

Species Diversity and Taxonomic Assessment of *Cosmarium* from a Freshwater Habitat: Aner Dam

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Abstract

The present study investigates the species diversity and taxonomic characteristics of the desmid Genus *Cosmarium* from the freshwater habitat of Aner Dam, located in Shirpur Taluka, Dhule District Maharashtra, India. A total of six *Cosmarium* species were identified and documented: *Cosmarium lundellii*, *Cosmarium pardalis*, *Cosmarium portianum*, *Cosmarium pseudoconnatum*, *Cosmarium pseudotaxichondrum*, and *Cosmarium spinuliferum*. These taxa were studied through detailed morphological observation using microphotography, focusing on key diagnostic features such as cell shape, dimensions, wall ornamentation, and isthmus structure. The findings highlight a notable species richness and microalgal diversity within the dam's phytoplankton community, underscoring its ecological importance. The occurrence of both common and relatively rare *Cosmarium* taxa in the region also suggests a favourable environment for desmid proliferation, potentially influenced by specific physico-chemical conditions of the water body. This study contributes to the growing body of taxonomic knowledge of freshwater desmids in India and provides baseline data for future ecological and conservation assessments of microalgal biodiversity.

Keywords: Desmids, *Cosmarium*, Freshwater algae, Taxonomy

Introduction:

Freshwater ecosystems, including rivers, lakes, reservoirs, and dams, are critical for sustaining biodiversity and providing essential ecological services. Within these ecosystems, microalgae play a fundamental role as primary producers, forming the base of aquatic food webs and contributing to nutrient cycling. Among the diverse groups of microalgae, desmids are a prominent component of the phytoplankton and periphyton communities in oligotrophic to mesotrophic freshwater bodies. These organisms are highly sensitive to changes in water chemistry and environmental conditions, making them important bioindicators for assessing ecological health and water quality. The desmids belong to the class Zygnematophyceae, order Zygnematales, and family Desmidiaceae. They are primarily non-motile, unicellular or colonial green algae characterized by their intricate and symmetrical cell morphology. The genus *Cosmarium* is one of the most taxonomically diverse and ecologically significant genera within this family. *Cosmarium* species typically possess two semi-cells separated by a central isthmus, and their cell walls often display unique ornamentations such as granules, spines, or ridges. These morphological traits serve as the basis for their classification and identification. India, with its varied climatic zones and

aquatic habitats, harbors a rich diversity of desmid flora. However, taxonomic studies on desmids, particularly in regions like Maharashtra, remain relatively scarce. The systematic exploration of local freshwater bodies is crucial for documenting algal diversity, understanding community structure, and establishing baseline data for future ecological assessments.

Aner Dam, located in the Shirpur Taluka Dhule district of Maharashtra, represents a freshwater ecosystem that has received limited attention in terms of algal biodiversity studies. The dam supports a range of aquatic flora and fauna and is used for irrigation and domestic water supply. Given its ecological significance, it presents an ideal site for the investigation of desmid diversity, particularly the genus *Cosmarium*.

The present study was undertaken to assess the species diversity and taxonomic features of *Cosmarium* species present in Aner Dam. Six species *Cosmarium lundellii*, *Cosmarium pardalis*, *Cosmarium portianum*, *Cosmarium pseudoconnatum*, *Cosmarium pseudotaxichondrum*, and *Cosmarium spinuliferum* were identified through detailed morphological observation using light microscopy. Emphasis was placed on identifying key diagnostic features such as cell size and shape, wall ornamentation, semi-cell symmetry, and isthmus structure.

This investigation aims to enrich the understanding of freshwater desmid diversity in Maharashtra and contribute to the growing taxonomic and ecological literature on *Cosmarium* species in India. The findings may also provide insights into the ecological status of Aner Dam and guide conservation efforts aimed at protecting microalgal biodiversity in freshwater habitats.

Materials and Methods

Study Area

Aner Dam, situated in the Dhule district of Maharashtra, India, is a significant freshwater reservoir providing water for irrigation and drinking purposes. The dam's geographical coordinates are approximately 21.25°N latitude and 74.75°E longitude. The surrounding region is characterized by a tropical climate with distinct wet and dry seasons, influencing the aquatic biodiversity within the reservoir.

Sampling Procedure

Sampling was conducted during the post-monsoon season of 2024 to capture the peak diversity of phytoplankton. Five sampling sites were strategically selected across the reservoir, encompassing various microhabitats such as open water zones, littoral regions, and areas with dense aquatic vegetation. At each site, surface water samples were collected using a plankton net with a mesh size of 20 µm, suitable for capturing microalgae like *Cosmarium* species. The net was towed horizontally just below the water surface for a standardized distance to ensure consistency across samples. Collected samples were transferred into clean, labelled polyethylene bottles.

Sample Preservation

To preserve the integrity of the algal cells for subsequent analysis, samples were fixed immediately after collection by adding 4% formalin solution to achieve a final concentration of 1%. The preserved samples were stored at ambient temperature and transported to the laboratory for further examination.

Microscopic Analysis

In the laboratory, samples were allowed to settle for 24 hours to concentrate the algal cells. A known volume of the concentrated sample was then transferred to a Sedgwick-Rafter counting chamber for

microscopic examination. Observations were made using a compound microscope equipped with 10x and 100x objective lenses. Identification of *Cosmarium* species was based on morphological characteristics such as cell shape, size, symmetry, and ornamentation, following standard taxonomic keys and literature.





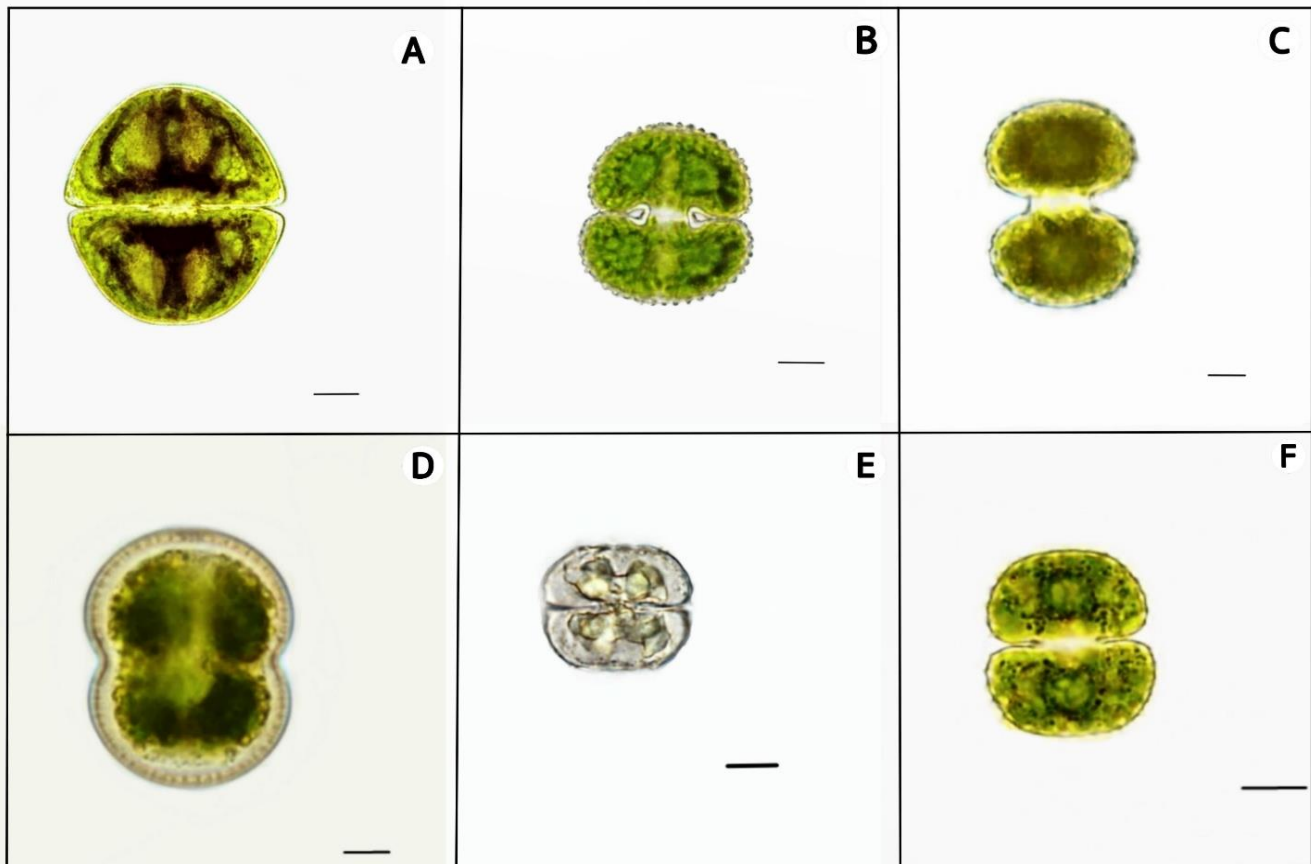
A Systematic Account:

- A) *Cosmarium lundellii* Delp. var. *Ellipticum* W. W. (1894). L 57-69 μm ; W 46-52 μm ; I 19-22 μm ; T 27-34 μm . Hab. Java 505; Borneo 270.
- B) *Cosmarium pardalis* Cohn (1874).
L 62; W 56; I 18; T about 25. Our illustrations are drawn from specimens in CoHN's original material preserved in WITTR. & NogDST. Exsicc. No. 559, this species has not been found in Indonesia and our figures are given for compares on with *Cosmarium scabrum* Turn. (g.v.).
Cosmarium peniomorphum nom. Nov. (Syn. *Peniumvariolum* West & West 1897).
- C) *Cosmarium portianum* Arch. var. *majus* var. Nov.
The form of the cells is similar, but much greater. Different variety as well as the fact that the orders are not horizontal, but the accolading up to the utro which is from the side of the line in the middle of the vertical, the angle of Ca. 25° against horizontal forming. which is a side of the vertical line Shape of cells similar to that of the species; size much larger. Differs also in that the rows of granules are not horizontal but slope upward from each side towards the vertical centerline, forming an angle of about 25° with the horizontal. L 58 μm ; W 45 μm ; I 18 μm ; T 29 μm . Hab. Java 504.
- D) *Cosmarium pseudoconnatum* Nordst. (1870).
L 65-66 μm ; W 49-54 μm ; I 45-49 μm . Hab. Java P; Sumatra 105.
- E) *Cosmarium pseudotaxichondrum* Nordst. var. *siamense* W & W (1901)
fa. *Denticulatum* fa. Nov. *cosmarium* size forms of var. *siamensi* similar; different possession of the granuli above isthmalis and four teeth of small a very small margin of the apical. In size and shape similar to var. *Siamense*. Differs in the possession of a above isthmian granule and four small teeth at just below the apical margin. L 30 μm ; W 31 μm ; I 9 μm ; T 18 μm . Hah. Java K.
- F) *Cosmarium spinuliferum* West & West (1902).
L 32-34 μm ; W 33-35 μm ; I 10-11 μm ; T 20-21 μm . Hab. Sumatra 108, 148

Plate No.1

- A. *Cosmarium lundellii* Delp. var. *Ellipticum* W. W.
- B. *Cosmarium pardalis* Cohn
- C. *Cosmarium portianum* Arch. var. *majus* var. Nova
- D. *Cosmarium pseudoconnatum* Nordst
- E. *Cosmarium pseudotaxichondrum* Nordst. var. *siamense* W & W
- F. *Cosmarium spinuliferum* West & West

Plate No. 1:



Scale bar = 10 μ m.

Symbol = L= Length,

W= Width,

T= Thickness,

I= width of isthmus.

Results:

A total of six species belonging to the genus *Cosmarium* were identified from the freshwater samples collected from Aner Dam. The species were examined using microphotography, and identification was based on morphological features including cell size and shape, semi-cell structure, isthmus width, and wall ornamentation. All six taxa showed distinct characteristics that facilitated species-level identification.

1. *Cosmarium lundellii* Delp. Var. *Ellipticum* W. W.

Cells were broadly ellipsoidal with deeply constricted isthmus; semi-cells rounded with smooth cell walls. The central region was slightly thickened. Cell dimensions ranged from 38–42 μ m in length and 28–32 μ m in breadth.

2. *Cosmarium pardalis* Cohn

Characterized by trapezoidal semi-cells with conspicuous granules arranged symmetrically on the cell surface. Cells measured approximately 50–54 μm in length and 40–44 μm in width. The median constriction was moderately deep.

3. *Cosmarium portianum* Arch. var. *majus* var. Nov

Cells were small, elliptical, with shallow constrictions. Semi-cells were almost hemispherical with smooth walls. Dimensions observed were 30–35 μm in length and 22–26 μm in breadth.

4. *Cosmarium pseudoconnatum* Nordst

This species showed semi-cells that were rectangular with rounded corners. The cell wall was finely granulated. Cell size ranged from 46–52 μm long and 36–42 μm wide. The isthmus was narrow, and the central part showed slight thickening.

5. *Cosmarium pseudotaxichondrum* Nordst. var. *siamense* W & W

Cells were deeply constricted, semi-cells oval with prominent granules forming longitudinal rows. Cell wall was clearly ornamented. Size measurements were 44–48 μm in length and 34–38 μm in breadth.

6. *Cosmarium spinuliferum* *Cosmarium spinuliferum* West & West

This species was distinctive due to the presence of small spines on the cell wall surface. Semi-cells were semicircular with a broad isthmus. Cells measured 42–46 μm in length and 36–40 μm in width.

The presence of both smooth-walled and ornamented *Cosmarium* species indicates a structurally diverse algal community. The observed taxa included both commonly reported species and less frequently encountered ones, suggesting a well-balanced aquatic environment with relatively stable physico-chemical conditions. The species richness and morphological variation observed reflect the ecological potential of Aner Dam to support diverse microalgal flora.

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