

ON SOME FRESH WATER CILIOPHORA (PROTOZOA)  
OF VISAKHAPATNAM

*By*

P. RAMA MOHANA RAO, K. HANUMANTHA RAO AND K. SHYAMASUNDARI  
*Department of Zoology, Andhra University, Waltair*

(With 8 Text-figures)

INTRODUCTION

While studying the ciliate fauna of Visakhapatnam we have observed some relatively rare species of ciliates. This paper deals with the morphological details of *Telotrochidium crateriforme* Kent, 1880-1882; *Spirostomum ambiguum* (O. F. Müller) Ehrenberg, 1883; *Spirostomum teres* Claparède and Lachmann 1858; *Brachonella spiralis* (Smith, 1897); *Stentor coeruleus* Ehrenberg, 1830 and *Halteria grandinella* O. F. Müller, 1786. *T. crateriforme* is new report for the Indian sub-continent. *B. spiralis* and *S. coeruleus* are new reports from the South India.

SYSTEMATIC ACCOUNT

Phylum : CILIOPHORA Doflein

Class : OLIGOHYMENOPHORA de Puytorac *et al.*

Sub class : PERITRICHIA Stein

Order : PERITRICHIDA Stein

Sub order : SESSILINA Kahl

Family : OPISTHONECTIDAE Foissner

Genus : **Telotrochidium** Kent, 1880-1882

**Telotrochidium crateriforme** Kent, 1880-1882

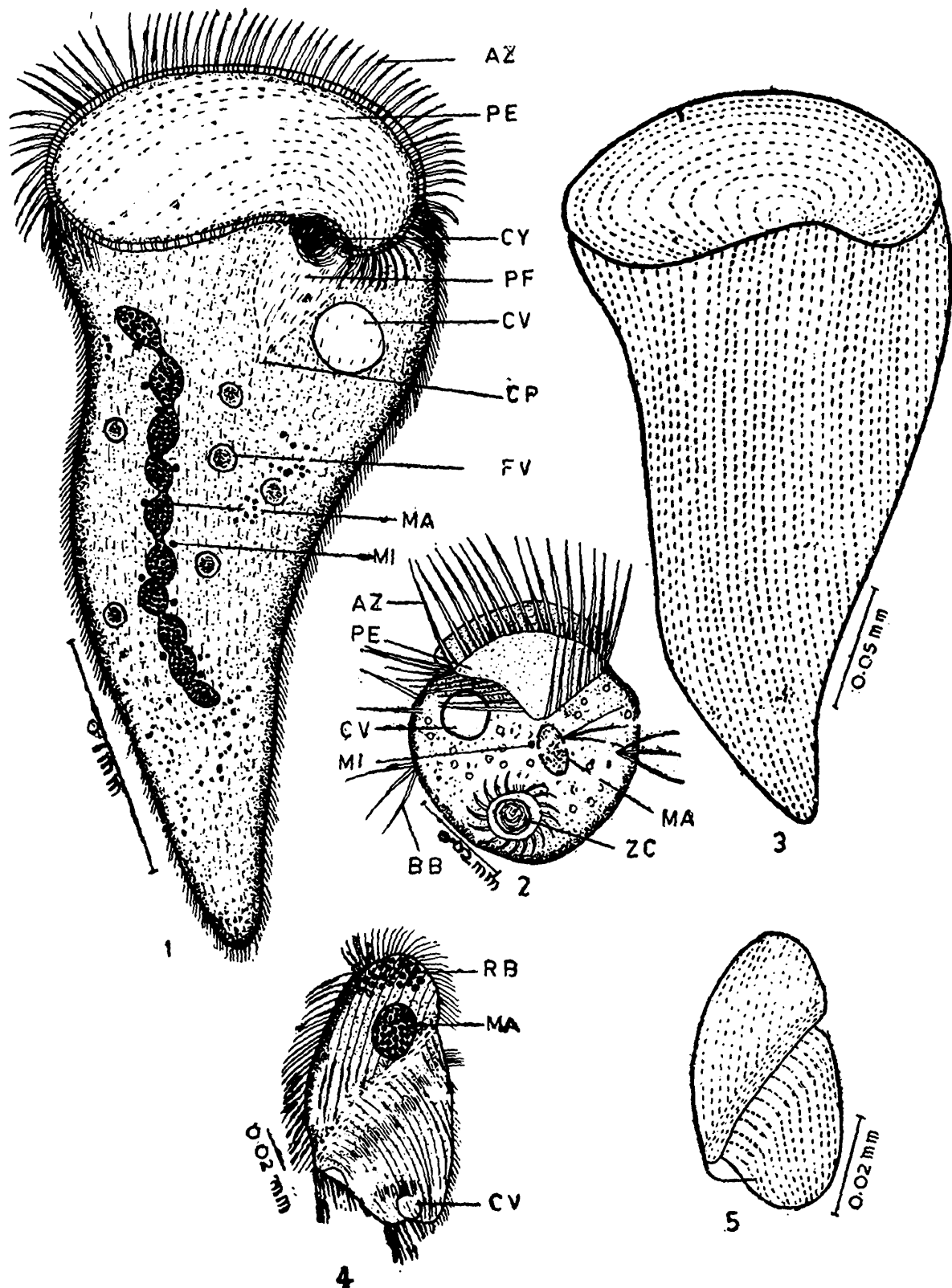
(Text-fig. 8)

Ovate or campanulate with a convex anterior margin and a non refractile rounded posterior end. Two ciliary girdles, each consisting of a single row of cilia. Cytostome ventral, situated immediately behind the anterior wreath of cilia. There is a thick annular border associated with the anterior girdle of cilia.

Contractile vacuole and macronucleus conspicuously developed. Macronucleus is long ribbon like with numerous karyosome like bodies.

The two extremities are curved to give it a horse-shoe appearance. Micronucleus lies close to the macronucleus. Multiplication is by longitudinal fission.

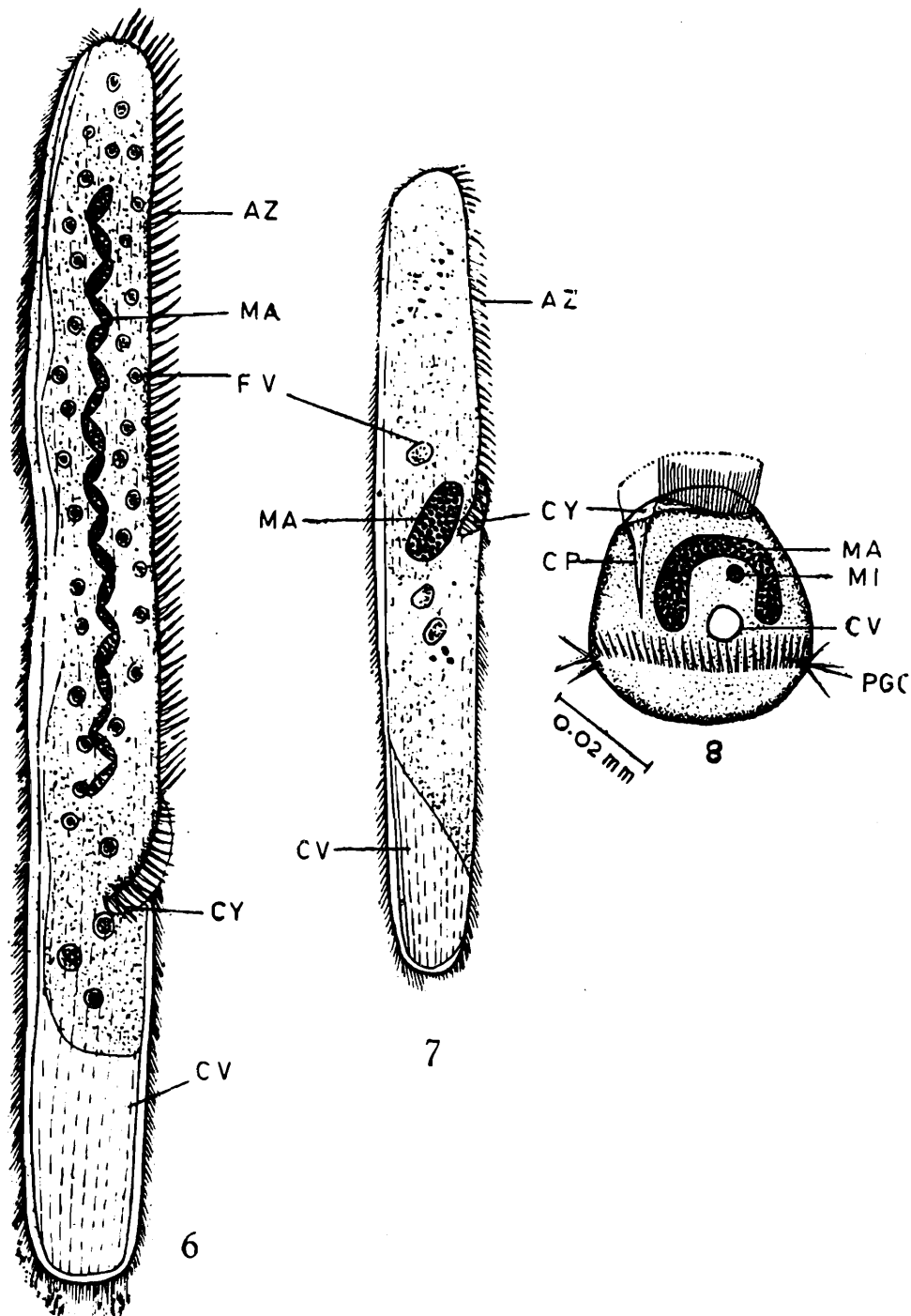
Kent (1880-1882) placed *Urocentrum* and *Telotrochidium* in the order Peritricha, but subsequent workers have shown that their correct posi-



Text-fig. 1. *Stentor coeruleus*—live animal. 2. *Halteria grandinella*—live animal. 3. *S. coeruleus*—infaciliature. 4. *Brachonella spiralis*—live animal. 5. *B. spiralis*—infaciliature.

tion is under Hymenostomata. Corliss (1961, 1977) placed this species in Peritricha. Kahl (1930-1935) is however, of the opinion that species of *Telotrochidium* are vorticellids detached from their stalks.

Gulati's (1925) and the present observations seem to show that the *Telotrochidium* is a valid genus. Bhatia (1936) is of the opinion that



Text-figs. 6. *Sporostomum ambiguum*—live animal. 7. *S. teres*—live animal. 8. *Telotrochidium crateriforme*—live animal.

ABBREVIATIONS USED

AZ—Adoral zone ; BB—Bristles ; CP—Cytopharynx ; CV—Contractile vacuole ; CY—Cytostome ; FV—Food vacuole ; MA—Macronucleus ; MI—Micronucleus ; PE—Peristome ; PF—Peristomial funnel ; PGC—Posterior girdle of cilia ; RB—Refractile bodies ; ZC—Zoochlorelle.

the position of the genus is close to *Urocentrum* and according to him vorticellids may be supposed to have been derived from such Holotrichian forms as *Urocentrum* and *Telotrochidium*. Corliss (1977) placed *Urocentrum* in the order Hymanostomatida of Hymenostomata and *Telotrochidium* in Peritrichida of Peritricha.

Present observations confirm the opinion of Corliss (1977) in placing *Telotrochidium* in Peritricha because in characters like shape of the body, shape of the nucleus, ciliary arrangements, single contractile vacuole it is closely related to Peritricha.

*Dimensions* : Body length ranges from 85 to 97  $\mu\text{m}$  and width ranges from 62 to 67  $\mu\text{m}$ .

Class : POLYHYMENOPHORA Jankowski

Sub class : SPIROTRICHA Butschii

Order : HETEROTRICHIDA Stein

Sub order : HETEROTRICHINA Stein

Family : SPIROSTOMIDAE Stein

Genus : *Spirostomum* Ehrenberg, 1833

*Spirostomum ambiguum* Ehrenberg, 1833

(Text-fig. 6)

This ciliate is elongate, thread like and slim, somewhat flattened laterally. Highly elastic, contractile and flexible. Ten to twenty times or more as long as broad, cylindrical, the anterior and posterior extremities often equal rounded in some forms. Posterior truncate condition has also been observed. Peristome is long extending down the left side of the ventral surface beyond the middle of body, continues as a short cytopharynx. AZM begins at the anterior end of the animal and runs along its length. Contractile vacuole is conspicuous, it lies in the posterior part of the body and is fed by a long canal stretching dorsally from anterior end. Macronucleus is elongated and moniliform. Numerous micronuclei are seen close to the macronuclear beads.

The form and structure of the macronucleus vary in different forms. In most cases the macronucleus beads are elongated, oval, tapering at either end, they are connected by narrow commissures. In some cases the macronucleus is vermiform. There is no correspondence between the number of micronuclei and the lobes of macronucleus.

In *S. ambiguum*, the two varieties were noted by Bishop (1923), *S. ambiguum major* is 800 to 900  $\mu\text{m}$  long, posterior end rounded, yellowish cytoplasm. Cytostome behind the mid-point. *S. ambiguum minor* is

400 to 500  $\mu\text{m}$  long and truncated posteriorly, greyish-white cytoplasm, with its cytostome in the anterior third of the body. Bhatia and Mullick (1930) concluded that *S. teres* and the minor and major varieties of *S. ambiguum* form a series, the structural peculiarities of which are closely paralleled by the stages of growth of the individual specimens of *S. ambiguum*. The specimens found here measured 545 to 860  $\mu\text{m}$  in length so that it could be concluded that they are *S. ambiguum* var. *major*. This species is cosmopolitan in distribution.

**Spirostomum teres** Claparède and Lachmann, 1858-1861

(Text-fig. 7)

Body is elongated, shape is similar to that of *S. ambiguum* but comparatively small. Colour yellowish or slightly brown, peristome extending up to one third of the length of the body. Posterior end may or may not be truncated. Contractile vacuole is single occupying most of the posterior end of the body and extending forward as a long canal. Oval macronucleus is situated at the middle of the body.

Bhatia (1936) reported that in the specimens found at Srinagar (India) the peristomial groove extends only up to about one third of the length of the body. But in the present study in some specimens the peristomial groove extends beyond one third of the body, in some cases up to the middle of the body.

*Dimensions* : Body length ranges from 175  $\mu\text{m}$  to 380  $\mu\text{m}$ .

Family : METOPIDAE Kahl

Genus : **Brachonella** Jankowski, 1964

**Brachonella spiralis** (Smith, 1897)

(Text-figs. 4 & 5)

Body roughly oval in shape. Posterior portion ends in a blunt cone. Except in the anterior left portion, the body is transparent. A few refractile granules are aggregated at the anterior left portion of the animal. The peristome is a spiral depression running diagonally from anterior half to the posterior right side thus the body presents a spiral shape. The portion near and just above the peristome is densely ciliated with long cilia, and in other parts of the body the ciliation is uniform. Body is striated in a linear form.

Macronucleus is spherical and single situated in the anterior half of the body above the peristome. Single rounded conspicuous contractile vacuole is present at the posterior end. Micronucleus is small and lies closely apposed to the macronucleus.

The description of the present species agrees with the description and illustrations given by Kahl (1930-1935), except for the few differences in dimensions. The length reported by Kahl is 80 to 150  $\mu\text{m}$ . But the present specimens measure only 60 to 75  $\mu\text{m}$ . Liebmann (1962) described this species as *Metopus contortus* and Jankowski (1964) described the present species as *Brachonella spiralis*. *Metopus contortus* is the synonym of *Brachonella spiralis* (Smith).

*Dimensions* : Body length ranges from 60 to 75  $\mu\text{m}$  and width ranges from 38 to 49  $\mu\text{m}$ .

Family : STENTORIDAE Carus

Genus : **Stentor** Oken, 1815

**Stentor coeruleus** Ehrenberg, 1830

(Text-figs. 1 & 3)

Body is cerulean blue in colour, cone or trumpet shaped in fully extended condition and capable of extension or of contraction into a sphere. The surface is covered by alternating longitudinal stripes of two kinds—bands of granules, often coloured and between these clear stripes which bear the rows of the body cilia. A thin pellicle forms the outermost surface of the cell. *S. coeruleus* anchors to the substratum by a temporary holdfast organell occurring at the posterior end. Peristomial disk slightly convex with membranellae at its margin. Frontal field is covered with alternating clear and granular stripes. Macronucleus moniliform and consists of many nodes lying within a common nuclear membrane. Micronuclei are many situated close to the macronuclear nodes. Contractile vacuole lies anteriorly and has a collecting canal.

The description given here agrees with the details and illustrations given by Tartar (1961). The specimen found here are longer than the previously reported forms. Tartar (1961) reported that the longest *Stentor* was 350  $\mu\text{m}$  in length. *S. coeruleus* is the largest of all stentors. They are coloured bright in the fully distended ciliate. The number of macronuclear nodes varies from 9 to 11. Mahajan (1971) reported only 7 macronuclear beads.

*Dimensions* : Length of fully extended animal is 340 to 370  $\mu\text{m}$ .

Genus : **Halteria** Dujardin, 1842

**Halteria grandinella** (O. F. Müller, 1786)

(Text-fig. 2)

Globular body. Anterior border with conspicuous frontals and AZM. Cytostome is situated at the end of the zone of the membranelles near the anterior end of the organism. A small membrane is

present on the right edge of the peristome. On the lateral body surface 7 groups of long tactile cilia or bristles are present each with three long bristles. There are over 20 par-oral membranelles. The macronucleus is oval, with a small micronucleus. Contractile vacuole lies to the left of the buccal cavity. Locomotion is of two types, slow rotatory movements and swift darts. Tamar (1974) reported that the oral membranelles are each longitudinally divided in the midline. The oral membranelles are longest anteriorly, towards the exterior opening of the buccal cavity. Our specimens show a oval macronucleus situated at the centre. But Tamar (1974) reported that the interphase macronucleus consists of two subglobose portions separated by a constriction. The present specimens are longer than those described by Dingfelder (1962), Mahajan and Nair (1971), Bick (1972) and Tamer (1974).

*Dimensions* : Body length ranges from 20 to 70  $\mu$ m.

#### SUMMARY

In the present paper six fresh water ciliates belonging to five families and five genera are described in detail. Details of the infraciliature of the ciliates have been touched. *Telotrochidium carteriforme* is the first record for the Indian sub-continent.

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#### REFERENCES

- BHATIA, B. L., 1936. Fauna of British India, including Ceylon and Burma (Protozoa : Ciliophora). 499 pp. London (Taylor & Francis).
- BHATIA, B. L. AND MULLICK, B. K., 1930. On some fresh water ciliates from Kashmir. *Arch. Protistenk.*, **72** : 390-403.
- BICK, H., 1972. Ciliated protozoa : An illustrated guide to the species used as biological indicators in fresh water Biology. 198 pp. Geneva (World Health Organisation).
- BISHOP, A., 1923. Some observations upon *Spirostomum ambiguum* (Ehrenberg). *Jl. microsc. Sci.*, **67** : 391-434.

- CORLISS, J. O., 1961. The ciliated Protozoa : Characterisation classification and guide to the literature. 310 pp. London (Pergamon Press).
- CORLISS, J. O. 1977. Annotated assignment of families and classes currently comprising the corlissian scheme of higher classification for the phylum Ciliophora. *Trans. Am. microsc. Soc.*, **96** : 104-140.
- DINGFELDER, J. H. 1962. Die Cilaten vorubergehender gewasser. *Arch. Protistenk.*, **105** : 509-658.
- GULATI, A. N. 1925. An account of some fresh water ciliates from Lahore. *J. Bombay nat. Hist. Soc.*, **30** : 744-755.
- JANKOWSKI, A. W. 1964. Morphology and evolution of Ciliophora III. Diagnosis and phylogenesis of 53 saprobionts, mainly of the order, Heterotrichida. *Arch. Protistenk.*, **107** : 185-294.
- KAHL, A. 1930-1935. Urtiere order Protozoa I : Wimpertiere oder ciliata (Infusoria), cine bearbetung der freilebenden und ectocommensalen Infusorien der Erde, unter Asschluss der marien Tintinnidae. In Dahl, GF, *Tierwelt Dtl.*, **18** (1930), **21** (1931), **25** (1932), **30** (1935).
- LIEBMANN, H. 1962. Handbuch der Frieschwasser-und abwasser biologie, biologie des Trinkwassers, badewassers, fischwassers, vorfluters, und adwassers. 2nd ed. 279 pp. Munich (Oldenbourg).
- MAHAJAN, K. K. 1971. Fauna of Rajasthan, India. Part 10. Protozoa (No. 2). *Rec. zool. Surv. India*, **63** : 47-76.
- MAHAJAN, K. K. AND NAIR, K. N. 1971. On some fresh water ciliates (Protozoa) from Calcutta and its environs. *Rec. zool. Surv. India*, **63** : 1-22.
- TAMAR, H. 1974. Further studies on *Halteria*. *Acta Protozool.*, **XII** : 11-20.
- TARTAR, V 1961. The biology of *Stentor*. 413 pp. New York (Pergamon Press).