

EMERGING TRENDS IN LIFE SCIENCES

Volume - I

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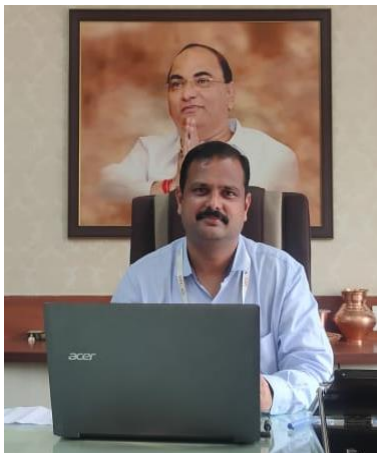
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PREFACE



DR RANJIT PATIL

Principal

Dr D Y Patil Unitech Society's, Dr D Y Patil Arts
Commerce and Science College, Pimpri, Pune, Maharashtra, India.

I welcome the book 'Emerging trends in life sciences' as an effort undertaken by editors and all authors. Life Sciences have always been a fundamental area of science. The exponential increase in the quantity of scientific information and the rate, at which new discoveries are made, require very elaborate, interdisciplinary, and up-to-date information. In recent years, trends and techniques in life sciences that has emerged over the last few years as a powerful tool for research advancement.

This volume is a rich source of information on advances in recombinant DNA technology, DNA barcoding, agriculture, diversity and distribution of flora and fauna, microgreens, phytoremediation techniques, bioinformatics, molecular analysis, and genomics.

Dr Vishnu Kiran Manam, Dr Aruna Kumari Nakkella and Dr Shital Kadam has ably edited the book, covering both classical and applied aspects of life sciences. The book puts forward a concise and smart approach and will appeal to experts, students of life sciences, researchers, young scientists, and end-users in life sciences.

I wish all the success to the editors and all authors.

FOREWORD



DR S M KAMBLE

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The book "Emerging Trends in Life Sciences" is a unique collection of most innovative research articles of eminent biologists of India. The present book is designed to arrange diverse areas of Life Sciences in coherent manner. A comprehensive account of current advances has added to the volume of book. The present book contains 28 chapters covering information on microbial technology; botany includes Euglenoids diversity of Chandrapur district of Maharashtra, fungal lactase application, DNA bar-coding of Pteridophytes, phenology of Mangroves of Sagar Islands, photo morphogenesis, effects of abiotic water logging stress and phytoremediation in plants discussed.

The present book includes soil and water analysis as well as environmental pollution and its impact on human health on plants. Emphasis has been given on applications of genetics, biotechnology and bioinformatics and biodiversity conservation at national and international levels. Excellent account of subtractive genomics and drug target identification tools of recombinant DNA technology have been given in the book. This book provides adequate background and current information on molecular analysis and its exploration

to the community. Articles on pandemic situation Covid 19 with special reference to reinforce immune responses against Covid 19 and medicinal plants used for Covid care global scenario have been included.

I trust this book will be useful to research scholars in various fields, teachers of life science, and environmentalist. I wish all the success to the authors.

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Chapter**4****STUDY OF DIVERSITY AND DISTRIBUTION OF
EUGLENOIDS FROM CHANDRAPUR DISTRICT,
MAHARASHTRA, INDIA****B. MALLESH REDDY**

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ABSTRACT

Euglenoids is a remarkable group of microorganisms with both plant and animal characters. They are unicellular, free-swimming eukaryotes with or without rigid envelop. They show great diversity and occupy all most all aquatic and swampy habitats. Present work has been carried out to document the diversity and distribution of Euglenoids among the major rivers of Chandrapur district of Maharashtra state, India. The present systematic study revealed a total of twenty-one taxa of six genera of Euglenophyceae. Out of these, the taxon *Phacus raciborskii* var. longus is reported first time from the country hence considered as a new report for India.

KEYWORDS: Euglenophyceae, Chandrapur, Wardha, Winganga, Pain Ganga, New report

INTRODUCTION

Euglenoids are one of the most beautiful and remarkable groups of microorganisms comprising the class Euglenophyceae. They live as both plants and animals; they are animal cells but with the help of chloroplast they can prepare their own food material. Hence, they are considered plant-animal organisms. Euglenoids are unicellular, free-swimming eukaryotes with or without rigid envelop.

Euglenoids show great diversity in shape and size, some of the species also act as indicators of water pollution, especially organic pollution. A lot of work has been done on the diversity and distribution of these tiny planktons throughout the country. In India, the class Euglenophyceae is represented by 21 genera, 384 species, 117 varieties and 15 forma (Gupta, 2012). Some of the important contributions on diversity and distribution of members of Euglenophyceae of Maharashtra state were made by Kamat (1964), Barhate and Tarar (1985), Bhoge and Ragothaman (1986), Mahajan and Nandan (2007).

But still, no taxonomic report regarding Euglenophyceae is available from the Chandrapur district. Hence, the present investigation has been undertaken to document the diversity and distribution of these Euglenoids from the Chandrapur district of Maharashtra state.

MATERIAL AND METHODS

Chandrapur district of the Maharashtra state is located between 18° 41' to 20° 50' north latitudes and 78° 48' to 80° 55' east longitudes (fig. 1) with 11,443 sq.km Of geographical area. Present work is carried out for two consecutive years between 2013 and 2015. During this work, water samples were collected from 21 sites of three major rivers Wardha, Winganga and Pain Ganga of the Chandrapur district (Table. 1).

The samples were collected between 8am to 10am during May, August, November and February months. From every site, approximately 50 litres of running water were filtered through phytoplankton net of 20 μ mesh size made up of bolting silk.

The samples were preserved in 4% formaldehyde solution and microphotographs were taken with Coslab microscope camera. Euglenoids were identified with the help of standard books, floras, monographs and recent research papers such as, Prescott (1962), Kim et. al. (2000), Karnkowska et. al. (2012), Alves da Silva and Hahn (2004) and Alves-da-Silva et. al. (2015).

Table 1: Sample collection sites

| Sr. No | Site | Location | Coordinates |
|--------|------|----------------|----------------------|
| 1 | S1 | Pardi | 19.74116, 78.91294 |
| 2 | S2 | Bori | 19.806521, 78.999683 |
| 3 | S3 | Gadegaon Wirur | 19.86346, 79.12374 |
| 4 | S4 | Dhanora | 19.90364, 79.18398 |
| 5 | S5 | Kadoli | 19.87521, 79.28792 |
| 6 | S6 | Sasti | 19.83374, 79.33524 |
| 7 | S7 | Rajura | 19.81348, 79.37489 |
| 8 | S8 | Koipara | 19.76654, 79.49025 |
| 9 | S9 | Arvi | 19.633623, 79.489308 |
| 10 | S10 | Polsa | 19.508021, 79.588534 |
| 11 | S11 | Tatepalli | 19.581930, 79.703676 |
| 12 | S12 | Gugus | 19.955476, 79.099068 |

| | | | |
|----|-----|---------------------|----------------------|
| 13 | S13 | Patala | 20.127590, 78.996672 |
| 14 | S14 | Soit | 20.279169, 78.818192 |
| 15 | S15 | Gondpipri - Ashti | 19.677346, 79.785461 |
| 16 | S16 | Gangapur | 19.841112, 79.753918 |
| 17 | S17 | Saoli – Chamorshi | 20.008005, 79.786234 |
| 18 | S18 | Saoli – Gadhiroli | 20.134877, 79.923606 |
| 19 | S19 | Kudesawali | 20.323513, 79.949483 |
| 20 | S20 | Brahmapuri - Armori | 20.483042, 79.946445 |
| 21 | S21 | Brahmapuri - Wadsa | 20.619367, 79.940179 |

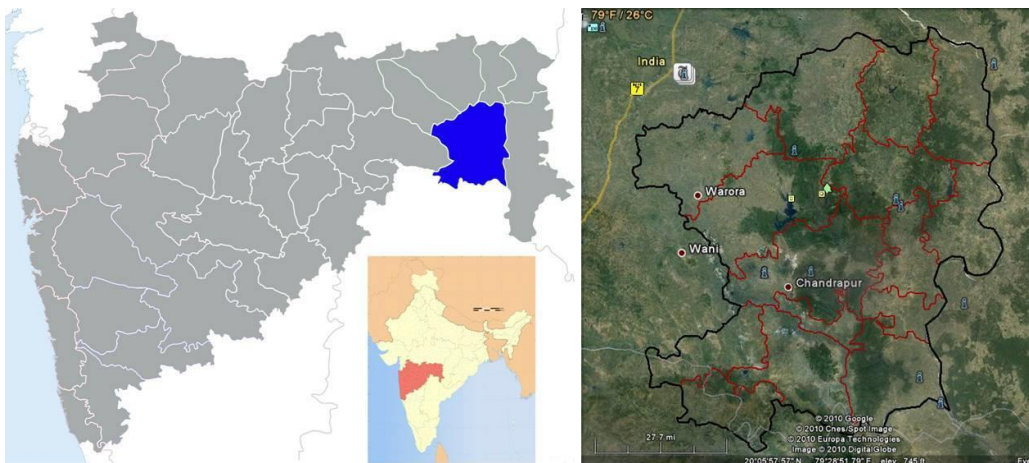


Fig. 1: Location map of Chandrapur district

SYSTEMATIC EVALUATION

The present manuscript deals with diversity, distribution and taxonomic evaluation of twenty-one taxa of six genera of class Euglenophyceae.

Class **EUGLENOPHYCEAE** [Key to the genera]

- | | |
|--|----------------------|
| 1a. Cells enclosed in a shell | 2 |
| 1b. Cells not enclosed | 3 |
| 2a. Cells spherical or ellipsoid, collar specified | <i>Trachelomonas</i> |
| 2b. Cells fusiform or ovate, collar not specified | <i>Strombomonas</i> |
| 3a. Cells dorsiventrally flattened | <i>Phacus</i> |

| | |
|--|---------------------|
| 3b. Cells not flattened, oval or circular in outline | 4 |
| 4a. Pellicle strips helically elevated appear screw like | <i>Monomorphina</i> |
| 4b. Pellicle otherwise | 5 |
| 5a. Cells metabolic, paramylon small | <i>Euglena</i> |
| 5b. Cells rigid, paramylon large | <i>Lepocinclis</i> |

Euglena Ehrenberg 1830.

Cells elongate, ovoid or fusiform with two flagella. Cells show metabolic movements. Chloroplast and paramylon bodies vary in size, shape and number in different species.

1. ***Euglena caudata*** K.Hübner 1886. [Pl. I, F. 3]
 Synonym: *Euglenaria caudata* (Hüber) A.Karnowska-Ishikawa, E.Linton & J.Kwiatowski in Linton et al. 2010.
 [Karnkowska et. al. 2012, p. 734, f. 1d]
 Cells spindle shaped, slightly tapered and rounded at anterior end, gradually tapered and pointed at posterior end. Chloroplast 8-10, spherical oval, paramylon bodies not observed.
 Size: Cells 12 μ -16 μ X 50 μ -60 μ in diameter
 Occurrence: S1-S3, S9-S11
2. ***Euglena deses*** Ehrenberg 1833. [Pl. I, F. 2]
 [Prescott 1962, p. 392, pl. 85, f. 20]
 Cells highly metabolic, twisted, elongate fusiform to cylindrical, anterior end rounded and posterior end attenuated to short tip. Many discoid chloroplasts with pyrenoid. Paramylon bodies many, small rod shaped.
 Size: Cells 8 μ -15 μ X 70 μ -100 μ .
 Occurrence: S1, S2, S15, S16, S18, S19, S21
3. ***Euglena ehrenbergii*** Klebs 1883. [Pl. I, F. 4]
 [Prescott 1962, p. 392, pl. 86, f. 13]
 Cells highly metabolic, elongate, band like and elliptic in cross section. Ends slightly tapered and rounded at both the poles. Cells with many short cylindrical paramylon bodies and small ovoid chloroplasts. Flagellum nearly half the length of the cell.
 Size: Cells 25 μ -35 μ X 250 μ -290 μ .
 Occurrence: S5-S7, S9, S12-S14
4. ***Euglena proxima*** P.A.Dangeard 1901. [Pl. I, F. 1]
 [Prescott 1962, p. 394, pl. 85, f. 25]
 Cells metabolic, fusiform, anterior end rounded, posteriorly tapered to pointed tip. Numerous discoid chloroplasts, many small rod-shaped paramylon bodies.
 Size: Cells 20 μ -25 μ X 90 μ -95 μ .

Occurrence: S8, S10, S11, S14, S15, S17, S18, S20, S21



Plate. I: F.1. *Euglena proxima*, F. 2. *E. deses*, F. 3. *E. caudate*, F. 4. *E. ehrenbergii*.

***Lepocinclis* Perty 1849.**

Cells ovoid, rigid and tapers into a posterior tail. Chloroplasts many, small, discoid bodies. Paramylons are generally two large rings or rods.

5. *Lepocinclis acus* (O.F.Müller) Marin & Melkonian in Marin et al. 2003. [Pl. II, F. 5]

Basionym: *Vibrio acus* O.F.Müller 1786.

Synonym: *Euglena acus* (O.F.Müller) Ehrenberg 1830.

[Prescott 1962, p. 390, pl. 85, f. 28]

Cells rigid, elongate fusiform. Anterior end tapered rounded, posterior end gradually tapered into long pointed tail. Chloroplasts many discs like, paramylon bodies 2-4 rod like.

Size: Cells 8 μ -12 μ X 110 μ -120 μ .

Occurrence: S4, S6, S7, S13-S15

6. *Lepocinclis acus* var. *longissima* (Deflandre) D.A.Kapustin 2011. [Pl. II, F. 6]

Basionym: *Euglena acus* var. *longissima* Deflandre 1924.

[Alves da Silva and Hahn 2004]

Cells rigid, elongate fusiform and much longer than type. Anterior end tapered and truncated, posterior end gradually tapered into long pointed tail.

Size: Cells 12 μ -15 μ X 210 μ -240 μ .

Occurrence: S5-S8, S10, S11, S13-S15

7. ***Lepocinclis caudata*** (A.M. da Cunha) Pascher 1927.[Pl. II, F. 7]
Basionym: *Crumenula caudata* A.M. da Cunha 1914.
[Alves da Silva and Hahn 2004]
Cells fusiform, anterior end slightly attenuated and rounded, posterior end gradually narrows down and form solid tail. Chloroplasts many, discoid, paramylon bodies two, ring like.
Size: Cells 25 μ -35 μ X 60 μ -70 μ .
Occurrence: S5, S7, S9
8. ***Lepocinclis fusiformis*** (H.J.Carter) Lemmermann 1901.[Pl. II, F. 10]
Basionym: *Euglena fusiformis* H.J.Carter 1859.
[Prescott 1962, p. 406, pl. 89, f. 1-4]
Cells fusiform or pyriform, anterior end obtuse pointed, posterior end produced, and form pointed basal point. Chloroplasts many, discoid. Paramylon bodies two, plate like.
Size: Cells 15 μ -20 μ X 23 μ -40 μ in diameter
Occurrence: S1-S3, S6-S8
9. ***Lepocinclis ovum*** (Ehrenberg) Lemmermann 1901. [Pl. II, F. 8]
Basionym: *Euglena ovum* Ehrenberg 1840.
[Prescott 1962, p. 407, pl. 89, f. 5, 6]
Cells broadly ovate, anterior end conical obtuse, posterior end form short caudus. Chloroplasts many, discoid. Paramylon bodies two, ring like.
Size: Cells 22 μ -26 μ X 28 μ -32 μ in diameter
Occurrence: S2, S3
10. ***Lepocinclis oxyuris*** (Schmarda) Marin & Melkonian in Marin et al. 2003. [Pl. II, F. 9]
Synonym: *Euglena oxyuris* Schmarda 1846.
[Prescott 1962, p. 393, pl. 85, f. 18]
Cells rigid, elongate cylindrical and twisted. Anterior end rounded with slight or without tapering, posterior end gradually tapered into a pointed tail. Chloroplasts many, discoid. Paramylon bodies two, large, ring like.
Size: Cells 22 μ -27 μ X 55 μ -65 μ .
Occurrence: S1-S14
11. ***Lepocinclis tripteris*** (Dujardin) Marin & Melkonian in Marin et al. 2003. [Pl. II, F. 11]
Basionym: *Phacus tripteris* Dujardin 1841.
Synonym: *Euglena tripteris* (Dujardin) Klebs 1883.
[Prescott 1962, p. 394, pl. 86, f. 4-6]
Cells rigid elongate cylindrical and twisted with three ridges. Anterior end rounded; posterior end tapered to form pointed tail. Chloroplasts many, discoid. Paramylon bodies two, rod like.
Size: Cells 12 μ -14 μ X 80 μ -100 μ in diameter
Occurrence: S1-S3, S5-S7, S10-S14, S17, S19

***Monomorphina* Mereschkowsky 1877.**

Cells near pyriform, rigid or slightly metabolic with long tail. Pellicle strips helically arranged, elevated with keels, and appears like screw thread. Chloroplast one too few, paramylon bodies as lateral plates.

12. ***Monomorphina nordstedtii*** (Lemmermann) T.G.Popova 1955. [Pl. III, F.12]

Basionym: *Phacus nordstedtii* Lemmermann 1904.

[Prescott 1962, p. 401, pl. 88, f. 1]

Cells napiform, anterior end tapered rounded with two papillae, posterior end slightly taper and produce long, straight, pointed tail. Periplast spirally ribbed, separated from protoplast. Chloroplast many, ovoid disc like.

Size: Cells 17 μ -19 μ X 22 μ -25 μ ; Tail: up to 10 μ long.

Occurrence: S1, S2, S4, S5, S15, S16, S18, S19, S21

13. ***Monomorphina pyrum*** (Ehrenberg) Mereschkowsky 1877. [Pl. III, F. 13]

Basionym: *Euglena pyrum* Ehrenberg 1832.

[Prescott 1962, p. 402, pl. 88, f. 22]

Cells elliptic with parallel sides, anterior end tapered rounded with two papillae, posterior end gradually tapered into long, pointed tail. Periplast spirally ribbed. Chloroplasts many, discoid. Paramylon bodies two, lateral, ring like.

Size: Cells 20 μ -22 μ X 30 μ -32 μ ; Tail: 24 μ -27 μ long.

Occurrence: S5-S7, -S21



**Plate. II: F.5. *Lepocinclis acus*, F. 6. *L. acus* var. *longissima*, F. 7. *L. caudate*, F. 8. *L. ovum*, F. 9. *L. oxyuris*, F. 10. *L. fusiformis*, F. 11. *L. tripteris*.
Phacus Dujardin 1841.**

Cells dorsiventrally flattened like leaf and become rigid. Ridges, folds and groves are common, which provide specific shape to some species. Also contain posterior spine or long tail. Chloroplast many, small and discoid. Paramylon bodies many large or small granules.

14. *Phacus acuminatus* Stokes 1885. [Pl. III, F. 14]

[Prescott 1962, p. 396, pl. 88, f. 4]

Cells oval to suborbicular, anterior end conical rounded, posterior end broadly rounded with very short, pointed tail. Periplast longitudinally striated. Chloroplasts many, small, discoid, paramylon bodies two, disc like.

Size: Cells 25 μ -30 μ X 35 μ -40 μ .

Occurrence: S6, S7, S9,

15. *Phacus raciborskii* var. *longus* V.Conforti 1989. [Pl. III, F. 15]

[Alves-da-Silva et. al. 2015, p. 488, f. 65-67]

Cell oblong leaf like, anterior end truncated, posterior end narrows down to long oblique tail. Cell with three fins, median one also extends up to the tail. Chloroplasts many, discoid, paramylon bodies one, large, disc like.

Size: Cells 18 μ -22 μ X 50 μ -55 μ .

Occurrence: S2

This is probably first report of the taxon from India.

16. *Phacus triqueter* (Ehrenberg) Dujardin 1841. [Pl. III, F. 16]

Basionym: *Euglena triquetra* Ehrenberg 1834.

[Prescott 1962, p. 404, pl. 107, f. 4-6]

Cells broadly ovoid to orbicular in outline, anterior end broadly rounded and lobed, posterior end broadly rounded and produce small, pointed, curved tail. On the dorsal surface there is a ridge which extends up to middle of the cell. Periplast longitudinally striated. Chloroplasts many, discoid. Paramylon bodies two, ring like.

Size: Cells 30 μ -35 μ X 40 μ -45 μ .

Occurrence: S1, S2, S4, S5



Plate. III: F. 12. *Monomorpha nordstedtii*, F. 13. *M. pyrum*, F. 14. *Phacus acuminatus*, F. 15. *P. raciborskii* var. *longus*, F. 16. *P. triqueter*.
Strombomonas Deflandre 1930.

Cells completely enclosed in an envelope, which tapers gradually to apical pore without properly defined collar. The envelope become transparent or yellow green. Chloroplast many, discoid bodies.

17. *Strombomonas species 1* [Pl. IV, F. 17]

Plants small, broadly fusiform, anterior end narrowed to form neck, posterior end attenuated and pointed, tail absent. Cells appear obovate.

Size: Cells 10 μ -12 μ X 16 μ -18 μ ; Plant 17 μ -18 μ X 28 μ -30 μ .

Occurrence: S1-S3, S6-S8, S10, S11

18. *Strombomonas species 2* [Pl. IV, F. 18]

Plants large, broadly fusiform to ellipsoid, anterior end narrowed to form neck, posterior end attenuated and drawn into a hyaline tail. Cells appear fusiform.

Size: Cells 25 μ -27 μ X 12.5 μ -12.7 μ ; Plant 30 μ -35 μ X 64-68 μ .

Occurrence: S4, S6-S8

19. *Strombomonas species 3* [Pl. IV, F. 19]

Plants large, broadly ellipsoid, anterior end form short neck, posterior end broadly round and convex. Cells ovate to fusiform.

Size: Cells 26 μ -28 μ X 39 μ -42 μ ; Plant 32 μ -35 μ X 50 μ -55 μ .

Occurrence: S13, S14

Trachelomonas Ehrenberg 1835.

Cells completely enclosed in an envelope with sharply defined neck or thickened collar. The envelope becomes brown coloured. Chloroplasts many, small and of different shapes.

20. *Trachelomonas hispida* (Perty) F.Stein 1878. [Pl. IV, F. 20]

Basionym: *Chonemonas hispida* Perty 1849.

[Kim et. al. 2000, p. 87, f. 24, 80]

Test ellipsoid with both the ends broadly rounded. Flagellum aperture with short thickening, flagellum single and long. Chloroplast discoid. Surface brown, rough with minute warts.

Size: 18 μ -21 μ X 30 μ -35 μ

Occurrence: S17, S18, S20

21. *Trachelomonas species* [Pl. IV, F. 21]

Test spheroid, flagellum apparatus surrounded by a short collar formed by elevation of cell wall. Wall yellowish green coloured.

Size: 45 μ -47 μ in diameter

Like *T. volvocina* but it is large in size.

Occurrence: S4, S5.



Plate. IV: F. 17. *Strombomonas* species 1, F. 18. *S.* species 2, F. 19. *S.* species 3, F. 20. *Trachelomonas hispida*, F. 21. *Trachelomonas* sp.

DISCUSSION AND CONCLUSION

The present study has been carried out to find out the diversity and distribution of Euglenoids in the major rivers of the Chandrapur district of Maharashtra state. It reveals the presence of twenty-one taxa of the family Euglenophyceae from the district. Out of these, four taxa belong to genus *Euglena*, seven to genus *Lepocinclis*, two of each to genus *Monomorphina* and *Trachelomonas* and three of each to *Phacus* and *Strombomonas*.

Among the isolated genera, the taxon *Phacus raciborskii* var. *longus* found first time in India and hence it is considered a new report for the country.

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