Morphology of Twelve Species of The Genera Euplotes (Class: Spirotrichea) From The Ayiramthengu Mangrove Ecosystem, Southwest Coast of India

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Abstract- *Ciliates comprise a diverse and ecologically important phylum of unicellular protists. One of the most spacious and best-defined genera is Euplotes. Twelve Euplotes species belonging to the class spirotrichea, Euplotes antarcticus, Euplotes encystylus, Euplotes urystomus, Euplotes minuta, Euplotes muscicola, Euplotes parabalteatus, Euplotes parawoodruffi, Euplotes raikovi, Euplotes rariseta, Euplotes sinicus, Euplotes vannus and Euplotes woodruffi were reported for the first time from the Ayiramthengu mangrove ecosystem .Their morphology features were described using silver impregnation technique.*

Keywords- Mangrove, Ciliate, Silver line system, Euplotes

I. INTRODUCTION

Ciliates are the diverse group of protozoan, may have evolved over 2 billion years ago, Lynn, 2007. Ciliates are grouped in to two subphyla and 11 classes based on the features of nuclear division and the patterns of fibrillar associates in their somatic kinetids. The class spirotrichea is the most diverse group of ciliate found in almost any habitat. The class name arises from the characteristically spiraling nature of the adoral zone. They are behaviorally planktonic and predominantly free swimming. The species-rich genus Euplotes has been revealed to be much more divergent genera belonging to the class spirotrichea. Extremely wide distribution and high adaptive potentialities make the genera more susceptible to changing climatic conditions (Curds, 1975 ; Lobban et al., 2005; Schwarz et al., 2007; Wilbert & Song, 2008).

In recent decades, from various habitats, many new Euplotes species have been studied, and added to this genus (Song et al., 1998; Lobban et al., 2005; Schwarz & Stoeck, 2007; Wilbert & Song, 2008). Compared to other protozoans Euplotes is a comparatively straightforward with a good set of quantifiable morphological characters allows taxonomists to define appropriate morphospecies boundaries. It is generally easy to perform identifications using morphological peculiarities.

II. MATERIAL AND METHODS

Samples were collected from the Ayiramthengu mangrove situated (lat. $9^0 6^1$ to $9^0 8^1$ N long.$76^0 28^1$ to $76^0 29^1$ 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).

Samples were collected from Mangrove substratum. 'Non- flooded Petri dish method' (Foissner, 1987) was performed to analyze the species composition. About 10 g of soil was placed in a petridish and was diluted with filtered mangrove water but not flooded. After settling the sample supernatant 1 ml solution was poured in to the Sedgwick rafter counting chamber and enumerate the epibiont composition. Living ciliates were observed using bright field microscope. For species level identification, epibionts were isolated and treated using the silver carbonate technique (Fernandez and Castro de, 1986). The systematic scheme proposed by Lynn (2008) was followed to categories the individuals in species level.

Fig. 1. Map of Ayiramthengu mangrove ecosystem.

III. RESULT

Systematics

The taxonomic position of the genus *Euplotes* is given below:

Subkingdom: Protozoa Goldfuss, 1818 emend. Siebold Von, 1848
Phylum: Ciliophora Doflein, 1901
Class: Polyhymenophora de Puytorac et al., 1974
Subclass: Spirotricha Bütschli, 1889
Order: Hypotrichida, Stein 1859
Sub order: Sporadotrichina, Faure Fremiet, 1961
Family: Euplotidae, Ehrenberg, 1838
Genus: *Euplotes* , Müller, 1786

Euplotes antarcticus*, *Fenchel & Lee, 1972

Body is elongate-ellipsoidal about 120 µm in vivo; anterior ventral surface distinctly protruding, with 3 or 4 inconspicuous ventral and 6–10 low dorsal ridges, dorsoventrally flattened. Cirri: 10 frontoventral, 5 transverse, 2 left-marginal, 3–6 caudal. Dorsal kineties 8–14 (11–21 dikinetids in mid-dorsal rows). Adoral membranelles 30–70. Macronucleus question-mark-shaped.

Euplotes encysticus, Yonezawa, 1985

Body is oval in outline, about 90 µm in vivo. Buccal field covering 3/4 of the entire body. There are 9 frontoventral, 5 transversal, 2 caudal and 2 left marginal cirri; 35 adoral membranelles and 8 dorsal kineties within obvious ridges. Macronucleus C-shaped.

Euplotes eurystomus, Wrzesniowski, 1870

This is a large (160 microns) ovoid hypotrich. The buccal region is triangular and there is a single anterior peristomial pouch. The margin to the adoral membranelle zone is high and prominent. The adoral membranelle zone is sigmoid and contains 50-65 membranelles. There are 9 frontoventral, 5 transverse and commonly 4 caudal cirri. . There are 17-25 dorsal cilia in the central kineties. The macronucleus is typically 3-shaped and there is sometimes a definite concave notch, which contains the micronucleus.

Euplotes minuta, Yocom, 1930

Body is oval in outline, about 50 µm in vivo. Dorsoventrally flattened, length of buccal field about 75% that of the entire body length. Macronucleus C-shaped, Ten frontoventral, 5 transverse and 2 caudal cirri separated and aligned evenly with small caudal cirri. There are Eight kineties extend entire length of cell, leftmost kinety containing 5 dikinetids.

Euplotes muscicola, Petroni et al., 2002

Body is oval in outline, about 70 µm in vivo. Buccal field is long and occupies about 3/4 of the anterior left side of the ventral surface. There are 9 frontoventral, 5 transverse and 4 caudal cirri. The dorsal argyrome is of the multiple type and consists of 4 regular rows of small polygons between the kineties. There are 10 dorsolateral kineties bearing up to about 35 cilia in the mid-dorsal rows. The macronucleus is an open C-shape with a compact micronucleus situated about halfway down its left side.

Euplotes parabalteatus, Jiang et al., 2010

Small-sized body is oval in outline, about 35 µm in vivo. Slender oval, no conspicuous dorsal or ventral ridges. Buccal field over two-thirds of cell length with about 20 membranelles; consistently 10 frontoventral cirri, 2 marginal cirri positioned posterior to 5 relatively fine transverse cirri

and close to 2 caudal cirri; 6–7 dorsal kineties with about 9 dikinetids in mid-dorsal row. Macronucleus slightly curved-bar-shaped.

Euplotes parawoodruffi, Song & Bradbury, 1997

Body is more or less rectangular about 120 µm in vivo, with a broad anterior end. Dorsoventrally flatted dorsal side strongly arched with numerous cortical granules. Macronucleus irregularly S shaped. Body covered with nine frontoventral, 2marginal and two caudal cirri.

Euplotes raikovi, Agamaliev, 1966

Body is oval in shape with truncated anterior end, the size is about 40 µm in vivo, with six conspicuous dorsal ridges; length of buccal field is about 40 % of the entire cell length. Seven normal frontoventral cirri, plus a reduced one, which consists of only a single pair of basal bodies, located in central area of frontal field. There are one marginal, 5 transverse 2 caudal cirri and 8 rows of dorsal kineties. The macronucleus is C-shaped.

Euplotes rariseta, Curds, 1974

Body is ellipsoidal to slightly triangular about 50 µm in vivo. 10 frontoventral, 5 transverse, 1 (sometimes 2 very closely set) left-marginal, 2 caudal. Dorsal kineties 5–8 (c. 6–14 dikinetids in mid-dorsal rows). Adoral membranelles 18–37. Macronucleus C- to S-shaped.

Euplotes sinicus, Jiang et al. 2010

Body is slender and oval in shape about 80 µm in vivo, with very conspicuous dorsal ridges. Length of the buccal area covers more than 50% of the entire cell length. Macronucleus C shaped . There are 10 frontoventral 5 transverse 2 caudal cirri one fine marginal cirrus and seven dorsal kineties with about 12 dikinetids in mid-dorsal rows.

Euplotes vannus, Müller, 1786

Body slightly rectangular outline. Length of the buccal field about 65% that of the body. macronucleus C shaped .Body size is about 90 µm long in vivo, with no conspicuous dorsal ridges. Cytoplasm hyaline, central area often dark due to food vacuoles and granules. Proximal portion curved, ten frontoventral cirri, two left marginal cirri, 3or 4 caudal cirri, nine or ten dorsal kineties extending the entire length of cell. Locomotion by medium fast-crawling on the substratum.

Euplotes woodruffi, Gaw 1939

Body is ovoid 145 µm long, inflexible; ventral surface flattened, dorsal surface convex; peristome broadly triangular. Cell body is ovoid, dorsoventrally flattened; dorsal surface may be equipped with three groups of cirri frontoventral, transverse and caudal extending 2/3 % of the total cell length. Macronucleus C-shaped and slightly curved.

IV. DISCUSSION

There are 12 described species of Euplotes from the study site (Fig 2 and 3). Most of the described species would not possess any uniform characteristics. *Euplotes eurystomus* was the largest species with an average length of 160 µm and *Euplotes parabalteatus* was the smallest one with an average length of 35 µm. The area covered by buccal field, counting cirri and observing the shape of macronucleus is considered as a discriminant feature for the identifying Euplotes in species level. The twelve species identified from the Ayiramthengu mangrove was the first report from Kerala. *Euplotes muscicola* is a fresh water hypotrichia rarely found in estuarine habitat, and considered as a first report from India.

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REFERENCES

[1] F.G. Agamaliev, “New species of psammobiotic ciliates of the western coast of the Caspian Sea”. Acta Protozool, vol 4, pp169–183, 1966.
[2] O. Bütschli, Protozoa. III. Abtheilung: Infusoria und System der Radiolaria. In: Bronn H.G. (ed.). Klassen und Ordnungen des Thier-Reichs, wissenschaftlich dargestellt in Wort und Bild, Vol. I,. Winter, Leipzig. Tafeln. pp. 1585–2035. 1889.
[3] C.T.E.Von.Siebold, Lehrbuch der Vergleicherden Anatomie der wirbellosen Thiere, Thiel,Berlin.1848.
[4] C.R.Curds, A guide to the species of the genus Euplotes(Hypotrichida,Ciliatea). Bull.br.Mus.nat.Hist.Zool. vol 28, pp 3–61,1975.
[5] C.R.Curds, Description of three species of Euplotes (Protozoa). Bull.br.Mus.nat.Hist.Zool. vol 27. pp113-125, 1974.
[6] D.H Lynn, The Criliated Protozoa. Characterization, Classification, and Guide to the literature, 3rd edition, , pp 1-605, 2008.
[7] Ehrenberg, C. G. (1838). Die Infusionsthierchen als vollkommene Organismen. Ein Blick in das tiefere

organische Leben der Natur. Leopold Voss, Leipzig. F. Doflein, Die Protozoen als parasite und Krankeitserreger, nach Biologischen Geschtspunkten dargestellt. Fischer Verlag, Jena, pp 274, 1901.

[8] Faure Fremiet, Vibratile cilia and flagella. Biol Rev Camb Philos Soc.vol36, pp 464-536, 1961.

[9] T. Fenchel and C.C. Lee, Studies on ciliates associated with the sea ice from Antarctica. I. The nature of the fauna. Arch. Protistenk. Vol 114, pp 231–236,1972.

[10] Fernandez and M. Zaldumbide. The morphology of Anophrys arenicola n . sp. (ciliophora, scuticociliatida). J. Nat. Hist, vol 20, pp 713- 721,1986.

[11] W.Foissner, Soil protozoa: fundamental problems, ecological significance, adaptations in ciliates and testacean, bioindicators and guide to the literature. In J. O. Corliss and D. J. Patterson, (eds) Progress in Protistolology vol 2, Biopress, Bristol, UK. 1987, pp 69-212.

[12] G.A .Goldfuss ,Uber die Entwicklungsstufen des Thieres, Nurenberg, vol18, pp21.1818.

[13] Z.H Gaw, Euplotes woodruffi sp. nov.. Arch. Protistenkd. Vol 93, pp1-5,1939.

[14] J. Jiang, Q. Zhang, X. Hu, C. Shao, K.A.S. Al-Rasheid and W. Song, Two new marine ciliates, Euplotes sinicus sp. nov. and Euplotes parabalteatus sp. nov., and a new small subunit rRNA gene sequence of Euplotes rariseta (Ciliophora, Spirotrichea, Euplotida). Int J Syst Evol Mirobiol. Vol 60, pp 1241–1251,2010.

[15] C.S Lobban, L. Modeo, F. Verni and G. Rosati Euplotes uncinatus (Ciliophora, Hypotrichia), a new species with zooxanthellae. Marine Biology vol147, pp1055–1061 2005.

[16] O.F. Müller,. (Diatomaceen (Vibrio paxillifer, V. bipunctatus, V. tripunctatus, Gonium pulvinatum). Animalcula infusoria fluviatilia et marina quae detexit, systematice, descripsit et ad vivum delineare curavit O.F. Muller.Havniae,1786.,LVI367 pp.,50 1786.

[17] P. de Puytorac, A. Batisse, J. Bohatier, J.O. Corliss, G. Deroux, P. Didier, J. Dragesco, G. Fryd-Versavel, J. Grain, C.A. Grolie´re, F. Iftode, M. Laval, M. Roque, A. Savoie and M. Tuffrau, Proposition d'une classification du phylum Ciliophora Doflein, 1901. C. R. Acad. Sci. Paris, vol 278 pp2799–2802 ,1974.

[18] M.V.J. Schwarz and T. Stoeck, Euplotes pseudoelegans n. sp. (Hypotrichida; Euplotidae): description of a new species previously misidentified as Euplotes elegans Kahl, 1932. Acta Protozoologica 46, pp193–200, 2007.

[19] W. Song, A. Warren B. and Hill , Description of a new freshwater ciliate, Euplotes shanghaiensis nov. spec. from China (Ciliophora, Euplotidae). Eur. J. Protistol. vol 34, pp104–110,1998.

[20] W. Song, and P.C. Bradbury,. Comparative studies on a new brackish water Euplotes, E. parawoodruffi n. sp., and a redescription of Euplotes woodruffi Gaw, 1939 (Ciliophora Hypotrichida). Arch.Protistenkd., vol8,pp399-412,1997.

[21] F. Stein, Characteristik neuer Infusorien-Gattungen. Lotos, vol 9(2–5) pp57–60,1859

[22] N. Wilbert and W. Song, A further study on littoral ciliates (Protozoa, Ciliophora) near King George Island, Antarctica, with description of a new genus and seven new species J. Nat. Hist, vol 42, pp 979–1012,2008.

[23] A. Wrzesniowski, Beobachtungen über Infusorien aus der Umgebung von Warschau. Z. wiss. Zool., XX, pp 467–511,1870.

[24] Yocom, Two new species of Euplotes from Puget Sound. Pub!. Puget Sound Mar. Bioi. Stat., vol 7 pp 241-248,1930.

[25] F. Yonezawa, Encystment process and the realtion of excystation to cell cycle in Euplotes encysticus (Ciliophora). J. Sci. Hiroshima Univ. (Ser. B, Div. I, Zoo!.) vol,32,pp 57-71, 1985.

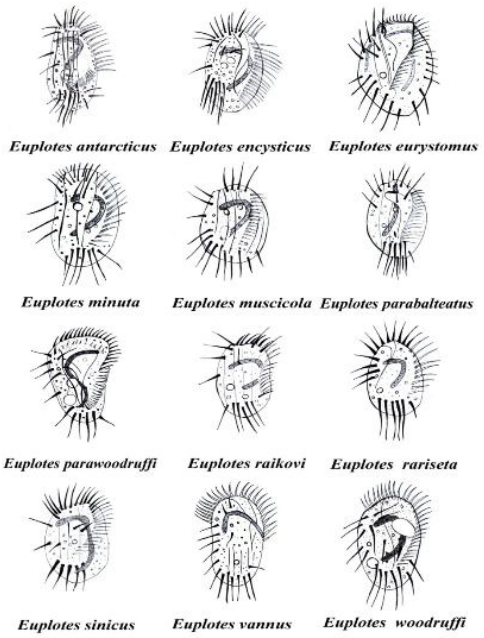

Fig. 2. Diagrammatic sketch of species identified.

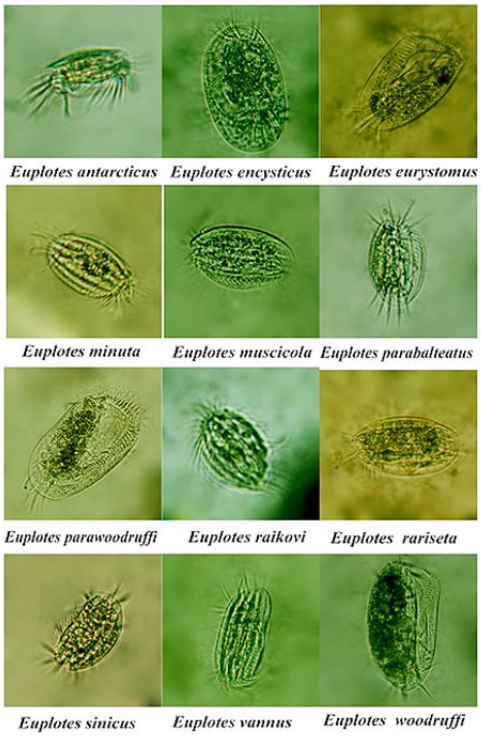

Fig. 3. Photomicrographs of species identified.