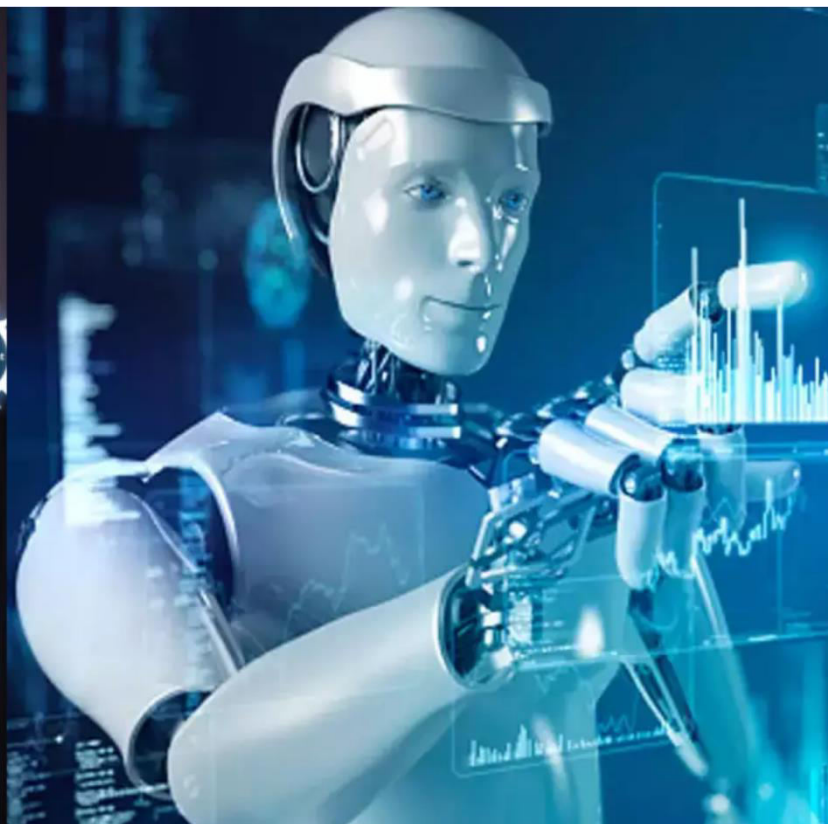




International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 15, Issue 3, March 2026

Taxonomical Study of Green Algae (Scenedesmus spp.) in Mangali River of Bundi, Rajasthan (India)

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ABSTRACT: Algae is diverse group of plant kingdom and distribute world widely it's simple to multicellular, non-vascular, thalloid cell structure. Algae act as primary product of food chain and indicator of water pollution. Chlorophyceae is large number of members belongs to this class and Chlorococcales an important order, this order contain wide range of green pigmented cells present solitary and colonial form in the water. The attention on Scenedesmus that belongs to the green algae (Chlorococcales) existing in Mangali river, Bundi. The water collection on 5 altered sites (S1, S2, S3, S4, S5) from Mangali river throughout the different seasons (Mansoon, Pre-mansoon and Post-mansoon) since 2023-2024. Almost 31 taxa of genus were recorded Scenedesmus have been listed and represented from the studied sites. Scenedesmus quadricauda, Scenedesmus bijugatus var. irregularis, Scenedesmus bijugatus, Scenedesmus obliquus, Scenedesmus dimorphous are some of the species those represented as dominant and more than other algae. Scenedesmus found in ponds, lakes and slow running water which is belongs to Chlorococcales order of green algae.

KEYWORDS: Green Algae, Chlorococcales, Scenedesmus, Mangali river, Dominant.

I. INTRODUCTION

Bundi is district of Rajasthan state and is also known as step well city situated latitude 24°59 N to 25°53 N to longitude 75°15 E to 76°15 E southern-eastern part of Rajasthan. The district is located in Ramgarh Vishdhari Wildlife Sanctuary and too near of Mangali river, covered large part of Bundi. Mangali river located longitude 75.40442-75.782899 to latitude 25.181379-25.411263 provides fresh water for drinking, cultivation, domestic animals.

Algae is the lower plant group in plant kingdom and its distribution world widely those who present in thallus, with photosynthetic pigment, non-vascular system, simple to multicellular body. Algae provides good water purifier, indicator of water tolerance and act the food chain as primary producer because Chlorophyceae member have containing chlorophyll pigment who helps in photosynthesis process. Chlorophyceae major, extensive, enormous class of algae. Chlorococcales is universally, large range of Chlorophyceae class present in single and aggregation form.

Scenedesmus often present group, non-motile, eutrophic fresh water Chlorococcalian green alga. Over One hundred species, which are abundant in freshwater bodies like pond and lakes. Scenedesmus of India has been studied by Jena & Adhikary (2007); Modi & Mali (2011); Mahato & Mahato (2012); Beherepatil & Deore (2013); Patil (2013); Reddy & Chaturvedi (2015); Roy & Pal (2015) Das & Keshri (2015); Rishi et al. (2016); Halder (2016); Jain (2016); Rishi et al. (2016); Barupal & Meghwal (2017); Patil et al. (2018); PS & John (2020); Desingurajan et al. (2021); Baruah et al. (2022); Diksha & Rathore (2023), Shakeel Ahamad & Rathore (2024).

II. MATERIAL & METHODS

Algal sampling was conducted at the five designated sites (S1-S5) during different seasons, including Pre-monsoon (February-May 2023-24), Monsoon (June-September 2023-24), and Post-monsoon (October-January 2023-24) Algal samples were collected using forceps, as well as with the aid of a phytoplanktonic net, dropper and clean plastic bottles with a large opening were used to collect the algae samples. The material was kept for further research in 4% formalin, and the gathered algae samples were checked to ensure they were as fresh as possible.

Using a binocular microscope and a camera, the samples were examined at predetermined intervals and captured on video. Standard approaches were used to identify the taxa in a systematic manner (Philipose, 1967; John et al., 2011 and Bhakta et al., 2011).

III. RESULT & DISCUSSION

Resulting a suspicious inquiry of the algal samples that were collected, 35 Scenedesmus species were recognized and given the following taxonomic add up to:

1. *Scenedesmus obliquus* (Fig.1)

Colonies are typically composed of four cells that are stacked upright and organized in a single, linear chain. Inner cells are fusiform, with almost straight sides and sharp or somewhat blunt ends. Terminal cells have concave or slightly convex outer sides. There are no teeth or spines on the smooth cell walls. Cells are 13–20 μ in length and 3.5–5.4 μ in width.

Collection site- S1, S2 and S3 site during post monsoon, pre-monsoon, monsoon.

2. *Scenedesmus dimorphus* (Turpin) Kuetzing (Fig.2a-b)

Colonies of four cells are typically arranged in linear or sub-alternating sequences; in colonies with eight cells, the arrangement is always sub-alternating. Terminal cells have attenuated apices and are roughly crescent in shape, whereas inner cells are generally spindle-shaped. There are no teeth or spines in any cell. The dimensions of a cell are 25.71 in length and 6.28 in width.

Collection site- S1, S2 and S3 site during post-monsoon, pre-monsoon, monsoon.

3. *Scenedesmus dimorphus* forma *tortus* G.M. Smith (Fig.3)

4 and 8 cell colony in which 4 cell colony is linear and 8 cell colony is always present in sub alternating series. Inner cells of the colony more or less straight, outer cells more and less lunate, cells end attenuated. Cells are 5.5 μ wide and 22.2 μ long.

Collection site- S2 and S3 site during post-monsoon.

4. *Scenedesmus acuminatus* (Lagerheim) Chodat (Fig.4)

Colonies are 2-celled, all cells of colony are lunate or fusiform and their poles are sharply pointed, sometimes inner cells of colony may form flat plate whereas other cells crescent shaped and at an angle to plane of inner cells. All cells are without any spines or teeth. Cells are 2.3-6.4 μ Wide and 12.8-19 μ long.

Collection site- S2 and S3 site during post-monsoon.

5. *Scenedesmus bernardii* G.M. Smith (Fig.5)

Colonies four through eightd. alternating, zigzag-shaped cells, Internal cells are 3.3-4.7 μ broad, 11.7-23 μ long, spindle-shaped to arch-like, with apices tapering to acute or occasionally slightly obtuse. They are joined by their apices to the middle or sub-apical section of adjacent cells. Cells have neither spines nor teeth.

Collection site- S1, S2 and S3 site during post-monsoon, pre-monsoon, monsoon.

6. *Scenedesmus incrassatulus* (Fig.6)

Colony of four cells. The inside side of the cell is somewhat concave, whereas the outside side is linearly curved. stumpy end of the cell with nodules at the apex. Cell dimensions: 9 μ broad and 22 μ long.

Collection site- S1, S2 and S3 site during post-monsoon.

7. *Scenedesmus bijugatus* (Turpin) Kuetzing (Fig.7)

colonies with a single chain of two to four spine-free cells that are slightly bent. The oblong-ellipsoid cells have broadly rounded ends. Cells: 7-11 μ length, 5-5.5 μ wide.

Collection site- S1, S2 and S3 site during post-monsoon, pre-monsoon, monsoon.

8. *Scenedesmus bijugatus* forma *parvus* (G.M.Smith) chodat (Fig.8)

colonies 4-celled with the arranged in a regular subalternating form cell wall smooth cell 3 μ broad, 7 μ long.

Collection site- S1, S2 and S3 site during post monsoon, pre-monsoon.

9. *Scenedesmus bijugatus* var. *graevenitzii* (Bernard) (Fig.9)

Colonies composed of eight cells. Cells are organized alternately, with neighboring cells contacting within a specific length, and might be fusiform, ellipsoidal, oblong, or ellipsoidal with obtuse ends. Cells measure 12.8–15.5 μ in length and 4.6–6.4 μ in width.

Collection site- S1, S2 and S3 site during post-monsoon, pre-monsoon.

10. *Scenedesmus bijugatus* var. *irregularis* (Wille) G.M.Smith (Fig.10)

colonies with four to eight cells, although eight-celled colonies are most prevalent. The arrangement of cells is uneven, sub-alternating, and occasionally nearly double row. Colony cells are found touching one another at the basal and lateral regions. Cells measure 6.8–9.2 μ in length and 2.1–5.3 μ in width.

Collection site- S1, S2 and S3 site during post-monsoon, pre-monsoon, monsoon

11. *Scenedesmus bijugatus* (Turp.) Kuetz. var. *alternans* (Reinsch) Hansg. (Fig.11)

Usually composed of eight cells, but sometimes just four, colonies are flat or slightly curved. Neighboring cells only connect to one another along a tiny portion of their length, and the cells are arranged in a clearly alternating pattern. Four-cell colony, diameter 28.78 μ m. Cells are ellipsoid to ovoid-ellipsoid, circular at the ends, 18 μ long, and 6.7 μ broad.

Collection site -S1, S2 and S3 site during post-monsoon, pre-monsoon, monsoon

12. *Scenedesmus Bijugatus* var. *flexuosus* (Fig.12)

Eight-celled colonies are arranged in a spiral fashion. The cells range in size from 7.57 to 10.60 in length and from 6.06 to 7.57 in width.

Collection site- S2 and S3 site during post-monsoon

13. *Scenedesmus platydiscus* (G.M. Smith) Chodat (Fig.13a-b)

Colonies flat 8-celled with oblong-elliptic cells arranged in double series interstices between cells minute or absent altogether. cells 5.5 μ broad μ long 14g.

Collection site- S1, S2, S3, S4 and S5 site during post-monsoon, pre-monsoon.

14. *Scenedesmus arcuatus* (Lemmermann) (Fig.14)

colonies of four cells grouped in a line; the cells are slightly curved and cylindrical, and their walls are smooth and spineless. Cells measure 9.3 μ in length and 3.8 μ in width.

Collection site- S1, S2 and S3 site during post-monsoon.

15. *Scenedesmus arcuatus* var. *capitatus* G.M. Smith – (Fig.15)

colonies with a double series of eight bent cells. Cells had a small curvature, with one side being straight and the other convex. Cell ends are stumpy and have thickening nodules. The cells are 18 μ length and 9 μ wide.

Collection site- S1, S2 and S3 site during post-monsoon.

16. *Scenedesmus prismaticus* Bruhl and Biswas (Fig.16a-b)

colonies of 4-8 prismatic cells that are organized in a single chain and have pyramidal end faces. The hexagonal shape appears in cross section, with the terminal and lateral edges meeting at sharp angles. Cell walls have no spines at the apices and are smooth. The cells measure 5.4 μ broad and 14.7 μ long.

Collection site- S1, S2 and S3 site during post-monsoon, monsoon.

17. *Scenedesmus acutiformis* Schroeder (Fig.17)

Colonies are usually 4-celled. cells with tapering apices that are cylindrical-fusiform and organized in a single chain. Outer faces of marginal cells may slightly convex. Cells with one to four ribs that run from pole to pole are found. Cell poles lack all kind of teeth or spines. The cells are 14 μ long and 5 μ wide.

Collection site -S1, S2 and S3 site during post-monsoon, pre-monsoon, monsoon.

18. *Scenedesmus brasiliensis* Bohlin (Fig.18)

Colonies usually 4-celled, cells cylindrical or oblong-ellipsoid with attenuate apices and with a longitudinal ridge extending from pole to pole on each side of the cell ends of cell with 3 teeth, cells 6.5 μ broad, 26.2 μ long.

Collection site- S1, S2 and S3 site during post-monsoon.

19. Scenedesmus armatus var. bicaudatus (Guglielmetti) Chodat (Fig.19)

Cells from Colonies 2-4 differ. diverge from the type in that the spines of the two terminal cells alternate, with the long spine originating from just one of the terminal cell's poles. Typically, only interior cells have longitudinal ribs. Colonies of four cells, 9-11.2 μ in width, 9.5-17.1 μ in length, with spines 7.2 μ long
Collection site- S1, S2 and S3 site during post-monsoon, pre-monsoon.

20. Scenedesmus hystrix lagerhein (Fig. 20)

Colonies are made up of four-celled, oblong-cylindrical cells with obtuse ends that are grouped in a single linear series with tiny spines covering the cell membrane. Cells are 15.71 length and 5.96 wide.
Collection site- S1, S2 and S3 site during post-monsoon, monsoon.

21. Scenedesmus denticulatus var. australis Playfair (Fig.21)

Colonies 4 celled arrangement of cell is linear form oblong cylindrical with more or less round ends with one short with forms the poles of all cells cells 5 μ broad, 18 μ long, teeth 1.2 μ long.
Collection site- S1, S2 and S3 site during post-monsoon, pre-monsoon, monsoon.

22. Scenedesmus opliensis P.Richter (Fig.22a-b)

Colonies consist of two cells arranged in an inner succession in a cylindrical to subfusiform pattern, with only about one-third of the cells touching. The interior cells are attenuated near the end and tumid in the middle. Terminal cells are frequently subrectangular and narrower. All semitruncate to rostrate poles may terminate in one or two very short spines; the terminal cell's poles have a longer, more or recurved spine. Cells are 25.13 μ length, 4.87 μ wide, and have 27 μ long spines.
Collection site- S1, S2 and S3 site during post-monsoon.

23. Scenedesmus abundans (kirchner) chodat (Fig.23a-b)

Colonies 2-4 celled ovoid or oblong-ovoid. External cells with one or more median lateral spines from the outer face in addition to spines from the four corners of the colony. Internal cell 1-2 spines from their poles. cells 2-7 μ broad, 15 μ spine 3.5-8 μ long
Collection site- S1, S2 and S3 site during post-monsoon, pre-monsoon, monsoon.

24. Scenedesmus abundans var. brevicauda G.M.Smith (Fig.24a-b)

4 to 8 celled, Cells smaller than in the type and with much shorter spines which are not more than three between the polar spines of terminal cells. cells 2.74 μ broad, 6.1 μ long spines 2.5 μ .
Collection site- S1, S2 and S3 site during post-monsoon, pre-monsoon, monsoon

25. Scenedesmus perforatus (LEMMERMANN) (Fig.25)

colonies 4 celled cells with capitate ends outer face of external cells slightly convex inner face concave poles curved outwards and with a long-recurved spine. Internal cells with concave sides and with linear to lenticular perforations between adjacent cells cells membrane smooth or punctate cells 8.5 μ broad, 25.3 μ long spines 12 μ long.
Collection site- S1, S2 and S3 pre-monsoon and monsoon.

26. Scenedesmus quadricauda (Fig.26)

Colonies consist of two, four, and in exceptional cases, eight cells. Cells are narrower than the type and have an ovoid to cylindrical shape. Both terminal cells have spines, which are somewhat longer than the length of the cell. Spines are 11-14.3 μ long, cells are 3.2-5.3 μ wide, and cells are 9.3-14.4 μ long.
Collection site- S1, S2 and S3 site during post-monsoon and pre-monsoon.

27. Scenedesmus quadricauda var. bicaudatus (HANSGIRG) (Fig.27)

Colony Four-celled colony without spines on the inner cells, with a single, straight spine at each end cell's poles. Cells that are 8.41 μ wide, 13.64 μ long, and have 5.54 μ long spines are grouped in a linear sequence with cylindrical, rounded ends.
Collection site- S1, S2 and S3 site during post-monsoon and pre-monsoon.

28. Scenedesmus quadricauda var. longispina (Chodat) G. M. Smith (Fig.29)

Colonies are 4 celled terminal cells with a long spine that extends from one pole, with one terminal cell's spine at the angle that is opposite to the other terminal cell interior cells that lack spines on their poles. Spines are 5.2μ long and cells are 4.3μ broad & 11.31μ long.

Collection site- S1, S2 and S3 site during post-monsoon.

29. Scenedesmus quadricauda var. eualternans Proschk. (Fig.30)

Colonies are usually 4- celled arranged in sub alternate series. Cells are small and broadly ellipsoid having broadly rounded ends; Cells are 3.8μ broad, 14μ long. Spines are 9μ in length.

Collection site- S1, S2 and S3 site during post-monsoon.

30. Scenedesmus quadricauda var. westii G. M. Smith (Fig.31)

Colonies 4 to 8 celled. Both terminal cells of colony have one spine at their each end while inner cells are without spines. Cells $4.4-7.8 \mu$ broad and $11.7-21.7 \mu$ long, Spines $10.3-15.5 \mu$ long.

Collection site- S1, S2 and S3 site during post-monsoon, pre-monsoon, monsoon.

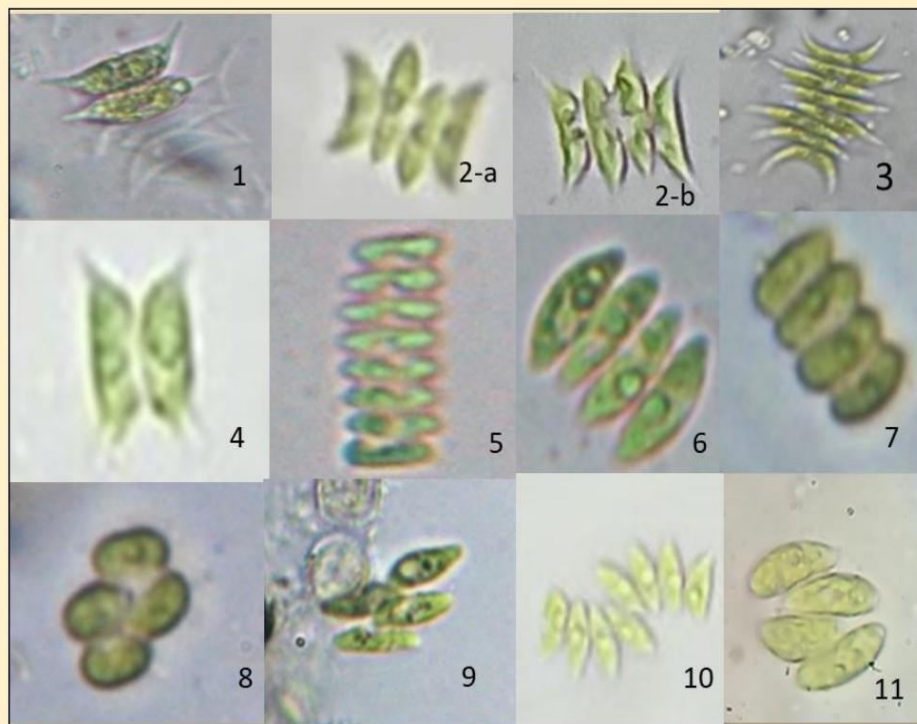


PLATE I- 1. *Scenedesmus obliquus* 2. *Scenedesmus dimorphus* (Turpin) Kuetzing 3. *Scenedesmus dimorphus* forma *tortus* G.M. Smith 4. *Scenedesmus acuminatus* (Lagerheim) Chodat 5. *Scenedesmus bernardii* G.M. Smith 6. *Scenedesmus incrassatulus* 7. *Scenedesmus bijugatus* (Turpin) Kuetzing 8. *Scenedesmus bijugatus* forma *parvus* (G.M. Smith) chodat 9. *Scenedesmus bijugatus* var. *graevenitzi* (Bernard) 10. *Scenedesmus bijugatus* var. *irregularis* (Wille) G.M. Smith 11. *Scenedesmus bijugatus* (Turp.) Kuetz. var. *alternans* (Reinsch) Hansg.

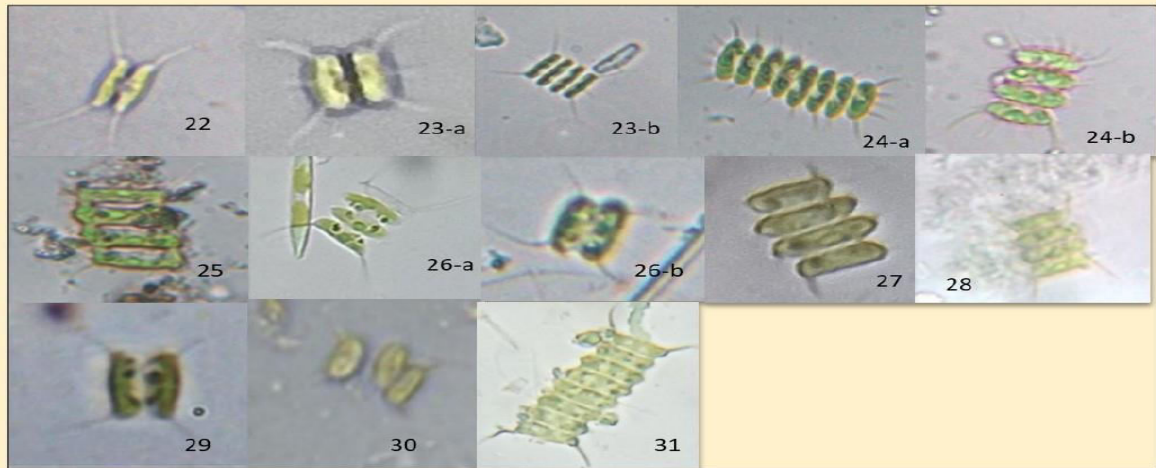


PLATE III- 22. *Scenedesmus optiensis* P. Richter 23. *Scenedesmus abundans* (kirchner) chodat 24. *Scenedesmus abundans* var. *brevicauda* G.M. Smith 25. *Scenedesmus perforatus* (LEMMERMANN) 26. *Scenedesmus quadricauda* 27. *Scenedesmus quadricauda* var. *bicaudatus* (HANSGIRG) 28. *Scenedesmus quadricauda* 29. *Scenedesmus quadricauda* var. *longispina* (Chodat) G. M. Smith 30. *Scenedesmus quadricauda* var. *eualternans* Proschk 31. *Scenedesmus quadricauda* var. *westii* G. M. Smith



PLATE II- 12. *Scenedesmus Bijugatus* var. *flexuosus* 13. *Scenedesmus platydiscus* (G.M.smith) Chodat 14. *Scenedesmus arcuatus* (Lemmermann) 15. *Scenedesmus arcuatus* var. *capitatus* 16. *Scenedesmus prismaticus* Bruhl and Biswas 17. *Scenedesmus acutiformis* Schroeder 18. *Scenedesmus brasiliensis* Bohlin 19. *Scenedesmus armatus* var. *bicaudatus* 20. *Scenedesmus hystrix* lagerhein 21. *Scenedesmus denticulatus* var. *australis* Playfair

IV. CONCLUSION

Present study included 31 species and varieties of Scenedesmus and some of the algal species observed as dominant algae such as Scenedesmus quadricauda, Scenedesmus bijugatus var. irregularis, Scenedesmus bijugatus, Scenedesmus obliquus, Scenedesmus dimorphus. It showed that Scenedesmus is widely distributed and richness in the Mangali river. The first reported of Scenedesmus from this river below learning high points the significance of this organism as a gauge of the health of freshwater ecosystems. It aids in Scenedesmus future study pointed at better understanding the diversity and ecological importance of in freshwater rivers by intent on seasonal fluctuations, ecological variables manipulating algal dispersion and molecular characterization.

V. ACKNOWLEDGMENTS

The authors would like to express their heartfelt gratitude to the Principal, Government College, Bundi and Head of Department of Botany, Government College, Bundi (Rajasthan) for providing laboratory and library facilities.

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