parasitic in tadpole, (diameter 35 -60 μm, height 25-55 μm, number of denticles 22-25)...............................*T. pediculus*

4 (3) Body disc-shaped, parasitic in fish.................................................................

5 (6) Total diameter 21.9 - 28.4 μm; diameter of denticulate ring 7.3 - 11.9 μm,.................

6 (5) Total diameter 44.4 - 83.2 μm, diameter of denticulate ring 16.6 - 27.3 μm,.................

...............................*T. nigra*


Diagnosis: Body bell-shaped to hemispherical, 40.8 - 52.7 μm in diameter; adhesive basal
disc concave, circular in outline, consisting of a striated membrane and denticulate ring containing 21 - 27 denticles; cytostome ventral, anterior to mid body level; adoral ciliary spiral of two parallel rows; macronucleus large, horse-shoe or arch-shaped; contractile vacuole located anterior to the left arm of the macronucleus.

**Host**: *Modiolus striatulus* (Hanley); site of infection: gills and labial palps.

**Distribution**: India: West Bengal (Calcutta district).

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**583. Trichodina indica** Tripathi


**Diagnosis**: Body semicircular or sub-spherical in side view and circular in anterior view; total diameter 21.9 - 28.4 μm, height 18.25 - 20.07 μm; anterior end arched, surrounded by oval ciliary groove; aboral end with skeletal ring consisting of an outer striated ring and inner denticular ring, latter consisting of 20-22 cone-shaped denticles, fitting into one another to form an interlocking ring; each denticle with 7-9 striae; macronucleus horse-shoe shaped, thicker at centre and slightly tapering at open ends; micronucleus elliptical and outer to macronucleus.

**Host**: *Labeo rohita*, *Labeo calbasu*, *Cirrhinus mrigala*, *Cirrhinus reba*, *Catla catla*, *Amblypharyngodon mola*, *Chela bacaila Channa gachua*, *Channa punctatus*, *Ambassia*, *Ambassia ranga*; location: gills.

**Distribution**: India: West Bengal (specific locality not mentioned).

**Remarks**: Tripathi (1954) recorded this species as the commonest ciliate parasite infecting the pond fishes and their fry and fingerings.

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**584. Trichodina nigra** Lom


**Diagnosis**: Body disc-shaped, 61-79 μm in diameter; adoral ron forming a spiral of about 360°-380°; adhesive disc large with distinct border membrane; denticles 20-28 in number with large distinct blades and thorns, blade falcated blade falcated in shape without any rounded apex, thorns directed to the centre of the adhesive disc, and with 7-8 radial pins; macronucleus horse-shoe shaped micronucleus single.

**Host**: *Nandus nandus* (Ham.), *Tilapia mossambica* (Peters) and site of infection: body surface and gills.

**Distribution**: India: West Bengal (Nadia district).

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**585. Trichodina pediculus** Ehrenberg


**Material examined**: 4 exs., India, West Bengal, Calcutta, 11.v.1960, K.N. Nair.

**Diagnosis**: Body ellipsoid often with a median constriction, diameter 35-60 μm, adoral spiral
complete, describing an arc more than 360°; macronucleus sausage-shaped, adhesive disc with denticulate ring with 22-25 denticles having curved hooks and long rays extending to middle of the disc.

Host: Tadpole; location: gill.

Distribution: India: West Bengal (Calcutta district).

586. Trichodina sp.

Host: Ophicephalus punctatus (Bloch).

Distribution: India: West Bengal (Nadia district).

Remarks: Haldar and Mukherjee (1978) reported this unnamed species from the aforesaid host.

587. Trichodina sp.

Host: Sphaeroides oblongus (Bloch); site of infection: gills.

Distribution: India: West Bengal (Medinipur district).

Remarks: Choudhury and Nandi (1973) reported this unnamed species from the aforesaid species of puffer fish (Order Tetradontiformes).

588. Trichodina sp.

Host: Tilapia mossambica (Peters); site of infection: gills.

Distribution: India: West Bengal (Calcutta district).

Remarks: Choudhury and Chandra (1972) reported on this unnamed species from the aforesaid host.

Genus Tripartiella Sramenk-Husek

Key to the species

1 (2) Anterior projection of the blade forming a sharp spike.................................. T. copiosa
2 (1) Anterior projection of the blade not in the form of sharp spike.................................
3 (4) Anterior projection of the blade resembling a rounded triangle forming a ‘V’ with the blade.............................................................. T. obtusa
4 (3) Anterior projection of the blade forming two distinct projections - one short and the other long with a notch................................................................. T. bulbosa

589. Tripartiella bulbosa (Davis)


Diagnosis: Body disc-shaped, 17.6 - 28.6 μm, in diameter, adhesive disc 15.4 - 22.0 μm diameter; denticulate ring 7.7 - 14.3 μm in diameter with a delicate central part, and relatively
long blade joining the centre by a more or less pronounced knee-like bend; blades rounded or
truncated at their peripheral ends, thorn short, straight and directed backwards, anterior projection
of the blade forming two distinct projections, one short and the other long with a notch; adoral
zone making a turn of 180-200°

Host : Catla catla (Ham) Labea rohita (Ham), Mystus bleckeri; Chanda nama and Cirrhinaus
mrigala (Ham.); site of infection : gills.

Distribution : India : West Bengal (Nadia district).

590. Tripartiella copiosa Lom


Diagnosis : Body disc-shaped, 16.5 - 23.1 μm, in diameter, denticles characterized by a
delicate central part with anterior projection of the blade in the form of a sharp sike; adoral
zone making a turn ranging from 180-225°; adhesive disc 12.1 - 19.2 (17.0) μm in diameter;
denticulate ring 6.6 - 11.0 μm in diameter with 18-25 (22) denticles, each having 5 radial pins.

Host: Labeo rohita (Himilton), Cyprinus carpio (Linn); site of infection : gills.

Distribution: India : West Bengal (Nadia district).

591. Tripartiella obtusa Ergens and Lom


Diagnosis: Body small, disc-shaped, 17.6 - 22.5 (19.8) μm in diameter; adhesive disc distinct,
14.8 - 19.5 (16.7) μm in diameter; denticulate ring 8-13.5 (9.4) μm in diameter with 20-25 (22)
denticles and 4 radial pins per denticle, blades rectangular in shape with anterior projection
resembling a rounded triangle forming a ‘V’ together with the blade and pointed anticlockwise;
adoral zone making a turn of 180-200°

Host: Ctenopharyngodon idella (Val.); site of infection : gills.

Distribution : India : West Bengal (Nadia district).

Class POLYHYMENOPHOREA
Order HETEROTRICHIDA

Key to the families

1 (2) Body plump-ovoid to ellipsoidal, occasionally tailed, sucker typically present on concave
side of the body, uniquely reinforced with polysaccharide skeletal elements.............
..........................................................SICUOPHORIDAE

2 (1) Body ovoid to slightly reniform, plump, sucker on ventral side lacking..................
..........................................................NYCTOTHERIDAE
Family NYCTOTHERIDAE

Key to the genera

1 (2) Body ovoid, pyriform or reniform, left margin convex, right margin more or less flat, micronucleus always below macronucleus, commensal of anurans .......... Nyctotheroides

2 (1) Body generally less flat, micronucleus most often located above macronucleus, commensal to both invertebrate and vertebrate ........................................... Nyctotherus

Genus Nyctotherus Leidy

1 (4) Cytopharynx reaching up to the middle of the body ..........................................................

2 (3) Body broadly egg-shaped, cytopharynx transversely directed, macronucleus egg-shaped .................................................................................................................. N. ovalis

3 (2) Body pyriform, cytopharynx obliquely directed, macronucleus oval .......... N. chatterjee

4 (1) Cytopharynx reaching up to two-thirds the body length, (body reniform, cytopharynx slightly curved, macronucleus elongately oval) ................................................. N. kemp;i

592. Nyctotherus chatterjee (Chakravarty and Chattarjee)


Diagnosis: Body pyriform, 92.4 - 105.0 µm x 48.4 - 66.0 µm; macronucleus band-shaped micronucleus attached to the broader end of macronucleus; peristomes initiate from the anterior end; cytopharynx ends beyond the posterior third of the body; cytopyge at the posterior rounded end; contractile vacuole single near the anal tube.

Host: Gryllotalpa vulgaris; site of infestation: rectum.

Distribution: India: West Bengal (Calcutta and Hugli districts).

593. Nyctotherus kemp;i Ghosh


Diagnosis: Body elongate, about thrice as long as broad, 170 µm x 84, µm much flattened dorso-ventrally, anterior half highly flexible; anterior end tapering to point, posterior end rounded, left side convex, right side more or less straight; peristome linear, along the right side and extending beyond the middle of the body; macronucleus elongately oval, lying in front of the middle, micronucleus adjacent; contractile vacuole single, small, at the posterior end of the body.

Host: Pila globosa (Swainson); site of infection: rectum.

Distribution: India: West Bengal (Calcutta and South 24- Parganas district).

594. Nyctotherus ovalis Leidy


Diagnosis: Body broadly oval, 70-360 m in length, divisible into two parts by caryophore diaphragm, smaller anterior one transparent and finely alveolar and larger posterior infranuclear portion with large alveole and numerous inclusions; cytopharynx slightly bent and reaching up to the middle. Contractile vacuole single, subterminal; macronucleus egg-shaped, curved.

Host: Periplaneta americana; site of infection: midgut and hindgut.

Distribution: India: West Bengal (Calcutta and Maldah districts); Punjab, Goa.

Genus Nyctotheroides Grasse

595. Nyctotheroides cordiformis (Ehrenberg)


Diagnosis: Body reniform, somewhat pointed anteriorly, 80-220 m in length; cytopharynx reaching beyond the middle of the body, broadly curved, contractile vacuole single, posteroterminal, with anal aperture close to it; macronucleus kidney-shaped, micronucleus located below macronucleus and centrally attached to it.

Host: Bufo melanostictus, Rana tigrina; location: intestine and cloaca.

Distribution: India: West Bengal (Calcutta, Hugli, North and South 24-Parganas districts), Goa, Karnataka, Rajasthan.

Family SICUOPHORIDAE

Genus Sicuophora de Puytorac & Grain

Diagnosis: Body ovoid, highly complex along inferior surface, provided with polysaccharide skeletal armature, commensal in anurans.

596. Sicuophora macropharyngeus (Bezzenberger)


Diagnosis: Body oval, posterior part of the body distinctly thicker than anterior part, 140-360 m in length; at anterior end a thinner portion appearing to project like a frill; cytopharynx large, funnel-shaped, posterior portion of it forming a coil in two and a half spiral turns; macronucleus of diverse shape (pentagonal, oval or cone-shaped), micronucleus placed over macronucleus; contractile vacuoles two or three located near posterior end.

Host: Rana tigrina, location: cloaca

Distribution: India: West Bengal (Calcutta, North and South 24-Parganas districts), Maharastra, Karnataka, Rajasthan.
GENERAL REMARKS ON DISTRIBUTION

Distribution of parasites is usually tagged with the localities wherefrom their respective hosts are collected although there is a probability that parasites may enter their hosts either directly or through vector in places sometimes far away from the actual collection spot of the host. This probability is more for birds, mammals and riverine and maritime fishes as well as migratory animals, animals kept in zoo or purchased from market. Keeping this in mind source of collection of hosts, if examined in zoo or purchased in market, is clearly indicated in the host-parasite list in the present communication.

Species-wise distribution of protozoan parasites of West Bengal has already been dealt with under their respective systematic account. District-wise distribution (Map. 1-3) of these parasites are presented below mentioning only the serial number of the species as specified in the parasite-host list of this paper in order of avoid repetition of species names.

District-wise distribution

BANKURA: Ma (11, 30, 32, 34, 35, 38, 56, 62); Sa (76); Ap (209, 210, 211, 212, 213, 215, 219, 357, 358, 379, 380, 381, 384, 387) : total = 23

BARDDHAMAN: Ma (5, 31, 33, 37, 56, 62); Sa (76); Ap (256, 304, 316, 379, 380, 381, 387) : total = 14

BIRBHUM: Ma (56, 62); Op (69); Sa (76); Ap (379, 380, 381, 387) : total = 8


DARJILING: Ma (31, 35, 37, 39, 45, 47, 48, 49, 56, 62); Op (68); Sa (76); Ap (85, 87, 88, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 102, 103, 106, 116, 196, 198, 209, 218, 227, 229, 278, 284, 286, 292, 294, 302, 313, 314, 315, 342, 348, 359, 368, 372, 374, 376, 379, 380, 381, 383, 386, 387, 393, 398, 407, 414, 416, 417, 418, 419, 420, 436, 437; Ci (547, 551) : total = 72

HAORA: Ma (46, 56, 62); Sa (76); Ap (186, 280, 293, 300, 337, 347, 352, 353, 364, 379, 380, 381, 387); Ci (539) : total = 18
HUGLI : $Ma$ (31, 35, 46, 56, 62); $Sa$ (76); $Ap$ (111, 118, 121, 130, 141, 152, 158, 176, 178, 181, 182, 186, 193, 194, 195, 197, 200, 201, 202, 203, 279, 339, 379, 380, 381, 387, 434); $My$ (452, 454, 494, 496, 505, 508, 509, 518, 520, 528, 532); $Ci$ (559, 560, 561, 580, 592, 595) : total = 50

JALPAIGURI : $Ma$ (29, 35, 56, 62); $Sa$ (76); $Ap$ (212, 225, 288, 291, 358, 379, 380, 381, 413) : total = 14

MALDAH : $Ma$ (20, 26, 28, 35, 56, 62); $Op$ (68), $Sa$ (76); $Ap$ (213, 379, 380, 381, 387); $Mi$ (443); $Ci$ (594) : total = 15

MEDINIPUR : $Ma$ (36, 37, 52, 62); $Op$ (66); $Sa$ (76); $Ap$ (214, 236, 379, 380, 381, 387); $My$ (453, 460, 461, 466, 507); $Ci$ (552, 553, 554, 559, 560, 561, 564, 567, 587) : total = 26

MURSHIDABAD : $Ma$ (5, 6, 12, 56, 62); $Op$ (68); $Sa$ (76); $Ap$ (113, 172, 209, 210, 358, 379, 380, 381, 387); $Mi$ (443); $My$ (455, 473, 499, 504, 531) : total = 22


NORTH 24-PARGANAS : $Ma$ (5, 16, 40, 41, 50, 56, 62); $Sa$ (76); $Ap$ (86, 89, 104, 105, 107, 119, 131, 134, 179, 180, 183, 193, 228, 230, 231, 239, 241, 246, 261, 263, 275, 299, 351, 377, 379, 380, 381, 387, 421, 429); $My$ (447, 462, 479, 480, 481, 482, 483, 486, 488, 493, 506, 510, 512, 517, 519, 523, 527, 530); $Ci$ (539, 549, 559, 560, 561, 568, 570, 571, 578, 595, 596) : total = 69

PURULIYA : $Ma$ (37, 56, 62); $Sa$ (76); $Ap$ (213, 216, 217, 379, 380, 381, 387); $Ci$ (549) : total = 12

SOUTH 24-PARGANAS : $Ma$ (1, 4, 5, 6, 7, 8, 9, 10, 15, 20, 23, 24, 25, 41, 42, 50, 56, 58, 62, 63); $Op$ (70); $Sa$ 972, 73, 74, 75, 76, 77, 79, 80, 81); $Ap$ (205, 208, 213, 222, 233, 235, 236, 248, 258, 262, 269, 271, 274, 275, 281, 295, 299, 317, 338, 358, 368, 379, 380, 381, 387, 394, 402, 425, 426, 432, 435); $My$ (445, 451, 463, 471, 492, 530); $Ci$ (538, 539, 540, 558, 559, 560, 561, 562, 563, 565, 566, 567, 579, 581, 593, 595, 596) : total = 84

WEST DINAJPUR : $Ma$ (21, 23, 56, 62); $Sa$ (76); $Ap$ (224, 379, 380, 381, 387) : total = 10

[Ma = Mastigophora; Sa = Sarcodina; Op = Opalinata; Ap = Apicomplexa; Mi = Microspora; My = Myxozoa; Ci = Ciliata]
Groupwise details of parasitic protozoa of this state along with their host-species are tabulated as follows:

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of</th>
<th>Family</th>
<th>Genera</th>
<th>Species</th>
<th>Host-species</th>
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<td>596</td>
<td>351*</td>
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</table>

(*) less than actual total since 140 hosts are reported with parasites of different groups

From the above cited data it is quite evident that more than 200 species of protozoan parasites embracing 5 phyla are reported from Calcutta and little more than 100 species belonging to 4 phyla are known from Nadia districts. The districts from where 50 or more species are recorded include South 24-Parganas, Darjiling, North 24-Parganas and Hugli.

So far, 133 species of invertebrates and 218 species of vertebrates covering 5 phyla and 11 classes are found to harbour 596 species of protozoan parasites from this state. Out of these, 140 species are reported to be infested/infected with single and the rest with multiple number of parasitic protozoan species, maximum being 20 from the frog, *Rana tigrina*. The goat *Capra hircus* is also found to possess 16 protozoan parasites excluding 49 species of protozoan symbiotes which inhibit the rumen of the goat and will be dealt with in the third part of this treatise. In this connection it is worth mentioning that 9 host-species, all vertebrates and studied in West Bengal since 1870 by many Protozoologists of several Universities and institutes are reported with more than 10 species of parasites. Among these, 4 are fishes (viz. *Catla catla*, *Channa punctata*, *Cirrhina mrigala* and *Labeo rohita*), 3 are amphibians (viz. *Bufo melanostictus*, *Rana limnocharis* and *Rana tigrina*) and 2 are mammals (viz., *Capra hircus* and *Homo sapiens*). This data indicates that many more species of parasitic protozoa may be recovered from such host-species from which single species of Protozoa is reported so far, if different tissues and organs of these hosts are searched thoroughly. The number of parasitic protozoan species will further increase to a considerable extent in this state if new invertebrate and vertebrate hosts are examined for this purpose.
Plate - 1

Figs. 1-4. Showing general structures of parasitic flagellates belonging to the genera *Trypanosoma* (fig. 1); *Giardia* (fig. 2A,B); *Monocercomonas* (fig. 3) and *Trichomonas* (fig. 4).

(Ax - Axostyle; Af - Anterior flagellum; Bl - Blepharoplast; C - Costa; CR - Chromatic ring; Cy - Cytostome; FF - Free flagellum; FL - Flagellum; KL - Kinetoplast; NU - Nucleus; PB - Parabasal body; PE - Pelta; PF - Parabasal filament; TF - Trailing flagellum; UM - Undulating membrane).
**Giardia trophozoite**

- **FL**: Flagellar labyrinth
- **NU**: Nucleus
- **AX**: Axonemes

**Giardia cyst**

- **FL**: Flagellar labyrinth
- **UM**: Uronema
- **NU**: Nucleus
- **KL**: Kinetosome

**References**

1. 431
2. DAS, et al.: Parasitic Protozoa
Figs. 1-10    Showing general structures and life cycle stages of some gregarines parasitizing invertebrate hosts of West Bengal. 1. An aseptate gregarine of earthworms; 2-3. Septate gregarines of coccinellid beetle (fig. 2) and psocopteran insect (fig. 3); 4-10. Life cycle stages of a cephaline gregarine, *Gregarina bilobosa* from Coleopteran insect Fig. 4. Young trophozoite attached to the host gut epithelium. Fig. 5 Fully grown trophozite, Fig. 6. Sporadin. Fig. 7. sporadins in syzygy. Fig. 8 A freshly formed gametocyst with two equal sized gametocysts. Fig. 9 A mature gametocyst with three sporocysts. Fig. 10. A barrel-shaped spore showing linearly arranged sporozoites.

(EP - Epimerite; PR - Protomerite; DE - Deutomerite)
Plate – 3


(IOW - Inner layer of oocyst wall, M - Micropyle, MC - Micropyler cap, OOw - Outer layer of oocyst wall, OR - Oocyst residuum, PG - Polar granule, S - Sporozoite, SB - Steida body, SN - Sporozoite nucleus, SP - Sporocyst, SR - Sporocyst residuum).
DAS, et al.: Parasitic Protozoa

1. EIMERIA OOCYST

2. ISOSPORAN OOCYST

3. Leucocytozoon sp

4. PLASMODIUM IN ERYTHROCYTES
Plate - 4

Figs. 1-2. Showing general structures and some life cycle stages of Piroplasmida. 1A-D. different stages of *Babesia Bigemina* in erythrocytes of bovine host. 2A-D. Different stages of *Theileria parva* in erythrocytes of bovine host. 3. Showing general structures of *Balantidium coli*.

(CY- cytopharynx; NU - Nucleus)
1  *Babesia bigemina*

2  *Theileria parva*

3  *Balantidium coli*
Plate – 5

Figs. 1-6  Showing some haemoflagellates inhabiting fishes of West Bengal. 1A-B. Trypanosoma anabasi Mandal 2A-B. Trypanosoma armeti Mandal. 3. Trypanosoma danilewskyi saccobranchi Qadri. 4. Trypanaosoma batrachi Qadri. 5A-B. Trypanosoma bengalensis Mandal. 6A-B. Trypanosoma choudhuryi Mandal.
Showing six species of haemoflagellates belonging to the genera *Trypanosoma* and *Trypanoplasma* from fishes of West Bengal. 1A-B. *Trypanosoma vittati* Tandon and Joshi. 2A-B. *Trypanosoma indica* Mandal. 3A-B. *Trypanosoma tandoni* Mandal. 4A-B. *Trypanosoma pancali* Mandal. 5. *Trypanosoma cancili* Mandal: 6A-B. *Trypanosoma gobida* Mandal, in press.
Plate – 7

Figs. 1-7  Showing trophozoites of seven species of aseptate gregarines from millipede (Fig. 3) and earthworms of West Bengal (Figs. 1, 2, 4-7). 1. *Nematocystis bengalensis* Ray Chowdhury and Haldar. 2. *Nemaotocystis mauritii* Ray Chowdhury and Haldar. 3. *Chakravartiella sugerieformes* Misra and Ray Chowdhury. 4. *Stomatophora pradhanis* Pradhan and Dasgupta. 5. *Informis informis* Pradhan and Das Gupta. 6. *Informis pseudotentaculatus* Pradhan and Das Gupta. 7. *Bisurculus variegatus* Pradhan and Das Gupta.
Plate – 9

Plate – 10

Figs. 1-24. Showing some myxozoan parasites of fishes of West Bengal. 1. Lateral view of fresh spore of *Leptotheca latesi*. 2. Lateral view of fresh spore of *Leptotheca macronesi*. 3. and 4. Stained spores of *Myxidium calcariferi*. 5. Stained spore of *Myxidium lieberkuhri*. 6. Front view of fresh spore of *Myxidium heteropneusti*. 7 and 8. Stained spores of *Ceratomyxa scatophagi*. 9. Fresh spore of *Zschokkella fossilae*. 10. Fresh spore of *Zschokkella illishae*. 11. Trophozoite of *Chloromyxum amphipnoui*. 12 and 13. Stained spores of *Chloromyxum amphipnoui*. 14-19. Different views of spores of *Myxobolus catiæ* (Fig. 15. side view showing single polar capsule, Fig. 16. showing iodinophilous vacuole, Fig. 17. front view, Figs. 18 & 19. Stained spores). 20-23. Different views of fresh spores of *Myxobolus clarii* (Figs. 20-22. front views; 23. side view). 24 -26. Different views of spores of *Thelohanellus rohitae* (Fig. 24. front view of fresh spore, Figs. 25 & 26. side view of stained spores showing sutural ridge (fig. 25) and polar filament (Fig.26).
Plate – 13

Nyctotheroides cordiformis

Nyctotherus kempi

Sicuophora macropharyngeus
Map 1. Showing district-wise distribution of parasitic protozoans (in number of species) belonging to five different phyla viz., Sarcomastigophora, Apicomplexa, Microspora, Myxozoa and Ciliophora.
Map 2. Showing district wise distribution of parasitic protozoans (in number of species) belonging to three different subphyla viz., Mastigophora, Opalinata and Sarcodina of the Phylum Sarcomastigophora.
Map 3.  Showing district-wise distribution of different groups of the phylum Apicomplexa viz., Gregarina, Adelina, Eimerina, Haemosporina and Piroplasmia in number of species.
SUMMARY

A comprehensive taxonomic account of parasitic protozoa recorded and reported so far from West Bengal is presented in this paper. This includes 596 species of parasitic protozoa belonging to 5 Phyla, 11 Classes, 22 Orders, 63 families and 131 genera, recovered from 351 host-species (133 invertebrate and 218 vertebrate species). Further, diagnostic feature of each species, its detail host and locality record and, district-wise distribution in West Bengal is incorporated. Key to the families, genera and species are also given in this paper for the aid in identification of species.

ACKNOWLEDGEMENT

Sincere thanks are due to Dr. S.K. Bhattacharyya, Scientist-SF- in-charge, Zoological Survey of India, Calcutta for providing facilities for this work and to Dr. A.K. Ghosh, Scientist-SF for critically going through the manuscript.

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Mandal, A.K. Sarkar, N.C. & Kahali, R. 1985. The protozoa *Haemogregarina colisa* sp. nov. from the fish *Colisa fasciatus* and *Haemtraguidium* sp. from *Arius sona* in India. *Bull. zool. Surv. India*, 5(2 & 3) : 139-144.


Roy, K. 1989. Some eugregarines (Sporzoa, Apicomplexa) from the stored fruit beetle, Oryzaephilus mercator Fauv. (Coleoptera) from India. J. Protozool., 36(1) : 20-23.


SYMBIOTIC PROTOZOA

A. K. DAS, A. K. MANDAL AND N. C. NANDI

Zoological Survey of India, Calcutta - 700 053

INTRODUCTION

Symbiotic Protozoa include two major taxonomic groups, namely, the flagellates inhabiting the gut of wood-eating termites and roaches and, the ciliates found in the rumen of ruminant mammals. These protozoa exhibit obligatory mutualistic relationship between them and their hosts. The termite flagellates represent large number of genera and species under several families and orders. The ruminant ciliates on the other hand belong to a few genera under one family Ophryoscoleidae with a very few exceptions.

First publication on termite flagellates from West Bengal was made by Simons (1890) who gave a brief account of two flagellates from the gut of termites of Calcutta without mentioning any generic or specific status of those flagellates and their host. Incidentally this is also the first publication on symbiotic flagellates from India. Then, after a long gap Chakravarty and Banerjee (1956) described three species of hypermastigid flagellates from the gut of an undetermined species of *Heterotermes* from Calcutta. Subsequently Das (1972-77, 1983) made a detailed taxonomic study of flagellate symbiotes from four species of termite hosts of West Bengal and recorded 28 species including 8 new ones. Tiwari (1977, 1978, 1981) also described one new species of hypermastigid and reported several known species of termite flagellates from this state.

So far as ruminant ciliates are concerned Ghosh (1922) is the pioneer worker from West Bengal as well as from India. He (*op. cit.*) dealt with 42 species of ciliates from the rumen contents of cows and goats, procured from public slaughter house located at Tangra, Calcutta. Subsequently Das Gupta (1935), Banerjee (1955) and, Choudhury and Chatterjee (1960) contributed to the subject from this state.

It is worth mentioning here that Ghosh’s aforesaid work has never been referred, till date, by any of his subsequent worker on this group from India and outside. This has caused considerable taxonomic inconvenience since Ghosh (*op. cit.*) described 13 new species and one new genus in the said publication. Original description of these new taxa is very inadequate. But, text-figures of those taxa are of standard quality and reveal many taxonomic features in most of the cases. Under the circumstances, an attempt has been made here to determine proper taxonomic status of these species in the light of current taxonomic knowledge on this group.

In all, 31 species of termite flagellates and 96 species of ruminant ciliates have been reported/collected from this state. These are being dealt with in the present communication. In addition, key to the families, genera and species of these protozoa is also incorporated to facilitate identification of this group.
MATERIAL AND METHODS

Termites were collected from different districts of West Bengal and from different habitats like timber depots, wood and logs, cemented brick built wall, plywood and pitch boards. The living flagellates were studied in fresh smears of gut contents diluted with 67% Locke’s solution or 0.5% saline water. For the collection of ruminant ciliates stomach contents of the ruminant mammals were procured from slaughter houses and diluted with normal saline. For permanent preparation of both termite flagellates and ruminant ciliates uniform smears of the gut contents were drawn on slides, fixed in Schaudinn’s and Carnoy’s fluid, stained in Heidenhain’s and Delafield’s haematoxylin and mounted in DPX.

MORPHOLOGY AND TERMINOLOGY

Most of the terminologies used in this communication have already been dealt with in earlier two papers on Protozoa of West Bengal (Das et al., in press). The remaining ones are represented diagramatically in plates (1–3).

Systematic list of symbiotic protozoa hitherto known from West Bengal

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<td>Oxymonas Janicki</td>
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1. *O. bengalensis* Das *Cryptotermehes havilandi* Calcutta
2. *O. bosei* Das *Neotermes bosei* Jalpaiguri, Koch Bihar
3. *O. grandis* Cleveland *Neotermes bosei* Jalpaiguri, Koch Bihar
4. *O. parvula* Kirby *Cryptotermehes havilandi* South 24-Parganas
   Order TRICHOMONADIDIA
   Family MONOCERCROMONADIDAE
   Genus Tricercomitus Kirby
5. *T divergens* Kirby *Cryptotermehes havilandi* Calcutta
   Family DEVESCOVINIDAE
   Genus Devescovina Foa
6. *D. glabra* Grassi *Cryptotermehes havilandi* Calcutta, Koch Bihar, South 24-Parganas, West Dinajpur
7. *D. lemniscata* Kirby  
*Cryptotermes havilandi*  
Calcutta, South 24-Parganas

8. *D. steini* Das  
*Cryptotermes havilandi*  
Calcutta, South 24-Parganas

Genus *Foaina* Janicki

9. *F. nana* (Kirby)  
*Cryptotermes havilandi*  
South 24-Parganas

10. *F. reflexa* Kirby  
*Cryptotermes havilandi*  
South 24-Parganas

11. *F. solita* Kirby  
*Cryptotermes havilandi*  
South 24-Parganas

Family CALONYMPHIDAE
Genus *Stephanonympha* Janicki

12. *S. minuta* Das and Choudhury  
*Neotermesbosei*  
Jalpaiguri, Koch Bihar

13. *S. pyriformis* Das and Choudhury  
*Cryptotermes havilandi*  
Calcutta, Koch Bihar

14. *S. silvestrii* Janicki  
*Cryptotermes havilandi*  
Calcutta

Order HYPERMASTIGIDA
Family HOLOMASTIGOTIDAE
Genus *Holomastigotoides* Grassi and Foa

15. *H. bengalensis* Chakravarty and Banerjee  
*Heterotermes indicola*  
Calcutta, Jalpaiguri, Koch Bihar, Maldah

*Heterotermes sp.*

*Coptotermes heimi*  
Calcutta  
South 24-Parganas, West Dinajpur

16. *H. campanula* (de Mello)  
*Heterotermes indicola*  
Calcutta, Jalpaiguri, Koch Bihar, South 24-Parganas, West Dinajpur

*Coptotermos heimi*  
Maldah

17. *H. emersoni* Das  
*Coptotermes heimi*  
Calcutta, Jalpaiguri, Murshidabad, South 24-Parganas

18. *H. globosus* de Mello  
*Heterotermes indicola*  
Calcutta, Jalpaiguri, North 24-Parganas

19. *H. hartmanni* Koidzumi  
*Coptotermes heimi*  
Maldah, Murshidabad, North 24-Parganas, West Dinajpur

20. *H. hollandei* Das  
*Heterotermes indicola*  
Maldah, Murshidabad, North 24-Parganas, West Dinajpur

21. *H. magnus* Uttangi  
*Heterotermes indicola*  
Koch Bihar, Maldah, North 24-Parganas
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<th>Heterotermes</th>
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<td><em>H. ogivalis</em> de Mello</td>
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DAS, et. al. : Symbiotic Protozoa

Phylum: CILIOPHORA
Class: KINETOFragMINIPHOREA
Order: TRICHOStOMATIDA
Family: ISOTRICHIDAE
Genus: Dasytricha Schuberg

32. *D. ruminantium* Schuberg  
    *Capra hircus*  
    Genus: Isotricha Stein  
    Calcutta

33. *I. prostoma* Stein  
    *Capra hircus*  
    Calcutta

Order: ENTODINIOMORPHA
Family: OPHRYOSCOLECIDAe
Genus: Diplodinium Schuberg

34. *D. anisacanthum* da Cunha  
    *Capra hircus*  
    Calcutta

35. *D. bengalensis* Chowdhury and Chatterjee  
    *Capra hircus*  
    Calcutta

36. *D. conicum* Ghosh  
    *Capra hircus*  
    Calcutta

37. *D. consors* (Dogiel)  
    *Capra hircus*  
    Calcutta

38. *D. costatum* Dogiel  
    *Capra hircus*  
    Calcutta

39. *D. cristagalli* Dogiel  
    *Capra hircus*  
    Calcutta

40. *D. cylindricum* ghosh  
    Goat  
    Calcutta

41. *D. dentatum* (Stein)  
    Goat  
    Calcutta

42. *D. dicanthum* (Dogiel)  
    Domestic goat  
    Buffalo  
    Calcutta

43. *D. flabellum* Kofoid and Mac Lennan  
    Domestic buffalo  
    Calcutta

44. *D. indicum* Banerjee  
    Cow  
    Calcutta

45. *D. longinucleatum* Chowdhury and Chatterjee  
    Goat  
    Calcutta

46. *D. monacanthum* (Dogiel)  
    Cow  
    Barking deer  
    Darjiling  
    Domestic goat  
    Calcutta

47. *D. minor* (Dogiel)  
    Cow  
    Goat  
    Calcutta

48. *D. pentacanthum* (Dogiel)  
    Sheep  
    Goat  
    Calcutta

49. *D. psittacium* (Dogiel)  
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<td>61</td>
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<td>ghosh</td>
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<td>66</td>
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<td>67</td>
<td><em>E. chatterjeei</em></td>
<td>Das Gupta</td>
<td>Capra hircus</td>
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<td>68</td>
<td><em>E. cylindricum</em></td>
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<td>69</td>
<td><em>E. dogieli</em></td>
<td>comb. nov.</td>
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<td>Buisson</td>
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*E. chatterjeei* and *E. dogieli* are additional records of Barking deer (*Muntiacus muntjak*) in Darjiling.
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<td>71.</td>
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<td>Calcutta</td>
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Host-parasites list of symbiotic protozoa from west Bengal

Phylum: ARTHROPODA
Class: INSECTA
Order: ISOPTERA
Family: KALOTERMITIDAE

1. Cryptotermes havilandi (Sjostedt) Devescovina glabra 
   Devescovina lemniscata Das (1974b); Tiwari and Ray (1981)
2. Neotermes bosei

Oxymonas bosei
Oxymonas grandis
Stephanonympna minuta
Stephanonympna pyriformis

Family RHINOTERMITIDAE

3. Coptotermes heimi
(Wasmann)

Holomastigotoides bengalensis
Holomastigotoides campanula
Holomastigotoides emersoni
Holomastigotoides hartmanni
Holomastigotoides ogivalis
Holomastigotoides rayi
Holomastigotoides sphaeroidalis
Pseudotrichonympna cardiformes
Pseudotrichonympna indica
Pseudotrichonympna subapicalis
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<td>4. Heterotermes incicola</td>
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<td>5. Heterotermes sp.</td>
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<tr>
<td>Spirotrichonympha pyriformis</td>
<td>Chakravarty and Banerjee (1956)</td>
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**Phylum**  |**CHORDATA**
---|---
**Order** |**ARTIODACTYLA**
**Family** |**BOVIDAE**

6. *Bos indicus* Linnaeus
Cow/Domestic cow

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<tr>
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<td>Epidinium bovis</td>
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<tr>
<td>Epidinium caudatum</td>
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State Fauna Series 3: Fauna of West Bengal

7. *Bubalus bubalis* (Linnaeus)
   Buffalo/Domestic buffalo

   - *Diplodinium flabellum* Banerjee (1955)
   - *Entodinium acutonucleatum* Banerjee (1955)
   - *Entodinium acutum* Banerjee (1955)
   - *Entodinium bengalensis* Banerjee (1955)
   - *Entodinium caudatum* Banerjee (1955)
   - *Entodinium chatterjei* Banerjee (1955)
   - *Entodinium dogielii* comb. nov. Banerjee (1955)
     (= *Entodinium elongatum* - a junior homonym)
   - *Entodinium dubardi* Banerjee (1955)
   - *Entodinium indicum* Banerjee (1955)
   - *Entodinium laterale* Banerjee (1955)
   - *Entodinium longinucleatum* Banerjee (1955)
   - *Entodinium rostratum* Banerjee (1955)
   - *Eoadinium lobatum* Banerjee (1955)
   - *Eremoplastron bosis* Banerjee (1955)
   - *Eremoplastron magnodentatum* Banerjee (1955)
   - *Eremoplastron rostratum* Banerjee (1955)
   - *Eudiplodinium maggi* Banerjee (1955)
   - *Ostracodium rugoloricatum* Banerjee (1955)
   - *Dasytricha ruminantium* Das Gupta (1935)

8. *Capra hircus* Linnaeus
   Goat/Domestic goat

   - *Diplodinium anisacanthus* Das Gupta (1935)
   - *Diplodinium bengalensis* Chowdhury and Chatterjee (1960)
   - *Diplodinium conicum* Ghosh (1922)
Diplodinium consors
Diplodinium costatum
Diplodinium cristagalli
Diplodinium cylindricum
Diplodinium dentatum
Diplodinium dicanthum
Diplodinium indicum
Diplodinium longinucleatum
Diplodinium monacanthum
Diplodinium minor
Diplodinium pentacanthum
Diplodinium psittacium
Diplodinium quadridentatum
Diplodinium tetracanthum
Diplodinium triacanthum
Diplodinium tuberculatum
Diploplastron affine
Elytroplastron bubali
Entodinium anteronucleatum
forme dilobum
Entodinium anteronucleatum
forme leaf
Entodinium anteronucleatum
forme monolobum
Entodinium biconcavum
Entodinium brevispinum
Entodinium bursa
Entodinium carinospinum
(= Entodinium lobospinosum)

Das Gupta (1935)
Das Gupta (1935)
Das Gupta (1935)
Ghosh (1922)
Chowdhury and Chatterjee (1960)
Chowdhury and Chatterjee (1960)
Chowdhury and Chatterjee (1960)
Chowdhury and Chatterjee (1960)
Chowdhury and Chatterjee (1960)
Chowdhury and Chatterjee (1960)
Ghosh (1922)
Chowdhury and Chatterjee (1960)
Chowdhury and Chatterjee (1960)
Chowdhury and Chatterjee (1960)
Das Gupta (1935)
Das Gupta (1935)
Das Gupta (1935)
Das Gupta (1935)
Entodinium caudatum  
Entodinium chatterjeei  
Entodinium cylindricum  

Entodinium dogieli com. nov. (= Entodinium elongatum a junior homonym)  
Entodinium dubardi  
Entodinium ellipsoideum  
Entodinium elongatum  
Entodinium ekendrae  
Entodinium furca forma dilobum  
Entodinium harendrae  
Entodinium jumnapari  
Entodinium laterale  
Entodinium longinucleatum  
Entodinium minutum  
Entodinium mukundai  
Entodinium muntiacum  
Entodinium nanellum  
Entodinium nudum  
Entodinium ovatum  
Entodinium ovinum  
Entodinium ovoidonucleatum  
Entodinium quadrispinosum  
Entodinium rectangulatum  
Entodinium rhomboideum  
Entodinium setnai  
Entodinium simplex  
Entodinium spinosum  
Entodinium submammilatum  
Epidinium cattanei
9. *Ovis* sp.
Sheep/Domestic sheep

- **Epidinium caudatum**
  - Ghosh (1922); Das Gupta (1935)
- **Epidinium ecaudatum**
  - Das Gupta (1935)
- **Epidinium parvicaudatum**
  - Chowdhury and Chatterjee (1960)
- **Epidinium quadriculaudatum**
  - Ghosh (1922)
- **Epidinium tricaudatum**
  - Ghosh (1922)
- **Eremoplastron brevispinum**
  - Das Gupta (1935)
- **Eremoplastron rostratum**
  - Das Gupta (1935)
- **Eudiplodinium maggii**
  - Das Gupta (1935)
- **Isotricha prostoma**
  - Das Gupta (1935)
- **Metadinium medium**
  - Das Gupta (1935)
- **Ophryoscolex inermis**
  - Ghosh (1922)
- **Ophryoscolex tricoronatus**
  - Das Gupta (1935)
- **Polyplastron bengalensis**
  - Chowdhury and Chatterjee (1960)
- **Diplodinium pentacanthum**
  - Banerjee (1955)
- **Elytroplastron bubali**
  - Banerjee (1955)
- **Entodinium acutum**
  - Banerjee (1955)
- **Entodinium dubardi**
  - Banerjee (1955)
- **Entodinium furca**
  - Banerjee (1955)
- **Entodinium formae dilobum**
- **Entodinium longinucleatum**
  - Banerjee (1955)
- **Entodinium nanellum**
  - Banerjee (1955)
- **Entodinium parvicaudatum**
  - Banerjee (1955)
- **Eudiplodinium maggii**
  - Banerjee (1955)

**Family CERVIDAE**

10. *Muntiacus muntjak*
Barking deer

- **Diplodinium monacanthum**
  - Banerjee (1955)
- **Entodinium dubardi**
  - Banerjee (1955)
- **Entodinium longinucleatum**
  - Banerjee (1955)
- **Entodinium muntiacum**
  - Banerjee (1955)
- **Eudiplodinium maggii**
  - Banerjee (1955)

**Miscellaneous**

11. Host not mentioned

- **Ophryoscolex eberleini**
  - Ghosh (1922)
SYSTEMATIC ACCOUNT

Subkingdom  PROTOZOA
Phylum       SARCOMASTIGOPHORA
Subphylum    MASTIGOPHORA
Class        ZOOMASTIGOPHOREA
Order        OXYMONADIDA
Family       OXYMONADIDAE

Diagnosis: Both attached (sessile) and motile phases present; attached phase with a conspicuous rostellum anterior end of which forming a tubular or flattened outgrowth for attachment with hosts' intestine; in motile phase rostellum less conspicuous; blepharoplasts 2 in number located near the shoulder of the axostyle; flagella 2 pairs – one pair arising from each blepharoplast; axostyle present; uni – or multinucleate, occurring in the intestine of kalotermitid termites.

Genus  Oxymonas  Janicki

Diagnosis: Predominantly uninucleate, axostyle conspicuous resembling a slender stilleto, a pennant or a broad scimitar; recurvant portion of axostyle often extending backward from the holdfast into the body.

Key to the species

1. Axostyle slender resembling a stilleto, nucleus with a karyosome
2
   Axostyle broad resembling a scimitar, nucleus without any karyosome............. O. grandis
2. Karyosome large, central or slightly eccentric surrounded by a distinct halo, axostyle never projecting beyond the posterior part of the body..................................................3
   Karyosome minute, eccentric, not surrounded by halo, axostyle slender and sometimes projecting far beyond the posterior part of the body............................................. O. parvula
3. Body broadly ovoidal, axostyle extending slightly below the nucleus............. O. bosei
   Body sub-elliptical, axostyle reaching upto the posterior end of the body............................... O. bengalensis

1. Oxymonas bengalensis  Das  


Diagnosis: Body usually subelliptical with pointed posterior end; dimensions 68(42.5-98.6) \( \mu m \times 16.6(15.3-17) \) \( \mu m \); rostellum very conspicuous, occasionally bifurcating at its anterior end; axostyle stout and stilleto-shaped, reaching posterior end of the body; nucleus ovoid, karyosome large, round, centrally located and surrounded by a distinct halo.

Host:  Cryptotermes havilandi  (Sjostedt); location: gut.

Distribution: India: West Bengal (Calcutta district)
2. Oxymonas bosei Das


Diagnosis: Body broadly ovoidal, dimensions 204.6 (172-236.2) μm x 38.2 (31-48.6)μm; rostellum conspicuous, axostyle stilleto-shaped extending little below the nucleus; nucleus elliptical, karyosome large, ovoid, almost centrally located, surrounded by a distinct halo.

Host: Neotermes bosei Snyder; location: gut

Distribution: India: West Bengal (Jalpaiguri and Koch Bihar districts).

Remarks: This species was collected from the gut of preserved termite specimens (preserved in 70% alcohol) applying some special methodology (see Das, 1974). Tiwari and Ray (1981) also collected this species from Jalpaiguri district from the gut of the type host.

3 Oxymonas grandis Cleveland


Diagnosis: Body ellipsoid, often irregular, dimensions 158.3 (78.7-266.2) μm x 30.7 (18.7-45) μm; rostellum conspicuous; axostyle resembling a scimitar in shape, recurvant portion of axostyle also conspicuous; nucleus ovoid, karyosome absent.

Host: Neotermes bosei Snyder; location: gut.

Distribution: India: West Bengal (Jalpaiguri and Koch Bihar districts).

Remarks: Das (1974) reported this species from West Bengal from Jalpaiguri and Koch Bihar districts. Subsequently Tiwari and Ray (1981) also collected this species from Jalpaiguri district from the gut of Neotermes bosei.

4. Oxymonas parvula Kirby


Diagnosis: Body ovoid or slender with round or truncate posterior end; dimensions 31.1 (23.8.45.9) μm x 5.9 (3.4-8.5) μm rostellum minute or as large as body length; axostyle slender, projecting sometimes far beyond the posterior end of the body; nucleus oval or round, karyosome small spherical, eccentric and not surrounded by halo.

Host: Cryptotermes havilandi (Sjostedt); location: gut

Distribution: India: West Bengal (South 24-Parganas district).
Order TRICHOMONADIDA

Key to the families

1. Nucleus single, mastigont also single with 3 to 6 flagella.................................2
2. Nucleus multiple, four flagella attached to each mastigont..............................................Family CALONYMPHIDAE

2. Three anterior flagella and a stout trailing flagellum, generally adherent in part to the body surface, cresta present..........................Family DEVESCOVINIDAE

Three to six flagella present, trailing flagellum free or adherent, but without any cresta..............................................Family MONOCERCOMONADIDAE

Family MONOCERCOMONADIDAE

Genus Tricercomitus Kirby

Diagnosis: Small, with 3 anterior flagella and a very long trailing flagellum, adhering to body surface until close to posterior end; nucleus far anterior, no endosome, relatively large blepharoplast with a parabasal body and an axial filament.

5. Tricercomitus divergens Kirby


Diagnosis: Ellipsoid, more rounded posteriorly, 7-15 μm × 3-4 μm in dimension; three anterior flagella and one stout trailing flagellum, axial filament distinct.

Host: Cryptotermes havilandi (Sjostedt); location: gut.

Distribution: India: West Bengal (Calcutta district).

Family DEVESCOVINIDAE

Key to the genera

Trailing flagellum 1 to 1-5 times the length of the body, parabasal body spiralled around axostyle or posterior part of the nucleus 1/2 turn to 5 turns..............................Genus Devescovina

Trailing flagellum exceeding twice the length of the body, parabasal body not coiled around exostyle)..............................................Genus Poaina

Genus Devescovina Foa

Key to the species

1. Trailing flagellum cord shaped, (posteromedial edge of cresta longer than anteromedial)............................................................................................................D. glabra
Trailing flagellum band shaped........................................................................................................2

2. Body elongated with pointed posterior end, axostyle bent and sinuous........................................................................................................... D lemniscata

Body ovoidal with broadly round posterior end, axostyle a straight rod protruding out from the posterior part of the body............................................................................ D. steini

6. Devescovina glabra Grassi


Diagnosis : Body elongated with pointed posterior end, 34-44.2 μm × 10.2-15.3 μm in dimensions, trailing flagellum cord shaped, cresta varying from 5.7 μm to 6.2 μm, posteromedial edge of cresta longer than anteromedial edge; parabasal body usually turning 1-5 times around the axostyle, axostyle straight or little curved with stout anterior and filamentous posterior end.

Host : Cryptotermes havilandi (Sjostedt), location : gut.

Distribution : India : West Bengal (Calcutta, Koch Bihar and West Dinajpur districts).

Remarks : Das (1974) was the first to report this species from West Bengal. Subsequently Tiwari and Ray (1981) collected it from Koch Bihar and West Dinajpur districts from the above mentioned termite host.

7. Devescovina lemniscata Kirby


Diagnosis : Body more or less pyriform with bluntly pointed posterior end, 51-71. 4 μm × 11.9-22.1 μm in dimensions; trailing flagellum resembling a broad ribbon in its middle part; cresta measuring 11-12.7 μm with broad proximal and pointed distal end, number of parabasal turns varying from 1-4; one turn of parabasal observed in specimens from the host, Cryptotermes havilandi, axostyle bent or sinuous in posterior portion of the body.

Host : Cryptotermes havilandi (Sjostedt), location : gut.

Distribution : India : West Bengal (Calcutta and South 24-Parganas districts).

Remarks : Das (1974) observed an interesting phenomenon of cytoplasmic extrusion in this species. In a nutshell, this phenomenon consists of an extrusion of a major cytoplasmic mass from the posterior part of the body and development of remaining small anterior portion as a full fledged adult organism.
8. *Devescovina steini* Das


*Material examined*: 21 exs., Jagannathpur (Falta), South 24-Parganas, 2.vi. 1971, Coll. A.K. Das.

*Diagnosis*: Body ovoidal with broadly round posterior end, 34-44.2 μm X 18.7 - 25.5 μm in dimension; trailing flagellum broad ribbon like, parabasal body turning twice around the axostyle in a close spiral; axostyle stout at anterior end gradually tapering and ultimately protruding out of the posterior part of the body to a considerable length.

*Host*: *Cryptotermes havilandi* (Sjostedt); *location*: gut.

*Distribution*: India: West Bengal (Calcutta and South 24-Parganas districts).

Genus *Foaina* Janicki

Key to the species

1. Parabasal body with 'U' shaped bend.................................................................*F. reflexa*
   Parabasal body without such bend...........................................................................2

2. Parabasal body with a long free filament, conspicuous clear area anterolateral to anterior end of the capitulum.............................................................................*F. nana*
   Parabasal body short and restricted to dorsal side of nucleus, conspicuous clear area anterolateral to anterior end of capitulum absent....................................................*F. solita*

9. *Foaina nana* (Kirby)


*Material examined*: 10 exs., Jagannathpur (Falta), South 24-Parganas, 2. vi. 1977, Coll. A.K. Das.

*Diagnosis*: Small, 11.9-21.6 μm X 3.44-6.8 μm in dimensions; anterior flagela slender, three in number and longer than the body length; trailing flagellum resembling a stout cord having 2-4 times the length of the body; a well marked clear area visible anterolateral to the anterior end of capitulum; cresta long and narrow; parabasal body generally running over dorsal side of posterior portion of nucleus; axostyle moderately stout projecting out from the posterior end of the body.

*Host*: *Cryptotermes havilandi* (Sjostedt); *location*: gut.

*Distribution*: India: West Bengal (South 24-Paraganas district).

10. *Foaina reflexa* Kirby


*Material examined*: 7 exs., Jagannathpur (Falta), South 24-Parganas, 2. vi. 1971, Coll. A. K. Das.
Diagnosis: Body ovoidal, 25.5-42.5 μm × 15.5-28 μm in dimension, anterior flagella three in number and equal to the length of the body, trailing flagellum resembling a stout cord, but occasionally band shaped exceeding twice the body length; cresta long but narrow; part of the parabasal body near blepharoplast showing a ‘U’-shaped bend; axostyle stout, projecting out of posterior part of the body to a distance of 10.2 to 18.0 μm.

Host: Cryptotermes havilandi (Sjostedt); location: gut.

Distribution: India: West Bengal (South 24-Paraganas district).

Remarks: Kirby (1942) observed a clear area anterolateral to the capitulum of the axostyle. However, such area is not traceable in present specimens (see Das, 1977).

11. Foaina solita Kirby


Material examined: 8 exs., Jagannathpur (Falta), South 24-Parganas, 2, vi. 1971, Coll. A.K. Das.

Diagnosis: Small, dimensions 7.6-17 μm × 3.2 - 9.2 μm; anterior flagella similar to those of F. nana in structure and number; trailing flagellum resembling a stout cord with a length 2-5 times the length of the body; parabasal body short and restricted to dorsal side of nucleus; axostyle moderately stout with or without enlarged cusp and projecting out from posterior part of the body.

Host: Cryptotermes havilandi (Sjostedt), location: gut.

Distribution: India: West Bengal (South 24-Parganas district).

Family CALONYMPHIDAE
Genus Stephanonympha Janicki

Diagnosis: Oval but plastic, numerous nuclei spirally arranged in the anterior half; karyomastigont present; axial filament forming a bundle.

Key to the species

1. Nuclei arranged in a single spiral series..........................S. minuta
   Nuclei arranged in more than one spiral series..........................2

2. Nuclei arrange in 2-3 spiral series..........................S. silvestrii
   Nuclei arranged in 8-9 spiral series..........................S. pyriformis

12. Stephanonympha minuta Das and Choudhury


Diagnosis: Body oval with broad anterior and bluntly pointed posterior ends, 28-26 μm × 20-29.7 μm in dimensions; nuclei oval, 6-10 in number and set closely to form a single spiral series near the anterior end of the body.

Host: Neotermes bosei Snyder; location: gut.

Distribution: India: West Bengal (Jalpaiguri and Koch Bihar districts).

Remarks: This species of flagellate was recovered from the gut of such host species which had been preserved in alcohol for long period.

13. Stephanonympha pyriformis Das and Choudhury


Diagnosis: Body shape pyriform with bluntly pointed posterior end, 70.2-86.7 μm × 38-47.5 μm in dimensions, nuclei ovoid or slightly elongated, numerous and embedded in a series of 8-9 concentric spirals occupying almost one-third portion of anterior end of the body; axial bundle running through the middle of the body and reaching almost its posterior extremity.

Host: Cryptotermes havilandi (Sjostedt) and Neotermes bosei Snyder; location: gut.

Distribution: India: West Bengal (Calcutta, Koch Bihar and South 24-Parganas districts).

Remarks: Das and Choudhury (1972) described this species from the termite host Cryptotermes havilandi collected from Calcutta. Tiwari and Ray (1981) recorded this species from Koch Bihar district from both the above mentioned hosts.

14. Stephanonympha silvestrii Janicki


Diagnosis: Oval or rounded, 45-56.2 μm × 31.5-41.2 μm in dimension; nuclei fusiform containing distinct chromatin granules and embedded closely in 2 or 3 spiral series occupying anterior portion of the body; axial bundle extending in the same fashion as in the preceding species.

Host: Cryptotermes havilandi (Sjostedt); location: gut

Distribution: India: West Bengal (Calcutta district).

Remarks: Grassi (1971) described two varieties of Stephanonympha silvestrii from termites, one from Cryptotermes havilandi and the other from Neotermes erythraeus and named them as S. silvestrii var. cryptotermes havilandi and S. silvestrii var. neotermes erythrei, respectively. Kirby (1926) changed these clumsy quadrinominals to S. havilandi and S. erythrei respectively. Accordingly, Das and Choudhury (1972) reported S. havilandi from West Bengal.

Since S. silvestrii and S. havilandi are identical in all morphological characters except in dimensions the latter is rightly considered by Grassi (1917) as the variety of the former and,
therefore, can not be considered as a separate species. Hence \textit{S. havilandi} which has been earlier recorded from West Bengal (Das and Choudhury, 1972) is synonymised under \textit{S. silvestrii} (see Das, 1983).

**Order HYPERMASTIGIDA**

Key to the families

1. Flagella arranged in spiral rows........................................................................................................2
   Flagella not arranged in spiral rows, (flagella not in tufts, posterior portion of the body not flagellated)..............................................................................................................Family EUCONYMPHIDAE

2. Spiral rows of cilia 12-40, a mass of dense cytoplasm usually surrounding ovoid nucleus near anterior end.............................................................Family HOLOMASTIGOTIDAE
   Spiral rows of cilia comparatively less in number, flagella deeply embedded in cytoplasm in anterior region, arising from one to several bands.............................................................Family SPIROTRICHONYMPHIDAE

**Family HOLOMASTIGOTIDAE**

Genus \textit{Holomastigotoides} Grassi and Foa

\textit{Diagnosis} : As for the family

Key to the species

1. Prenuclear zone present.........................................................................................................................2
   Prenuclear zone absent.........................................................................................................................9

2. Posterior portion of the body glabrous...............................................................................................3
   Posterior portion of the body not glabrous...........................................................................................4

3. Posterior one-fifth of the body without any flagella.................................................................\textit{H. magnus}
   A small posterior portion of the body without any flagella and longer flagella occupying the posterior most portion of the body.........................................................\textit{H. bengalensis}

4. Flagella of uniform size.......................................................................................................................5
   Flagella of the posterior portion of the body much longer.................................................................6

5. Body exactly spherical in shape.......................................................................................................\textit{H. spheroidalis}
   Body resembling an ‘inverted cup’ with finger-like projection at the anterior end..........................\textit{H. ogivalis}

6. Longer flagella occupying the posterior fifth of the body.........................................................\textit{H. rayi}
   Longer flagella occupying only the posterior extremity of the body................................................7

7. More or less round in shape, having moderately projected finger-like elevation with apical pit at anterior end........................................................................................................\textit{H. hollandai}
   Body oval, elliptical or club-shaped without any apical pit at anterior end........................................8
8. Body elliptical or club-shaped with considerable elevation at anterior end forming a
nipple-like structure....................................................R. emersoni
Body oval or elliptical and slightly narrowed at anterior end..................H. hartmanni

9. Body resembling a bell jar without any apical knob............................H. campanula

15. *Homomastigotoides bengalensis* Chakravarty and Banerjee


*Diagnosis*: Body more or less oval, occasionally elliptical, anterior end bluntly pointed
resembling a nipple and posterior end rounded; 8.3-107.1 μm in dimension; flagella of two
types, shorter ones covering a major portion of the body in dexiotropic manner, leaving a small
glabrous portion; this portion without having any flagella; longer flagella occupying posterior
most portion of the body; axostyle well developed extending almost up to posterior extremity
of the body; prenuclear zone conical and densely granulated.

*Hosts*: *Heterotermes indicola* (Wasmann), *Heterotermes* sp and *Coptotermes heimi* (Wasmann);
location: gut

*Distribution*: India: West Bengal (Calcutta, Jalpaiguri, Koch Bihar, Maldah, South 24-Parganas
and West Dinajpur districts).

*Remarks*: Das (1974), Tiwari (1978) and, Tiwari and Ray (1981) reported this species from
Calcutta, South 24- Parganas and West Dinajpur districts respectively.

16. *Holomastigotoides campanula* (de Mello)


5 exs., Berhampur, Murshidabad, 24.iii. 1984, Coll. A.K. Das; 3 exs., Sainthia, Birbhum, 12.iv.1984,

*Diagnosis*: Body resembling exactly a bell jar without apical knob; 42.5-69.1μm X 56.1-73.3μm
in dimension; flagella of two types, shorter ones arranged all over the body in dexiotropic rows
and longer ones restricted to posterior extremity of the body; axostyle short but district, prenuclear
zone absent.

*Hosts*: *Heterotermes indicola* (Washman), *H. malabaricus* Snyder; *Coptotermes heimi* (Wasmann);
location: gut.

*Distribution*: India: West Bengal (Birbhum, Calcutta, Jalpaiguri, Murshidabad and South
24-Parganas districts); Diu, Karnataka.
17. **Holomastigotoides emersoni** Das


*Diagnosis*: Body elliptical or club-shaped, maximum width being near posterior half of the body; anterior end of the body considerably elevated forming a nipple like structure and posterior end broadly round; flagella of two types, shorter ones covering major portion of the body dexiotropically and longer ones restricted only to posterior extremity; axostyle indistinct; dense and homogeneous prenuclear zone present.

*Host*: *Coptotermes heimi* (Wasmann); *location*: gut.

*Distribution*: India: West Bengal (Calcutta, Jalpaiguri, Murshidabad and South 24-Parganas districts).

18. **Holomastigotoides globosus** de Mello


*Diagnosis*: Body typically oval; 90.5-124.1 μm X 56.1-81.6 μm in dimensions; flagella of one type covering entire body dexiotropically, axostyle moderately developed reaching almost middle of the body; prenuclear zone lacking.

*Hosts*: *Heterotermes indicola* (Wasmann), *H. malabaricus* Snyder, *Coptotermes* sp.; *location*: gut.

*Distribution*: India: West Bengal (Calcutta, Jalpaiguri and North 24-Parganas districts); Daman, Diu and Karnataka.

19. **Holomastigotoides hartmanni** Koidzumi


*Diagnosis*: Oval or elliptical with slightly narrowed anterior end, 93.75-175.5 μm X 63.65-86.25 μm in dimensions; flagella of two types, shorter ones covering the entire body dexiotropically and longer ones restricted to posterior extremity of the body; prenuclear zone well developed.

*Host*: *Coptotermes heimi* (Wasmann); *location*: gut.

*Distribution*: India; West Bengal (South 24-Parganas district).

*Remarks*: Tiwari (1978) reported this species from West Bengal.

20. **Holomastigotoides hollandei** Das


Diagnosis: Body more or less round with finger like projection at the anterior end bearing apical pit; 45.9-96 μm x 30.6-73.1μm in dimensions; posterior extremity of the body, thickly studded with much longer flagella; axostyle fibrillar and well developed, reaching obliquely almost the posterior part of the body; prenuclear zone conspicuous.

Host: Heterotermes indicola (Wasmann); location: gut.

Distribution: India: West Bengal (Maldah, Murshidabad, North 24-Parganas and West Dinajpur districts).

Remarks: Das (1974) described this species from North 24-Parganas, West Bengal while Tiwari and Ray (1981) reported it from Murshidabad and West Dinajpur districts.

21. Holomastigotoides magnus Uttangi

1962. Holomastigotoides magnus Uttangi, J. Karnatak Univ., 7, p. 188.


Diagnosis: Body comparatively large and ovoidal; both anterior and posterior ends broadly round, 100.3-170 μm X 74.8-102 μm in dimensions; flagella of one type covering major portion of the body dexiotropically leaving a posterior glabrous region measuring about one-fifth of the body length; axostyle fibrous and moderately developed reaching beyond the middle of the body; prenuclear zone clearly visible in stained preparation.

Distribution: India: West Bengal (Koch Bihar, Maldah and North 24-Parganas districts); Gujarat and Karnataaka.

22. Holomastigotoides ogivalis de Mello


Diagnosis: Body shape resembling an inverted cup with a blunt finger like elevation at the anterior end; 71.4-91.8 μm x 34-74.8 μm in dimension; shorter flagella covering the entire body dexiotropically while longer flagella thickly set at the posterior extremity of the body; axostyle short but distinct; prenuclear zone present.

Hosts: Coptotermes heimi (Wasmann); Coptoptermes sp.; location: gut.

Distribution: India: West Bengal (Birbhum, Jalpaiguri, Medinipur, Murshidabad and South 24-Parganas districts); Daman and Karnataaka.
23. **Holomastigotoides rayi** Karandikar and Vittal


**Diagnosis**: Body oval, sometimes with apical pit, 88.4-125.8 μm X 61.2-70.5 μm in dimensions; flagella of two types, first type covering the body dextriotropically while the second type, sometimes longer (Das, 1976), sometimes of almost equal length (Karandikar and Vittal, 1954) setting irregularly around one- fifth of the posterior region of the body; axostyle faintly visible; prenuclear zone distinct in stained preparation.

**Host**: *Coptotermes heimi* (Wasmann); **location**: gut.

**Distribution**: India: West Bengal (Birbhum, Medinipur, Murshidabad and South 24-Parganas districts); Karnataka.

24. **Holomastigotoides spheroidalis** de Mello


**Diagnosis**: Body spherical, 67.5-86.2 μm in diameter; flagella of one type, covering entire body dextriotropically; nucleus circular and located very near a point at anterior end from which flagellar bands seem to diverge out; axostyle well developed, prenuclear zone distinct.

**Hosts**: *Coptotermes heimi* (Wasmann),  *Coptotermes sp.*; *Heterotermes indicola* (Wasmann), *Heterotermes malabaricus* Snyder; **location**: gut.

**Distribution**: India: West Bengal (Birbhum, Calcutta, Koch Bihar districts); Daman and Karnataka.

**Family**: SPIROTRICHONYMPHIDAE

**Genus**: Spirotrichonympha Grassi and Foa

Diagnosis: Elongate, pyriform, flagella deeply embedded in cytoplasm in anterior region, arising from one to several bands; mass of dense cytoplasm conical and its base indistinct.

**Key to the species**

1. Axostyle distinct.......................................................................................................................... 2
   Axostyle absent............................................................................................................................ 3

2. Body pyriform with finger-like projection at anterior end bearing a hyaline apical cap
   ...................................................................................................................................................... S. roonwali
Body cone-shaped, conspicuously long flagella spreading out from posterior surface in a brush-like manner................................................................. $S. \text{froilanoi}$

3. Body pear-shaped with average dimension $30.02 \mu m \times 1.46 \mu m$ with 5 chromosomes................................................................. $S. \text{pyriformis}$

Body pear-shaped with average dimensions $50.4 \mu m \times 27.3 \mu m$; nucleus with 6 chromosomes.................................................................$S. \text{bhadeswarensis}$

25. Spirotrichonympha bhadeswarensis


Diagnosis: Body more or less pear-shaped with pointed anterior and slightly compressed posterior end, a short tubule originating at the anterior end; nucleus spherical, located at anterior third of the body having scattered choromatin granules and 6 chromosomes; axostyle not found.

Host: Coptotermes heimi (Wasmann), location: gut.
Distribution: India: West Bengal (Hugli district).
Remarks: Tiwari (1978) described this species from West Bengal.

26. Spirotrichonympha froilanoi Karandikar and Vittal


Diagnosis: Body cone-shaped, anterior portion narrowed to a blunt end and posterior extremity broadest, $20.4-42.5 \mu m \times 11.9-27.2 \mu m$ in dimensions; nucleus round and located near anterior third of the body; four flagellar bands originating from the centroblepharoplast, covered by apical operculum; conspicuously long flagella spreading out from posterior surface in a brush-like manner; axostyle distinct and cord-like in post nuclear region extending obliquely towards posterior extremity and occasionally protruding out from the body.

Hosts: Coptotermes heimi (Wasmann), Heterotermes malabaricus Snyder; location: gut.
Distribution: India: West Bengal (Birbhum, Jalpaiguri, South 24-Parganas and West Dinajpur districts); Karnataka.
Remarks: Earlier Das (1974) and, Tiwari and Ray (1981) reported this species from West Bengal.

27. Spirotrichonympha pyriformis Chakravarty and Banerjee


Diagnosis: Body pear-shaped, anterior end terminating to a point, average dimensions $30.02 \mu m \times 15.48 \mu m$; nucleus spherical, located at anterior third of the body, possessing eccentric nucleus, scattered chromatin granules and chromosomes; axostyle not found.
Host: *Heterotermes indicola* (Wasmann), *Heterotermes* sp., location: gut.

Distribution: India: West Bengal (Calcutta and West Dinajpur districts).

Remarks: Chakravarty and Banerjee (1956) described this species from Calcutta and Tiwari and Ray (1981) reported it from Balurghat, West Dinajpur district.

28. *Spirotrichonympha roonwali* Das


Diagnosis: Body pyriform in shape with a finger-like projection at anterior end bearing a hyaline apical cap or operculum, greatest width near posterior end of the body, nucleus more or less round located below anterior third of the body; axostyle thin extending beyond the middle of the body.

Host: *Coptotermes heimi* (Wasmann), location: gut.

Distribution: India: West Bengal (Birbhum, Maldah, South 24-Parganas and West Dinajpur districts).


Family EUCONYMPHIDAE

Genus *Pseudotrichonympha* Grassi and Foa

Diagnosis: Anterior portion consisting of apical cap and campanula; campanular surface covered with three types of flagella, first type shortest and immobile strictly confined to rostral tube, second type longest and arranged below frist type in a thick circular band, third type arranged in longitudinal rows in leiotropic manner covering rest of the body excepting short glabrous end.

Key to the species

1. Campanula anterior and medially placed.................................................................2
   Campanula disposed obliquely one side of the median axis and distinctly subapical........

   ............................................................................................................................................P. subapicalis

2. Body heart-shaped with sphaerita like microorganisms.................................P. cardiformis
   Body elongated and truncated at both ends, (nucleus with scattered chromatin granules).................................................................P. indica

29. *Pseudotrichonympha cardiformis* Karandikar and Vittal


Diagnosis: Body typically heart-shaped, anterior part consisting of bell-like campanula demarcated by a faintly stained circlet-like line from the rest of the body; campanula placed mid apically at anterior end of the body; nucleus spherical and located generally above the middle region of the body, endoplasm with sphaerita-like micro-organisms.

Hosts: Coptotermes heimi (Wasmann), Heterotermes indicola (Wasmann), Heterotermes malabaricus Snyder; location: gut.

Distribution: India: West Bengal (Birbhum, Darjiling, Jalpaiguri, Koch Bihar, Maldah, Medinipur, Murshidabad and South 24-Parganas districts); Karnataka.

Remarks: Earlier Das (1974) and, Tiwari and Ray (1981) reported this species from West Bengal.

30. Pseudotrichonympha indica Chakravarty and Banerjee


Diagnosis: Body much elongated with its broadest part being almost near the middle; 165-221.2 μm × 22.5-52.5 μm in dimensions; campanular region very short in comparison to body length; campanula located mid apically at anterior end; nucleus more or less round located near middle of the body (rarely near posterior region) containing scattered chromatin granules.

Hosts: Coptotermes heimi (Wasmann), Heterotermes indicola (Wasmann), Heterotermes sp.; location: gut.

Distribution: India, West Bengal (Birbhum, Calcutta, Darjiling, Koch Bihar, Maldah, Murshidabad and South 24-Parganas districts).

Remarks: Chakravarty and Banerjee (1956) described this species from Calcutta, West Bengal. Subsequently Das (1974) and, Tiwari and Ray (1981) reported it from this state.

31. Pseudotrichonympha subapicalis Karandikar and Vittal


Diagnosis: Body generally rounded, swollen anteriorly and narrowed posteriorly to a blunt end; 172.5-205 μm × 82.5-90 μm in dimension; campanula disposed obliquely one side of the median axis and distinctly subapical; nucleus spherical, located at anterior region of the body (occasionally in the middle).

Hosts: Coptotermes heimi (Wasmann); Heterotermes indicola (Wasmann); location: gut.

Distribution: India; West Bengal (South 24-Parganas district), Karnataka.
Remarks: Tiwari (1978) reported this species from West Bengal from the gut of *Heterotermes indicola*.

<table>
<thead>
<tr>
<th>Phylum</th>
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<tr>
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**Diagnosis**: Cytostome located at or near antapical pole, body ovoid with uniform dense somatic ciliation, in stomach of ruminants.

**Key to the genera**

Body ovoid with dense longitudinal ciliary rows, karyophore present.............. *Isotricha*

Body oval, cilia in longitudinal spiral rows, karyophore lacking.............. *Dasytricha*

**Genus** *Dasytricha* Schuberg

32. *Dasytricha ruminantium* Schuberg


**Diagnosis**: Oval, flattened, 50-75 μm X 30-40 μm in dimensions, ciliation uniform, characterised by arrangement of cilia in spiral rows.

**Host**: Capra hircus; **location**: stomach.

**Distribution**: India: West Bengal (Calcutta district); Karnataka.

**Remarks**: Das Gupta (1935) recorded this species from West Bengal from the stomach contents of goat collected from the slaughter house of Tangra, Calcutta.

**Genus** *Isotricha* Stein

33. *Isotricha prostoma* Stein


**Diagnosis**: Body ovoid, with dense longitudinal rows, 80-195 μm × 53-85 μm.

**Host**: Capra hircus; **location**: stomach.

**Distribution**: India: West Bengal (Calcutta district), Karnataka.

**Remarks**: Das Gupta (1935) reported this species from the stomach contents collected from the slaughter house at Tangra, Calcutta.

**Order** ENTODINIOMORPHOA

**Family** OPHRYOSCOLECIDAE

**Diagnosis**: Synciliary tufts limited mainly to oral or adoral area, skeletal plates usually present, number of contractile vacuoles variable (1-15), in the stomach of artiodactylan ruminants and in one species in rodent (in guineapig).
Key to the genera

1. Adoral zone of membranelles at truncate anterior end, without dorsal zone of membranelles and skeletal plate................................................................................................................... Entodinium
   With both adoral and dorsal zones of membranelles, with or without skeletal plate...... 2

2. Without any skeletal plate, both adoral and dorsal zones located at the same level.... 3
   With skeletal plate, adoral and dorsal zones at the same or at different level............. 4

3. Macronucleus straight, rod-like beneath the dorsal surface.................................. Eodinium
   Macronucleus with its anterior third bent ventrally at an angle of 30°-90° beneath the right side of the body................................................................. Diplodinium

4. Adoral and doral zones located at same level.......................................................... 5
   Adoral and dorsal zones located at different level..................................................... 11

5. With one skeletal plate............................................................................................. 6
   With more than one skeletal plates............................................................................. 8

6. Skeletal plate narrow............................................................................................ 7
   Skeletal plate broad, (cytopharyngeal fibrils thick extended to posterior end)........... Ostracodinium

7. Macronucleus triangular or rod-like, anterior end of which often bent ventrally......
   ............................................................................................................................ Eremoplastron
   Macronucleus rod-like with its anterior end enlarged to form a hook, opening dorsally................................................................. Eudiplodinium

8. Two skeletal plates beneath the right surface, no other skeletal plate present......... 9
   Two skeletal plates beneath the right surface plus other additional plates............. 10

9. Macronucleus with 2-3 distal lobes .............................................................. Metadinium
   Macronucleus narrow rod-like .............................................................................. Diploplastron

10. Three longitudinal plates beneath left surface connected by cross bars in addition to one or two skeletal plates beneath right surface ........................................ Polyplastron
    A small plate beneath ventral surface and a long plate below left side, (conspicuous fibrils beneath dorsal-right side) ......................................................... Elytroplastron

11. Elongate and twisted around the main axis, dorsal zone behind the anterior end of body, three skeletal plates with secondary plates, two contractile vacuoles....... Epidinium
    Body not twisted around main axis, dorsal zone lying some distance behind anterior end, encircling three-fourth the distance around the middle of the body, three skeletal plates, 9-15 contractile vacuoles in two rows.............................. Ophryoscolex

* Genus Triplodinium described by Ghosh (1921) could not be included in the key due to its inadequate description.
Genus *Diplodinium* Schuberg

So far, 20 species of *Diplodinium* have been reported from this state.

Key to the species

1. Body with caudal fan ending in spines ........................................................................... 2
   Body without any caudal fan as above ........................................................................... 3

2. Left side of the body extending posteriorly, forming a caudal fan with 2 to 7 spines, dorsal surface of the body without spine ...........................................*D. cristagalli*
   Right side of the body extending posteriorly, forming caudal fan with 5 to 7 spines, posterior dorsal surface with 2 small spines ...........................................*D. flabellum*

3. Body with broad and truncated posterior end .............................................................. 4
   Body with narrow or conical posterior end .................................................................. 6

4. Posterior end of the body with 3 small unequal lobes with a slit between them and placed somewhat laterally .................................................................*D. tuberculatum*
   Posterior end of the body with 6 spines ..................................................................... 5

5. All caudal spines incurved, macronucleus heavy, rod-like ...........................................*D. dentatum*
   Caudal spines straight, only the dorsal one slightly incurved, macronucleus very elongated .................................................................*D. longinucleatum*

6. Posterior end of the body provided with a preanal sickle-shaped spine, movably jointed with the body .................................................................*D. consors*
   Posterior end of the without such spine ..................................................................... 7

7. Posterior end of the body tapering and conical ............................................................ 8
   Posterior half of the body triangular ......................................................................... 14

8. With one caudal spine .................................................................................................. 9
   With more than one caudal spines .............................................................................. 11

9. Longitudinal cuticular groove present along the right surface of the body, with relatively large ventral spine .................................................................*D. monacanthum*
   Longitudinal cuticular groove absent, ventral spine relatively small ......................... 10

10. Ventral spine thin and acute, macronucleus stout rod-like .........................................*D. psittaceum*
    Ventral spine thick, with pronounced caudal lobe, macronucleus large .....................
    .................................................................................................................................... *D. indicum*

11. With two caudal spines ............................................................................................. 12
    With three caudal spines .......................................................................................... 13
    With four caudal spines ............................................................................................ 12
    With five caudal spines ............................................................................................. 12
With six caudal spines ................................................................................................•.. 13

12. A distinct longitudinal cuticular groove present along right dorso-lateral surface, macronucleus heavy rod-like with its anterior third bent vertically at an angle ............... ................................................................. D tetraconatum
Longitudinal cuticular groove lacking, macronucleus elongated band-like .................. D quadridentatum

13. Posterior end with a central rounded process surrounded by six short spines, macronucleus elongated .......................................................................................... D cylindricum
Posterior end with six spines but without any central rounded process; macronucleus stout rod-like with its anterior end bent vertically at an angle ...................... D anisacanthum

14. Body irregularly conical, a second conical process on the longer side of the body displacing peristome on one side .......................................................... D conicum
Body oval or broadly oval without any second conical process .......................... 15

15. Body broadly oval, endoplasmic sack extending into operculum ................. 16
Body oval, endoplasmic sack not extending into operculum .......................... D minor

16. Body 80-180 μm in length, macronucleus slender hook-like with two distinct limbs .......................................................... D costatum
Body 63-86 μm, macronucleus broad and heavy with rounded anterior and posterior ends and without any sharp concavity on ventral side .......................... D bengalensis

34. Diplodinium anisacanthum da Cunha


Diagnosis: Body marked by a tapering of posterior half, giving it somewhat a conical shape, a longitudinal cuticular groove along dorso-lateral surface, 46-67 μm in length, with 6 caudal spines - one ventral, one dorsal and 2 on each side; macronucleus stout rod-like with its anterior end bent vertically at an angle.

Hosts: Bos indicus and Capra hircus; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district); Karnataka.

Remarks: Das Gupta (1935) recorded this species from West Bengal from the host Capra hircus.

35. Diplodinium bengalensis Chowdhury and Chatterjee


Diagnosis: Body broadly oval and truncated anteriorly, 63-86 μm in length; on right side a narrow cuticular dorsal thickening starting from the dorsal zone of memberanellae and running posteriorly up to the anus forming an angular projection; ventral lobe of ectoplasmic thickening forming a prominent smooth rounded projection without any caudal spine.

Host: Goat; location: stomach (rumen).
**Distribution**: India: West Bengal (Calcutta district).

36. *Diplodinium conicum* Ghosh


**Diagnosis**: Body irregularly conical, widest anteriorly and somewhat flattened laterally, 110\(\mu\)m in length; a second conical process on the longer side of the body displacing peristome on one side; cuticular thickening more anteriorly and less so posteriorly round the anal canal; macronucleus stout, short and band-like.

*Host*: Goat; *location*: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

37. *Diplodinium consors* (Dogiel)


**Diagnosis**: Body oval, both dorsal and ventral surfaces strongly convex, 65-108 \(\mu\)m in length; posterior end of the body provided with a preanal sickle shaped spine movably joined with the body; endoplasmic sac simple, not extending anteriorly into the operculum; macronucleus relatively short and broad.

*Host*: *Capra hircus*; *location*: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Das Gupta (1935) found this species in one case only in the rumen of *Capra hircus* from West Bengal.

38. *Diplodinium costatum* Dogiel


**Diagnosis**: Body broadly oval, truncated anteriorly and triangular posteriorly, 80-180 \(\mu\)m in length, a narrow longitudinal cuticular thickening extending along right dorsal surface from the anterior end to the anus, endoplasmic sac having an anterior diverticulum extending into the operculum, macronucleus in the form of hook with two distinct limbs.

*Host*: *Capra hircus*; *location*: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Das Gupta (1935) observed this species from West Bengal in two cases in the rumen of *Capra hircus*.

39. *Diplodinium cristagalli* Dogiel

Diagnosis: Body triangular in lateral view, 77-100 μm in length; left side of the body extending posteriorly to form a prominent caudal fan with two to seven spines; macronucleus hatchet-shaped, its anterior end not strongly developed.

Host: Capra hircus; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

Remarks: Das Gupta (1935) reported this species from the rumen of Capra hircus from Calcutta.

40. Diplodinium cylindricum Ghosh


Diagnosis: Body cylindrical, subtruncate at both ends, anterior end with three irregular lobes, 100 μm in length; posterior end with a central rounded process, surrounded by six short spines directed towards the centre.

Host: Goat; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

41. Diplodinium dentatum (Stein)


Diagnosis: Body relatively short and heavy, posterior end of the body broad and truncated, compressed laterally, 65-82 μm in length; with six large incurved caudal spines, ventral spine longest, dorsal spine a continuation of a heavy longitudinal dorsal rib; macronucleus heavy rod-like with its anterior third bent vertically at an angle.

Host: Goat; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

Remarks: Choudhury and Chatterjee (1960) reported this species from this state from the rumen contents of goat.

42. Diplodinium dicanthum (Dogiel)


Diagnosis: Body relatively short and heavy, tapering posteriorly, 50-70 μm in length; both dorsal and ventral surfaces convex but dorsal convexity greater; with two caudal spines ventral spine long and a second smaller spine on the right latero-ventral portion of the body; a distinct longitudinal cuticular groove present along the right dorso-lateral surface.

Hosts: Bos gaurus, domestic goat and buffalo. location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district); Karnataka.
Remarks: Banerjee (1955) and Chowdhury and Chatterjee (1960) reported this species from West Bengal from the rumen of domestic buffalo and goat respectively.

43. Diplodinium flabellum Kofoid and Mac Lennan


Diagnosis: Body laterally compressed, roughly triangular in lateral view, tapering rapidly from mid-region to rounded posterior end, 82-118 μm in length; right side extending posteriorly forming a prominent caudal fan with five to seven spines, spines may simple, bifurcate, even trifurcate; macronucleus stout rod-like.

Hosts: Bos indicus and domestic buffalo; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

Remarks: Banerjee (1955) recorded this species from West Bengal from domestic buffalo.

44. Diplodinium indicum Banerjee


Diagnosis: Somewhat oval with flattened anterior and tapering extremities, 130-180 μm in length; left posterior extremity ending in a curved spine and right posterior extremity ending in a blunt posterior lobe; macronucleus larger in size.

Hosts: Cow and goat; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

Remarks: Banerjee (1955) described this species from West Bengal from rumen of cow, subsequently Chowdhury and Chatterjee (1960) recorded it from domestic goat.

45. Diplodinium longinucleatum Chowdhury and Chatterjee


Diagnosis: Body relatively elongate, anterior and posterior ends sharply truncated and laterally compressed, 83-104 μm in length; with six large and prominent caudal spines, ventral spine being longest; dorsal spine slightly incurved and the rest of the spines almost straight, macronucleus very elongated, slender and rod-like.

Host: Goat; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

46. Diplodinium monacanthum (Dogiel)


Diagnosis: Morphologically similar to D. dicanthum except in spination, 50-68 μm in length, with single caudal spine, 10-17 μm in length; a longitudinal cuticular groove present along the right-dorso-lateral surface.

Hosts: Bos gaurus, cow, goat and Barking deer; location: stomach (rumen).
Distribution: India: West Bengal (Calcutta and Darjiling districts); Karnataka.

Remarks: Banerjee (1955) was the first to report this species from West Bengal in the rumen of cow and barking deer. Subsequently Chowdhury and Chatterjee (1960) recorded it from this state from domestic goat.

47. Diplodinium minor (Dogiel)


Diagnosis: Body oval, truncated anteriorly, strongly compressed laterally and somewhat triangular in lateral views in the posterior third of the body, 53-80 μm in length; a narrow longitudinal cuticular line extending along right dorsal surface from the base of outer dorsal furrow to dorsal edge of the anal opening; endoplasmic sack not extending into the operculum; macronucleus relatively stout and hatchet-shaped.

Hosts: Bos gaurus, Muntiacus muntjak and domestic cow and goat; location: stomach (intestine).

Distribution: India: West Bengal (Calcutta district); Karnataka, Orissa.

Remarks: Banerjee (1955) and Chowdhury and Chatterjee (1960) recorded this species in the rumen of cow and goat respectively from West Bengal.

48. Diplodinium pentacanthum (Dogiel)

1927. Anoplodinium denticulatum forma pentacanthum Dogiel, Arch. Protistenk., 59, p. 82.

Diagnosis: Morphologically similar to D. dicanthum excepting number and disposition of caudal spines; caudal apine five in number, one relatively large ventral spine, a second smaller spine on lateroventral edge of the right surface, a third small spine on dorsal edge, the fourth spine present on laterodorsal edge of the right side and the fifth one on the left side.

Hosts: Bos gaurus, domestic goat and sheep; location: stomach (intestine).

Distribution: India: West Bengal (Calcutta districts); Karnataka.

Remarks: Banerjee (1955) and Chowdhury and Chatterjee (1960) recorded this species from this state from the hosts sheep and goat respectively.

49. Diplodinium psittacium (Dogiel)


Diagnosis: Body rounded, 95-150 μm in length, laterally compressed; oral area relatively small in diameter, operculum short but conspicuous and relatively broad; a low narrow rib arising on the posterior half of ventral mid line and ending at anus in short acute spine; a flange arising in the posterior quarter of the dorsal mid-line and disappearing near anus; macronucleus a stout rod.

Gists: cow and goat; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district); Tamil Nadu.
**Remarks**: Chowdhury and Chatterjee (1960) recorded this species in the rumen of domestic goat from this state.

50. *Diplodinium quadridentatum* Ghosh


**Diagnosis**: Body band-shaped and tapering at both ends; four curved caudal spines placed at equal distance from one another; macronucleus elongated, band-like.

**Host**: Goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

51. *Diplodinium tetracanthum* (Dogiel)


**Diagnosis**: Morphologically similar to *D. dicanthum* excepting number and disposition of caudal spines; 53-56 μm in length, one large ventral spine, second smaller spine, on right latero-ventral edge, third small spine on dorsal edge and the fourth spine on left lateroventral edge.

**Hosts**: *Bos gaurus*, goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district); Karnataka.

**Remarks**: Chowdhury and Chatterjee (1960) recorded this species from West Bengal in the rumen of goat.

52. *Diplodinium tricanthum* (Dogiel)


**Diagnosis**: Morphologically similar to *D. dicanthum* excepting spination, 64 μm in length, caudal spines three in number; disposition of these spines as in *D. tetracanthum* but, spine on right laterodorsal edge lacking.

**Hosts**: *Bos gaurus* and goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district); Karnataka.

**Remarks**: Chowdhury and Chatterjee (1960) recorded in the rumen of domestic goat from this state.

53. *Didinium tuberculatum* Ghosh


**Diagnosis**: Body elongately oval, wide in the middle, tapering anteriorly and rounded posteriorly; 100 μm in length; posterior end with three unequal lobes, with a slit between them and placed somewhat laterally; macronucleus elongated, stout and band-like.

**Host**: Goat; **location**: stomach (rumen).
Distribution: India: West Bengal (Calcutta district).

54. **Diploplastron affine** (Dogiel and Fedorowa)


**Diagnosis:** Body small, oval, operculum small, two skeletal plates near right surface, contractile vacuoles two; macronucleus narrow rod-like; endoplasmic sac extending posteriorly beyond anterior end of rectum; rectum narrow and tubular.

**Host:** *Capra hircus*; **location:** stomach (rumen).

**Distribution:** India: West Bengal (Calcutta district).

**Remarks:** Das Gupta (1935) observed this species once only in the rumen of *Capra hircus* in Calcutta. This is so far the only record of this species from India.

Genus **Elytroplastron** Kofoid and Mac Lennan

55. **Elytroplastron bubali** (Dogiel)


**Diagnosis:** Body ellipsoidal, 90-195 μm in length, laterally compressed and posterior end smoothly rounded without lobes or spines; oral area relatively large, inclined ventrally, four skeletal plates—two extending diagonally from the edge of adoral membranellae zone across the middle of the body, gradually fading in that region, one very short triangular plate on left ventral side just behind left adoral zone, the fourth plate lying beneath the left surface, extending posteriorly and dorsally from the base of the operculum; contractile vacuoles four, macronucleus elongate with a deep indentation in its left dorsal side.

**Hosts:** *Bos indicus, Capra hircus*, sheep; **location:** stomach (rumen).

**Distribution:** India: West Bengal (Calcutta district); Tamil Nadu.

**Remarks:** Das Gupta (1935) and Banerjee (1955) recorded this species from West Bengal in the rumen of *Capra hircus* and domestic sheep respectively.

Genus **Entodinium** Stein

As many as 43 species of *Entodinium* have been reported so far from West Bengal.

**Key to the species**

1. Without any caudal process .......................................................... 2
   With caudal lobes or spines .......................................................... 13

2. Macronucleus not extending beyond posterior half of the body .......... 3
   Macronucleus extending beyond posterior half of the body ............... 4

3. Body elongately oval, usually slightly compressed laterally with posterior end rounded; ratio of length to breadth 1.45 ............................... *F. anteronucleateus f. laeve*
   Body broadly oval, dorsal, ventral and lateral surface exhibiting marked convexity,
both anterior and posterior ends almost rounded, ratio of length to breadth 1.21........
.......................................................................................................................... E. mukundai

4. Small or very small, usually upto 50 μm in length ................................................. 5
Medium sized or large usually above 50 μm in length ............................................. 12

5. Very small, almost spherical, with 9-15 μm in diameter .................. E. minutum
Small, not spherical, length above 20 μm ................................................................. 6

6. Body elongated or elongated oval ............................................................... 7
Body ovoid or broadly oval ......................................................................................... 9

7. Body markedly elongated, length-breadth ratio 2.35, endoplasmic sac with a characteristic
concavity ............................................................................................................. E. dogieli
Body elongated oval, length-breadth ratio 1.5-1.75, endoplasmic sac without any concavity
........................................................................................................................................ 8

8. Macronucleus ovoidal to spherical and located at the middle of dorsal side, body
dimensions 26-35 μm × 15-18 μm ................................................................. E. chatterjeei
Macronucleus band-shaped closely applied against dorsal surface of the body and
confined to anterior two-thirds, body dimensions 38-50 μm × 21-29 μm ..................
........................................................................................................................................ 11

9. Posterior end of the body smoothly rounded, anal canal not very prominent .......... 10
Posterior end of the body not smoothly rounded, anal canal very prominent ........... 11

10. Macronucleus thin wedge-shaped, broader anteriorly and lying along the dorsal mid-line,
contractile vacuole single ................................................................. E. nanellum
Macronucleus thick, band-shaped extending almost up to posterior end, contractile
vacuoles two in number ......................................................................................... E. nudum

11. Macronucleus large, variable in size, contractile vacuole single, situated to the left of
anterior end of macronucleus ........................................................................... E. dubardi
Macronucleus large, sausage-shaped, contractile vacuoles two, situated to the left of
both anterior and posterior ends of macronucleus ............................................. E. ovatum

12. Body stoutly ellipsoid, anterior end flattened and posterior end rounded, macronucleus
large cylindrical ........................................................................ E. bursa
Body regularly oval with somewhat truncate anterior end and rounded posterior end,
macronucleus large, sausage-shaped .............................................................. E. ovinum

13. With only one caudal process ................................................................. 14
With more than one caudal processes ..................................................................... 25

14. Caudal process in the form of a prominent ventral lobe ..................................... 15
Caudal process in the form of preanal spine ............................................................ 33

15. Posterior dorsal region not with biconcave areas ............................................ 16
Posterior dorsal region with biconcave bilateral areas ................................................. \textit{E. biconcavum}

16. Macronucleus located at anterior half of the body ........................................ 17
Macronucleus located at or extending beyond the middle of the body ................ 18

17. Body elongated, posterior end provided with a bent ventral lobe, macronucleus short
and massive ................................................................. \textit{E. anteronucleatum f. monolobum}
Body broadly oval, posterior end provided with a large smoothly rounded ventral lobe,
macronucleus large, broadly oval ........................................ \textit{E. jumnapari}

18. Body ellipsoid or oval .................................................................................................. 19
Body elongated or rhomboidal .......................................................... 22

19. Macronucleus short stout or band-like, posterior end of the body forming a large
rounded process with a finger-like projection ................................................. \textit{E. elliposoidum}
Macronucleus large, posterior end of the body with prominent ventral lobe ........ 20

20. Body oval, macronucleus sausage-shaped or club-shaped with slightly thickened anterior
end ........................................................................ \textit{E. harendrai}
Body ellipsoideal, macronucleus elongate or band-shaped, (ventral lobe blunt and
prominent, contractile vacuole single lying close against the left side of macronucleus)
................................................................. \textit{E. longinucleatum}

21. Body rhomboidal, posterior end terminating in a large ventral lobe ...... \textit{E. rhomboidum}
Body elongated, posterior end terminating in a short ventral lobe ..................... 22

22. Body elongated with a short and bent ventral lobe, macronucleus very large, band-
shaped extending almost from anterior to posterior end .......................... \textit{E. elongatum}
Body elongated cylindrical, with short smoothly rounded ventral lobe, macronucleus
short slightly elongated rod-like ................................................................. \textit{E. cylindricum}

23. Ventral spine parallel to main axis, macronucleus broad wedge-shaped .... \textit{E. brevispinum}
Ventral spine curved dorsally, macronucleus band-shaped ............................... 24

24. Body long and slim, ventral spine large, curved dorsally ........................ \textit{E. rostratum}
Body oval, truncate anteriorly and rounded posteriorly, ventral spine small, inwardly
directed near centre ................................................................................ \textit{E. spinosum}

25. With two caudal processes ................................................................................. 26
With more than two caudal processes ................................................................ 30

26. Both the processes more or less lobe-like ......................................................... 27
Only one process lobe-like and the other resembling spine....................... \textit{E. carinospinosum}

27. Caudal lobes of almost same size, more or less pointed, separated by a distinct bay
.................................................................................................................. \textit{E. furca} f. \textit{dilobum}
Caudal lobes of different disposition, ventral preanal lobe more prominent than dorsal
lobe .................................................................................................................. 78
28. Macronucleus elongated, sausage-shaped ........................................... *E. anteronucleatum* f. dilatum
Macronucleus narrow elongated, some what constricted in middle and bent posteriorly ................................................................. *E. submammillatum*  

29. Dimensions 50-60 µm, macronucleus spherical situated near the middle of the body, commensal in the rumen of goat ................................................................. *E. severti*
Dimensions 25-40 µm, macronucleus spherical or oval situated at anterior part of the body, commensal in the rumen of barking deer ........................................... *E. mucronatum*  

30. With three caudal processes ................................................................................................................................. 31
With more than three caudal processes ....................................................................................................................... 41  

31. Posterior end with two rounded processes and a projecting keel on one side.............................................................. *E. mammilocaudatum*
Posterior end with dorsal and ventral spines sometimes with lateral spine or lobe ................................................................. 32  

32. With one dorsal and two ventral spines one on each side of ventral lobe ........... 33
With one dorsal and one ventral spine, and one lateral lobe or spine .......... 40  

33. Posterodorsal region with bilateral biconcave areas, (oval in shape, dorsal spine broad triangular, ventral spines large, macronucleus short to long band-like) ................................................................. *E. acutum*
Posterodorsal region without bilateral biconcave area ........................................... 34  

34. Body compressed laterally ................................................................................................................................. 35
Body not laterally compressed ................................................................................................................................. 38  

35. Ventral and right side of the body continued posteriorly in a flange-like ventral spine occupying one-third of the circumference of the body ................. *E. rectangularum*
Ventral spine not such flange-like or well developed ........................................... 36  

36. Macronucleus elongated, extending along four-fifths of the dorsal mid-line ........ 37
Macronucleus broad wedge-shaped, one-half to two-third of the body-length ................................................................. *E. laterale*  

37. Dorsal spine relatively broad than two ventral spines, body short and stout, 25-39 µm in length ................................................................. *E. acutonucleatum*
Dorsal and ventral spines are almost equal, body more or less oval with slightly tapering ends, 35-50 µm in length ................................................................. *E. bengalensis*  

38. Body oval, with elongated laterally flattened dorsal spine, spirally curved towards dorsal side, macronucleus sausage-shaped ................................................................. *E. caudatum*
Body broadly oval, dorsal spine not spirally curved or laterally composed, macronucleus ovoid ................................................................. 39  

39. Body 25-30 µm in length, dorsal spine as long as the body ................. *E. ovoidonucleatum*
Body 30-35 µm in length, dorsal spine not very long ........................................... *E. eckertiae*
40. Body short, broad, ellipsoid, 22-23 μm in length, three prominent ribs running the length of the body, right ventral rib blade-like, lying in the lateral side. 

........................................................................................................................................... *E. tricostatum*

Body broad, 25-40 μm in length, spines long triangular, larger one lying on the left side  ........................................................................................................... *E. indicum*

41. Body elongated, somewhat barrel-shaped, more tapering posteriorly, posterior end with four inwardly curved spines, contractile vacuole single  ........................................................................... *E. quadrispinosum*

Body irregularly and broadly oval, strongly convex dorsally, posterior end bent ventrally and provided with fine elongated recurved spines, contractile vacuoles two............................................................................................... *E. subsphericum*

56. *Entodinium acutonucleatum* Kofoid and MacLennan


*Diagnosis*: Body short and stout, laterally compressed, 25-39 μm in length, dorsal surface continued posteriorly in a sharp, relatively broad, dorsal spine curving ventrally; ventral lobe with two small spines, one on each side curving dorsal ward; macronucleus elongated extending along four-fifths of the dorsal mid-line.

*Hosts*: Cow and Buffalo; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district); Karnataka, Tamil Nadu.

*Remarks*: Banerjee (1955) reported this species from the rumen contents of buffalo collected in Calcutta.

57. *Entodinium acutum* Kofoid and MacLennan


*Diagnosis*: Body oval, laterally compressed, convex on both dorsal and ventral surfaces, 30-65 μm in length; a broad triangular posterodorsal spine and two large caudal spines present, all the three spines of nearly equal length; contractile vacuole single located near dorsal mid-line to the left of macronucleus; macronucleus short to long band-like.

*Hosts*: Cow, buffalo and sheep; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district), Tamil Nadu.

*Remarks*: Banerjee (1955) reported this species from the rumen contents of buffalo and sheep, collected from different abattoir in Calcutta.

58. *Entodinium anteronucleatum* froma dilobun Dogiel


*Diagnosis*: Body elongated oval, usually slightly compressed laterally; posterior end of the body provided with two lobes- ventral preanal lobe and dorsal lobe, the former more prominent; macronucleus short and massive not extending beyond the middle of the body.
Host: *Capra hircus*; Location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

59. *Entodinium anteronucleatum* forma *laeve* Dogiel


Diagnosis: General organisation as in *E. anteronucleatum* forma *dilobum* but posterior end of the body rounded and without any caudal process.

Host: *Capra hircus*; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

60. *Entodinium anteronucleatum* forma *monolobum* Dogiel


Diagnosis: General organisation as in *E. anteronucleatum* forma *laeve* excepting that posterior end of the body provided with short preanal ventral lobe bent dorsalwards like a hook.

Host: *Capra hircus*; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

61. *Entodinium bengalensis* Banerjee


Diagnosis: Body more or less oval with slightly tapering ends, dorsal surface concaves, ventral surface nearly flat; 35-40-μm in length; posterior end provided with three caudal spines-one arising from dorsal side, one from ventral side and the third from the right extremity of the body; all the spines of almost equal length, sharply pointed and incurved; macronucleus elongated with knob-like posterior extremity.

Host: Buffalo; location: stomach (rumen).

Distribution: India West Bengal (Calcutta district).

62. *Entodinium biconcavum* Kofoid and MacLennan


Diagnosis: Body oval, laterally compressed; 28-41 μm in length, both dorsal and ventral surfaces strongly convex; posterior dorsal region of the body depressed laterally, forming bilateral concave areas, a small blunt ventral lobe, the only caudal projection; macronucleus short stumpy to long thin band-like.

Hosts: *Bos indicus*; *Capra hircus*; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district); Tamil Nadu.

Remarks: Das Gupta (1935) recorded this species from rumen contents of goat collected from a public abbatoir at Tangra (Calcutta).
63. **Entodinium brevispinum** Kofoid and MacLennan


**Diagnosis**: Body oval, 26-36 μm in length, laterally compressed with dorsoventral diameter greatest near anterior end; both dorsal and ventral surfaces convex; ventral spine small, parallel to main axis; macronucleus broad wedge-shaped, one-half to two-thirds of the body length.

**Hosts**: Cow and Goat; **location**: Stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district); Tamil Nadu.

**Remarks**: Chowdhury and Chatterjee (1960) recorded this species from West Bengal from the rumen contents of goat.

64. **Entodinium bursa** Stein


**Diagnosis**: Body stoutly ellipsoid, 80-121 μm × 52-83 μm in dimensions, anterior end flattened and posterior end rounded, cytostome relatively large; contractile vacuole single, lateral laying somewhat behind anterior end; macronucleus large, cylindrical extending almost from oral end to posterior end of the body.

**Host**: Capra hircus; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

65. **Entodinium carinospinosum** Ghosh


**Diagnosis**: Body somewhat barrel-shaped, anterior end truncate with broad oral area; posterior end provided with two processes—one preanal gently rounded (resembling keel) and the other a spine; contractile vacuole single; macronucleus band-like.

**Host**: Goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Dogiel (1927) described *E. loboso-spinosum* and Das Gupta (1935) recorded this species from the rumen contents of Capra hircus from Calcutta without referring Ghosh's work (1922). The characteristic features of this species is quite similar with *E. carinospinosum*. Hence the former is synonymised with the latter.

66. **Entodinium caudatum** Stein


**Diagnosis**: Body oval, 35-50 μm in length; three caudal processes of different shape; of these processes the dorsal spine longest, elongated and laterally flattened curved spirally dorsal
wards; other two processes preanal and lobe-like, right lobe triangular with pointed end directed backward and left one not so broad but more rounded than right; macronucleus sausage-shaped, fitting closely against the dorsal margin of the body.

Hosts: Goat and buffalo; location: stomach (rumen)

Distribution: India: West Bengal (Calcutta district).

Remarks: Das Gupta (1935) and Banerjee (1955) recorded this species from West Bengal from rumen contents of *Capra hircus* and buffalo respectively.

67. *Entodinium chatterjeei* Das Gupta


Diagnosis: Body elongated oval, 26-35 μm long, broad anteriorly, gradually tapering towards posterior end; posterior end rounded without any caudal process, ventral side slightly concave or flattened; macronucleus ovoidal to spherical situated in the middle of dorsal side.

Hosts: Buffalo and goat; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

Remarks: Das Gupta (1935) and Banerjee (1955) reported this species from West Bengal from *Capra hircus* and buffalo respectively.

68. *Entodinium cylindricum* Chowdhury and Chatterjee


Diagnosis: Body elongated and cylindrical in lateral view, 24-35 μm in length, dorsal and ventral surfaces convex, greatest diameter at anterior two-thirds, posterior end almost rounded: dorsal surface ending posteriorly in a lip-like structure and ventral surface terminating in a short smoothly rounded lobe; macronucleus a short slightly elongated massive rod, thicker at its posterior end and situated at the mid dorsal region of the body.

Host: Goat; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta District).

69. *Entodinium dogielii* comb. nov.


Diagnosis: Body considerably elongated, ventral surface almost flat, dorsal surface slightly convex, 41-50 μm × 17-22 μm in dimensions, posterior end obliquely truncated and without any caudal process; contractile vacuole single lying towards anterior end of macronucleus; macronucleus short, thick, symmetrical and rounded at both poles.

Hosts: Buffalo and goat, location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

Remarks: Dogiel (1927) described a new species of *Entodinium* and named it as *E. elongatum*. Since name of this Dogiel's species is preoccupied by Ghosh (1922) it becomes a junior homonym.
Hence it is named as *E. dogieli* comb. nov. after the name of the author. Mention is to be made here that Das Gupta (1935) and Banerjee (1955) reported this species from Calcutta from *Capra hircus* and buffalo respectively under the name *E. elongatum*.

70. *Entodinium dubadi* Buisson


*Diagnosis*: Body oval, anterior end truncated, strongly flattened latterally, 25-55 μm in length, ectoplasmic expansions of the sides relatively large, anal canal prominent, contractile vacuole single, lying left of anterior end of macronucleus; macronucleus large, band-shaped or sausage-shaped, somewhat narrowed posteriorly.

*Hosts*: Buffalo, goat, sheep and Barking deer, *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta and Darjiling districts) orissa.

*Remarks*: Das Gupta (1935) was the first to report this species from Calcutta as well as from India from the rumen contents of goat, *Capra hircus*. Subsequently Banerjee (1955) recorded it from Calcutta from buffalo and sheep and from Darjiling from the host, Barking deer, *Muntiacus muntjak*.

71. *Entodinium ellipsoideum* Ghosh


*Diagnosis*: Body ellipsoid, slightly flattened; anterior end truncate, entirely occupied by peristome; posterior end forming a large rounded process with a finger-like projection; contractile vacuoles two located at posterior half of the body, at the side opposite to that of the macronucleus; short, stout and band like.


*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Kofoid and MacLennan (1927) also described a species of *Entodinium* and named it as *E. ellipsoideum*. This species is recorded from Tamil Nadu (see Bhatia, 1936) from the host *Bos indicus*. Since name of this Kofoid and MacLennan’s species is precoccupied by Ghosh (1922) it is named as *Entodinium kofoidi* comb. nov. after the name of the senior author.

72. *Entodinium elongatum* Ghosh,


*Diagnosis*: Body elongated, 65 μm in length somewhat flattened laterally and tapering at both ends; anterior end narrow, truncate, posterior end broadly conical and pointed and, with a slightly curved rounded process on one side; contractile vacuole two, lying near macronucleus; macronucleus elongated and band-like.

*Host*: Goat; *location*: stomach (rumen).
**Distribution**: India: West Bengal (Calcutta district).

73. *Entodinium ekendrae* Das Gupta


*Diagnosis*: Body broadly oval, 30-35 μm x 28-30 μm in dimensions; three caudal processes of different shapes; one of these a long spine, 18-20 μm in length arising from right side and the other two smaller and hook-like arising from left side; dorsal side convex, ventral side flat, contractile vacuole single lying close to anterior end of macronucleus; macronucleus broadly oval lying near anterior end of the body.

*Host*: *Capra hircus*; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

74. *Entodinium furca* forma *dilobum* Dogiel


*Diagnosis*: Body elongated oval, broadest at posterior third of the body; two caudal processes in the form of laterally flattened lobes, convex along their outer margins and concave along the inner margins; macronucleus sausage-shaped extending about the two-thirds the length of the dorsal margin of the body.

*Hosts*: Goat and sheep; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Das Gupta (1935) and Banerjee (1955) reported this species from West Bengal from the hosts goat, *Capra hircus* and sheep respectively.

75. *Entodinium harendra* Chowdhury and Chatterjee


*Diagnosis*: Body oval, 27-44 μm x 20-33 μm in dimensions, dorsal surface convex, ventral surface with little anterior curvature and then ending in a short but broad smoothly rounded lobe, reaching anal opening; posterior end truncated without any caudal process; macronucleus large, sausage-shaped or club-shaped; contractile vacuole single lying dorsal side anterior to macronucleus.

*Host*: Goat; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

76. *Entodinium indicum* Kofoid and MacLennan


*Diagnosis*: Body oblong in lateral outline, laterally compressed, tapered anteriorly towards the contracted oval opening and terminating posteriorly in three long terminal spines—one dorsal, one
ventral and one large spine on left side; contractile vacuole 25-40 μm in length, single, lying close to left side of the macronucleus; macronucleus wedge-shaped, situated in the mid-dorsal line.

**Hosts**: Cow and Buffalo; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district)

**Remarks**: Banerjee (1955) reported this species from West Bengal from the rumen contents of buffalo.

77. *Entodinium jumnapari* Chowdhury and Chatterjee


**Diagnosis**: Body broadly oval, both dorsal and ventral surfaces convex; 23-46 μm x 19-32 μm in dimensions; ventral, adoral and dorsal lips protruded; posterior end sharply truncated at the centre and without any spine; ventral surface terminating in a large smoothly rounded lobe, reaching the anal opening, dorsal surface also rounded near anal opening without any posterior prolongation; contractile vacuole single, lying anterior to macronucleus; macronucleus large, broadly oval situated near the dorsal wall in the anterior half of the body.

**Host**: Goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

78. *Enterodinium laterale* Kofoid and MacLennan


**Diagnosis**: Body short, fairly broad, 19-28 μm in length; both dorsal and ventral surfaces convex, posterior part of the body broad, terminating in three spines; dorsal spine long, thin and flattened laterally, left ventral spine fleshy and right ventral spine a small triangular flap; contractile vacuole single, lying in the middle of left side just opposite the oesophagus; macronucleus broad, wedge-shaped located along dorsal mid-line.

**Hosts**: Cow, buffalo and goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district); Tamil Nadu.

**Remarks**: Das Gupta (1935) and Banerjee (1955) recorded this species from West Bengal from the hosts goat, *Capra hircus* and buffalo respectively.

79. *Entodinium longinucleatum* Dogiel


**Diagnosis**: Body ellipsoid, 39-51 μm in length, anterior end broad and blunt, flattened laterally, ventral lobe prominent, contractile vacuole single lying close to left side of macronucleus; macronucleus elongate, extending along dorsal mid-line from two-thirds to three-quarters of the body length.

**Hosts**: *Bos indicus, Bos gaurus, Capra hircus, Muntiacus muntjak*, domestic buffalo and sheep; **location**: stomach (rumen).
**Distribution**: India: West Bengal (Calcutta and Darjiling) districts, Karnataka and Tamil Nadu.

**Remarks**: Das Gupta (1935) was the first to report this species from West Bengal from the rumen contents of goat, *Capra hircus*. Banerjee (1955) recorded this species from this state from the domestic buffalo and sheep and Barking deer, *Muntiacus muntjak*.

80. **Entodinium mammilo-carinatum** Ghosh


**Diagnosis**: Body elongated 70 µm in length, wide towards posterior end; anterior end narrow and entirely occupied by peristome; a slight constriction round the body above middle of its length; posterior end with two rounded processes and a projecting keel on one side; contractile vacuole single; macronucleus more or less club-shaped.

**Host**: Cow; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

81. **Entodinium minutum** Chowdhury and Chatterjee


**Diagnosis**: Very small, almost spherical, 9-15 µm in length; dorsal, ventral and lateral surfaces markedly convex; posterior end smoothly rounded and without any lobe and spine; macronucleus small rod-shaped lying on the middle of the body on dorsal side.

**Host**: Goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

82. **Entodinium mukundai** Chowdhury and Chatterjee


**Diagnosis**: Body broadly oval, 30-37 µm in length; ventral dorsal and lateral surfaces exhibiting marked convexity; both anterior and posterior ends almost rounded; posterior end devoid of any lobe or spine; contractile vacuole single and located near the anterior end of macronucleus.

**Host**: Goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

83. **Entodinium muntiacum** Banerjee


**Diagnosis**: Body oval, 25-40 µm in length, both dorsal and ventral surfaces slightly convex, with two caudal lobes, dorsal and ventral; macronucleus ovoid to spherical and situated dorsally at anterior end.

**Hosts**: Barking deer and goat; **location**: stomach (rumen).
Distribution: India: West Bengal (Calcutta and Darjiling districts).

Remarks: Banerjee (1955) and Chowdhury and Chatterjee (1960) reported this species from this state from the hosts barking deer and goat respectively.

84. Entodinium nanellum Dogiel


Diagnosis: Body ovoid, laterally compressed, widest in anterior half, posterior end smoothly rounded, 20-35 µm in length, both dorsal and ventral surfaces convex, dorsal more convex in anterior half while ventral more convex in posterior half; contractile vacoule single, lying left of anterior end of macronucleus wedge-shaped, lying along dorsal mid-line.

Hosts: Bos indicus, Bos gaurus, Capra hircus and domestic sheep; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district), Karnataka and Tamil Nadu.

Remarks: Das Gupta (1935) and Banerjee (1955) reported this species from West Bengal from the hosts Capra hircus and domestic sheep respectively.

85. Entodinium nudum Ghosh


Diagnosis: Body greatly elongated tapering at both ends, 50 µm in length, anterior end narrow truncate, posterior end tapering to a blunt rounded process; contractile vacuoles two, lying in the anterior half of the body; macronucleus elongated.

Host: Goat; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

86. Entodinium ovatum Ghosh


Diagnosis: Body elongate, tapering at both ends, 55 µm in length, anterior end narrow and truncate with a deep fissure on one side, posterior end tapering to a blunt end with an oblique canal opening at one side; contractile vacuoles two: macronucleus long and band-like.

Host: Goat; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

87. Entodinium ovinum Dogiel

1927. Entodinium ovinum Dogiel, Arch. Prostistenk., 59, p. 44.

Diagnosis: Body oval with truncate anterior and rounded posterior ends, 53-69 µm in length; contractile vacuole single, large, lying left of anterior end of macronucleus; macronucleus large, sausage-shaped, extending almost from anterior end to posterior one-third of the body.
**Host**: Capra hircus, Muntiacus muntjak; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district), Orissa.

88. *Entodinium ovoidonucleatum* Das Gupta


**Diagnosis**: Body oval, 20-30 μm × 22-24 μm in dimensions with three differently shaped caudal processes; the longest one dorsal, 28-30 μm in length, running straight backwards and tapering to a point; the other two processes preanal and lobe-like, the right lobe triangular with pointed end slightly curved dorsal wards and the left lobe smaller and, more sharply pointed; macronucleus contractile vacuole single and located at the outer anterior side of macronucleus; macronucleus ovoid, lying at the anterior half of the body.

**Host**: Capra hircus; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

89. *Entodinium quadrispinosum* Ghosh


**Diagnosis**: Body elongated, somewhat barrel-shaped, 35 μm in length, anterior end truncate, posterior end with four inwardly curved spines; contractile vacuole single, located at posterior half of the body near macronucleus; macronucleus elongated band-like and tapering posteriorly.

**Host**: Goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

90. *Entodinium rectangulatum* Kofoid and Mac Lennan


**Diagnosis**: Body stout, 29-50 μm in length, laterally compressed, dorsal and ventral surfaces equally convex; posterior end of the body truncate with three caudal spines; dorsal spine flattened laterally, left ventral spine fleshy and right ventral spine flange-like, occupying one-third of the circumference of the body; contractile vacuole single, lying just opposite to oesophagus; macronucleus broad wedge-shaped, broader at anterior end, and located along the dorsal mid-line.

**Hosts**: Bos indicus, Capra hircus; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district), Tamil Nadu.

**Remarks**: Das Gupta (1935) reported this species from West Bengal from the host Capra hircus.

91. *Entodinium rhomboideum* Kofoid and Mac Lennan


**Diagnosis**: Body rhomboid, comparatively long, 30-47 μm in length, greatest diameter at the middle of the body; anterior end truncate to form a very narrow oral area, posterior end
terminating in a large smooth ventral lobe; contractile vacuole single; macronucleus thin wedge-shaped, broader anteriorly and extending one-half to two-thirds the body length.

*Hosts*: Cow and buffalo; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district), Tamil Nadu.

*Remarks*: Banerjee (1955) recorded this species from West Bengal from the rumen contents of goat.

92. *Entodinium rostratum* Fiorentini


*Diagnosis*: Body long and slim, 28-41 μm in length; dorsal side terminating in a short broad dorsal lobe, the ventral side in a heavy blunt spine; contractile vacuole single, lying directly anterior to the macronucleus; macronucleus straight, rod-like, lying in the middle half of the body along dorsal mid-line.

*Hosts*: Cow and buffalo; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district), Tamil Nadu.

*Remarks*: Banerjee (1955) recorded this species from West Bengal from the rumen contents of buffalo.

93. *Entodinium setnai* Das Gupta


*Diagnosis*: Body oval, anterior and broader than the posterior, 50-60 μm in length; dorsal side convex anteriorly and ending in a blunt lobe posteriorly; ventral side more or less straight, terminating in two small pointed lobes; right lobe with a broad base and left lobe more pointed than right; contractile vacuole situated anterior to macronucleus; macronucleus spherical and situated in the middle of dorsal line.

*Host*: Capra hircus; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

94. *Entodinium simplex* Dogiel


*Diagnosis*: Body elongated oval, with rounded posterior end and without any caudal process, 38-50 μm in length; contractile vacuole single, lying left of anterior end of macronucleus; macronucleus band-shaped and confined to anterior one third of the body.

*Host*: Capra hircus, Muntiacus muntjak; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district), Orissa.
95. **Entodinium spinosum** Ghosh


**Diagnosis**: Body oval, 35 μm in length, truncate anteriorly and rounded posteriorly; posterior end with a small, inwardly directed spine near centre, contractile vacuole single, located posteriorly; macronucleus band-like.

**Hosts**: Cow and goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

96. **Entodinium submammilatum** Ghosh


**Diagnosis**: Body elongated, 32 μm in length, somewhat flattened laterally, anterior end tapering, narrow and truncate, posterior end with a rounded process in one side and a projecting curved blunt process on the other; macronucleus narrow, elongate, somewhat constricted behind the middle and bent posteriorly; contractile vacuole two, lying on the side opposite to that of macronucleus.

**Host**: Goat; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

97. **Entodinium subsphericum** Ghosh


**Diagnosis**: Body irregularly and broadly oval, strongly convex dorsally, more or less straight on the other side, 50 μm in length; anterior end narrow, posterior end bent ventral wards and provided with fine elongated recurved spines; contractile vacuoles two, located at the middle of the body; macronucleus short, stout and rod-like.

**Host**: Cow; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

98. **Entodinium tricostatum** Kofoid and MacLennan


**Diagnosis**: Body short, broadly ellipsoid, 22-23 μm; three prominent ribs present - one dorsal, two ventral, running the length of the body in a weak dextral spiral; the dorsal and left ventral ribs terminating in the caudal spines, the thin blade-like right ventral rib in the lateral lobe; contractile vacuole at the left of anterior end of macronucleus; macronucleus very short, stout, lying in the dorsal rib and following its spiral course.

**Host**: *Bos indicus*; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Banerjee (1955) reported this species from West Bengal.
Genus *Eodinium* Kofoid and MacLennan

99. *Eodinium lobatum* Kofoid and MacLennan


*Diagnosis*: Body small, narrow, ellipsoid in dorsal view, laterally compressed, 44-66 μm in length; operculum very small; a distinct ventral lobe at posterior end; contractile vacuoles two, lying in anterior and posterior depressions on dorsal side of macronucleus; macronucleus narrow rod-like with three large depressions in its dorsal side.

*Hosts*: Buffalo and cow; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district); Tamil nadu.

*Remarks*: Banerjee (1955) reported this species from West Bengal in the rumen of cow and buffalo. Specimens obtained from the cow were much bigger (120 μm × 70 μm in dimension) than those obtained from buffalo (45-55 μm × 27.5-35 μm) (Banerjee, op. cit.)

Genus *Epidinium* Crawley

**Key to the species**

1. Body elongate, tapering in posterior half of the body and terminating in small rounded posterior end........................................................................................................ 2
   Body relatively short and truncate posteriorly, (five long straight caudal spines) .................................................................................................................................................. *E. cattanei*

2. Without any caudal spine................................................................................................................................. 3
   With caudal spine ........................................................................................................................................ 4

3. Smaller, 50 μm in length, posterior end with two rounded lobes, one projecting beyond the other; macronucleus short, irregularly pyriform, occupying middle of the body .......................................................................................................................... *E. bengalensis*
   Larger, 90-152 μm in length, posterior rounded lobes not as above; macronucleus large, elongated extending to posterior part of the body....................................................... *E. ecaudatum*

4. With single ventral caudal spine .................................................................................................................. 5
   With more than one caudal spine ................................................................................................................ 6

5. Caudal spine possessing an accessory skeletal place ................................................................................... *E. eberleini*
   Caudal spine without any accessory skeletal plate ............................................................................. *E. caudatum*

6. With three caudal spines, one dorsal, one ventral and one lateral........................................... 7
   With more than three caudal spines, one dorsal, one ventral and more than one lateral .............. 8

7. Caudal spines of equal length, body length 150-200 μm .................................................. *E. bovis*
   Caudal spines of unequal length, ventral spine being longest, body length 85-131μm ....................................................... *E. tricaudatum*
8. With four unequal caudal spines, one dorsal, one ventral and two right laterals...

E. quadricaudatum

With five unequal caudal spines, one dorsal, one ventral, two right laterals and one left lateral...

E. parvicaudatum

With a peripheral circular row of six unequal spines...

E. spinosum

100. Epidinium bengalensis (Ghosh)


Diagnosis: Body elongated tapering at both ends, 50 μm in length; posterior end with two rounded lobes; one projecting beyond the other; macronucleus short, irregularly pyriform, occupying the middle of the body; contractile vacuoles two, one near the girdle and the other near posterior lobes.

Host: Cow; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

Remarks: Ghosh described this species from the rumen of cow and accommodated it under the genus Ophryoscolex Stein. But, its characteristic features, viz. i) dorsal membranellae zone just behind the anterior end of the body and ii) presence of two contractile vacuoles clearly reveal that this species actually belongs to the genus Epidinium Crawley.

101. Epidinium bovis Banerjee


Diagnosis: Body more or less elongated, posterior end tapering, 150-200 μm in length; dorsal and ventral surfaces almost flat with slight convexity; with three equal sized caudal spines, one dorsal, one ventral and one lateral, all spines long, sharply pointed and slightly incurved; contractile vacuoles two; macronucleus large, elongated and dorsally placed with anterior portion broad and posterior portion gradually tapering.

Host: Cow; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

102. Epidinium cattanei (Fiorentini)

1889. Diplodinium cattanei Fiorentini, Interno ai Protisti dello stomaco dei Bovini., p. 16.


Diagnosis: Body relatively short and heavy 78-120 μm in length, left and dorsal surfaces concave between dorsal membranellae zone and the base of left spine, right surface convex; largest and most prominent five straight caudal spines, each spine arising from relatively broad base but tapering rapidly in proximal third so that distal two third appearing relatively thin, the ventral spine being the largest; contractile vacuoles two; macronucleus elongate, lying beneath the right dorsal surface.

Hosts: Capra hircus and cow; location: stomach (rumen).
**Distribution**: India: West Bengal (Calcutta District).

**Remarks**: Das Gupta (1935) and Banerjee (1955) reported this species from West Bengal from rumen of *Capra hircus* and cow respectively.

103. *Epidinium caudatum* (Fiorentini)


**Diagnosis**: Body elongate, 85-140 μm in length, tapering towards posterior end; single caudal spine arising from the posteroventral end of the body curving dorsally and to the right; cuticle with longitudinal striations; contractile vacuoles two; macronucleus elongate, lying beneath the right dorsal surface adjacent to the edge of dorsal skeletal plate.

**Hosts**: *Bos gaurus*, *Capra hircus* and cow; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district), Karnataka.

**Remarks**: Ghosh (1922) was the first to report this species from Calcutta as well as from India from the rumen of cow and goat. Subsequently, Das Gupta (1935) recorded this species from this state from the host *Capra hircus*.

104. *Epidinium eberleini* (da Cunha)


**Diagnosis**: Body elongate, 85-118 μm in length, with a relatively blunt posterior end; right side of the body continues posteriorly as a broad laterally flattened lobe; a narrower heavier lobe projecting from the posterior end of the left surface; a large curved spine arising from the posterior end and a long thin accessory skeletal plate extending from the middle of ventral surface to the top of the large spine.

**Host**: Cow; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district); Tamil Nadu.

**Remarks**: Banerjee (1955) recorded this species from West Bengal.

105. *Epidinium ecaudatum* (Fiorentini)


**Diagnosis**: Body elongate, 90-152 μm; posterior half of the body tapering and terminating in small rounded posterior lobe; without any caudal spine; contractile vacuoles two; macronucleus elongate.

**Host**: *Capra hircus*; **location**: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Das Gupta (1935) reported this species from West Bengal.
106. *Epidinium parvicaudatum* (Awerinzew and Mutafoa)


*Diagnosis*: Body relatively long, 70-120 μm × 37 μm and tapering posteriorly, ventral and left surfaces almost plain or slightly convex, dorsal and right surfaces convex; with five caudal spines - one ventral, one dorsal, one on the left side and two on the right side, ventral spine being large and curved dorsally; fine longitudinal striations over cuticle; contractile vacuoles two; macronucleus elongated rod-like.

*Hosts*: *Bos gaurus*, goat and sheep; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district); Tamil Nadu.

*Remarks*: Banerjee (1955) and Chowdhury and Chatterjee (1960) reported this species from this state from the hosts sheep and goat respectively.

107. *Epidinium quadricaudatum* (Sharp)


*Diagnosis*: Body elongate, tapering posteriorly, 110-119 μm in length; ventral and left surfaces considerably concave, dorsal and right surfaces convex; with four caudal spines - ventral, dorsal and two right laterals, dorsal spine being longest curved dorsally rightwards; cuticle with fine longitudinal striations, contractile vacuoles two; macronucleus elongate.

*Hosts*: *Bos gaurus* and goat; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district); Karnataka.

*Remarks*: Ghosh (1922) recorded this species from Calcutta from the rumen of goat.

108. *Epidinium spinosum* (Ghosh)


*Diagnosis*: Body elongate, both dorsal and ventral surfaces convex, 45 μm in length; posterior end with circular row of six caudal spines, ventral spine being longest bent rightwards; contractile vacuoles two; macronucleus elongated and band-like.

*Host*: Cow; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Ghosh (1922) described this species and placed it under the genus *Ophryoscolex* Stein. Original description of this species is very inadequate but, its diagram is considerably clear sufficient for determining its generic identity. Characteristic features recorded by Ghosh (op.cit), viz. i) secondary girdle of membranellae, i.e., dorsal membranellae zone close to the anterior end of body ii) presence of two contractile vacuoles and iii) single circlet of spine clearly reveal that the present species is a member of the genus *Epidinium* Crawley.
109. *Epidinium tricaudatum* (Sharp)


*Diagnosis*: Body elongate, tapering towards posterior end, 85-131 μm: ventral and left surfaces flat or slightly concave, dorsal and right surfaces convex; with three caudal spines - ventral, dorsal and right lateral; ventral spine largest and curved dorsally rightwards; contractile vacuoles two; macronucleus elongate.

*Host*: Goat; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Ghosh (1922) recorded this species from West Bengal under the name *Ophryoscolex ecaudatus* var. *tricaudatus*. This constitutes the only records of this species from India.

**Genus* Eremoplastron* Kofoid and MacLennan**

**Key to the species**

1. Posterior end of the body provided with lobes ................................................. 2
   Posterior end of the body provided with spine ................................................. 3

2. Posterior end with a small ventral lobe only, 52-100 μm in length .............. *E. bovis*
   Posterior end with a well pronounced ventral lobe, size of the body large, 390-456 μm in length ................................................................. *E. asiaticus*

3. With thick dorsal flange and one large ventral caudal spine ................... *E. rostratum*
   With two caudal spines ....................................................................................... 4

4. Body ellipsoidal in side view, with two short caudal spines .................... *E. brevispinum*
   Body rectangular in side view, with two large caudal spines ....... *E. magnodentatum*

110. *Eremoplastron asiaticus* Banerjee


*Diagnosis*: Body very big sized, 390-456 μm in length, ellipsoidal in shape and laterally compressed; dorsal and ventral surfaces slightly convex; a big smoothly rounded ventral lobe projecting from the ventral half; macronucleus rod-like and bent dorsally.

*Host*: Cow; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

111. *Eremoplastron bovis* (Dogiel)


*Diagnosis*: Body ellipsoidal, 52-100 μm in length, compressed laterally, ventral surface more
or less flattened except posterior quarter, dorsal surface strongly convex; a small smoothly rounded ventral lobe projecting from ventral half of posterior end; contractile vacuoles two; macronucleus elongate.

*Hosts*: Cow, buffalo and sambar; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district), Bihar.

*Remarks*: Banerjee (1955) recorded this species from this state from the rumen of buffalo.

112. *Eremoplastrom brevispinum* Kofoid and MacLennan


*Diagnosis*: Body ellipsoidal, 72-92 μm in length, laterally compressed; dorsal surface convex, ventral surface flat or slightly concave in anterior half and convex in posterior half; caudal spines two in number, short and broad, one dorsal to anus, the other ventral to it and a slight prolongation of ventral lobe; contractile vacuoles two; macronucleus rod-like.

*Host*: *Capra hircus*; *location*: stomach (remen).

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Das Gupta (1935) recorded this species from West Bengal as well as from India.

113. *Eremoplastron magnodentatum* Kofoid and MacLennan


*Diagnosis*: Body rectangular in side view, 58-82 μm in length, anterior end with largest diameter; dorsal surface flat, ventral surface slightly convex; caudal spines two, large, laterally compressed and such placed as to give a characteristic pincer-like appearance; contractile vacuoles two; macronucleus elongate rod-like.

*Host*: Buffalo; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Banerjee (1955) recorded this species from West Bengal as well as from India.

114. *Eremoplastron rostratum* (Fiorentini)


*Diagnosis*: Body small, relatively long, 40-75 μm in length, laterally compressed, dorsal surface convex, ventral surface almost flat; caudal spine single, long, extending posteriorly from the region between anus and ventral surface; posterior third of the dorsal side of the body forming a flange-like projection; contractile vacuoles two; macronucleus rod-like.

*Hosts*: *Bos taurus*, *Capra hircus* and Buffalo; *Location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district), Karnataka.

*Remarks*: Das Gupta (1935) and Banerjee (1955) reported this species from West Bengal from the hosts *Capra hircus* and buffalo respectively.
Genus  *Eudiplodinium* Dogiel

115. *Eudiplodinium maggii* (Fiorentini)


*Diagnosis*: Body roughly triangular in side view, 104-255 μm in length, truncated anteriorly and tapering to a smoothly rounded posterior end; dorsal surface convex, ventral surface flat or concave anteriorly at anterior half and convex at posterior half; contractile vacuoles usually two; macronucleus elongate, rod-like with anterior end enlarged to form a hook, opening dorsally.

*Hosts*: *Bos gaurus*, goat, buffalo, sheep and Barking deer and sambar; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta and Darjiling districts), Bihar, Karnataka, Orissa and Tamil Nadu.

*Remarks*: Das Gupta (1935) and Banerjee (1955) reported this species from West Bengal from the hosts goat and, buffalo, sheep and Barking deer respectively.

Genus  *Metadinium* Awerinzew and Mutafowa

Key to the species

1. Posterior end of the body truncated or smoothly rounded ........................................ 2
   Posterior end of the body provided with keel and incurved spines .......................... 3

2. Skeletal plates not fused at their posterior end, macronucleus with three dorsal obes
   ................................................................................................................................. *M. medium*

   Skeletal plates fused at their posterior end, macronucleus with a large lateral lobe on
   its left edge .................................................................................................................. *M. rotundatum*

3. Posterior end rounded with a keel on one side ........................................... *M. carinatum*
   Posterior end with six incurved spines arranged in pair ............................... *M. quadratum*

116. *Metadinium carinatum* Ghosh


*Diagnosis*: Body broadly oval and slightly flattened, 150 μm in length, posterior end rounded with a keel on one side, both dorsal and ventral surfaces convex; contractile vacuole large single; macronucleus stout with a dilated end and placed more or less transversely.

*Host*: Cow; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: This species is very inadequately described by Ghosh (1922). In the description nothing is mentioned regarding skeletal plates.
117. *Metadinium medium* Awerinzew and Mutafowa


*Diagnosis*: Body large and heavy, 108-224 μm in length, anterior end blunt, posterior end truncated and slightly rounded; skeletal plates two in number and not fused at their posterior end; two large contractile vacuoles present; macronucleus elongate with three large dorsal lobes.

*Hosts*: *Bos gaurus*, *Bos indicus* and *Capra hircus*, *Muntiacus muntjak*; *location*: Stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district); Karnataka, Orissa and Tamil Nadu.

*Remarks*: Das Gupta (1935) reported this species from the host *Capra hircus* from West Bengal.

118. *Metadinium quadratum* Ghosh


*Diagnosis*: Body irregularly quadrilateral, somewhat flattened with ventral surface concave and dorsal surface convex; posterior end provided with six recurved spines arranged in pairs, ventral pair of spines largest and the dorsal pair shortest; contractile vacuole single; macronucleus elongated stout and rod-like.

*Host*: Cow; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: In the original description of this species Ghosh (1922) did not mention anything regarding skeletal plates.

119. *Metadinium rotundatum* Kofoid and Christenson


*Diagnosis*: Body relatively short, 52-73 μm in length, posterior end smoothly rounded; both ventral and dorsal surfaces convex; skeletal plates two in number and fused at their posterior ends; contractile vacuoles two; macronucleus elongate with a large lateral lobe on its left edge.

*Hosts*: *Bos gaurus* and cow; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district); Karnataka.

*Remarks*: Banerjee (1955) recorded this species from this state from the rumen of cow.

**Genus Ophryoscolex Stein**

**Key to the species**

1. Posterior end of the body more or less tapering and with caudal spines .............. 2
   Posterior end rounded and without any spine ................................................. *O. inermis*

2. Main caudal spine relatively short and stout, accessory spines in one or two rows.
   ................................................................................................................. 3
Main caudal spine long and slender, accessory caudal spines arranged in three rows.  

3. Accessory caudal spines bifurcate and arranged in a single row .............. *O. eberleini*  
Accessory caudal spines bi- or trifurcate and arranged in two rows .............. *O. spinosus*

120. *Ophryoscolex eberleini* Ghosh


*Diagnosis*: Body elongated with slight neck like constriction anteriorly, 135 μm in length; anterior end tapering; posterior end abruptly tapering with a greatly curved stout spines, 'surrounded by a row of bifid teeth', contractile vacuoles four or five; macronucleus a stout band.

*Host*: not mentioned

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Description of this species given by Ghosh (1922) is very inadequate. Even then, the following morphological features clearly show that this species belongs to the genus *Ophryoscolex*: i) dorsal membranellae zone situated about one-third the length of the body from the anterior pole (as evident from the figure), ii) contractile vacuoles several and iii) main caudal spines and accessory caudal spines Ghosh (*op. cit.*) 'surrounded by a row of bifid teeth' present.

121. *Ophryoscolex inermis* Stein


*Diagnosis*: Body relatively slender, 170-190 μm in length and 65-100 μm in breadth; posterior end smooth, rounded and without any spine.

*Hosts*: Goat and cow; *location*: stomach (rumen).

*Distribution*: India: West Bengal (Calcutta district).

*Remarks*: Ghosh (1922) recorded this species from Calcutta in the rumen of goat. It is a rare species differing from the other species of *Ophryoscolex* in having a rounded posterior end, without any spine.

122. *Ophryoscolex spinosus* Kofoid and MacLennan


*Diagnosis*: Body relatively slender, 122-160 μm in length; all surfaces strongly convex, only middle of ventral side slightly concave; posterior end with caudal spine short and stumpy and two rows of accessory caudal spines; anterior circlet comprising simple or bifurcate spines and posterior circlet composed of bifurcate or trifurcate spines; middle skeletal plate extending up to the tip of main caudal spine; contractile vacuoles ten, arranged in two rows; macronucleus elongate.

*Host*: Cow; *location*: stomach (rumen).
**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Banerjee (1955) recorded this species from West Bengal.

123. *Ophryoscolex tricoronatus* (Dogiel)


**Diagnosis**: Body relatively stout, 137-162 μm in length, posterior end with a long slender main caudal spine and three circlets of secondary spines; anterior circlet comprising six usually trifurcate spines, middle circlet three to five and posterior circlet three to seven spines; middle skeletal plate not extending up to the tip of main caudal spine; contractile vacuoles nine, arranged in two rows.

**Host**: *Capra hircus*; location: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district).

**Remarks**: Das Gupta (1935) recorded this species from West Bengal. So far, this is the only report of this species from India.

**Genus** *Ostracodium* Dogiel

**Key to the species**

With one caudal lobe, the ventral lobe .............................................. *O. rugoloricatum*

With two caudal lobes, one dorsal and one ventral ................................... *O. mammosum*

124. *Ostracodinium mammosum* (Railliet)


**Diagnosis**: Body 41-110 μm in length, ventral surface convex in anterior half, then flat or slightly concave and again convex in posterior part; dorsal surface convex; one dorsal caudal lobe; ventral lobe hollow on its dorsal side, skeletal plate single and broad; contractile vacuoles three; macronucleus long rod-like, with a large shallow depression near the middle of its dorsal surface.

**Host**: Cow; location: stomach (rumen).

**Distribution**: India: West Bengal (Calcutta district); Tamil Nadu.

**Remarks**: Banerjee (1955) recorded this species from West Bengal.

125. *Ostracodium rugoloricatum* Kofoid and MacLennan


**Diagnosis**: Body ellipsoidal in dorsal view, with both ends bluntly rounded, 84-125 μm in length; ventral surface flat or slightly concave in anterior three-quarters and convex in posterior quarter; dorsal surface flat, or slightly concave in anterior half and strongly convex in the posterior half; a flattened ventral lobe present; skeletal plate broad; contractile vacuoles three; macronucleus straight rod-like with deep depression on the middle of its left dorsal side.
Hosts: Cow and buffalo; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district); Tamil Nadu.

Remarks: Banerjee (1955) reported this species from West Bengal from the rumen of buffalo.

Genus *Polyplastron* Dogiel

126. *Polyplastron bengalensis* Chowdhury and Chatterjee


Diagnosis: Body stout and oval, 114-139 μm in length; posterior end with a broad and heavy ventral lobe; with four skeletal plates two on the right and two on the left side; contractile vacuoles five; macronucleus elongated with a slight mid dorsal curvature.

Host: Goat; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

Genus *Triplodinium* Ghosh

Diagnosis: Peristome on one side; two secondary spirals of membranellae on other side placed in small conical depression and connected with each other by a row of membranellae.

127. *Triplodinium bovis* Ghosh


Diagnosis: Body elongated, 50 μm in length, slightly tapering anteriorly, more so posteriorly and somewhat flattened laterally; posterior end with three more or less flattened unequal spines; contractile vacuoles two, lying on the opposite side of the macronucleus; macronucleus elongated and somewhat fusiform.

Host: Cow; location: stomach (rumen).

Distribution: India: West Bengal (Calcutta district).

Remarks: Original description of the genus *Tripodinium* Ghosh and that of the type species *T. bovis* are so inadequate that (see Ghosh, 1922) it is very difficult to determine its proper taxonomic status. In the aforesaid description nothing is mentioned regarding number and nature of skeletal plate, which is, at present, treated as an important yard-stick for assigning generic identity in the family Ophryoscolecidae. However, number of contractile vacuoles, disposition of caudal spine and the original text figure indicates that the present species is possibly a member of the genus *Diplodinium*. However, peristome and adoral zone of membranellae as drawn and described by Ghosh (op. cit.) show some deviation from those of the genus *Diplodinium*. No further comment on the taxonomic status of this genus is possible unless fresh material of allied specimens are available for study.

**GENERAL REMARKS ON DISTRIBUTION**

Symbiotic protozoa are very inadequately studied in West Bengal. Only four host-species of termites, namely, *Coptotermes heimi, Cryptotermes havilandi, Heterotermes indicola* and *Neotermes*...
bosei as well as one undetermined species of Heterotermes have been studied in details for their flagellate symbiotes from this state resulting the record of 31 species. On the other hand, taxonomic studies of ruminant ciliates are solely based on the examination of rumen contents of buffalo, cow, goat and sheep procured mainly from the slaughter house of Tangra, Calcutta. Banerjee (1955), however, studied the rumen contents of Barking deer (Muntiacus muntjak) collected at Gielle Reserve forest, Darjiling district, West Bengal and recorded five species of ruminant ciliates.

Distribution of each species of symbiotic protozoa of this state is dealt with under the respective systematic account. The district-wise distribution of these protozoa is shown in the Map 1. & 2 as well as in Table—1.

**TABLE – 1**

<table>
<thead>
<tr>
<th>District</th>
<th>Number of species of :</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td>termite flagellates</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ruminant ciliates</td>
<td></td>
</tr>
<tr>
<td>Bankura</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Barddhaman</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Birbhum</td>
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<td>8</td>
</tr>
<tr>
<td>Calcutta</td>
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<td>96</td>
</tr>
<tr>
<td>Darjiling</td>
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<td>5</td>
</tr>
<tr>
<td>Haora</td>
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<td>–</td>
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<tr>
<td>Hugli</td>
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<td>–</td>
</tr>
<tr>
<td>Jalpaiguri</td>
<td>10</td>
<td>–</td>
</tr>
<tr>
<td>Koch Bihar</td>
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</tr>
<tr>
<td>Maldah</td>
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<td>–</td>
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<tr>
<td>Medinipur</td>
<td>3</td>
<td>–</td>
</tr>
<tr>
<td>Murshidabad</td>
<td>8</td>
<td>–</td>
</tr>
<tr>
<td>Nadia</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>North 24-Parganas</td>
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</tr>
<tr>
<td>Puruliya</td>
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<td>–</td>
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<tr>
<td>South 24-Parganas</td>
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<td>–</td>
</tr>
<tr>
<td>West Dinajpur</td>
<td>6</td>
<td>–</td>
</tr>
</tbody>
</table>

From the Table—1 it is quite evident that termite flatellates are reported/collected so far from 12 districts while ruminant ciliates are recorded from two districts only, viz, Calcutta and Darjiling. Interestingly, all the 96 species of ruminant ciliates recorded so are from West Bengal have also been collected from Calcutta. Five districts from which symbiotic protozoa are yet to be explored are Bankura, Barddhaman, Haora, Nadia and Puruliya.
Fig. 1. Showing general structures of termite flagellate, *Oxymonas* sp.
Plate - 2

Figs. 1 & 2. Showing general structures of termite flagellates, *Devescovina* sp. (Fig. 1) and *Stephanonympha* sp. (Fig. 2).
Figs. 1 & 2.  Showing general structures of termite flagellates, *Pseudotrichonympha* sp. (Fig. 1) and *Holomastigotoides* sp. (Fig. 2).
Plate 4

Plate - 5

Figs. 1-5. Showing some devescovinid flagellates from termites of West Bengal.
Showing some calonymphid flagellates of termites from West Bengal.
1. Stephanonympha pyriformis Das and Choudhury
2. Stephanonympha minuta Das and Choudhury
3. Stephanonympha sylvestrii Janicki
Figs. 1-9. Showing some holomastigotoidid flagellates from termites of West Bengal.
1. Holomastigotoides hollandei Das  2. Holomastigotoides globosus de Mello  
3. Holomastigotoides magnus Uttangi  4. Holomastigotoides campanula (de Mello)  
5. Holomastigotoides sphaeroidalis de Mello  6. Holomastigotoides ogivalis de Mello  
7. Holomastigotoides rayi Karandikar and Vittal  8. Holomastigotoides emersoni Das  
9. Holomastigotoides bengalensis Chakravarty and Banerjee (Scale of 50 μm for figs. 2-7 and 9)
Figs. 1-5 Showing some spirotrichonymphid flagellates from termites of West Bengal.
Figs. 1 & 2. Showing general structures of ruminant ciliates, Diplodinium sp. (Fig. 1) and Entodinium sp. (Fig. 2).
Map 1. Showing district-wise distribution of symbiotic protozoa viz., termite flagellates and ruminant ciliates (in number of species); numerical number indicates number of species of concerned group (TF = Termite flagellate; RC = Ruminant ciliate).

**BIRBHUM**
: TF (16, 22, 23, 24, 26, 28, 29, 30) : Total = 8

**CALCUTTA**
: TF (1, 5, 6, 7, 8, 13, 14, 15, 16, 17, 18, 24, 27, 30) : Total = 14; RC (32-127, all the 96 species) : Total = 96

**DARJILING**
: TF (28, 29) : Total = 2
   RC (46, 70, 79, 83, 115) : Total = 5

**HUGLI**
: TF (25) : Total = 1

**JALPAIGURI**
: TF (2, 3, 12, 15, 16, 17, 18, 22, 26, 29) : Total = 10

**KOCH BIHAR**
: TF (2, 3, 6, 12, 13, 15, 21, 24, 29, 30) : Total = 10

**MALDAH**
: TF (15, 20, 21, 28, 29, 30) : Total = 6

**MEDINIPUR**
: TF (22, 23, 29) : Total = 3

**MURSHIDABAD**
: TF (16, 17, 20, 22, 23, 24, 29, 30) : Total = 8

**NORTH 24-PARGANAS**
: TF (18, 20, 21) : Total = 3

**SOUTH 24-PARGANAS**
: TF (4, 6, 7, 9, 10, 11, 13, 15, 16, 17, 19, 22, 23, 26, 28, 29, 30, 31) : Total = 19

**WEST DINAJPUR**
: TF (6, 15, 20, 26, 27, 28) : Total = 6
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Map - 1

Index

- Termite flagellate
- Ruminant ciliate

(Number indicates number of species of concerned group)
Map 2. Showing district-wise distribution of different groups termite flagellates viz., oxymonads (O), monocercomonads (M), devescovinids (D), holomastigotoids (H), spirotrichonymphids (S) in number of species; numerical number indicates number of species of concerned group.

BIRBHUM : H(16, 22, 23, 24); S(25, 28, 29, 30) : Total = 8
CALCUTTA : O(1); M(5); D(6, 7, 8); C(13, 14); H(15, 16, 17, 18, 24); S(27, 30) : Total = 14
DARJILING : S(28, 29) : Total = 2
HUGLI : S(25) : Total = 1
JALPAIGURI : O(2, 3); C(12); H(15, 16, 17, 18, 22); S(24, 26) : Total = 10
KOCH BIHAR : O(2, 3); D(6); C(12, 13); H(15, 21, 24); S(29, 30) : Total = 10
MALDAH : H(15, 20, 21); S(28, 29, 30) : Total = 6
MEDINIPUR : H(22, 23); S(29) : Total = 3
MURSHIDABAD : H(16, 17, 20, 23, 24); S(29, 30) : Total = 8
NORTH 24-PARGANAS : H(18, 20, 21) : Total = 3
SOUTH 24-PARGANAS : O(4); D(6, 7, 9, 10, 11); C(13); H(15, 16, 17, 19, 22, 23); S(26, 28, 29, 30, 31) : Total = 19
WEST DINAJPUR : D(6); H(15, 20); S(26, 27, 28) : Total = 6
SUMMARY

1. Taxonomic account of all the species of symbiotic protozoa reported and collected so far from West Bengal is dealt with in the present communication. This includes 127 species comprising 31 species of termite flagellates (belonging to 1 class, 3 orders, 6 families and 8 genera) and 96 species of ruminant ciliates (under 1 class 2 orders, 2 families and 15 genera).

2. Key to all these species and their genera and families as well as their district-wise distribution are also incorporated.

3. Present taxonomic status of 13 species described by Ghosh (1922), which are never referred before by any subsequent worker till date is also dealt with in the present communication.

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REFERENCES


State Fauna Series 3 : Fauna of West Bengal


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