



Original Research Paper

The morphological study of genus Euglenoids from the Bharamasagara and Katral take of Chitradurga district, Karnataka

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Abstract

The taxonomy and diversity of Euglenophyceae class members in Bharamasagara & Katral Lake Chitradurga district, Karnataka, India, are revealed in this study. Samples were gathered from four sampling locations over the course of two years, from January 2023 to December 2025. Fourteen euglenoid species from four genera were identified in the current study. *Euglena adhaerens*, *Euglena geniculata*, *Euglena granulata*, *Euglena polymorpha*, *Euglenaformis proxima*, *Euglena sanguinea*, *Euglena tuberculata*, *Lepocinclis acus*, *Lepocinclis globulus*, *Phacus nordstedtii*, *Phacus orbicularis*, *Phacus curvicauda*, *Trachelomonas superba* var. *duplex*, and *Trachelomonas subplanctonica*. Forever *Euglena polymorpha*, were more dominant at katral lake. For the first time, every taxon was recorded. Freshwater, brackish water, and marine environments are the monophyletic group of algae known as Euglenophyceae, which is made up of both pigmented and colorless, unicellular flagellates.

Key words Euglenophyta, Katral lake, Bharamasagara lake, Dominant.

1. Introduction

Lakes are essential to humanity because they provide water. However, ponds may have been created for a variety of purposes, such as domestic or agricultural use, transportation, defence, ritual or industrial use, social aggrandisement, swimming, fish farming, etc., or they may have been natural water sources that humans exploited at different times to meet different needs. (Rajagopal et al. 2010)

The Phylum Euglenoids are free-living flagellated unicellular protists with both heterotrophic and Photoautotrophic characters. (Anindita Singha Roy and Ruma Pal 2016)

Euglenoids also comprise non-photosynthetic varieties and do not possess the light-sensitive structures typically linked to the flagellum. They demonstrate both phagotrophic and photoautotrophic nutritional strategies. (Vasanthakumar et al 2021)

A key to the subgenera, species, and varieties of euglenoids is included for easier

identification of the taxa discussed below. Euglenoids have been differentiated based on the number, size, shape, and position of chloroplasts in the cell (axial or parietal), as well as the presence or absence of pyrenoid; paramylon grain features are occasionally correlated with the characteristics of chloroplasts. (Kim et al 1998) A few of them are heterotrophic, particularly phagocytic or saprophytic. These are distinguished by two anterior uneven flagella that are rooted in a canal known as "gullet" or "ampulla" and a unique cell wall made of spiral strips called a "Pellicle" and surrounded by "Lorica". (Gour Gopal Satpati et al 2017)

The Euglenophyceae class consists of phototrophic organisms from the Euglenida within the Excavata supergroup, commonly found in the plankton of marine, brackish, and freshwater habitats. This class includes free-living unicellular flagellates that are phototrophic, possessing one or more plastids of secondary origin that have three membranes and contain chlorophylls a and b;

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additionally, it contains colorless species that have lost their ability to photosynthesize as well as the associated photosensory structures related to cilia. (Bicudo CEdM and Menezes M 2016)

Aquatic environments are home to most of the taxonomic phyla that now exist. The most prevalent kind of tiny, unicellular organism in watery settings is phytoplankton. The Euglenophyceae family includes euglenoids. The majority of freshwater habitats are inhabited by these globally widespread animals; a limited number of these taxa live in brackish or marine biotopes, and a minor number of these creatures may be found in edaphons. (Yasmeen 2024)

They possess one, two, or three pantonematic-type flagella that originate from a front cell invagination. Paramylum, which is a type of polysaccharide, serves as the storage product. Euglenoid flagellates are commonly found in puddles, ditches, ponds, streams, lakes, and rivers, particularly in regions where animal waste or decaying organic material has polluted the water. (Yasmeen 2024)

There have been various reports on Euglenophytes from India. (gonzalves & Joshi, 1943) (hosmani 1976) (Waghodekar & Patel 1991) (Sinha 2002) However all these works, were limited to the country's north and west. There are very few records from coasts of eastern India. (habib & Pandey 1990) (Bhakta et al., 2010)

Thiruvananthapuram Museum Lake in India is the first place where Euglenaria clepsydroides has been found. Previously, reports of this species came from Poland. (Anila et al 2016)

In a Central Mexican eutrophic reservoir, higher species richness of euglenoids has been observed during the summer. (Gloria et al 2011)

This study aims to provide a floristic and taxonomic overview of the genus *Euglena*, focusing on its morphological characteristics. We present comprehensive descriptions and illustrations based on specimens collected from different water sources. (Kim et al 1998)

There is currently no published research on the ecology, distribution, morphological study and interaction between euglenoids and the physiochemical properties of the water bodies in the study area. Hence the floristic survey of the class euglenophyceae, its distribution pattern, taxonomical description in two lakes of Bharamasagara and Kathral lake at Chitradurga district, Karnataka.

2. Materials and Methods

Study Area

Bharamasagara Lake: -

Bharamasagara Lake is situated in Karnataka Chitradurga (T) & (D). Built in the 18th century, Bicchugatti Bharamanna Nayaka Lake is located in the Krishna River Basin at latitude 14°22'34.0"N and longitude 76°11'53.7"E (Figure 1) Bharamasagara Lake primary uses include fishing, irrigation, and providing drinking water to the nearby 42 villages of Bharamasagara Hobli, Hissamudra, and Bevanalli. The reservoir has recently been refilled with water from the nearby Tungabhadra river via the Rajanahalli lift irrigation project.

Katral Lake:-

Katral Lake is one of a hotstop for bird watching with recording several bird species in the area located nearer to Chitradurga (T) & (D), Karnataka, and its Latitude is 14°16'55.7"N and Longitude is 76°11'53.7"E is Krishna River Basin (Figure 2) the main purpose is for irrigation and supply of drinking water to Biravara, Kalkunte & Goshala. The lake has been disturbed with the human interference.

Sample Collection and Analysis

Samples were collected in random sampling method in four different sampling sites used to collect the algae species from Jan 2023 to Dec 2024 in every month. The samples are collected at morning time 6am to 10 am. Samples were collected in polythene container. The collected samples were stored as 4% formaldehyde solution stored in bottles for further morphological studies. A light microscope (Olympus VANOX AHB3) was used to examine the specimens under 1,000X. Additionally, the living materials were examined using an Olympus IX70 inverted microscope. A drawing tool was used to create the illustrations. The measurements of 50–100 cells were used to calculate the mean cell and organelle dimensions.

Phytoplankton samples were identified based on morphologically and taxonomic character such as Shape, Cell member, Pigmentation, Thallus Organization size colour pigmentation, Raphe, Striae, Centriole, Silica Sheath & Size, Chloroplast, Phytoplankton was done with the help of standard books and monographs (Prescott 1951) (Desikachary 1959) (Taylor 2007) (Fritsch 1935) etc



Fig 1: Map showing Bharamasagara lake of study area

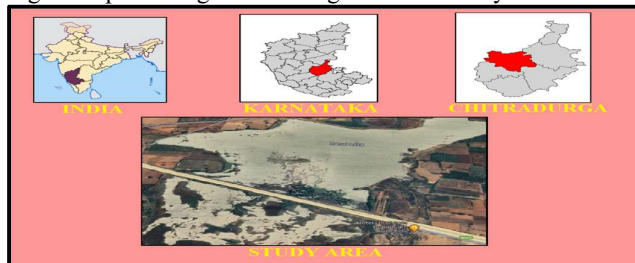


Fig 2: Map showing katral lake of study area

3. Result and Discussion

Table:1 Algae Species found in Katral & Bharamasagara Lake

No	Sl	Class	Name of phytoplankton	Katra lake	Bharamasagara lake
1		Euglenoida	<i>Euglena adhaerens</i>	++	+
2			<i>Euglena geniculata</i>	++	+
3			<i>Euglena granulata</i>	++	++
4			<i>Euglena polymorpha</i>	+++	+
5			<i>Eugleniformis proxima</i>	+	+
6			<i>Euglena sanguinea</i>	+	—
7			<i>Euglena tuberculata</i>	+	+
8			<i>Lepocinclis acus</i>	—	+
9			<i>Lepocinclis globulus</i>	+	++
10	1		<i>Phacus nordstedtii</i>	++	+
11	1		<i>Phacus orbicularis</i>	+	+
12	1		<i>Phacus curvicauda</i>	+	—
13	1		<i>Trachelomonas superba</i> var. <i>duplex</i>	++	++
14	1		<i>Trachelomonas subplanctonica</i>	+	+

(+++; Dominant); (++; common); (+; rare); (—: Not found).

Comparative distribution of Euglenophyceae species from Katral Lake and Bharamasagara Lake is displayed in Table 1 represented by 14 taxa of these organisms, belonging to major algal classes of Euglenoida, were identified during the investigation. The distribution pattern showed substantial diversity of phytoplankton in freshwater ecosystems suggesting conducive environments for algal growth and development. Species of the Euglenoida (e.g., *Euglena*, *Lepocinclis*, *Phacus*, *Trachelomonas*) also were present in both lakes. *Euglena polymorpha*, were more dominant at katral lake, otherwise *Euglena granulata*, *Trachelomonas superba* var. *duplex* are common in both lakes *Euglena tuberculata*, *Phacus orbicularis* are rare at both the lake, *Lepocinclis acus* is not found in katral lake & *Euglena sanguinea*, *Phacus curvicauda* are not found at Bharamasagara Lake. Euglenoids are frequently linked with nutrient rich biomes and accumulation of organic matter thus, they are localized and enriched in certain parts of the lakes. Comparative study showed Katral Lake to harbour some higher abundance.

A total of 14 species of the phylum Euglenophyta have been identified following standard classification. A detailed observation in light microscope was carried out for the dominant species for distinct cell wall morphology. taxonomic accounts of the identified taxa are as follows:

Taxonomic Classification

Phylum: Euglenozoa

Class: Euglenophyceae

Order: Euglenales

Family: Euglenaceae

Euglena adhaerens Matvienko (pl.1 fig a)

Konrad Wołowski *et al.* (2017), P. 1-11.

Cells are elongated, narrow type; blunt end anterior, tapering end posterior, discoid or plate like numerous small chloroplasts. Cell length = 80–86 μm , width = 7-8 μm

Place of collection: Katral lake & Bharamasagara lake

Euglena geniculata Dujardin 1841 (pl.1 fig b)

Gour Gopal Satpati and Ruma Pal. (2017), P. 105-122.

Konrad Wołowski *et al.* (2017), P. 1-11.

Cells fusiform, cylindrical, ovoid, central nucleus with 1 anterior & 1 posterior, slightly damaged of 2 star shaped chloroplasts, ribbon like numerous chloroplasts with plastids, helical striations with periplast. Cell length = 50–80 μm , width = 10-21 μm .

Place of collection: Katral lake & Bharamasagara lake

Euglena granulate (Klebs) F. Schmitz 1884 (pl.1 fig c)

Gour Gopal Satpati and Ruma Pal. (2017), P. 105-122.

Konrad Wołowski *et al.* (2017), P. 1-11.

Cells fusiform, pyriform, elongated, blunt end tip narrow gradually towards posterior end, an aperture of flagellum originated by anterior end, diplopyrenoids of wavy like disc-shaped chloroplasts with paramylon caps. Cell length = 90–106 μm , width = 20- 30 μm .

Place of collection: Katral lake & Bharamasagara lake

Euglena polymorpha Dangeard (pl.1 fig d)

Anindita Singha Roy and Ruma Pal. (2016), P. 113-121

Prescott G.W (1982) pl. no. 85, fig. 21.

Pear-shaped, ovoid & sub-cylindrical cells, short gradually narrowed posterior side, tip is blunt, many chloroplasts with small ovoid grains of paramylon bodies. Cell length 80-90 μm , diameter= 20-28 μm .

Place of collection: Katral lake & Bharamasagara lake

Eugleniformis proxima (Dangeard) Bennett & Triemer 2014 (pl.1 fig e)

Leonardo H. Mendoza-Cabajal *et al.* (2023) P.1-28.

Gour Gopal Satpati and Ruma Pal. (2017) P. 105-122.

Prescott G.W. (1982) pl. no. 85, fig. 25

Cell fusiform, rounded-conical anterior end, acute tail-like extension & tapering posterior end, cell consists discoid numerous chloroplasts, within the cell arranged, randomly. Cell length= 49-53 μm and Width=10-16 μm .

Place of collection: Katral lake & Bharamasagara lake

Euglena sanguinea Ehrenberg (pl.1 fig f)

Jun tae kim *et al.* (1998) P.173-197

Prescott G.W (1982), P.832.

Cell cylindrical, ovoid, spindle shaped, green colour, rounded anterior end, blunt, short, towards of posterior end, cell consists single or numerous chloroplasts, finely pellicle, many ovoid shaped of several paramylon grains. Cell length= 66-106 μm and Width=26-54 μm .

Place of collection: Bharamasagara lake

Class: Euglenoidea

Order: Euglenida

Euglena tuberculata Swirenko (pl.1 fig g)

Anindita Singha Roy and Ruma Pal. (2016), P. 113-121.

Cell fusiform, green colour, middle of the cell is wide, short & narrow tail, rounded anterior end & conical posterior end, cell consists numerous plate like chloroplasts, paramylon grains is oval shaped. Cell length= 45-50 μm and Width=15-19 μm .

Place of collection: Katral lake & Bharamasagara lake

Order: Euglenales

Family: Phacaceae

Lepocinclis acus (O.F.Müller) Marin & Melkonian 2003 (pl.1 fig h)

Kouassi *et al.* (2013) P. 1176-1187.

Leonardo H. Mendoza-Caebajal *et al.* (2023) P.1-28.

Fusiform cells, spindle shaped elongate, slightly twisted & narrow anterior end, tapering point long incision hyaline posterior end, longitudinal striae numerous paramylons grains. Cell length= 100-121 μm and Width=15-21 μm .

Place of collection: Bharamasagara lake

Lepocinclis globulus perty (pl.1 fig i)

Kouassi *et al.* (2013) P. 1176-1187.

Oblong-elliptic to cells – elliptic, rounded broad anterior end, caudal bluntly pointed short, sharp narrow posterior end, discoid numerous chloroplasts, ring-shaped, lateral two paramylons grains. Cell length= 25-28 μm and Width=15-18 μm .

Place of collection: Katral lake & Bharamasagara lake

Phacus nordstedtii Lemmermann 1904 (pl.1 fig j)

Sylwia Kosmala *et al.* (2007), P. 1071–1082.

Napiform cell, green, broadly rounded anterior, narrow posterior, tail-like appendage straight pointed straight, spirally straited thin film, numerous chloroplasts. Cell length 56-59 μm , width 33-35 μm , tail length 17-19 μm

Place of collection: Katral lake & Bharamasagara lake

Phacus orbicularis Huebner 1886 (pl.1 fig k)

Sylwia Kosmala *et al.* (2007), P. 1071–1082.

Shadia Rahman *et al.* (2024), P.6-11.

Orbicular & circular cell with a short -tail, convex dorsal side, broadly rounded anterior end & short bent tail posterior end, striated pellicle. Cell length =46- 48 μm , width = 26-30 μm , tail length 2-12 μm .

Place of collection: Katral lake & Bharamasagara lake

Phacus curvicauda Swirenko 1915 (pl.1 fig l)

Shadia Rahman *et al.* (2024), P.6-11.

Ovoid cell, furrow like dorsiventral, slightly narrow, rounded anterior end, tail-piece short curved terminating & broad posterior end, numerous chloroplasts, short tail with blunt end with lightly curved caudas, paramylons bodies is two with circular disc. Cell length =35- 38 μm , width = 23-28 μm , tail length 1-2 μm .

Place of collection: Katral lake

Order: Euglenales

Family: Euglenaceae

Trachelomonas superba var. *duplex* Deflandre (pl.1 fig m)

Małgorzata Poniewozik *et al.* (2025), P.1-13.

Lorica broadly oval or ellipsoidal, surface covered with densely sharp spines, at the polar end slightly longer, numerous large pores on wall surface, without collar of apical pore. Lorica length= 32-34 μm and Width= 27-30 μm .

Place of collection: Katral lake & Bharamasagara lake

Trachelomonas subplanctonica Jiang & Pang (pl.1 fig n)

Xiaodie Jiang *et al.* (2022), P.1-12.

Lorica cylindrical or ellipsoid, collar cylindrical with toothed edge & perforation surface, haplopyronoid with 6-12 discoid chloroplasts, cylindrical collar apical pore, Lorica length= 22-30 μm and Width= 18-28 μm .

Place of collection: Katral lake & Bharamasagara lake.

Plate - 1

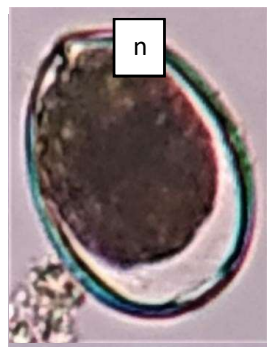
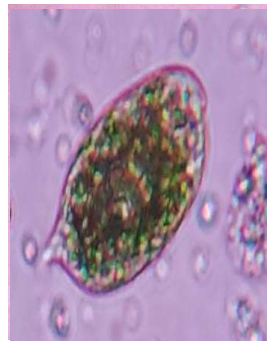
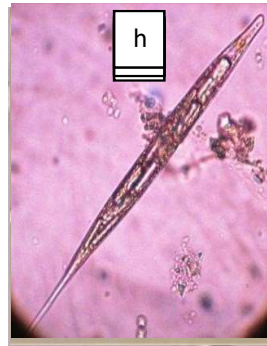
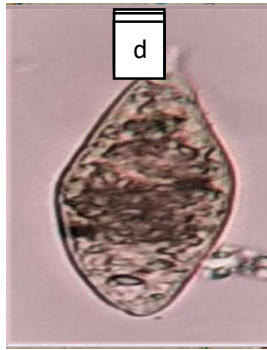
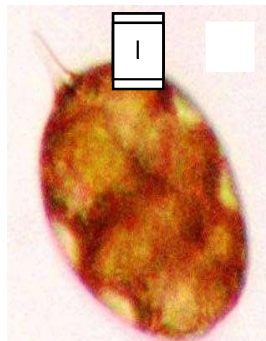


Fig a. *Euglena adhaerens*, Fig b. *Euglena geniculata*, Fig c. *Euglena granulata*, Fig d. *Euglena polymorpha*, Fig e. *Euglenaformis proxima*, Fig f. *Euglena sanguinea*, Fig g. *Euglena tuberculata*, Fig h. *Lepocinclis acus*, Fig i. *Lepocinclis globulus*, Fig j. *Phacus nordstedtii*, Fig k. *Phacus orbicularis*, Fig l. *Phacus curvicauda*, Fig m. *Trachelomonas superba* var. *duplex*, Fig n. *Trachelomonas subplanctonica*.

4. Discussion

The study provides a comprehensive assessment of phytoplankton diversity in two freshwater lakes Katral and Bharamasagara by categorizing algae based on relative dominance and ecological indicators. Euglenophyceae are generally Plentiful in streams of waters rich in organic materials (Kalf J. 2000) *Euglena* is a dominant genus in contaminated waterways (Alam A, Khan A.A 1996) Many researchers have researched the ecological distribution of euglenoids (Munawar M 1970) (Singh U, Swarup DK 1979) Many scientists have explored, organic matter and albumonoid ammonia effect the growth and development of euglenophyceae.



(Sunder Singh 2015) (Murulidhar V.N 2015) Euglenoids directly influences nutrient stress or organic loading and classical indicators of pollution in eutropic waters (Palmer 1969) (Reynolds 2006). Further studies involving physicochemical profiling, seasonal variation analysis and long-term monitoring are essential to formulate sustainable management plans.

5. Conclusions

The current study of Euglenophyceae reveals that 4 major genera viz., *Euglena*, *Phacus*, *Lepocinclis*, *Trachelomonas* recorded in both the study areas. *Euglena polymorpha* is dominant and highest species richness at katral lake. Euglenoids are frequently linked with nutrient rich biomes and accumulation of organic matter thus, they are localized and enriched in certain parts of the lakes. That can be used as a good pollution indicator.

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