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Occurrence of Desmid *Cosmarium* Corda ex Ralfs from Chankapur fresh water reservoir of Maharashtra, India

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Abstract
The Genus *Cosmarium* Corda ex Ralfs is a very common desmid in lentic and lotic ecosystems. It is the largest genus of desmids. While studying algal flora of Chankapur reservoir in Nashik district of Maharashtra, 16 taxa of *Cosmarium* were recorded during October 2023 to September 2025. *Cosmarium bioculatum, Cosmarium costatum, Cosmarium leave, Cosmarium subimpressulum, Cosmarium variolatum and Cosmasrium* sp. were found dominant. Winter and summer seasons were found suitable for abundance of *Cosmarium*. It is an indicator of unpolluted clean and pure water. Abundance of *Cosmarium* indicate good water quality and ecological stability of the reservoir. Present study serves as baseline data for the taxonomic, diversity and seasonal abundance study of Desmids.

Keywords: Diversity, abundance, seasonal variation, *Cosmarium*

Introduction
Cosmarium is a large genus of desmids. It is a unicellular desmid comprising semicells separated by a narrow constriction or isthmus. Each semicell may be rounded, reniform, pyramidal, or quadrate in outline, with margins that are either entire or undulate; the cell wall may be smooth with scattered pores or ornamented with small to large granules, emergent verrucae, round or triangular pits, or short spinules. Mucilaginous sheath secreted through cell wall pores, often surrounds cell. Each semicells contains a green chloroplast with pyrenoids. The cell contains a single nucleus situated in the isthmus region. Asexual reproduction occurs through simple cell division. Sexual reproduction takes place by conjugation. Species identification of *Cosmarium* is based on the size and shape of the cells, as well as the characteristics of their surface ornamentation. According to algae database *Cosmarium* has more than 1137 species (Guiry & Guiry 2023, Patil 2024) [10,19]. *Cosmarium* is mainly found in oligotrophic aquatic environment. Occasionally sub aerial or in basic eutrophic waters. In India studies on *Cosmarium* began in the late 18th century (Turner 1892) [24]. *Cosmarium* is the most frequently occurring genus in Indian water bodies (Agarkar &Agarkar 1973; Bharati & Hegde 1982; Prasad & Misra 1985; Habib & Pandey 1990; Dwivedi & Misra 2007; Talekar & Jadhav 2009; Dhande and Jawale 2009; Mhaske and Talwankar 2018, Nandi et.al. 2019; Patil & Kumawat 2019; Yadav 2020; Babu & Vasantkumar 2020; Dhurve et. al. 2022; Saini et.al. 2023; Krishnan et. al. 2023, Patil 2024 & Mahajan 2025) [1, 4, 21, 11, 9, 23, 7, 16, 17, 18, 25, 3, 8, 22, 12, 19, 14]. While working on algal flora of Chanakapur fresh water reservoir of Maharashtra authors came across some interesting taxa of *Cosmarium*.

Material and Method
Chankapur fresh water reservoir is located (20.4988632^0 N & 73.8834431^0 E) in Nasik District of Maharashtra. The algal samples were collected regularly at monthly intervals from October 2023 to September 2025 from the four selected sites of Chankapur reservoir. The collections were made in morning hours. Sampling has been carried out by using plankton net. Collected algal samples were preserved in 4%. Formalin for further taxonomic investigations. Fresh as well as preserved algal samples were observed thoroughly under research microscope with the help of standard literature. Microphotographs were also taken and incorporated in taxonomic description.

Taxonomic Description
Class: Chlorophyceae
Order: Conjugales
Sub-order: Desmidioideae
Family: Desmidiaceae
Genus: *Cosmarium*

1. ***Cosmarium bioculatum* Berb:** Length of cell 2um, breadth 18um, length of semicell 13um.
2. ***Cosmarium bioculatum* Berb var. *hians*. West and West:** Length of cell 21um, breadth 15um, length of semicell 8um.
3. ***Cosmarium costatum* Nordst:** Cells as long as broad, deeply constricted length 51-54 um long, 42-45 um broad, isthmus 16-18 um in diameter.
4. ***Cosmarium decoratum* West &West:** The wall shows ornaments of pits and granules, length of cell 54um, breadth 42um, and isthmus 15um.
5. ***Cosmarium formulosum* Hoff:** Cells longer than broad, moderately constricted, cells 24 um long, 21 um in diameter, isthmus 13um long. Cell wall rough.
6. ***Cosmarium leave* Rambenhorst:** Cells longer than broad, deeply constricted, semicells nearly elliptic, cells 17-18 um diameter, 25-27 um long, isthmus 4 um in diameter, cell wall smooth, chloroplast one, axile, with a central pyrenoid.
7. ***Cosmarium libogense* West and West:** Cells longer than broad, deeply constricted, sinus linear, narrow, slightly dialated at the apex, outer extremity open;

semicells pyramidate -truncate, flattened, side convex, side view of semicells semicircular, vertical view elliptic: cells 15-16.5 µ in diameter. 20-21.8 µ long, isthmus 4.5-5 µ in diameter, cell wall strongly punctate.

8. ***Cosmarium magnificum* Nordst var. *subcirculare* Skuja (1949). Fa**Cells large, longer than broad, 31-33 um broad, 55 -57 um long, isthmus 21 um broad, cell wall is with ornamentation. Surface of cell with subcircular shallow pits.

9. **Cosmarium obtustam Berb:** Length of cell 27um, breadth 21 um, length of semicell 13 um.

10. ***Cosmarium subimpressulum* Borge:** Cells small, longer than broad, deeply constricted, sinus linear, narrow; semicells transversely rectangular in lower part, pyramidate truncate above, with 4 crenulations on each side, vertical view elliptic, with broad inflations on each side, lateral view of semicells ovate, apices traunceate, tumid in the middle portion on both the sides; cells 17.2-18.5 µ in diameter, 24.8-26.5 µ long, isthmus 5-6.8 µ in diameter; cell wall smooth; chloroplast one, with a central pyrenoid.

11. ***Cosmarium sublatereundatum* West and West:** Cells nearly as long as broad, deeply constricted, broadly elliptical or circular in outline, semicells broadly elliptical. Cells 18 um in diameter, 23-24 um long, isthmus 10-11 µ in diameter; cell wall smooth.

12. ***Cosmarium subtumidum* Nordest:** Cells 30-37 um long, 23-29 um broad and isthmus is 9-13 um broad. Apex flat and broad.

13. ***Cosmarium undulatum* Corda ex Ralfs:** Cells medium sized, about 1½ times as long as broads, deeply constricted, sinus linear, narrow; semicells truncate-sub pyramidate, with 8-10 undulations on each side of the semicells, lateral view of semicells sub circular to ovate, vertical view elliptic; cells 16-17.5 µ in diameter, 22.5-24.8 µ long. Isthmus 5-5.2 µ in diameter: cell wall smooth: chloroplasts two, parietal, each with a pyrenoid.

14. ***Cosmarium variolatum* Lund:** Cells longer than broad, up to twice as long as broad, deeply constricted, sinus narrow, linear, not dialated at apex: semicells triangular to pyramidate, angles convex, apices rounded, side view of semicells elliptic-ovate, vertical view elliptic; cells 14.5-15.2 µ in diameter, 26.8-28.2 µ long, isthmus 4.5 µ in diameter; cell wall punctate; chloroplast with a central pyrenoid.

15. ***Cosmarium variolatum Lund. v. rotundatum (Krieger) Messik*:** Cells longer than broad, about 1½ times as long as broad, deeply condtricted, sinus narrowly linear, slightly dialated at apex; semicell triangular to subpyramidate, angles rounded, apices rounded, side view of semicells subcircular, vertical view elliptic; cells 17.5-18.8 µ in diameter, 28.2-29.8 µ long, isthmus 4.8-5.2 µ in diameter; cell wall punctate; chloroplast with a central pyrenoid.

16. ***Cosmarium* sp:** Cells as long as broad, deeply constricted, length 21-24 um long, breadth 16-18 um broad, isthmus 7-9 um broad.

Results and Discussion

A total of 16 taxa of *Cosmarium* were identified and recorded during the present study. Maximum number of *Cosmarium* taxa were recorded at S1 while minimum number of *Cosmarium* taxa were recorded at S4. The *Cosmarium* diversity composition is in the range of S1>S2>S3>S4 (Table 1). *Cosmarium bioculatum, Cosmarium costatum, Cosmarium leave, Cosmarium subimpressulum, Cosmarium variolatum and Cosmasrium* sp. were found abundant. Dhande and Jawale (2009) [7] Mahaske and Talwankar (2018) [16] and Patil (2024) [19] studied diversity and abundance of *Cosmarium* from fresh water reservoirs. Talekar and Jadhav (2009) [23], Aquino et.al. (2016) [2], Krishnan et al. (2023) [12] and Saini et. al. (2023) [22] documented the diversity of different taxa of *Cosmarium* in lotic environment. Claassen and Eicker (1985) [6] studied cell ornamentation of *Cosmarium* taxa using scanning electron microscopy.

Table 1: Site wise occurrence of *Cosmarium* from Chankapur fresh water reservoir

Sr. No.	Name of Taxa	S1	S2	S3	S4
1.	*Cosmarium bioculatum* Berb	+	-	+	-
2.	*Cosmarium bioculatum* Berb var. *hians*. West and West	+	+	+	–
3.	*Cosmarium costatum* Nordest	+	+	+	+
4.	*Cosmarium decoratum* West &West	+	+	-	-
5.	*Cosmarium formulosum* Hoff	+	-	-	-
6.	*Cosmarium leave* Rambenhorst	+	+	+	+
7.	*Cosmarium libogense* West &West	-	-	+	+
8.	*Cosmarium magnificum* Nordst *v. subcircularescja* Fa	-	+	-	-
9.	*Cosmarium obtustam* Berb	+	-	+	-
10.	*Cosmarium subimpressulum* Borge	+	+	+	+
11.	*Cosmariums sublatereundatum* West & West	-	-	-	+
12.	*Cosmarium subtumidum* Nordest	+	+	-	+
13.	*Cosmarium undulatum* Corda ex Ralf	+	+	+	-
14.	*Cosmarium variolatum* Lund	+	+	+	+
15.	*Cosmarium variolatum Lund. v. rotundatum (Krieger) Messik*	-	+	-	-
16.	*Cosmarium sp.*	+	+	+	+
Total		12	11	10	08

In present study taxa of *Cosmarium* shows interesting seasonal variation. Maximum number of the *Cosmarium* taxa were recorded in winter season followed by summer season. Occurrence of *Cosmarium* taxa were also observed in rainy season (Table 2). One taxa *Cosmarium subtumidum* was observed throughout the year irrespective of the seasonal changes. Talekar and Jadhav (2009) [23] recorded luxuriant growth of *Cosmarium* in summer season. Paul and Sreekumar (2015) [20] observed maximum taxa of *Cosmarium* in winter season, which is followed by rainy season summer seasons. Similar kind of observations were made by Mahaske and Talwankar (2018) [16]. *Cosmarium* can serve as an indicator of water quality. It is an indicator of unpolluted, clean and pure water (Lee 2008) [13]. Species of *Cosmarium* prefer neutral and clean fresh water environment. As *Cosmarium* is rich in minerals, vitamins, proteins and fatty acids, it can be utilized as source of nutrition (Blekley and Hayes 2017) [5]. It is also serves as source of food for various aquatic organisms (Mahajan 2025 a) [14].

Table 2: Seasonal variation of *Cosmarium* from Chankapur fresh water reservoir

Sr. No.	Name of Taxa	Winter	Summer	Monsoon
1.	*Cosmarium bioculatum* Berb	+	-	+
2.	*Cosmarium bioculatum* Berb var. *hians*. West and West	+	+	-
3.	*Cosmarium costatum* Nordest	+	+	+
4.	*Cosmarium decoratum* West &West	+	+	+
5.	*Cosmarium formulosum* Hoff	+	+	-
6.	*Cosmarium leave* Rambenhorst	+	+	+
7.	*Cosmarium libogense* West &West	+	-	-
8.	*Cosmarium magnificum* Nordst v. *subcirculare* Skuja (1949). Fa.	+	-	-
9.	*Cosmarium obtustam* Berb	+	+	-
10.	*Cosmarium subimpressulum* Borge	-	-	+
11.	*Cosmariums sublatereundatum* West & West	+	-	-
12.	*Cosmarium subtumidum* Nordest	+	+	+
13.	*Cosmarium undulatum* Corda ex Ralf	+	+	+
14.	*Cosmarium variolatum* Lund	+	-	+
15.	*Cosmarium variolatum Lund. v. rotundatum (Krieger) Messik*	+	+	-
16.	*Cosmarium sp.*	+	-	+

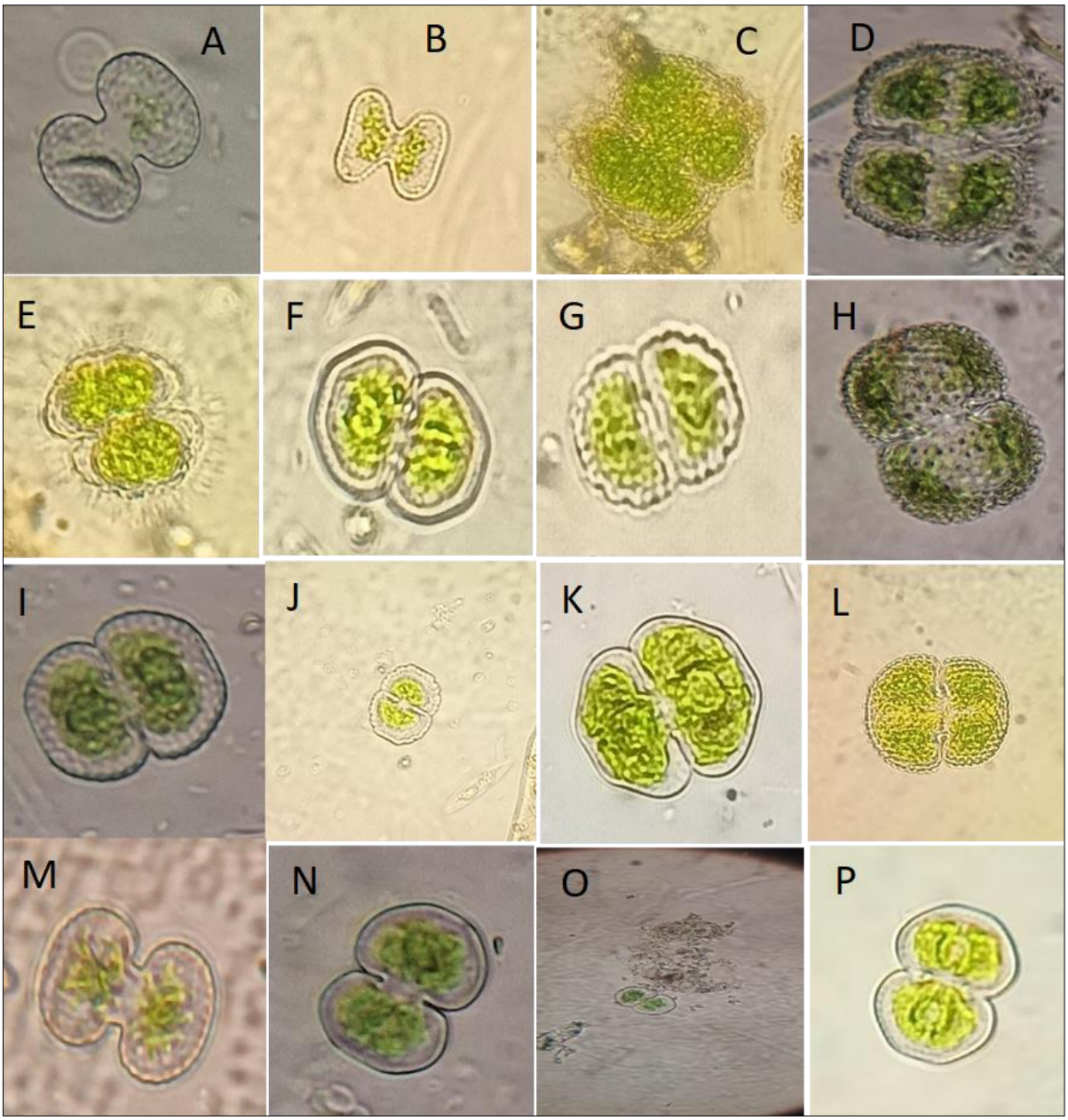

Figure 1: a) *Cosmarium bioculatum* Berb b) *Cosmarium bioculatum* Berb var. *hians*. West and West; c) *Cosmarium constatum* Nordst ; d) *Cosmarium decoratum* West & west; e) *Cosmarium formulosum* Haff; f) *Cosmarium leave* Rambenhorst; g) *Cosmarium libogense* West & West ; h) *Cosmarium magnificum* Nordst v. *subcirculare* Skuja Fa. i) *Cosmarium obtustam*; Berb j) *Cosmarium subimpressulum* Borge k) *Cosmarium sublatereundatum* West & West ; l) *Cosmarium subtumidum* Nordest; m) *Cosmarium undulatum* Corda ex Ralf; n) *Cosmarium variolatum* Lund; o) *Cosmarium variolatum Lund. v. rotundatum (Krieger) Messik;* p) *Cosmarium* sp.

Conclusion

A total of 16 taxa of *Cosmarium* were recorded in the present study. Extensive review of literature reveals that all the taxa are reported for the first time from the selected reservoir. Abundance of *Cosmarium* taxa were observed in winter season which is followed by summer and rainy season. *Cosmarium* can serve as an indicator of water quality. It is an indicator of unpolluted, clean and pure water. Abundance of *Cosmarium* species reflects good ecological condition of water bodies. Since *Cosmarium* is rich in minerals, vitamins, proteins and fatty acids it can be used as source of nutrition. The Chankapur fresh water reservoir supports rich diversity of *Cosmarium* species. This study serves as baseline data for the taxonomic, diversity and seasonal abundance study of desmids.

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