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SPECIES DIVERSITY OF EUGLENOIDS IN VELLAYANI LAKE OF THIRUVANANTHAPURAM DISTRICT, KERALA

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ABSTRACT

The present investigation aims to assess the species diversity of euglenoids in Vellayani lake. The algal collections were carried out during the year 2013-2014. The phytoplankton were enumerated for the computation of biological indices which indicate the diversity, richness, dominance and evenness of the euglenoids in the sample. Around 16 different species of euglenoids belonging to 4 genera *Euglena, Phacus, Lepocinclis and Trachelomonas* were observed in the sample collected. Among these *Trachelomonas* exhibited the highest values for Margalef's richness index (1968), dominance index, Pielou's (1975) Evenness index, Shannon Weiner (1949) diversity index such as 0.6, 0.74, 2.14, 2.29 and *Lepocinclis* was shown to be the poorly represented genera with values 0.13, 0.36, 1.3 and 0.79 respectively.The higher values of Shannon's Index (Ht)indicated the greater species diversity. This index also determines the pollution status of a water body. The normal values range from 0-4. The values of the index greater than 3 indicate clean water; 1-3 indicate moderate pollution and value less than 1 are characterized as heavily polluted and the present showed an average Ht value of 1.5 which indicates that the Lake is subjected to only moderate pollution.

KEY WORDS
Vellayani Lake
Euglenoids
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INTRODUCTION

Phytoplankton are the diverse group of photosynthetic organisms that ranges from single-celled to complex forms. They respond rapidly to changes in their environment with concomitant changes in overall abundance, growth rates and species composition, changes in physical and chemical water quality and thus have a rapidly changed species composition (Charles and Smol, 1994; Dixit *et al.*, 1992). The algal flora constitutes a vital link in the food chain and its productivity depends on water quality at a given time (Meshram and Dhande, 2000). The present study deals with the abundance and diversity of euglenoids in a freshwater ecosystem. Euglenophyta is a division of highly differentiated algal flagellates which mostly inhabits freshwater environment. They are microscopic forms of eukaryotic organization usually with two flagella for locomotion, an undifferentiated cell wall and chloroplasts.

Considerable work has been carried out in India about systematic survey, distribution, seasonal occurrence of algae. Shankar (2010) studied the phytoplankton in Mysore Lakes and Leela *et al.* (2010) assessed the Euglenoid diversity of some lakes in Maharashtra . Only a very few reports are available on the phytoplankton diversity especially of euglenoids from the freshwater habitats of Kerala. Jose and Francis (2010), Arulmurugan *et al* (2010) Tessy and Sreekumar (2012) have described euglenoids from freshwaters of Kerala. Phytoplankton study provides a relevant focus for research on eutrophication and its adverse impact on aquatic life. These green euglenoids in a freshwater environment are usually pollution tolerant and their abundance and diversity indicates the quality status of the water. The present study on these bio indicators may serve as a baseline data for further quality monitoring approaches in the Lake. The paper deals withassessing the diversity of phytoplankton belonging to Euglenophyceae in Vellayani Lake.

Area of study

Vellayani Lake, or *Vellayani Kayal* as known in local language, is the largest fresh water lake in Thiruvananthapuram district of Kerala. It lies between 8º24'09"-8º 26'30" N Latitude and 76º59' 08"- 76º59'47" E Longitude. The lake is bordered by Thiruvallom and Nemom villages of Neyyattinkara Taluk (Fig. 1).

Major part of the lake is stagnant but a small portion flows to Karamana River. It is the main source of water supply to four neighbouring panchayats. Algal samples were collected from different sites of Vellayani Lake *viz* Mukaloor Moola, Venniyoor, Palappoor, Kalliyoor and Kakkamoola during the year of 2013-2014.

MATERIALS AND METHODS

Algal samples were collected from the selected sites of Vellayani Lake during the period of 2013-2014. Plankton net of mesh size 25μm was swept on surface water and plankton collected was transferred into separate glass bottles. The

samples were preserved in 4% formalin. Each sample was mounted on the glass slide using glycerine and observed under advanced Research microscope. The algal genera were identified by referring various monographs (Prescott, 1978 and Anand, 1980) and related publications. Phytoplankton counting was done using Sedgwick – Rafter Cell method (Trivedi and Goel, 1986). For assessing the diversity and evenness, Margalef's richness index (1968), Bellan- Santini Dominance index (1969), Pielou's Evenness index (1975), Shannon Wiener (1949) diversity index were calculated using the formulas given below.

Margalef's richness index- *(S-1)*/ln *(n)*, where *S* is the number of taxa, and *n* is the number of individuals.

The Dominance index of a particular species was estimated by DI = m/M x 100

Where m = individual number of species in the stations and

M = total individual number of all the species.

Pielou's (1975) evenness index was estimated by j = H'/ log2S

Where H' = Shannon and Weaver Index (1949) and S= species number.

The Shannon and Weaver (1949) index was estimated Shannon's Index H' = - pi ln pi

Where pi = the proportion of individuals of species i.

RESULTS AND DISCUSSION

Detailed microscopic examination of phytoplankton collected from the Vellayani lake during the study period revealed the occurrence of about 16 species of Euglenoids belonging to different genera such as *Euglena, Phacus, Lepocinclis, and Trachelomonas*.

Taxonomic description

Genus: ***Euglena*** Ehrenberg (1838)

Euglena acus Ehrenberg Fig. 1

Cells elongated, spindle shaped, 140-180 micron long, 10-13 micron broad, anterior end narrowed and truncate, posterior end long, fine tapering point; chloroplast numerous and disc like.

Euglena oxyuris Schmarda Fig: 2

Cells elongate-cylindrical and twisted, 160 micron long, 22 micron broad, anterior end round with slight indentation at opening of canal, posterior end taper to short tail piece; periplast with prominent striation; chloroplast numerous and disc like.

Euglena sanguinea Ehrenberg Fig: 4

Cells sub-cylindrical, 24-33 micron broad, 55-120 micron long, anterior end narrow rounded, posterior end taper to a short blunt tail piece; periplast spirally striated; hematochrome granules present.

Euglena gracilis Klebs (1883) Fig: 3

Cells 35-55 µm long, 6-25 µm wide; cylindrical to elongate ovate; fusiform chloroplasts variable in number (Kudo, 1966). Less than 20 chloroplasts; paramylon body attached to each side of each chloroplast.

Genus: ***Phacus*** Dujardin (1841)

Phacus longicauda (Ehrenberg) Dujardin Fig: 5

Cells ovoid, flat, 85-170 micron long, 45-70 micron broad, anterior end broadly rounded, posteriorly taper gradually to form a long straight and sharply pointed caudus; periplast longitudinally striated.

Phacus tortus (Lemmermann) Skvortzow Fig. 6

Cells 80-100 µm long, highly flattened; pellicle firm; body form flat and leaf-shaped with longitudinally twisted ridges (Yamagishi ,1992).

Phacus orbicularis Huebner Fig. 7

Nearly triangular when viewed in its optical cross-section with a blunt dorsal keel. The ventral side is plain. The sting is 15 µm long. Periplast with longitudinal stripes.

Phacus hispidulus (Eickwald) Lemmermann Fig. 8

Cells with a short caudal projection. Pellicle with minute knobs arranged longitudinally; pointed flagellum about the body length; incurved with small papilla.

Genus: ***Trachelomonas*** Ehrenberg (1835) Fig. 9

Trachelomonas armata Stein var.

longispina (Playf.) Deflandre

Cells broadly ovate, 40-43 micron long, 30 micron diameter, with spines; flagellum aperture without collar but with a circle of erect spines at the margin; spines short in anterior region but stout, both short and long in posterior region.

Trachelomonas hispida (Perty) Stein Fig. 10

cells ovoid to oblong, 31 microns in length, 21 micron diameter, thickly covered with short spines, collar slightly raised.

Trachelomonas volvocina Ehrenberg Fig. 11

Cells reddish brown, globose, 14-16 microns in diameter, flagellum aperture without a collar, wall smooth.

Table 1: Biological index values of euglenoids from Vellayani Lake

Biological indices	*Euglena*	*Lepocinclis*	*Phacus*	*Trachelomonas*
Shannon Weiner diversity	1.9	0.79	1.4	2.29
Pielou's evenness	2.1	1.3	1.5	2.14
Margalef's richness	0.39	0.13	0.38	0.60
Dominance index	0.72	0.36	0.54	0.74

Figure 1: Map showing the study area- Vellayani Lake

Euglenoids of Vellayani Lake

Figure 1: *Euglena acus*

Figure 2: *Euglena oxyuris*

Figure 3: *Euglena gracilis*

Figure 4: *Euglena sanguinea*

Figure 5: *Phacus longicauda*

Figure 6: *Phacus tortus*

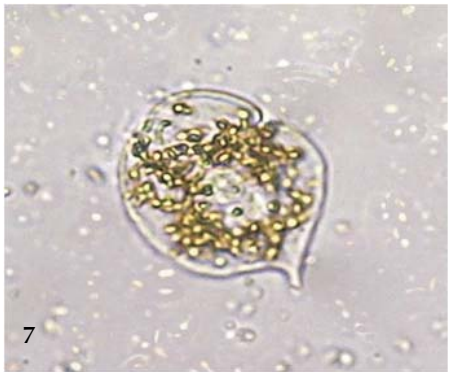

Figure 7: *Phacus orbicularis*

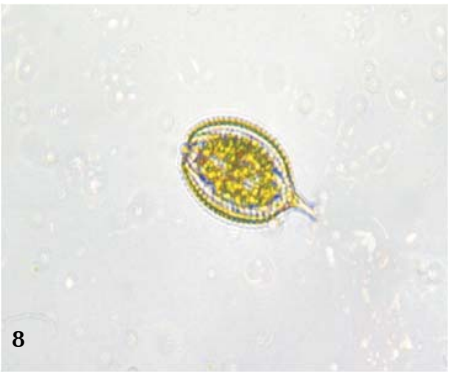

Figure 8: *Phacus hispidulus*

Figure 9: *Trachelomonas armata*

Figure *10*: *Trachelomonas hispida*

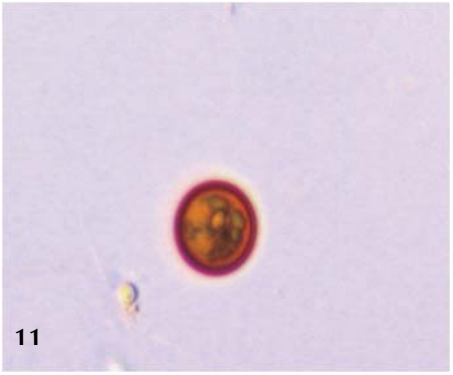

Figure 11: *Trachelomonas volvocina*

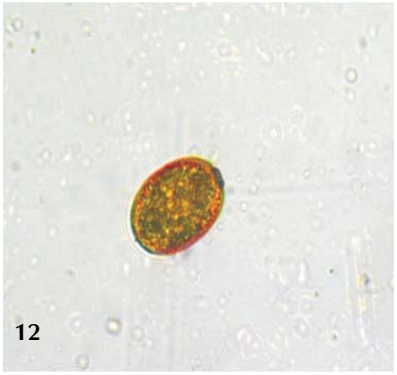

Figure 12: *Trachelomonas pulcherrima*

Trachelomonas pulcherrima var. **Latior** Playfair Fig. 12

Lorica ellipsoidal length of 24.5 to 28.5 microns long and 13-14 microns in diameter. Poles and broadly rounded lateral margins nearly parallel. Pore surrounded by an annular thickening. Wall brown, loosely dotted.

Trachelomonas cylindrica Ehrenberg Fig. 13

Figure 13: ***Trachelomonas cylindrica***

Figure 14: ***Trachelomonas caudata***

Figure 15: ***Lepocinclis fusiformis***

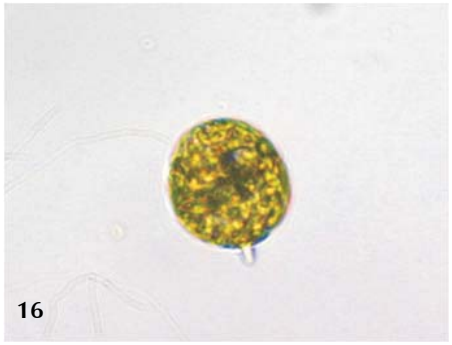

Figure 16: ***Lepocinclis ovum***

Lorica long cylindrical, smooth, rounded at both end; collar very short or absent; 15-20 ìm long, 8-10 ìm diam.

Trachelomonas caudata (Ehrenberg) F. Stein Fig. 14

Lorica ellipsoid to nearly fusiform, posterior end conically tapering into a stout projection; flagellum apertures with a low collar having a circle of spines; wall covered with short spines; 45-50 ìm long.

Genus: ***Lepocinclis*** Perty (1849)

Lepocinclis fusiformis (Carter) Fig. 15

Cells broadly fusiform, 30 micron long, 16 micron broad; Periplast spirally striated.

Lepocinclis ovum (Ehrenberg) Lemmermann Fig. 16

Cells broadly ovate with short, blunt caudus, 30 micron long, 21 micron broad, rounded both anteriorly and posteriorly; periplast spirally striated.

Biological Indices

Euglenoids have been commonly recorded in the water bodies of India especially in Tamil Nadu (Jayanthi, 1987; Sivakami,1 996) and Kerala (Shaji and Patel, 1991; Nasser and Suresh kumar, 2013). During the study period, in general the abundance of euglenoids was very low and the main phytoplankton communities were dominated by chlorophycean forms, diatom and blue green algae. These communities have been described as typical of eutrophic water bodies (Padisák and Dokulil, 1994; Nogueira and Leandro-Rodrigues, 1999; Borics *et al., 2000)*. Similar species of *Phacus*, *Trachelomonas*, *Euglena* and *Lepocinclis* collected during the present study was also reported from the polluted and unpolluted water of Maharashtra (Kumawat and Jayashri, 2011). Margalef's richness index (1968) relies only on the number of taxa and it increases when abundance is spread over a greater number of categories but does not take into account the evenness of the distribution. Among the four genera of Euglenophyceae reported from the Lake, *Trachelomonas* showed the highest values for Shannon - Weiner diversity index, Pielou's evenness index, Margalef's richness and Dominance index. *Lepocinclis* was the poorly represented genera among the euglenoids (Table-1). *Phacus* and *Euglena* showed intermediate dominance, diversity and richness values. The higher values of Shannon's Index (H'), indicates greater species diversity. This index also determines the pollution status of a water body. Wilham and Dorris (1968) concluded that the values of Shannon -Weiner index greater than 3 indicate clean water, values in the range of 1 to 3 are characterized by moderate pollution and values less than 1 are characterized as heavily polluted. In the present study the Shannon -Weiner index shows an average value of 1.5 and it reveals moderately polluted status of the Vellayani Lake. The presence of organic and inorganic nutrients in the water might have contributed to the abundance of these algal flagellates, eventually resulting in the decline of drinking quality of the water from the Lake.

Phytoplankton encountered in the water body reflects the average ecological condition and therefore, they may be used as indicator of water quality (Bhatt, *et al.,* 1999; Saha *et al.*, 2000).

Vellayani Lake is under constant threat of anthropogenic influences and hence similar biological as well as ecological studies are being performed in the Lake to assess the rate of deterioration of water quality.

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REFERENCES

Anand N. 1998. Indian freshwater Microalgae. *Bishen Singh Mahendra Pal Singh. Dehra Dun,* India. pp. 1-94.

Arulmurugan, P., Nagaraj, S. and Anand, N. 2010. Biodiversity of freshwater algae from temple tanks of Kerala. *Rec. Res. Sci. Tech.* **2:** pp. 58-72.

Bellan and Santini, D. 1969. Contribution a letude des peuplement inflraliltorase Sur Substrat rocheuse (Etude qualitative et. *Quantative de la franch Superiore) Recherche, France*. **63(47):** 9-284

Bhatt, L. R., Lacoul, P., Lekhal, H. D. and Jha, P. K.1999. Physico-

chemical characteristic andphytoplanktons for Taudha lake, Kathmandu. *Poll. Res.* **18(4):** 353-358.

Borics, G., Gregorsky 1., Szabó, S. and Padisák, J. 2000. Phytoplankton associations in a small hypertrophic fishpond in East Hungary during a change from bottom-up to topdown control. *Hydrobiologia*. **424:** 79-90.

Charles, D. F. and Smol, J. P. 1994. Long term chemical changes in lakes: Quantitative inference using biotic remains in the sediment record. *Advances in Chemistry*. **237:** 1-57.

Dixit, S. S., Smol, J. P., Kingston, J. C. and Charles, D. F. 1992. Diatoms: powerful indicators of environmental change. *Environmental Science and Technology*. **26:** 23-33.

Jayanthi, M. 1987. A study on diurnal and seasonal variation in selected physico-chemical parameters and the plankton analysis of Sivaganga tank, Tiruchirappalli. *M. Phil.Dissertation, Bharathidasan University, Tiruchirappalli,* India.

Jose, J. and Francis, M. S. 2010. Wetland Algal resources of Western Ghats (Idukki District Region) Kerala, India. *J. Basic and Applied Biology*. **4(3):** 34-41.

Kumawat, D. A. and Jayashri, P. 2011. Euglenoids of polluted and unpolluted water from North Maharashtra , India. *The Ecoscan*. **1:** 309-317.

Leela, J. Bhosale, Surekha, N. Dhumal and Anjali, B. S. 2010. Seasonal Variations in occurrence of phytoplankton and primary productivity of some selected Lakes in Maharashtra. *The Bioscan*. spl. Issue. **2:** 569-578.

Lemmermann, E. 1910. Algen I. Kryptogamen flora der Mark Brandenburg hrsg. Von dem Bot., Verein. *Der Provinz Brandenburg* **3:** 1-172.

Margalef, D. R. 1968. Perspectives in Ecological Theory. *The University of Chicago Press Chicago*. p. 111.

Meshram, C. B. and Dhande, R. R. 2000. Algal diversity with respect to pollution status of wadali lake, Amaravati, Maharashtra, India. *J. Aqua. Biol.***15:** 1-5.

Mohamed Nasser, K. M and Sureshkumar, S. 2013. Interaction between microalgal species richness and environmental variables in Peringalkuthu Reservoir, Western Ghats, Kerala. *J. Environ Biol.* **34(6):** 1001-1005.

Nogueira1. De, S. and Leandro-Rodrigues, N. E. 1999. Algas planctónicas de um lago artificial de Jardin Botánico Chico Mendes, Goiánia, Goiás. Florístic e algumas consideracóes ecológicas. *Revista Brasileira de Biologia*. **59(3):** 377-395.

Padisák, J. and Dokulil, M. 1994. Contribution of green algae to the phytoplankton assemblage in a large, turbid shallow lake (Neusiedlersee, Austria/Hungary), *Biologia Bratislava 49:* 571-579.

Pielou, E.C. 1975. Ecological Diversity. *Wiley-Inter Science Publ., London*. p. 165.

Prescott, G. W. 1978. How to Know the Freshwater Algae. *Wm. C. Brown Co., Publishers, Duluque Iowa*. p. 293.

Shaji, C. and Patel, R. J. 1991. Contributions to Euglenoids of Kerala, India. *Phykos*. **30(1&2):** 109-114.

Shankar, P. H. 2010. Phytoplankton diversity in Lakes of Mysore District, Karnataka State , India. *The Ecoscan*. **4(1):** 53-57.

Shannon, C. E. and Weiner, V. 1949. A mathematical Theory of Communication University Press, Illinois Urbana. pp. 101-107.

Sivakami, R. 1996. Limnological profile of two contrasting lentic systems and their aquaculture Potential. *Ph.D.Thesis, Bharathidasan University, Tiruchirappalli,* India.

Tessy Paul, P. 2012. Studies on the Algal Flora of Kole lands in Thrissur district, Kerala. Ph. D Thesis, Mahatma *Gandhi University, Kerala, India*

Trivedi, R. K. and Goel, P. K. 1986. Chemical and biological methods for water pollution studies. *Environmental Publishers, Karad,* India. p. 248.

Wilham, J. L. and Dorris, T. C. 1968. Biological Parameters of water Quality Criteria *Bioscience*. **18:** 447-481.