



## Distribution and ecology of euglenoids in certain lakes of Tumakuru District, Karnataka, India

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### Abstract

*Distribution and ecology of euglenoids in relation to physico-chemical characteristics of water in four lakes of Tumakuru district was studied during 2015-17 and discussed. Euglenoids function as indicators of aquatic superiority. Composite samples were taken at two feats depth from surface level on monthly basis for the enumeration of euglenoids. A total of ten species under three genera were identified. Guluru lake harboured 46.66% followed by Colony and Teeta lakes 20% each and Bugudanahalli lake with 13.33%. Seasonally all the lakes recorded maximum density of euglenoids during summer except in Colony lake, where they reached their peak during rainy season. Euglenoids showed significant positive correlation with water temperature ( $r=0.664; P<0.05$ ), Sulphate ( $r=0.757; P<0.05$ ) and Silica ( $r=0.775; P<0.05$ ) at 5% level. Euglenoids established negative correlation with dissolved oxygen and ammonical nitrogen.*

**Keywords:** Correlation, euglenoids, lake, physico-chemical characters.

### Introduction

Euglenophytes comprises distinct group of free living protists which are phototrophic species, colourless phagotrophic and osmotrophic species, bacteriophagic in nature<sup>1,2</sup>. Euglenoids are group of motile fresh water flagellates often produce water bloom in ponds and lakes, which gives red colouration to the water due to the presence of characteristic euglenoid pigment called astaxanthin. The class euglenophyceae is an important group in terms of its richness and abundance in shallow aquatic ecosystems with higher concentrations of organic materials<sup>3,4</sup>. Euglenoids often serve as indicators of organic pollution<sup>5</sup>. They also serve as connecting organisms between flora and fauna<sup>6</sup>. Occurrence of euglenophyceae members in fresh water bodies pointed towards the possibility of eutrophication and they act as pollution indicator groups<sup>7</sup>. Water is the utmost imperative abiotic aspect backing life. The physico-chemical possessions of water monitor the lifespan of aquatic animals existing in water. Any alteration in the water eminence has straight impact on biotic populations where diverse species of flora and fauna display unlimited variations in their responses to the reformed environment<sup>8,9</sup>.

Preservation of water superiority for the development of aquatic biota is very significant. There has been no publication yet on the ecology, distribution pattern, seasonal dynamics, relative abundance of euglenoids and their relationship with physico-chemical characteristics of the existing water bodies in the present study area. Hence, an effort has been made with a principal objective of floristic survey of the class euglenophyceae, its distribution pattern, seasonal dynamics,

relative abundance and their relationship with different physico-chemical parameters in water bodies of four lakes of Tumakuru district in Karnataka state.

### Materials and methods

Study Area: Guluru, Bugudanahalli, Colony and Teeta are the four lakes situated within the radius of 30 kilometers from Tumakuru city. Two liters of surface water samples were collected from each of these lakes at an interval of 30 days for two years for the estimation of physico-chemical characteristics using standard procedures<sup>10</sup>. Water temperature was measured on the spot with the help of thermometer and expressed in °C. Water samples were fixed at each sampling station for the estimation of dissolved oxygen using Winkler's iodometric method. Physico-chemical parameters such as pH, dissolved oxygen, free carbon dioxide, nitrate nitrogen, phosphate, sulphate, ammonical nitrogen and silica were estimated using standard procedures and expressed in terms of mg/l except pH. Water samples were also collected simultaneously from all the four lakes at monthly intervals for a period of two years for the enumeration of euglenophyceae. One liter of water sample from each lake was fixed separately with 20ml of 1% lugol solution for 24 hours. 100ml of sediment sample from each lake is centrifuged at 1500rpm for 45 minutes and 10ml of the sediment from each sample is preserved for the enumeration of euglenoids. For diversity studies camera lucida technique was adopted for writing diagrams and euglenoids were identified up to the species level using monographs. The density of euglenoid population was calculated by using standard procedures<sup>11</sup>. Biannual averages of physico-chemical parameters were

calculated. Seasonal variations and relative abundance of Euglenoids were also enumerated and represented in figures. Carl Pearson's correlation co-efficient was employed to establish the relationship between euglenoid population and physico-chemical parameters.

### Results and discussion

Euglenophyceae are generally abundant in waters rich in organic matters<sup>12</sup>. A total of 10 species of euglenophyceae under 3 genera were recorded during the present study. Camera Lucida diagrams of the euglenoids recorded during the study are represented in Figure-3. Euglena is represented by 4 species. Phacus is considered to be dominant genera of polluted waters<sup>13</sup>. The genus Phacus in the present investigation is represented by 5 species which indicates the presence of higher pollution load. The genus Tracheolomonas is represented by single species (Table-1). Seasonally three of the four lakes investigated recorded maximum density of Euglenoids during summer, except in Colony lake where they showed their peak during rainy season (Figure-1). Biannual average values of physico-chemical parameters related to this group are described (Table-2). Seasonal and relative abundance of euglenoids are represented in Figures-1 and 2 respectively. In order to understand positive and negative impact of physico-chemical parameters on euglenophycean population, the values of physico-chemical parameters and occurrence of euglenoid population were subjected to Carl Pearson's correlation coefficient and the results obtained are portrayed in Table-3.

The ecological distribution of euglenoids was studied by so many workers<sup>14,15</sup>. The role of temperature, organic matter and albuminoid ammonia on the growth and development of euglenophyceae was discussed by many scientists<sup>16</sup>. Many scientists have attributed the distribution of euglenoids to the concentration of free carbon dioxide, dissolved oxygen and phosphate where, higher concentration of free carbon dioxide coupled with low amount of dissolved oxygen influences the multiplication of euglenoids<sup>17-20</sup>. In the present investigation concentration of carbon dioxide and dissolved oxygen were found to be low in all the lakes with less margin between them. Hence, it is concluded that, these two parameters have not much influence on the distribution and abundance of euglenoids. This is also evidenced by correlation matrix where dissolved oxygen showed negative bearing on the distribution of euglenoids and free carbon dioxide remained as an independent variable (Table-3).

It was concluded that temperature of the range 25-28°C enhanced the growth of euglenoids<sup>20</sup>. In the present investigation, temperature range between 26.45°C to 27.62°C influenced the average growth of euglenoids. However, water temperature showed positive correlation with growth and dynamics of euglenoids (r=0.664) at 5% level (Table-3). Similar observations have been made by other workers<sup>21</sup>. The multiplication of euglenophyceae is less when the water

temperature is below 25°C<sup>17,22</sup>. Hence, it is apparent that the water temperature between 26-28°C is congenial for the growth of euglenoids (Tables-1, 2 and Figure-1). Hence the present findings are in conformity with the above findings. It was suggested that higher concentrations of nitrate nitrogen promote the growth of euglenoids<sup>22</sup>. Similar feature was observed in the present study also where nitrate nitrogen remained positively correlated to the abundance and dynamics of euglenoids at significant level (Table-3). Increase in the concentration of phosphate favours the abundant growth of euglenophyceae<sup>5</sup>. This is not in accordance with the results of the present investigation where, phosphate remained as an independent variable and did not show any influence on the diversity and distribution of euglenoids (Table-3). It was observed euglena species from polluted lentic water bodies of Jammu and reported that, the rich growth of pollution tolerant species is due to the increase in nutrients by the decomposing macrophytic vegetation in lake during summer and inlet of agricultural runoff during monsoon which carries organically rich water in to the lake<sup>23,24</sup>. Similar observations were reported by many other workers<sup>25-29</sup>. In the present investigation, sulphate concentration varied between 30.22mg/l in Colony lake and 73.86mg/l in Guluru lake (Table-2) and showed significant positive correlation (r=0.757) at 5% level with the distribution of euglenoids. However, ammonical nitrogen established a negative bearing on the dynamics of euglenoids (Table-3). Silica also showed positive bearing on the ecology and distribution of euglenoids (r=0.775) at significant level (Table-3).

**Table-1:** Occurrence of euglenoids in certain lakes of Tumakuru district (2015-2017)

Name of the organisms	Lakes			
	Guluru	Bugudanahalli	Colony	Teeta
Euglena minuta	+	-	-	+
Euglena Polymorpha	+	-	-	+
Euglena Proxima	+	-	-	-
Euglena nirids	-	+	-	+
Phacus accuminatus	+	-	-	-
Phacus amkylonoton	+	-	+	-
Phacus caudatus	-	+	+	-
Phacus hispidulus	-	-	-	-
Phacus undulates	+	-	+	-
Tracheolomonas armata	+	-	-	-

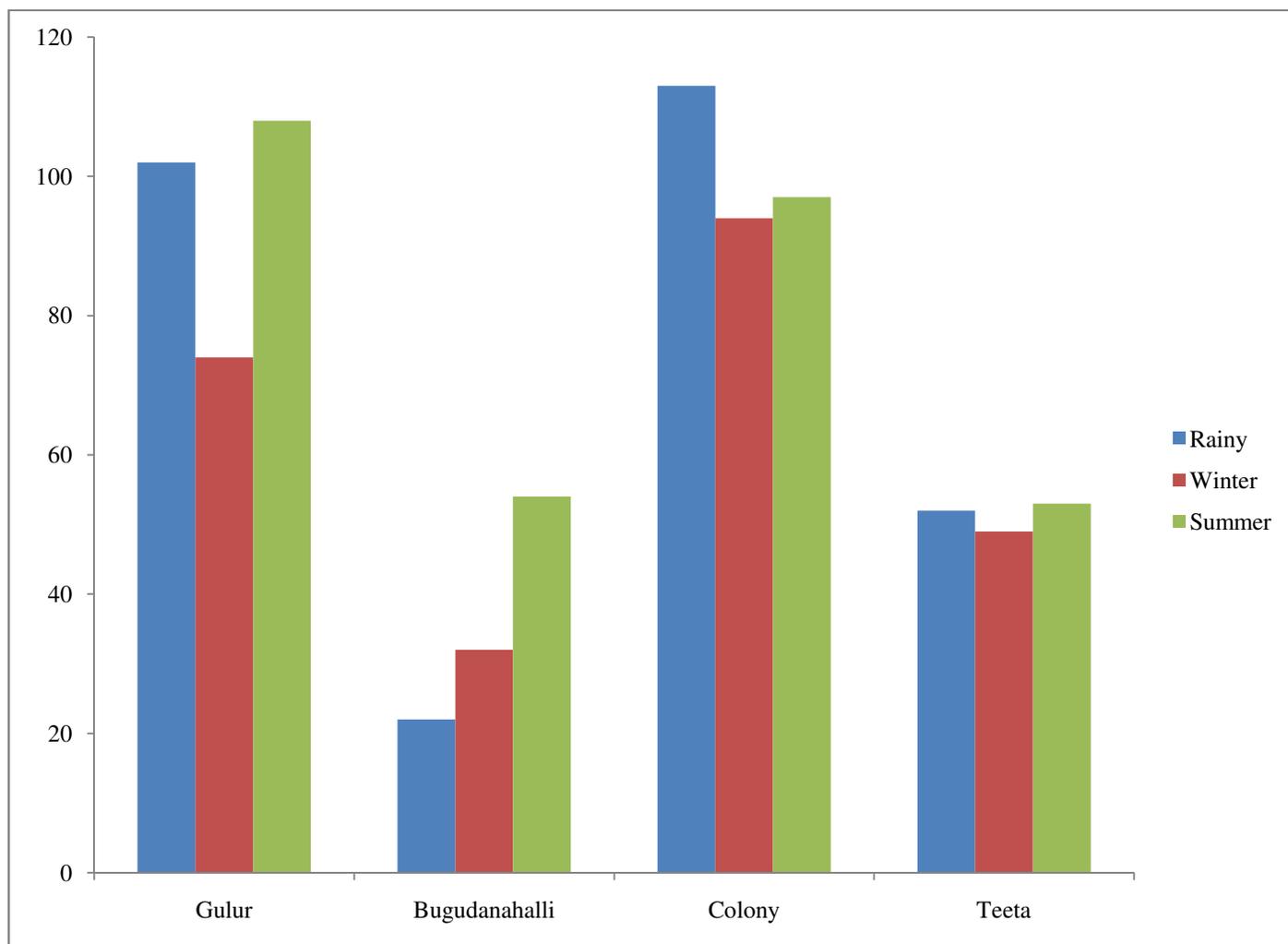
+ = Present, - = Absent

**Table-2:** Biannual averages of certain related physico-chemical factors (2015-17)

Factors	Guluru	Bugudanahalli	Colony	Teeta
Water temperature	26.45	27.16	27.62	26.75
Dissolved oxygen	7.93	7.60	7.47	8.08
Free CO <sub>2</sub>	10.98	8.0	3.05	1.66
Nitrate nitrogen	6.48	0.4	0.39	0.69
Phosphate	0.81	0.23	0.18	0.28
Sulphate	73.86	39.91	30.22	30.53
Ammonical nitrogen	3.55	2.34	2.0	1.75
Silica	35.31	109.8	139.6	40.48

**Table-3:** Carl Pearson's Correlation Matrix Euglenoids V/S Physico-chemical factors

Physico-chemical factors	Euglenoids r - value
Water temperature	0.664* 0.000
Dissolved oxygen	-0.597 0.002
Free CO <sub>2</sub>	-0.376 0.070
Nitrate nitrogen	0.425* 0.038
Phosphate	0.139 0.516
Sulphate	0.757* 0.000
Ammonical nitrogen	-0.725 0.000
Silica	0.775* 0.000



**Figure-1:** Seasonal variations of Euglenoids in certain lakes of Tumakuru district.

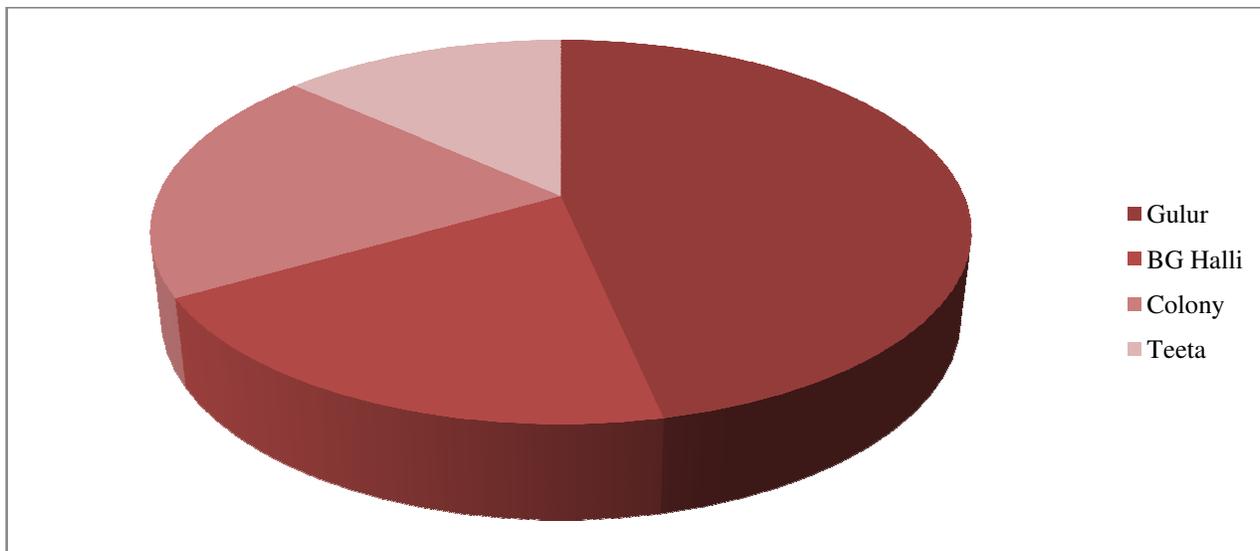


Figure-2: Relative abundance of Euglenoids in certain lakes of Tumakuru district.

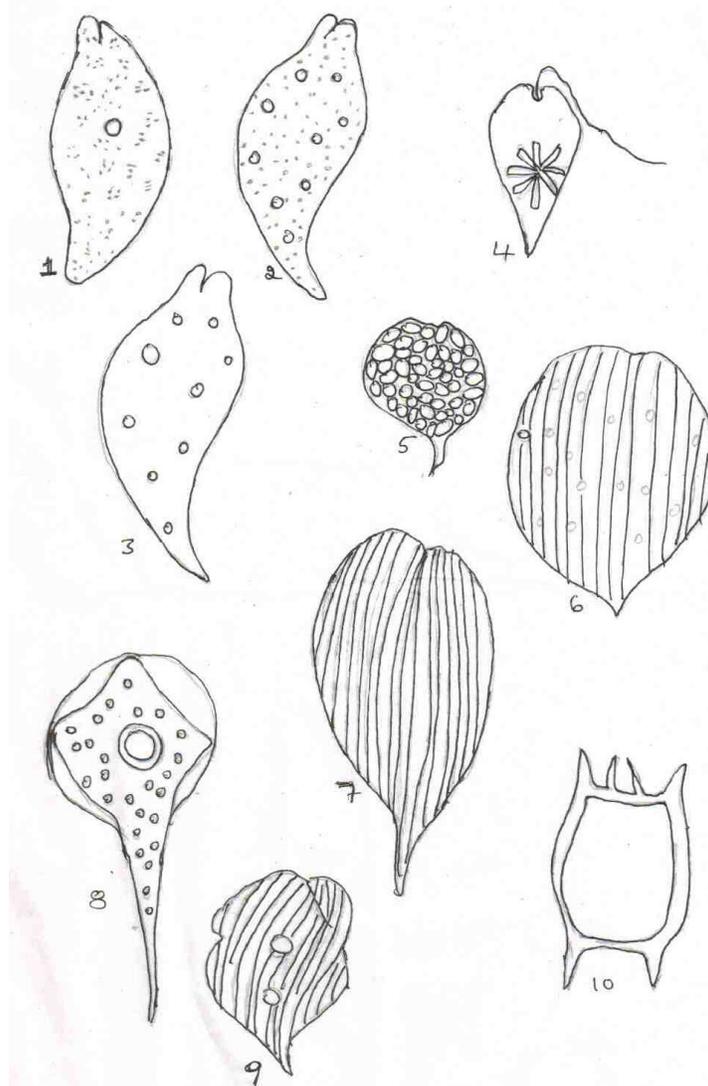


Figure-3: Camera Lucida diagrams of euglenoids.

## Conclusion

From the results of the study it is concluded that, the higher concentration of euglenoids during summer season is due to surface runoff from agricultural fields. The study also helped in understanding the distribution of euglenoids in lakes of Tumakuru district and the physico-chemical factors having positive bearing on their growth. Carl Pearson's correlation coefficient also served as an important tool in understanding the impact of different physico-chemical parameters on the distribution of euglenoids. As the euglenoids serve as pollution indicator organisms, the moderate density of euglenoids in the lakes investigated indicates that, the lakes are tending towards biologically eutrophic condition. The data obtained is also helpful in deriving the conservational strategies.

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