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Freshwater Desmids from Sawai Madhopur Part-I - *Closterium* Nitzsch

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Abstract: ***Desmids as part of microalgae have been investigated from Sawai madhopur Rajasthan. Closterium Nitzch a desmids genus has been selected for investigation and 15 species were identified. The identified species are Closterium acerosum Ralfs.; Closterium aciculare T. West; Closterium acutum Ralfs.; Closterium cynthia De Notaris; Closterium dinae Ralfs.; Closterium dianae Ralfs. var. arcuatum (Brébisson) Rabenhorst; Closterium ehrenbergii Ralfs; Closterium intermedium Ralfs; Closterium leibleinii Ralf; Closterium lunula Ralfs; Closterium malmei Borge; Closterium monoliferum Ralfs; Closterium rostratum Ralf; Closterium subcoticum Gutwinski; Closterium venus Ralfs.***

Keywords: Microalgae, Desmids, *Closterium* Nitzsch, Freshwater, Rajasthan

1. Introduction

Algae are ubiquitous in their nature and freshwater microalgae have large number of group. The desmids belongs conjugales and prominently found in freshwater habitats. Desmids are primarily found in freshwater habitats, such as ponds, rivers, and lakes. There, they may live as phytoplankton, on the bottom as benthic dwellers, or on the submerged portions of plants. They may also be found in saline waters, or in snow or ice. While most desmids are unicellular, many species grow as long filamentous colonies. Desmids have no flagella; they were lost at some point in the group's evolution. Reproduction therefore, cannot rely on motile gametes, but rather two cells will meet and join in a process called conjugation. Once the two desmids have joined, their cytoplasm fuses into a single diploid cell, the zygote, which encases itself in a thick wall. Later, the zygote will undergo meiosis to produce new haploid individuals. Growing desmids cells therefore have only a single set of chromosomes, and the zygote is the only diploid cell in the life cycle.

Indian desmids are illustrated by Suxena and Venkataswarlu (1966), Vidyavati and Nizam (1970, 1974, 1975) from Andhra Pradesh; Das and Purti (1990) from Bihar; Kamat (1974), Ashtekar and Kamat (1979), Tarar et al. (1998) from Maharashtra; Iyengar and Vimala Bai (1941), Ramanathan (1962, 1964) from Tamilnadu; Bharti (1965a, b, c, 1966, 1971) from Maharashtra and Karnatka; Agarkar (1969, 1971, 1975), Agarkar and Agarkar (1973), Agarkar *et al*., (1979) from Madhya Pradesh; Patel (1969, 1980), Patel and Asokakumar (1979, 1980, 1981) from Gujarat; Mukherjee and Srivastava (1993) from West Bengal; Patel (1982) from Kerala; Habib and Chaturvedi (1993) and Dwivedi *et al*. (2004) from Uttar Pradesh. Habib (1999) have reported desmids from Himachal Pradesh and Misra *et al.* (2006, 2007) from Himachal Pradesh and Kumaon Himalaya. The Desmids from study area are not reported earlier.

2. Material and Methods

Cells always longer than broad, tapering from mid-region to narrower apices, showing varying degree of curvature. cells divded into two halves with very small constriction. The chloroplast simple and ribbon like or with radiating longitudinal ridges with varying numbers of pyrenoids scattered in series along the core. The wall is colorless or brownish with or longitudinal striae. The identified species are found in fresh running water/pods/muddy area. The majority species are planktoic and few are associated with other macrophytes. The shape of apices is an important taxonomic criteria and curvature (degree of arc) is determined by the drawing a semicircle on tracing paper and marking from degree from 0-180 sing a 5^{o} and 10^{o} intervals. Within this curve a number of inner curves and radial lines are added, the latter corresponding to the 5^{o} or 10^{o} intervals. These concentric curves should than be superimposed on a drawing or photomicrograph of species to be identified. The monograph of John Whitton Brook entitled “The Freshwater algal flora…. ” Second Edition (2011) Cambridge publication and many research papers on Indian desmids are utilized for taxonomic enumeration.

3. Study Area

The study is carried out in the Sawaimadhopur district of Rajasthan. The district is situated in the western part of the Rajasthan and the rainfall is moderate. It cover area 5042.99.99 sq km and situated in between North longitudinal 25°-45' to 26°-41 and in between 75°-59' to 77°-0 East longitude. The temperature ranges from 4^{o} to 45^{o}c with average rainfall 873.40 mm. The district has rolling hills of Aravalli and Vindhyas ranges. Sawai Madhopur is known for Ranthambhor, a Wildlife reserve and a place of historical importance. The district is divided in to eight tehsils namely1. Sawai madhopur 2. Khandar, 3. Chauth ka Barwara 4. Gangapur City.5. Bonli; 6. Bamanwas; 7. Vazirpur; 8 Malarna Dungar. The area has many freshwater ponds, Dams and lakes. The perennial river Chambal in the Khandar tehsil is natural boundary between Rajasthan and Madhya Pradesh. The sampling sites are denotes in the figure below

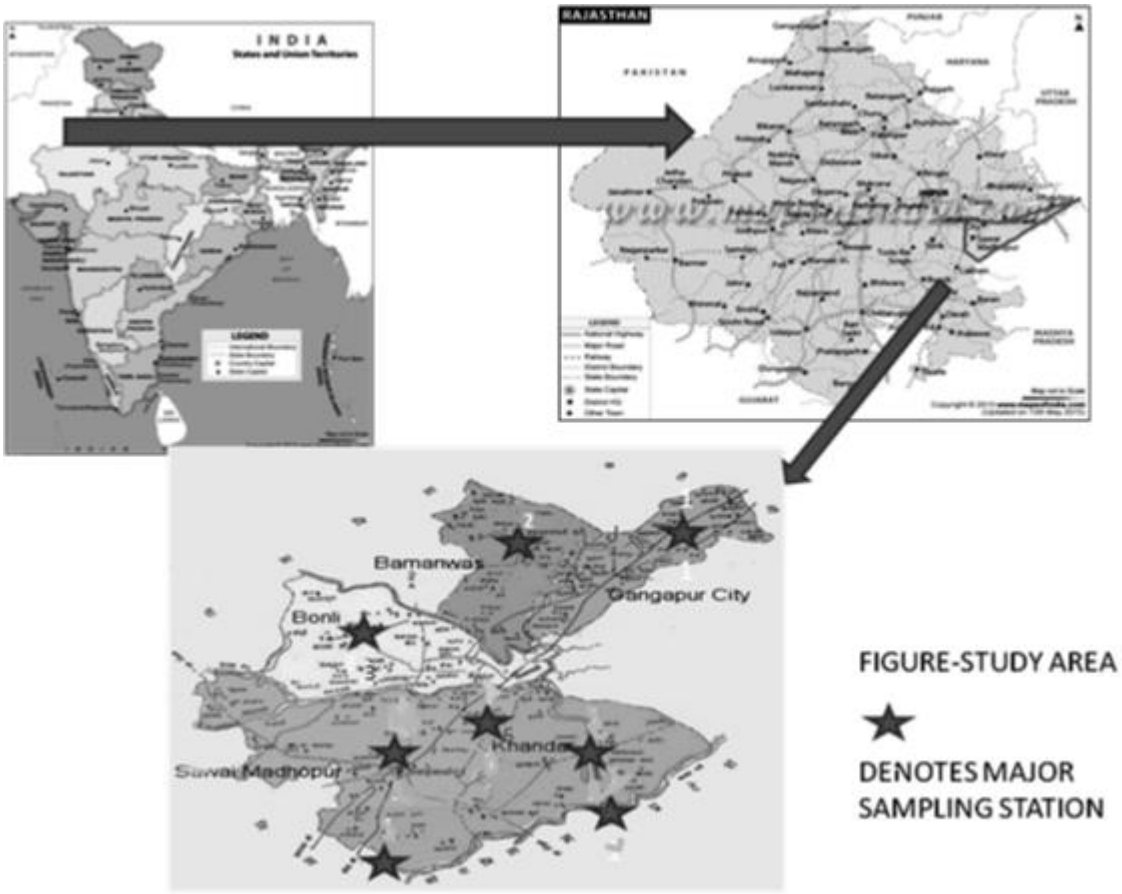

Table 1: Major sampling site and their sampling numbers

Sampling Number (**SN**)	Sampling site and Their Abreviation	Date
1	Wazirpur area Gangapur city sawai madhopur (S-I)	4 Sept 2021
2	Bamanwas (S-II)	4 Sept 2021
3	Bonli (S-III)	10 Oct 2021
4	Khandar Chambal area (S-IV)	15 Oct 2021
5	Khandar Gilai Sagar (S-V)	15 Oct 2021
6	Khandar Jaitpur dam (S-VI)	21 Oct 2021
7	Ranthambhore National Park (S-VII)	30 Oct 2021

Taxonomic Enumeration
Class-Chlorophyta
Order Zygnematales
Suborder-Closteriinae
Family-Closteriaceae
Genus-*Closterium* Nitzsch 1817

1. *Closterium acerosum* Ralf 1892; **Fig.1, 2. SN-2, 7.**
Cells fusiform, variable in size, apices rounded; curvature 28–35^{o} of arc; cell wall finely striate, yellowish brown, ridged chloroplast with 6-7 pyrenoids, length 250–390 µm; width 25–35 µm.
2. *Closterium aciculare* T. West, 1860; **Fig.14. SN-2**
This is typically planktonic species because of its high cellular surface to volume ratio sinking velocity is low, this species is generally found in eutrophic water bodies during spring or autumn, cells slender, narrower, 55-70 times longer than wide, slightly curved, gradually tapering towards apices; end of apices rounded. Chloroplast does not extend into apices, cell wall smooth. .
3. *Closterium acutum* Ralfs 1848. **Fig 11**. **SN-1, 5**
Cells slightly curved, 105.0 – 108.0 µm and 4.5 µm wide gradually tapering to the end from median portion, 20-22 times longer than wide, cell wall smooth chloroplast with usually 3 pyrenoids in semicells.
4. *Closterium cynthia* De Notaris 1867; **Fig.10. SN-4**
Cells strongly curved, 250.0 – 260.0 µm long and 20.0 – 21.0 µm wide, 8-10 times longer than wide, 110–145^{o}C of arc; in most cases with a straight parallel median portion, thereafter gradually and evenly attenuated to bluntly rounded apices; wall with true girdle band, wall yellowish brown and finely striate, chloroplast with 3-6 pyrenoids.
5. *Closterium dinae* Ralfs 1848.; **Fig.3, 4. SN-3, 6.**
Cells 16–18 times longer than broad, strongly curved, 115^{o}–125^{o} arc; apices tapering to obliquely truncate, cell wall smooth; chloroplast 11-15 pyrenoids. Length 280–360 µm, width 21–28 µm.
6. *Closterium dianae* Ehr. var. *arcuatum* (Brébisson) Rabenhorst; **Fig.18, 22. SN-5, 7.**
Cells strongly curved, 280.0-290.0 µm long and 15.0 – 18.0 µm wide, 110–150^{o} of arc; apices obliquely truncate, cell wall smooth, yellowish, chloroplast with 8-9 pyrenoids.
7. *Closterium ehrenbergii* Ralfs 1848. **Fig-5. SN-1, 2, 3, 5, 6, 7**
Cells stout and large, 390–450 µm long, 65–75 µm wide strongly curved, 120–145^{o} of arc; slightly bulging at mid-

region, dorsal margin broadly convex; wall smooth, chloroplast with many scattered pyrenoids.

8. *Closterium intermedium* Ralfs 1848, **Fig.15. SN-4, 6**

Cells slightly curved, obliquely truncate apices, cell wall striated, sutures usually more than three, chloroplast 10-11 ridged. Length 235–265 µm, width 14–16 µm.

9. *Closterium leibleinii* Ralfs 1848, **Fig.16. S N-5**

Cells strongly curved, 110–215 µm long, 17–32 µm wide, 150–165^{o} arc; slightly tumid in the mid-region, apices rounded, cell wall smooth.

10. *Closterium lunula* Ralfs 1848. **Fig.17. SN-6**

Cells more or less straight, gradually attenuated from the middle towards the poles; apices rounded truncate and a little bit recurved. Cell wall smooth (not striate), chloroplast 8-10 ridges with many scattered pyrenoids. Length 450–580 µm and width 85–98 µm.

11. *Closterium malmei* Borge, **Fig.21, 13. SN-2, 3.**

Cells strongly curved, gradually tapering from middle towards half conical shaped apices, cell wall ribbed, chloroplast 8-11 ridged, spores brown coloured. Length 195–215 µm, width 31–42 µm.

12. *Closterium monoliferum* Ralfs 1848. **Fig-6, 7, 12**. **SN-2, 6, 7.**

Cells large, strongly curved, ventral margin slightly swollen in the median portion, 110–145^{o} of arc, strongly attenuated to truncate rounded apices, cell wall smooth; many and scattered pyrenoids, length 300–500 µm, width 45–72 µm.

13. *Closterium rostratum* Ralfs 1848. **Fig.8. SN-6**

Cells large, 390.0 – 400.0 µm long and 35.0-40.0 µm wide, about 8-10 times longer than broad; slightly curved 30-40^{o}c arc; ventral margin strongly tumid in the mid region and more convex than the dorsal margin; strongly attenuated to produce narrow, wall smooth and striate in the mid region; cell terminated by incurved obliquely rounded apices.

14. *Closterium subcoticum* Gutwinski 1902. **Fig 19, 20**. **SN-1, 4.**

Cells slightly curved, apices button shaped, chloroplast 4-8 ridged with some pyrenoids; cell wall finely punctate, yellowish-brown. Length 235–265 µm, width 13.5–15.0 µm, apex 8.0–10.5 µm.

15. *Closterium venus* Ralfs 1848. **Fig-9**. **SN-7**

Cells strongly curved with tapering ends, 75.0 – 80.0 µm long and 8.0 – 9.0 µm wide, 8-9 times longer than broad, 155–162^{o} arc, semi-cell with two pyrenoids in middle girdle of chloroplast, wall smooth.

4. Conclusion

The identified species are first report from study area and will enrich the documentation of algal diversity. The presence of desmids also shows that the study area is still not too polluted and need to conserve to save algal diversity.

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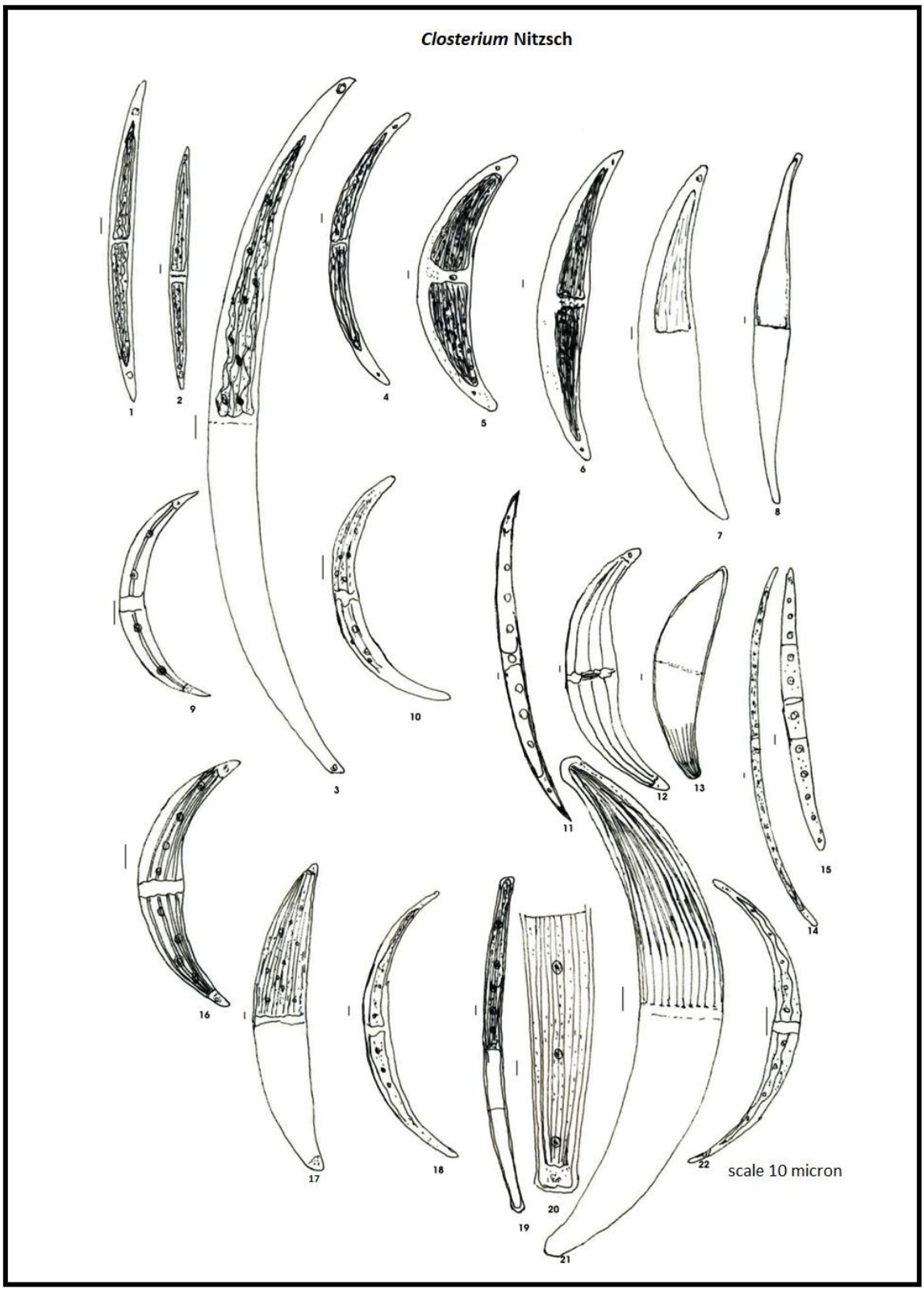

Legends of figures
1) *Closterium acerosum* Ralf
2) *Closterium acerosum* Ralf
3) *Closterium dinae* Ralfs
4) *Closterium dinae* Ralfs
5) *Closterium ehrenbergii* Ralfs
6) *Closterium monoliferum* Ralfs
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8) *Closterium rostratum* Ralfs
9) *Closterium venus* Ralfs

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