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First Report of Peritrich Ciliates of Genera *Pseudovorticella* from the Ayiramthengu Mangrove Ecosystem, Southwest Coast of India

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Abstract: Twelve peritrich ciliates, *Pseudovorticella banatica*, *P. clampi*, *P. dingi*, *P. fossneri*, *P. jaerae*, *P. jankowskii*, *P. mollis*, *P. monilata*, *P. pseudocampanula*, *P. quadrata*, *P. sinensis*, *P. stilleri* were reported for the first time from the Ayiramthengu mangrove ecosystem of Kerala, southwest coast of India. Their morphology and silver line system were described using live observation and silver impregnation. The study revealed that all the species were found to be new records from India.

Keywords: Mangrove, Ciliate, Silver line system, *Pseudovorticella*, prop root

I. INTRODUCTION

The subclass Peritrichia is one the largest and taxonomically diverse group of ciliates, containing over 1000 nominal species (Kahl, 1933, 1935; Kent, 1880-1882; Song, 1986, 1991; Stiller, 1971). The genus *Pseudovorticella* was established by Foissner and Schiffmann (1974) to include those peritrichs which are morphologically similar to *Vorticella* species but had a reticulate pattern of silver line system with a line running vertically as well as horizontally. Silver line system is particularly useful for species diagnosis in *Pseudovorticella*, and biometric analyses have been carried out on several species (Foissner and Schiffmann, 1974 and 1975; Foissner, 1979). Morphological features traditionally used in vorticellid taxonomy are also useful diagnostic characters of species of *Pseudovorticella* and these include the size and shape of the zooid, number and position of contractile vacuoles and shape and position of the macronucleus (Noland and Finley, 1931; Foissner, 1979; Warren, 1986). Among peritrich ciliates, *Pseudovorticella* became one of the most difficult challenges in taxonomy because of the following reasons (1) *Pseudovorticella* has a relatively small number of species compared with *Vorticella* species and receives little attention in taxonomy despite its wide distribution; (2) *Pseudovorticella* species are very similar in vivo and the known species are insufficiently described; (3) *Pseudovorticella* species are quite similar to *Vorticella* species in living morphology, however, the taxonomic status of many *Vorticella* species themselves is highly doubtful because of a lack of silver staining data. (Clamp 2005, 2006; Foissner 1979; Foissner et al, 1992; Kahl 1933, 1935; Kent, 1880–1882; Noland and Finley, 1931; Stiller, 1971; Wang *et al*, 2012; Warren, 1986, 1987).

II. MATERIAL AND METHODS

Samples were collected from the Ayiramthengu mangrove situated (lat. 9° 6' to 9° 8' N long. 76° 28' to 76° 29' E) in Kollam district of Kerala, a part of Kayamkulam estuary, which is the narrow stretch of tropical backwater on the southwest coast of India (Fig. 1). Mangrove prop roots and litter were covered and attached by epibionts films and samples were taken by scraping 1 cm² patch of the moist film into sterile 15 ml collecting tubes containing 3% formalin. Living ciliates were observed using bright field microscopy. For proper identification of epibionts, they were isolated and treated using the silver carbonate technique of Fernandez and Castro de (1986). The systematic scheme proposed by Lynn (2008) was followed.



Fig. 1. Map of Ayiramthengu mangrove ecosystem

III. RESULT

A. Systematics

The taxonomic position of the genus *Vorticella* is given as follows:

Subkingdom: Protozoa Goldfuss, 1818 emend. Siebold Von, 1848

Phylum: Ciliophora Doflein, 1901

Class: Oligohymenophora de Puytorac et al., 1974

Subclass: Peritrichia Stein, 1859

Order: Peritrichida Stein, 1859

Sub order: Sessilina Kahl, 1933

Family: Vorticellidae Ehrenberg, 1838

Genus: pseudovorticella Foissner and Schiffmann, 1974

Pseudovorticella banatica Sun et al., 2009

Description: Zooid approximately spherical, 65-72 x 58-63 μm in vivo. Peristomial lip relatively thin, single layered. Macronucleus J- shaped. Single contractive vacuole located near ventral wall of infundibulum. Pellicle smooth, with conspicuously reticulate striations.

B. *Pseudovorticella clampi*, Ji et al., 2005

Description: Zooid elongated bell shaped, 85x65 μm in vivo. Single layered peristomial lip. Macronucleus J- shaped. Single contractile vacuole located near ventral wall of infundibulum. Pellicle with densely- arranged greyish granules.

C. *Pseudovorticella dingi*

Description: Cell inverted bell-shaped, measuring about 33–38 μm in vivo. One apically locate contractile vacuole. Macronucleus J-shaped. Pellicle with granules. Peristomial lip relatively thin, well extended and body not constricted beneath it. Peristomial disk flat and moderately elevated when cell fully extended. Stalk approximately 130–170 μm long, 3 μm in diameter and surface of stalk usually smooth.

D. *Pseudovorticella fossneri* sun et al; 2007

Description: Zooid conspicuously flattened 22-32 x 41-52 μm in vivo. Peristomial lip tin and single layered. Macronucleus j shaped. To contractile vacuoles situated near ventral all of infundibulum .pellicle with inconspicuous pellicular blisters which is recognizable only under high magnification.

E. *Pseudovorticella jaerae* Precht, 1935

Description: Zooids inverted bell-shaped 42-58 x 27-48 μm in vivo. Peristomial lip single layered, relatively thick. Macronucleus J-shaped. Single contractile vacuole located near the ventral wall of the infundibulum. Pellicle with a thin layer of greyish pellicular blisters.

F. *Pseudovorticella jankowskii* Sun et al 2009

Description: Zooids almost invariable in shape, inverted bell-shaped. Peristomial disc moderately elevated above the peristome. Peristomial lip rather than thin, only 2-4 μm thick, smooth, extending well beyond the zooid margin. Two contractile vacuoles located near the ventral wall of the infundibulum. Macronucleus with its peristomial end lying across the peristome. Pellicle appears smooth at low magnifications.

G. *Pseudovorticella Mollis* Stokes, 1887

Description: Zooid inverted bell-shaped 38-43 μm long 23 μm wide; peristomial lip 42 μm in diameter; infundibulum reaches one third body length; two contractile vacuoles situated in the anterior part of zooid; stalk 60-80 length.

H. *Pseudovorticella monilata* Tatem, 1870

Description: Zooid inverted bell-shaped, 43-72 μm long 40-46 μm wide; peristomial lip 52 μm in diameter; infundibulum reaches half body length; two contractile vacuoles situated in the anterior part of zooid; macronucleus j shaped; stalk 70-90 μm length.

I. *Pseudovorticella pseudocampanula* Foissner, 1979

Description: Zooid inverted bell-shaped, 36-48 x 20-22 μm in vivo. Peristomial lip 34 μm in diameter. Peristomial lip becomes puckered in some time. Infundibulum reaches half body length, contractile vacuole situated close to infundibulum, macronucleus J shaped. Thecoplasmic granules present on spasmoneme.

IV. DISCUSSION

Vorticella and pseudovorticella are the most successful symbionts of the class oligohymenophorea coming under the phylum Ciliophora. Peritrichous ciliates contain many stalk-possessing groups that are found in both marine and freshwater habitat Foissner et al, 1992. Because of the presence of identical morphological features many known forms, especially in species rich genera such as Zoothamnium, vorticella and Pseudovorticella are difficult to differentiate each other Kahl, 1933, Kusters, 1974. Live observation and, silver staining methods facilitate the species level differentiation of twelve peritrich ciliates, and it to be the first ever report from India.

V. CONCLUSION

In India 2577 species of Protozoa have been reported so far constituting about 8 percent of the total world protozoan population. However, most of the species under the class Oligohymenophora was untouched by many Indian authors. This study analyzes the species composition of class Oligohymenophora with a special reference to Pseudovorticella. Moreover, the study represents the pioneer attempt to analyses the species composition of class Oligohymenophora and further studies are needed to confirm the interdependence among organisms.

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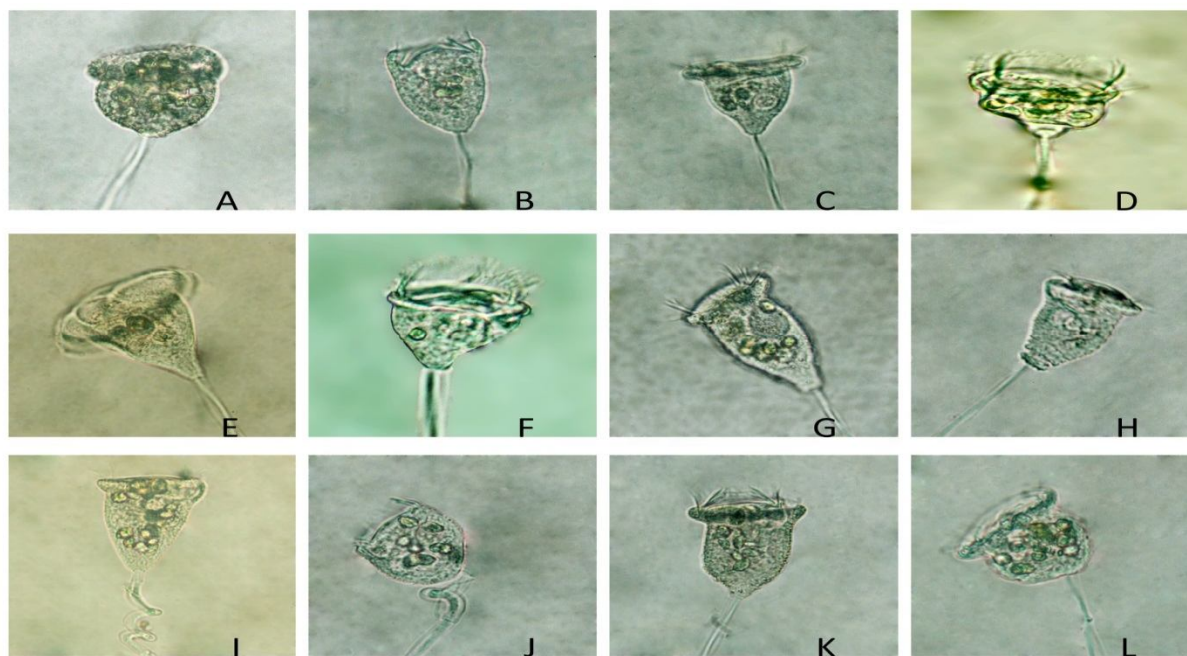


Fig. 2. A-L. Photomicrographs of species identified. A. *Pseudovorticella banatica* Sun et al., 2009, B. *Pseudovorticella clampi*, Ji et al., 2005, C. *Pseudovorticella dingi*, D. *Pseudovorticella fossneri* sun et al; 2007, E. *Pseudovorticella jaerae* Precht, 1935, F. *Pseudovorticella jankowskii* Sun et al 2009, G. *Pseudovorticella mollis* Stokes, 1887, H. *Pseudovorticella monilata* Tatem, 1870, I. *Pseudovorticella pseudocampanula* Foissner, 1979, J. *Pseudovorticella quadrata* Foissner, 1979, K. *Pseudovorticella sinensis* ji et al, 2003, L. *Pseudovorticella stilleri* Stiller, 1963

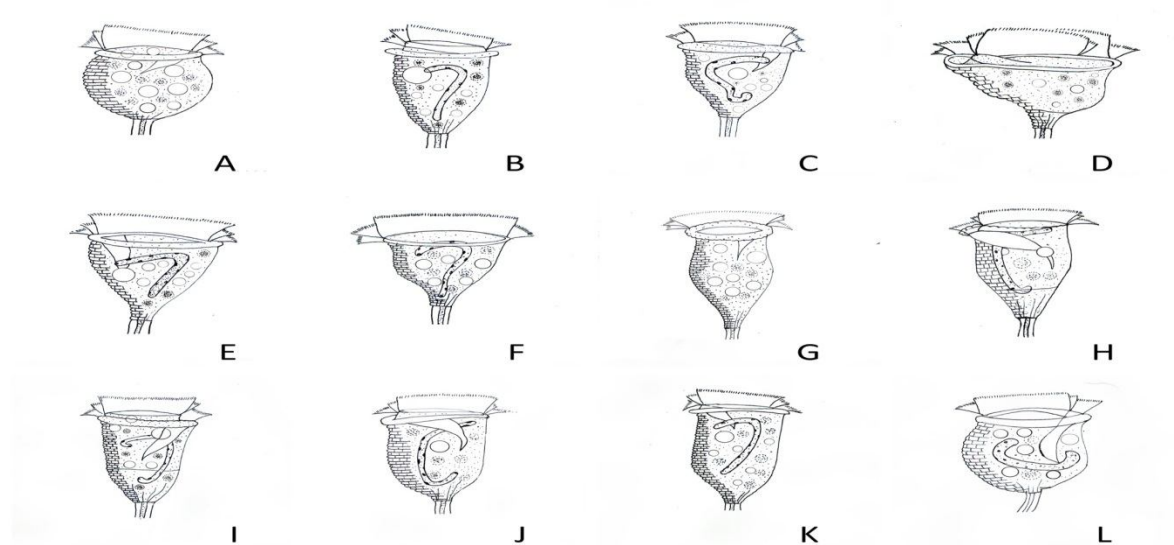


Fig. 3. A-L. diagrammatic sketch of species identified. A. *Pseudovorticella banatica* Sun et al., 2009, B. *Pseudovorticella clampi*, Ji et al., 2005, C. *Pseudovorticella dingi*, D. *Pseudovorticella fossneri* sun et al; 2007, E. *Pseudovorticella jaerae* Precht, 1935, F. *Pseudovorticella jankowskii* Sun et al 2009, G. *Pseudovorticella mollis* Stokes, 1887, H. *Pseudovorticella monilata* Tatem, 1870, I. *Pseudovorticella pseudocampanula* Foissner, 1979, J. *Pseudovorticella quadrata* Foissner, 1979, K. *Pseudovorticella sinensis* ji et al, 2003, L. *Pseudovorticella stilleri* Stiller, 1963



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