



## Contribution to Desmidiaceae - Genus *Cosmarium* Corda ex Ralfs from Anjani Dam of Jalgaon District-III, Maharashtra

Patil Sanjay Bhagwat

Department of botany, Sardar Vallabhbhai Patel Arts and Science College, Ainpur, District Jalgaon, (M.S.) - 425507

### Abstract

The present investigation deals with the exploration, documentation and descriptions of *Cosmarium* species and varieties (Desmidiaceae) from Anjani dam of Jalgaon district, Maharashtra. The algal samples are collected from different sites of Anjani Dam for the period of two years. The total 90 taxa of genus *Cosmarium* corda to family Desmidiaceae has been recorded during the course of study. In this paper only 30 taxa of *Cosmarium* with 18 species, 11 varieties and 01 forma which are systematically described with illustrations. *Cosmarium subcontractum* has been recorded for the first time from India, hence which is a new addition to the desmids flora of India.

**Keywords:** Anjani dam, *cosmarium*, *desmids*, *desmidiaceae*, Maharashtra, *taxa*.

### Introduction

Desmids are a group of highly diversified and most attractive microscopic unicellular green algae belong to the class Zygnematophyceae. They are described as beautiful because they exhibit great diversity with beautiful ornamentation in their external morphology as well as show complex cell symmetry making them most attractive in appearance. The cells transversally curved by constriction called *sinus* into two symmetrical semi-cells connected by an isthmus. The genus *Cosmarium* Corda ex Ralfs (Zygnematophyceae) is a unicellular placoderm desmid and most species-rich genus of desmids group with approximately 1137 species which are currently accepted taxonomically (Guiry and Guiry, 2023) and exhibit great species diversity in morphology and show remarkably complex cell symmetry. The cell morphology, amount of pyrenoids, cell wall ornamentation, length of isthmus, apical and lateral views are identifying characteristics of species and the varieties of *cosmarium*. Desmids diversity of Maharashtra were explored through the contributions of Kamat (1975), Kamat and Tiwari (1978), Freitas and Kamat (1979), Agarkar and Kamat

(1979), Tarar *et al.*, (1998), Nandan and Jain (2004), Jawale *et al.*, (2005), Dhande and Jawale (2009), Mahajan (2011), Jadhavar and Papdiwal (2011, 2012), Bandgar and Papdiwal (2013), Patil and Jawale (2014), Patil and Kumawat (2014, 2015), Patil and Deore (2017), Reddy and Chaturvedi (2017), Shejul and Sawant (2018), Mhaske and Talwankar (2018), Bansod and Patil (2019), Patil and Kumawat (2019), Patil (2019 a,b), Valvi and Gautam (2020), Yadav (2020), Andhale (2021), Jadhavar and Papdiwal (2022). In this article the authors represents 30 taxa of genus *Cosmarium* from Anjani dam of Jalgaon district, Maharashtra, India.

### Materials and Methods

Anjani dam is situated near the Palasdal village (20° 54' North latitude and 75° 19' East longitudes) on Anjani river in Erandol Tahsil of Jalgaon district, Maharashtra. The algal samples were collected early in the morning between 7.00 to 09.00 am in different sized plastic vials from (May, 2017 to April, 2019) from different sites of Anjani dam. These samples were examined fresh as far as possible. Camera lucida drawings were made

with the help of mirror type of camera lucida under appropriate magnifications with labomed LX-400 trinocular research microscope. Taxonomic identification of *Cosmarium* up to species level with the help of consultation of keys and descriptions in literature such as West and West (1905,1908,1912), Scott and Prescott (1961), Prasad and Mishra Vol.-II (1992), Das and Keshri (2016) and relevant research publications were used in this study.

## Result

### Taxonomical description

Class: **Zygnematophyceae**

Order: **Desmidiaceae**

Family: **Desmidiaceae**

Genus- *Cosmarium*

### *Cosmarium quadratum* Ralfs. **Pl.1, Fig.1**

Hirano M.1956, P. 143-144, Pl.24, Figs. 5, 6.

**Dimension:** Cell 37.0  $\mu\text{m}$  broad, 72.1  $\mu\text{m}$  long and isthmus 13.8  $\mu\text{m}$  broad.

**Description:** Cell medium size, twice as long as broad, slightly constricted, sinus shallow semicells sub-quadrate with rounded angles and slightly notched, apex convex. Semicell ovate or elliptic-pyramidate in side view, smooth cell-wall; chloroplast having two pyrenoids.

**Coll. No.** 422.

**Distribution in India:**-Suxena and Venkateswarlu (1968) Andhra Pradesh, Agarkar and Agarkar (1977), Dhurve *et al.*, (2022) Madhya Pradesh, Freitas and Kamat (1979), Reddy and Chaturvedi (2017) Maharashtra, Sindhu and Panikkar (1995) Kerala, Suseela and Toppo (2007) Sikkim, Verma *et al.*, (2021) Uttar Pradesh

### *Cosmarium quadratum* Ralfs var. *willei* (Schmidle) Krieg. & Gerl. **Pl.1, Fig.2**

Prasad B.N. and Misra R. 1987, P. 170, Pl 2, Fig 12.

**Dimension:** Cells 41.6-46.2  $\mu\text{m}$  broad, 80.4-81.4  $\mu\text{m}$  long and isthmus 13.8 -14.8  $\mu\text{m}$  broad.

**Description:** Cells medium size, almost two times longer than broad sinus narrow at apex;

but somewhat open towards the outside; semicells sub-quadrate, slightly narrow upwards, basal angles rounded. Sides of semicell straight. Cell-wall smooth. Axile chloroplast having two pyrenoids in each semicell.

**Coll. Nos.** 412, 422.

**Distribution in India:**-Suxena (1979) Kashmir, Prasad and Misra (1987) Sikkim, Shobha Rani *et al.*, (2020) Andhra Pradesh,

### *Cosmarium quadrum* Lund. **Pl.1, Fig.3**

West, W. and West, G.S. 1912, P. 20, Pl. 100, Figs. 3-6

**Dimension:** Cell 42.5  $\mu\text{m}$  broad, 49.9 long  $\mu\text{m}$  and isthmus 10.1  $\mu\text{m}$  broad.

**Description:** Cells small, quadrate, nearly as longer as broad, constriction deep, sinus narrow, linear with dilated extremities; semicells sub-rectangular, basal and apical angles rounded, sides curved, apex slightly rounded cell wall granulate, granules in somewhat oblique and less distinct vertical series, 28-23 at the margin of semicell; top view oblong elliptic; each semicell having axile chloroplast with two pyrenoids.

**Coll. No.** 494.

**Distribution in India:**-Agarkar and Agarkar (1977), Dhurve *et al.*, (2022) Madhya Pradesh, Pandey and Pandey (1980), Habib and Chaturvedi (1993), Verma *et al.*, (2021) Uttar Pradesh, Prasad *et al.*, (1987), Shukla *et al.*, (2008), Sharma *et al.*, (2022) Uttarakhand, Das *et al.*, (1990) Bihar, Pal and Santra (1993), Nandi *et al.*, (2019) West Bengal, Jena *et al.*, (2006), Dash *et al.*, (2020) Odisha, Kerkar and Lobo (2009) Goa, Deka *et al.*, (2011), Yasmin *et al.*, (2011), Phukan and Bora (2012), Baruah *et al.*, (2013), Baruah *et al.*, (2020), Baruah *et al.*, (2022) Assam, Paul and Sreekumar (2015) Kerala, Patil and Deore (2017), Patil and Kumawat (2019), Andhale (2021) Maharashtra, Babu and Vasanthakumar (2020) Tamil Nadu, Shobha Rani *et al.*, (2020) Andhra Pradesh, Vidyashree and Malammanavr (2021) Karnataka,

*Cosmarium quadrum* Lund. var. *quadrum*.  
Pl. 1, Fig.4

Das Debjyoti and Keshri J.P, 2016, P.120, Pl.5 Fig.156, 157, Pl.6 Fig.160, 161.

**Dimension:** Cell 46.2 µm broad, 54.5 long µm and isthmus 12.9 µm broad

**Description:** Cell larger slightly longer than broad. Median constriction is deeply constricted, the sinus narrow, linear and dilated slightly towards ends, semi cell sub-rectangular in shape, lower and upper angles broadly rounded, lateral margins slight convex, apex slightly narrow; cell wall granulate densely granules solid arranged in separate oblique and slight less distinct in vertical series. 34 granules at the margin of a semicell and slight reduced in size in the centre of the apex.

**Coll. No.**164.

**Distribution in India:** -Das and Keshri (2013, 2016) Sikkim, Das (2020) Assam, Verma *et al.*,(2021) Uttar Pradesh,

*Cosmarium regnellii* Wille  
Pl.1, Fig.5

Prasad, B. N. and Misra, P. K. 1992, P. 180, Pl. 21, Fig. 25.

**Dimension:** Cell 11.2 µm broad, 14.2 µm long and isthmus 4.1 µm broad

**Description:** Cell as long as broad; deeply constricted in the middle; sinus linear open; semicells sub-rectangular with rounded basal angles; apex straight; undulate lateral margins; each semicell with single pyrenoid.

**Coll. Nos.** 195,222.

**Distribution in India:**-Suxena(1979) Kashmir, Isaacs and Hegde (1986) Karnataka, Das *et al.*,(1990) Bihar, Misra *et al.*,(2008) Uttarakhand,Kerkar and Lobo (2009) Goa, Bandgar and Papdiwal (2013),Patil and Kumawat (2014, 2015) Andhale (2021), Reddy and Chaturvedi (2017) Shejul and Sawant (2018), Mhaske and Talwankar (2018) Maharashtra, Baruah *et al.*,(2022) Assam, Verma *et al.*, (2021) Uttar Pradesh

*Cosmarium regnellii* Wille f. *minus* Boldt.  
Pl.1, Fig. 6

Suxena, M. R. and Venkateswarlu, V. 1968, P. 191, Pl. 5, Figs. 53 a, b.

**Dimension:** Cell 11.2 µm broad, 13.8 µm long and isthmus 4.8 µm broad.

**Description:** Cells small, slight longer than broad, constricted deeply, narrow sinus, semicells depressed-globose; apex rounded; each semicell has a single pyrenoid.

**Coll. Nos.**194, 212.

**Distribution in India:**-Suxena and Venkateswarlu (1968) Jammu and Kashmir, Agarkar and Agarkar (1977) Madhya Pradesh, Ashtekar and Kamat (1979) Maharashtra, Habib *et al.*,(1990) Uttar Pradesh,

*Cosmarium regnellii* Wille var. *chondrophorum* Skuja.Pl.1Fig. 7

Scott A.M. and Prescott G.W., 1961; P. 68 Pl. 32, Fig. 14.

**Dimension:** Cell 11.2 µm broad, 14.2 µm long and isthmus 3.0 µm broad.

**Description:** Cells small, longer than broad with distinct median constriction, sinus linear; semi cells trapezoid, hexagonal, apex with slightly mid region of each semicell with small granular thickening.

**Coll. No.**197.

**Distribution in India:**-Hegde and Issacs (1988) Karnataka, Gupta (2012) West Bengal,

*Cosmarium reniforme* (Ralfs) ArchPl.1, Fig.8

Prasad, B. N. and Misra, P. K. 1992, P. 181, Pl. 23, Fig. 8.

**Dimension:** Cell 42.8-49.9 µm broad, 57.0-65.6 µm long and isthmus 11.2-16.6 µm broad.

**Description:** Medium sized cells, slightly longer than broad with deep constriction, sinus narrow and linear with widely dilated extremity; shape of the semicells reniform; cell wall granulate, granules fairly regular in horizontal and indistinct vertical series; each semicell with axile chloroplast with two pyrenoids.

**Coll. Nos.** 122,123,164.171,196.

**Distribution in India:**-Suxena and Venkateswarlu, (1968) Kashmir, Patel (1969) Gujarat, Das *et al.*, (1990) Bihar, Braupal (2011) Rajasthan, Paul and Sreekumar (2015) Kerala, Pandey and Pandey (1980), Verma *et al.*, (2021) Uttar Pradesh, Yasmin *et al.*, (2011), Phukan and Bora (2012) Assam, Kamat (1975), Dhande and Jawale (2009) Patil and Kumawat (2014, 2015), Patil and Deore (2017), Mhaske and Talwankar (2018), Bansod and Patil (2019) Valvi and Gautam (2020) Maharashtra, Shobha Rani *et al.*, (2020) Andhra Pradesh, Komal *et al.*, (2021) Punjab,

*Cosmarium reniforme* (Ralfs) Arch. var. *compressum* Nordst.

**Pl.1, Fig.9**

West W. and West G.S., 1908, P.158, Pl, 79, Figs 3, 4.

**Dimension:** Cell 46.2  $\mu\text{m}$  broad, 46.2 long  $\mu\text{m}$  and isthmus 11.1  $\mu\text{m}$  broad.

**Description:** Cells slightly longer than broad, constricted deeply; sinus deep, narrow, closed in middle, widely dilated inside but closed towards outside, semi-cells kidney-shaped but apices flat and compressed with wide rounded basal angles and the sides, upper angles and apices all convex, walls with large rounded granules.

**Coll. No.**164.

**Distribution in India:**-Shaji and Patel (1990) Kerala, Verma *et al.*, (2021) Uttar Pradesh.

*Cosmarium retusifforme* (Wille) Gutwinski. **Pl.1, Fig. 10**

West W. and West G.S. 1905, P. 180, Pl. 57, Figs. 17-18

**Dimension:** Cells 18.7  $\mu\text{m}$  broad, 26.2  $\mu\text{m}$  long and isthmus 4.5  $\mu\text{m}$  broad.

**Description:** Cells small in size, 1.3-1.4 times longer than broad with deep median constriction, narrow sinus, semicells sub-pyramidal with reduced apex; rounded basal angles, lower part of the lateral margin is slight convex, upper portion is retuse converging to the poles; smooth cell wall; axial chloroplast; each semicell with pyrenoid.

**Coll. No.** 187.

**Distribution in India:**-Kamat (1975) Maharashtra, Prasad and Mehrotra (1977) Pandey and Pandey (1980), Misra and Srivastava (2003), Dwivedi and Misra (2007), Verma *et al.*, (2021) Uttar Pradesh, Bongale and Bharati (1980), Isaacs and Hegde (1986) Venkateswarlu *et al.*, (2011) Karnataka, Prasad *et al.*, (1987) Uttarakhand, Shaji and Patel (1990), Paul and Sreekumar (2015) Kerala, Kant and Gupta (1998) Jammu and Kashmir, Dwivedi *et al.*, (2009) Himachal Pradesh, Baruah *et al.*, (2020) Tripura,

*Cosmarium seelyanum* Wolle. **Pl.1 Fig.11**

Tripathi, S.K., Misra, U., and Misra P.K. 2012, P.7, Pl.2, Fig.1.

**Dimension:** Cell 20.2  $\mu\text{m}$  broad, 24.3  $\mu\text{m}$  long and isthmus 5.6  $\mu\text{m}$  broad

**Description:** Cells as broad as long, broadest at the crenate apex, its angles rounded and granulate; sides expanding from a closed sinus, with two crenate, each topped by a single granule; with one row of granules within the apex and a double row within the sides; central tumor bearing granules, semicell semicircular in lateral view with 3-crenate protuberance; ovate in vertical view with a 3-crenate protuberance and intra marginal granules.

**Coll. No.** 4103.

**Distribution in India:**-Isaacs and Hegde (1986) Karnataka, Toppo and Suseela (2009) Chhattisgarh, Tripathi *et al.*, (2012), Verma *et al.*, (2021) Uttar Pradesh, Patil and Kumawat (2019) Maharashtra, Babu and Vasanthakumar (2020) Tamil Nadu.

*Cosmarium speciosum* Lund. **Pl.1, Fig.12**

Prasad B. N. and Misra P. K., 1992, P. 183, Pl. 24, Figs. 10,14.

**Dimension:** Cells 31.1  $\mu\text{m}$  broad, 46.8  $\mu\text{m}$  long and isthmus 11.2  $\mu\text{m}$  broad.

**Description:** Cells size is medium, about 1.5 times longer than broad, constricted moderately, linear narrow sinus; semicells sub-rectangular(sub-pyramidal), angles rounded; slightly convex sides and very gradually attenuated upwards to widely



reduced apex, margin with 4 apical and 7 lateral crenations; cell wall granulate, granules in regular, radial and concentric series, with 3-4 granules, space across the base and just above the isthmus exhibits 5-6 vertical series of 6-7 granules; axile chloroplast in each semicell with two pyrenoids.

**Coll. No.** 2111.

**Distribution in India:**-Misra *et al.*,(2008), Shukla *et al.*,(2008),Sharma *et al.*,(2022) Uttarakhand, Jena and Adhikary (2011) Manipur, Deka *et al.*,(2011) Assam, Patil and Jawale (2014),Patil and Kumawat (2014,2015), Shejul and Sawant (2018), Patil (2019) More (2020) Maharashtra, Paul and Sreekumar (2015) Kerala, Verma *et al.*,(2021) Uttar Pradesh,

*Cosmarium subalatum* W. *et* G.S. West.  
**Pl.1, Fig.13**

Prasad B. N. and Misra P. K., 1992, P. 185, Pl. 24, Figs. 19, 22.

**Dimension:** Cell 15.0-16.8  $\mu\text{m}$  broad, 22.8-23.6  $\mu\text{m}$  long and isthmus 5.2-7.1  $\mu\text{m}$  broad.

**Description:** Cells small in size, slightly longer than wide with deep constriction, sinus narrowly linear, semicells widely truncate to pyramidate, sides tricriate, angles rounded towards apex with two small crenations, bigranulate crenations, central tumour

rounded with 7 granules arranged in circular styles; top view oval; axile chloroplast with one pyrenoid in each semicell.

**Coll. Nos.**493, 1106.

**Distribution in India:**-Misra *et al.*,(2008), Shukla *et al.*,(2008) Uttarakhand, Dwivedi *et al.*,(2009) Himachal Pradesh, Baruah *et al.*,(2013) Assam, Patil and Kumawat (2014, 2015), Maharashtra, Verma *et al.*,(2021) Uttar Pradesh,

*Cosmarium subcontractum* West & G. S. West.**Pl.1, Fig.14**

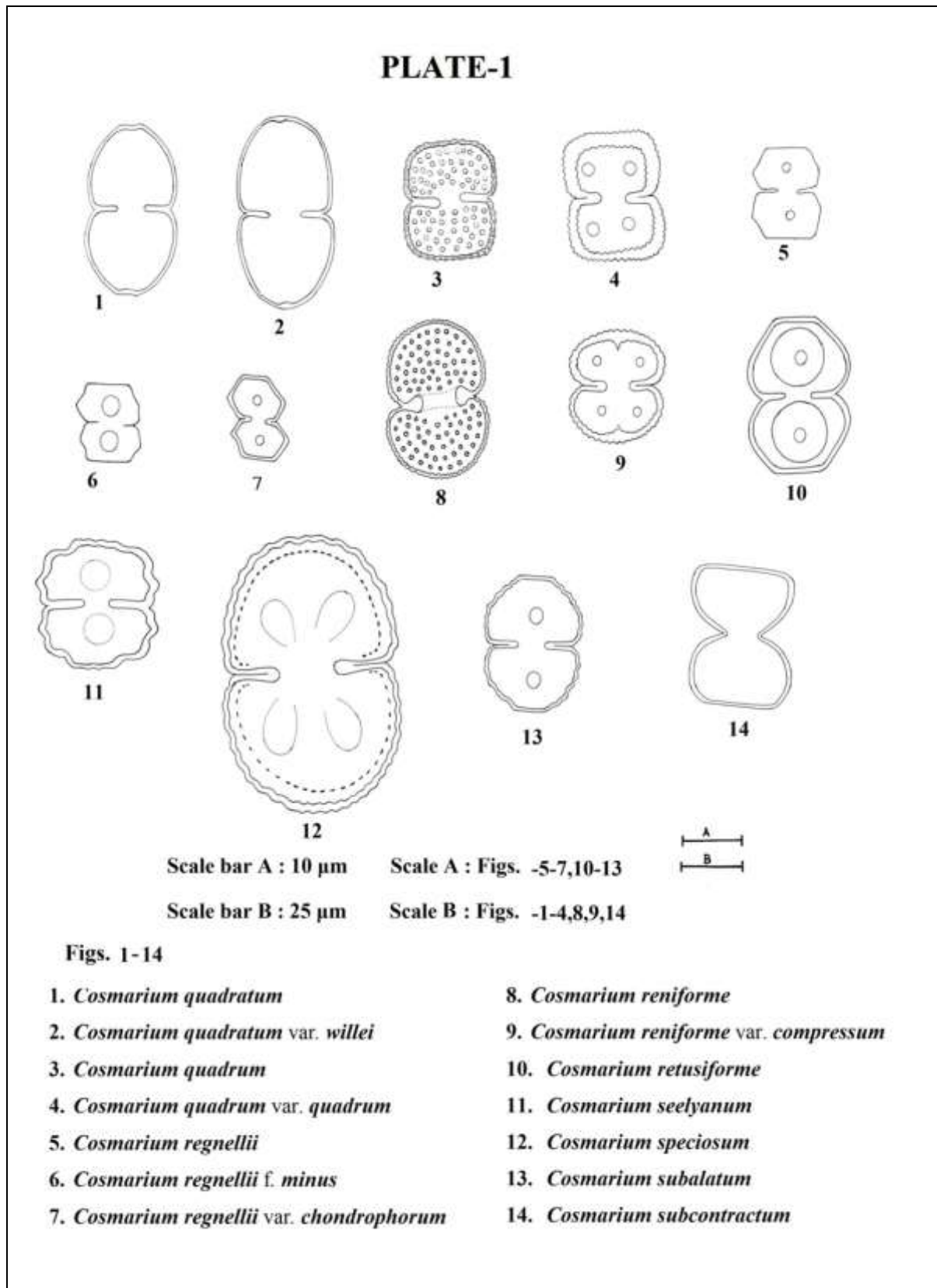
West W. and West G.S., 1905, P.174, Pl., 61, Figs. 36-37.

**Dimension:** Cell 23.6  $\mu\text{m}$  broad, 31.8  $\mu\text{m}$  long and isthmus 6.7  $\mu\text{m}$  broad.

**Description:** Cells small, little longer than broad, very deep constriction, sinus narrow near the apex but widely open outwards ; semicells obversely semicircular with a broad and almost straight apex, upper rounded lateral angles; semicell circular in side view. Cell wall minutely punctate. axile chloroplasts with one central pyrenoid.

**Coll. No.** 3105.

**Distribution in India:** -There is no distributional record for this taxon in India; hence, this taxon is probably first time report from India.



*Cosmarium subimpressulum* Borge. Pl. 2, Fig.1  
 Sinha J. P. and Mishra G. D., 1967, P. 102, Fig.2.

**Dimension:** Cell 16.8-20.6 µm broad, 24.7-28.8 µm long and isthmus 4.1-5.6 µm broad.

**Description:** Cell small, longer than broad, deeply constricted in the middle; sinus linear; margins broadly undulate, apex flat; cell wall smooth; chloroplast parietal; single pyrenoid in each semicell.

**Coll. Nos.** 164, 2115.

**Distribution in India:**-Kamat (1963), Ashtekar and Kamat (1979), Yadav (2020) Maharashtra, Sinha and Mishra (1967) Jharkhand, Suxena and Venkateswarlu (1968) Kashmir, Pandey and Pandey (1980), Chaturvedi *et al.*, (1987), Verma *et al.*, (2021) Uttar Pradesh, Hegde and Issacs (1988), Hegde (1986) Karnataka, Das *et al.*, (1990) Bihar, Asoka Kumar and Patel (1988) Gujarat.

*Cosmarium submamillatum* West *et* West  
**Pl.2 Fig.2**

Krieger W. and Gerloff J., 1962, P. 101, Pl. 21, Fig.9.

**Dimension:** Cell 18.7 µm broad, 31.5 µm long and isthmus 4.5 µm broad.

**Description:** Cell medium sized, about 1¼ times as longer as broad, deep constriction, closed sinus, apex dilated; semicells trapeziform, widely rounded basal angles, hemispherical apical angles, apices and sides concave, elliptic vertical view; smooth cell wall.

**Coll. No.** 222.

**Distribution in India:**-Gupta (2012) West Bengal, Yadav (2020) Maharashtra,

*Cosmarium subprotumidum* Nordst. **Pl.2 Fig.3**  
Suxena M.R. and Venkateswarlu V., 1966, P. 61, Figs. 45a, b.

**Dimension:** Cell 26.2 µm broad, 37.5 µm long and isthmus 7.5 µm broad.

**Description:** Cells small, almost as broad as long, constriction deep; linear sinus with apex slightly dilated; undulated semicells, sub-rectangular to elliptic; straight apex, facial swellings of semicell with larger granular than the marginal ones, variously arranged; each semicell with axile chloroplast having a single pyrenoid.

**Coll. No.** 412.

**Distribution in India:**-Suxena and Venkateswarlu (1966) Andhra Pradesh, Pandey and Pandey (1980), Habib and Chaturvedi (1993), Verma *et al.*, (2021) Uttar Pradesh, Deka *et al.* (2011), Baruah *et al.*, (2013), Baruah *et al.*, (2020) Assam, Patil and Deore (2017) Maharashtra, Sharma *et al.*, (2022) Uttarakhand.

*Cosmarium subportumidum* Nordst. var. *gregorii* Roy *et* Biss. **Pl.2, Fig.4**

Prasad B.N. and Misra P.K., 1992, P.186, Pl. 24, Fig. 23.

**Dimension:** Cell 20.6 µm broad, 33.7 µm long and isthmus 6.7 µm broad.

**Description:** Cell small in size, a little longer than broad. linearly narrow sinus; semicells trapeziform, upper half narrowed to broadly reduce apex, sides with 3 faintly bigranulate crenations and apex with 3 or 4 slight undulation; cell wall with radially arranged granules within the margin, generally in pair above but single further away, centre with tumour above the isthmus, consisting of relatively larger granules disposed in irregular vertical series; each semicell with axile chloroplast with single pyrenoid.

**Coll. No.** 423.

**Distribution in India:**-Shukla *et al.*, (2008) Uttarakhand, Mhaske and Talwankar (2018), Shejul and Sawant (2018), Andhale (2021) Maharashtra

*Cosmarium subspeciosum* Nordst. **Pl.2, Fig.5**  
Dwivedi P.K, Shukla C.H., Misra, P.K. and Seth, M.K. 2009, P. 244, Pl.2, Fig. 10.

**Dimension:** Cells 30.0 µm broad, 48.7 µm long and isthmus 12.0 µm broad.

**Description:** Cell large in size, longer than broad about 1½ times as long as wide; deeply constricted, sinus linear, dilated at the apex, outer boundary open; semicells semicircular, basal angles rounded; cell wall granulated with six to seven longitudinal series of granules in the centre; semicell with the two pyrenoids in each chloroplast.

**Habitat:** Coll. No. 212.

**Distribution in India:**-Suxena (1979), Subba Raju and Suxena (1979) Kashmir, Pandey and Pandey (1980), Verma *et al.*,(2021) Uttar Pradesh, Dwivedi *et al.*,(2009) Himachal Pradesh, Deka *et al.*,(2011) Assam,

*Cosmarium subspeciosum* Nordst. var. *validius* Nordst. **Pl.2 Fig.6**

Suxena M. R. and Venkateswarlu V., 1968, P. 40, Fig. 44;

**Dimension:** Cells 37.5-39.0  $\mu\text{m}$  broad, 57.0-61.8  $\mu\text{m}$  long and isthmus 10.5-12.3  $\mu\text{m}$  broad.

**Description:** Cells longer than wide, deep median constriction; dilated sinus towards the apex; pyramidal semicells, slightly undulations on lateral margin; side view circular, end view widely elliptic; six vertical rows of granules on the central tumor; each semicell with axile chloroplast having two pyrenoids.

**Coll. Nos.** 4116, 4115.

**Distribution in India:**-Kamat (1975), Patil and Kumawat (2015), Reddy and Chaturvedi (2017) Maharashtra, Sindhu and Panikkar (1995), Paul and Sreekumar (2015) Kerala, Agarkar (1971) Madhya Pradesh, Pandey and Pandey (1980) Uttar Pradesh, Bharati and Hegde (1982), Isaacs and Hegde (1986) Karnataka, Das and Purty (1990) Jharkhand, Toppo and Suseela (2009) Chhattisgarh,

*Cosmarium subtumidum* Nordst.

**Pl.2 Fig.7**

Hirano M., 1957, P. 132, Pl. 20, Fig.7

**Dimension:** Cell 18.7  $\mu\text{m}$  broad, 28.1  $\mu\text{m}$  long and isthmus 4.5  $\mu\text{m}$  broad.

**Description:** Cells slightly longer than wide, constricted deeply, narrow linear sinus, apex slightly dilated; open outer border; semicells truncate-pyramidal, widely rounded basal angles, sides convex and covering upward, slightly rounded upper angles, apices small truncate, straight, side view of semicells sub-circular, elliptic vertical view; cell wall minutely granulated and often obscurely punctate; each semicell with axile chloroplast having single pyrenoid.

**Habitat:** Coll. No.2116.

**Distribution in India:**-Suxena (1979) Kashmir, Pandey and Pandey (1980) Verma *et al.*,(2021) Saini *et al.*,(2023) Uttar Pradesh, Das *et al.*,(1990) Bihar, Deka *et al.*,(2011) Assam, Nandi *et al.*,(2019) West Bengal, Mahajan (2011), Patil and Kumawat (2019) Maharashtra, Shobha Rani *et al.*,(2020) Andhra Pradesh, Komal *et al.*,(2021) Punjab, Jose *et al.*,(2022) Kerala,

*Cosmarium subtumidum* Nordst. var. *borgei* Krieg. *et Gerl.*

**Pl.2 Fig.8**

Groenblad R. and Croasdale H, 1971, P. 17, Figs. 75-76.

**Dimension:** Cell 20.6  $\mu\text{m}$  broad, 28.5  $\mu\text{m}$  long and isthmus 6.0  $\mu\text{m}$  broad.

**Description:** Cells larger than wide, median constriction deep in the middle; narrowly linear sinus and apices dilated; semicells pyramidal, apex and basal angles rounded; circular side view and end view elliptic broad and thicker; semicell having chloroplast with one pyrenoid.

**Coll. No.**222.

**Distribution in India:**-Hegde and Issacs (1988) Karnataka, Das and Purty (1990) Jharkhand, Dhande and Jawale (2009), Patil and Kumawat (2014, 2015), Shejul and Sawant (2018) Maharashtra,

*Cosmarium subtumidum* Nordst var. *klebsii* (Gutw.) W. and G. S. West. **Pl.2 Fig.9**

West W. and West G.S. 1905, P.193, Pl 63, Fig., 21-23

**Dimension:** Cell 20.6  $\mu\text{m}$  broad, 29.2  $\mu\text{m}$  long and isthmus 6.7  $\mu\text{m}$  broad.

**Description:** Cells longer than wide, with a constriction in the middle; narrowly linear sinus and dilated towards the apices. Basal angles of semicells more widely rounded, and the sides more convergent, making a narrower truncate apex.

**Coll. No.**1103.

**Distribution in India:**-Verma *et al.*,(2021) Uttar Pradesh



***Cosmarium subtumidum* Nordst. var. *minor* Strom. Pl.2 Fig.10**

Groenblad R. and Croasdale H., 1971, P. 18, Fig. 77.

**Dimension:** Cells 15.0-16.8  $\mu\text{m}$  broad, 21.3-23.2  $\mu\text{m}$  long and isthmus 4.8 -5.6  $\mu\text{m}$  broad.

**Description:** Cells longer than wide, constricted deeply in the middle; narrowly linear sinus with a slight dilated apex; semicells pyramidate semicircular, rounded basal angles, convex lateral margin; semicell circular in lateral view ; elliptic apical view; semi cells with axile chloroplast having a single pyrenoid.

**Coll. Nos.**196, 197.

**Distribution in India:-**Ashtekar and Kamat (1979) Maharashtra, Dhande and Jawale (2009) Maharashtra.

***Cosmarium succisum* West var. *hyalinum* Skvortzow.Pl.2 Fig. 11**

Hirano M., 1957, P.125-126, Pl.20, Fig.22

**Dimension:** Cell 10.5  $\mu\text{m}$  broad, 12.3  $\mu\text{m}$  long and isthmus 3.0  $\mu\text{m}$  broad.

**Description:** Cell as long as broad. Median constriction is shallowly constricted and sinus is closed. Semicell has the shape of a trapezoid with widely flat apex. Both basal regions of lateral margin are round and swollen. Cell wall is smooth. In lateral view, it is circular. In vertical view, it is elliptical.

**Coll. No.** 2113.

**Distribution in India:-**Freitas and Kamat (1979) Maharashtra, Kamat (1968) Himachal Pradesh

***Cosmarium trilobulatum* Reinsch. Pl.2, Fig.12**

West W. and West G.W., 1905, P.185, Pl.62, Fig 28, 30.

**Dimension:** Cell 9.3  $\mu\text{m}$  broad, 16.8  $\mu\text{m}$  long and isthmus 3.7  $\mu\text{m}$  broad.

**Description:** Cells very small in size , a little longer than wide up to almost 1½ times longer than wide with deep constriction, narrowly linear sinus with a slightly-dilated

extremity; semicells somewhat three-lobed, lobes short, sub rectangular; angles rounded, apical lobe widest, apex straight or convex slightly, incisions between lobes wide and shallow. Smooth cell wall; semi cells having axile chloroplasts with one pyrenoid.

Cell 9.3  $\mu\text{m}$  broad, 16.8  $\mu\text{m}$  long and isthmus 3.7  $\mu\text{m}$  broad.

**Coll. No.** 288.

**Distribution in India:-**Kamat (1962) Gujarat, Suxena and Venkateswarlu (1968) Andhra Pradesh, Agarkar, (1969), Dhurve *et al.*,(2022) Madhya Pradesh, Pandey and Pandey (1980) Uttar Pradesh, Asoka Kumar and Patel (1988) Gujarat, Shaji,*et al.*,(1988) Kerala, Chaturvedi and Habib (1995) Uttarakhand, Dhande and Jawale (2009) Maharashtra, Yasmin *et al.*,(2011) Assam, Komal *et al.*,(2021) Punjab.

***Cosmarium undulatum* Corda var. *minutum* Wittr.****Pl.2, Fig.13**

West W. and West G.W., 1905, P.148-149, Pl.59, Fig 7, 8.

**Dimension:** Cell 16.8  $\mu\text{m}$  broad, 20.2  $\mu\text{m}$  long and isthmus 6.3  $\mu\text{m}$  broad.

**Description:** Cells smaller in size, slight longer than wide; constricted deeply, sinus narrow, semicells sub-semicircular, rounded basal angles, margin indulate, with 12-14 undulations. Cell wall smooth; semicell having axile chloroplast with one pyrenoid.

**Coll. No** 194.

**Distribution in India:-**Kamat (1963),Ashtekar and Kamat (1979), Freitas and Kamat (1979) Patil and Kumawat (2014, 2015) Yadav (2020), Andhale (2021) Maharashtra, Kamat (1968)Himachal Pradesh, Suxena and Venkateswarlu (1968) Jammu and Kashmir, Agarkar *et al.*,(1979) Madhya Pradesh, Pandey and Pandey (1980) ,Verma *et al.*,(2021) Uttar Pradesh, Baruah *et al.*,(2020) Assam

***Cosmarium venustum* (Breb.)Arch. Pl.2, Fig.14**  
Croasdale H., 1956, P.60, Pl. 8, Fig. 2.

**Dimension:** Cells 35.6  $\mu\text{m}$  broad, 45.3  $\mu\text{m}$  long, and isthmus 11.2  $\mu\text{m}$  broad.

**Description:** Cells large, as long as broad; constriction deep, sinus linear, apex dilated; semicells truncate-pyramidal, with three undulation on each side, apices retuse, semicells elliptic in side view and vertical view, smooth cell wall and each cell having chloroplast with two pyrenoid.

**Coll. No.**165.

**Distribution in India:**-Kamat (1963), Ashtekar and Kamat (1979), Yadav (2020) Maharashtra, Suxena and Venkateswarlu (1968) Andhra Pradesh, Agarkar *et al.*, (1979) Madhya Pradesh, Pandey and Pandey (1980), Verma *et al.*, (2021) Uttar Pradesh, Gurudeva, *et al.*, (1983) Karnataka, Suseela and Toppo (2007) Sikkim,

***Cosmarium vexatum* West. Pl.2, Fig.15**

West W. and West G.S 1908, P.187, Pl. 92, Fig. 4.

**Dimension:** Cell 37.5  $\mu\text{m}$  broad, 48.7  $\mu\text{m}$  long and isthmus 10.1  $\mu\text{m}$  broad

**Description:** Cells longer than broad, deep constriction in the middle, narrow linear sinus with dilated apex; semicells elliptic, margins

crenate; each semicell having axile chloroplast with two pyrenoids.

**Coll. No.**412.

**Distribution in India:** -Kamat (1962) Gujarat, Freitas and Kamat (1978), Dhande and Jawale (2009) Maharashtra, Pandey and Pandey (1980), Verma *et al* (2021) Uttar Pradesh

***Cosmarium wembaerense* Schm. Pl.2, Fig.16**

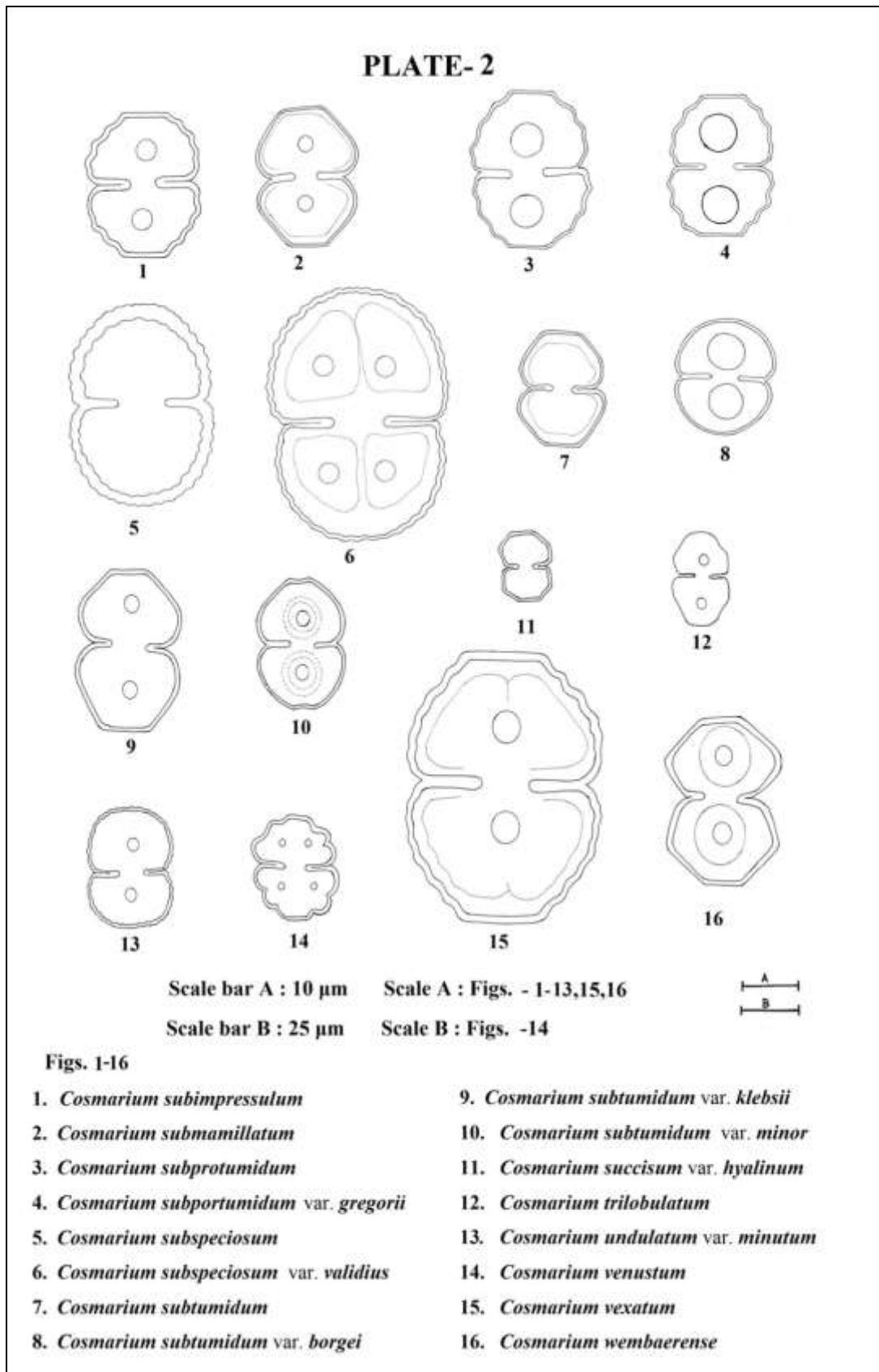
Groenblad R., Scott A. M. and Croasdale H., 1964, P. 27, Pl. 11, Fig. 259.

**Dimension:** Cells 18.0-22.1  $\mu\text{m}$  broad, 28.8-31.1  $\mu\text{m}$  long and isthmus 4.1- 6.1  $\mu\text{m}$  broad.

**Description:** Cell longer than wide, constricted deeply; narrow linear sinus, apices are dilated; semicells more angular, slightly elliptic, basal angle is rounded, slight straight or convex; each semicell with axile chloroplast having single pyrenoid.

**Coll. Nos.** 162, 164, 1101, 1106.

**Distribution in India:**-Agarkar and Agarkar (1973) Madhya Pradesh, Dhande and Jawale (2009), Shejul and Sawant (2018) Maharashtra,



**Discussion**

The present research work explores the diversity of genus *Cosmarium* Corda ex Ralfs from Anjani dam of Erandol Tahsil of Jalgaon

district, Maharashtra. During the study total 30 taxa of *cosmarium* with 18 species, 11 varieties and 01 forma has been identified. Of these *Cosmarium subcontractum* reported first

time from Maharashtra and which is a new addition to the desmids flora of India. The highest number of *Cosmarium* taxa indicating oligotrophic nature of dam water. Reynolds (2006) who reported that the *Cosmarium* genus of desmids refers the oligotrophic environment and indicative of oligotrophic plankton. This may indicate clarity, purity and undisturbed conditions of water body. The recorded data serve as a baseline for the diversity of *Cosmarium* in Jalgaon district, Maharashtra.

### Acknowledgements

The author acknowledge thanks to the Principal and Head, Department of Botany and Research centre Arts, Science and P.O.Nahata Commerce College, Bhusawal, District Jalgaon for providing laboratory facilities.

### References

1. Agarkar, D.S. & Agarkar, D.S. "Contribution to the Desmids of Gwalior, Madhya Pradesh, India." *Phykos* 8.1&2 (1969): 1-10.
2. Agarkar, D.S. & Agarkar, D.S. "Contribution to the Desmids of Gwalior, Madhya Pradesh (India)-II." *Phykos* 10.1&2 (1971): 54-69.
3. Agarkar, D.S. & Agarkar, M.S. "Contribution to the Desmids of Madhya Pradesh, India (Desmids from Vindhyan Region)." *Portugaliae Acta Biologica* (B), 12.1/4 (1973): 159-178.
4. Agarkar, M.S. & Agarkar, D.S. "Desmids from Pachmarhi, Madhya Pradesh, India." *Hydrobiologia*, 54.1 (1977): 23-32.
5. Agarkar, P.V. & Kamat, N.D. "Additions to the desmid flora of Marathwada, Maharashtra." *Phykos*, 18.1-2 (1979): 45-50.
6. Agarkar, D.S., Agarkar, M.S. & Dixit, Rajiv. "Desmids from Bandhavgarh, Madhya Pradesh, India." *Hydrobiologia*, 65.3 (1979): 213-223.
7. Andhale, S.B. "Desmids from the Gangapur Dam of Nashik District, Maharashtra, India." *World J. Cur. Sci. Res.*, 1.3 (2021): 179-184.
8. Ashoka Kumar, C.K. & Patel, R.J. "Desmids of Gujarat- Genus *Cosmarium* Corda." *Phykos*, 27.1 & 2 (1988): 117-128.
9. Ashtekar, P.V. & Kamat, N.D. "Additions to the desmid flora of Marathwada, Maharashtra." *Phykos*, 18.1 & 2 (1979): 45-50.
10. Bandgar, S.G. & Papdiwal, P.B. "Some desmidial algae at Nathsagar water body, Paithan, Maharashtra." *The Bioscan*, 68.1 (2013): 311-313.
11. Bansod, V.I. & Neelima, H. P. "Diversity of genus *Cosmarium* from Bodalkasa Dam, Gondia District, Maharashtra, India." *Journal of Emerging Technologies and Innovative Research*, 6.6 (2019): 124-130.
12. Baruah, P.P., Bhattacharjee S., Nath S., Boruah B. & Kalita H. "Algal diversity in riparian lentic habitats of Brahmaputra valley." *Nelumbo*, 64.2 (2022): 81-118.
13. Baruah, P.P., Baruah, B., Nath, S., Kalita, H. & Bhattacharjee S. "Algal diversity in Deepor Beel of Assam: a Ramsar site of North East India." *Nelumbo*, 62.2 (2020): 221-252.
14. Baruah, P.P., Kalita, H. & Nath, S. "A Taxonomic Account on Phytoplankton of Rudrasagar Ramsar Site Tripura (India) Chlorophyta and Euglenophyta." *J. Indian bot. Soc.*, 100.3&4 (2020): 91-118.
15. Baruah, P.P., Baruah, R. & Thakuria, J. "Chlorophycean diversity of Deepor Beel Wildlife sanctuary." *Phykos*, 43.2 (2013): 33-42.
16. Behera, C., Dash S. R., Pradhan B., Jena Mrutyunjay and Adhikary S.P. "Algal Diversity of Ansupa Lake, Odisha, India." *Nelumbo*, 62.2 (2020): 207-220.
17. Behera, C., Dash S. R., Pradhan B., Mrutyunjay, J. and Padmalochan, H. "Cocoid green algae genus *Coelastrum* and some desmids from coastal region of



- Odisha, India." *J. Indian bot. Soc.*, 103.3 (2023): 182-188.
18. Behera, C., Pradhan, B., Panda, R. R. Nayak, R., Nayak, Sneha & Jena Mrutyunjay, "Algal Diversity of Saltpans, Humma (Ganjam) Odisha, India." *J. Indian bot. Soc.*, 101.1&2 (2021): 107-120.
  19. Bharati, S.G. & Hegde, G.R. "Desmids of Karnataka state and Goa- Part- I." *Phykos*, 21(1982): 143-149.
  20. Bharati, S.G. & Hegde, G.R. "Desmids from Karnataka State and Goa Part III. Genus *Cosmarium* Corda." *Nova Hedwigia*, 36.2&4 (1982): 733-757.
  21. Bongale, U.D. & Bharati, S.G. "Fresh water algae of Davangere and Raichur of Karnataka state, India." *J. Bombay Nat. Hist. Soc.*, 77.1 (1980): 6-11.
  22. Braupal, G.K. "On some desmids from Koyalat lake, Bikaner (Rajasthan)." *Life Science Bulletin*, 8.1 (2011): 35-38.
  23. Chaturvedi, U.K. & Habib, I. "Algal flora of Srinagar (Garhwal), Uttar Pradesh." *Phykos*, 34.1&2 (1995): 105-111.
  24. Chaturvedi, U.K., Pandey, U.C., Habib, I. & Shukla, S.H.M. "Desmids of Bareilly-II." *Phykos*, 26.1&2 (1987): 95-102.
  25. Croasdale, H. "Freshwater algae of Alaska. I. Actinotaenium, Micrasterias and *Cosmarium*." *Trans. Amer. micros. Soc.*, 75.1 (1956): 1-70.
  26. Das, R.N., Mahato, A.K. & Mahato, P. "Desmids of Singhbhum district I. Genus *Cosmarium* Corda." *Phykos*, 29.1&2 (1990): 115-120.
  27. Das, R. "Preliminary checklist of desmids from Kokrajhar District, Assam, India." *Journal of Biodiversity and Environmental Sciences*, 17.4 (2020): 10-20.
  28. Das, S.K. & Adhikary, S.P. "Freshwater algae of Eastern India." *Astral International Pvt. Ltd.*, New Delhi (2014): 1-453.
  29. Das, Debjyoti. & Keshri, J.P. "Desmids of Khechiperi Lake, Sikkim Eastern Himalaya." *Algological Studies*, 143 (2013): 27-42.
  30. Das, Debjyoti. & Keshri, J.P. "Algae from Gurudongmar lake (North Sikkim eastern Himalaya)." *NeBio*, 4.6 (2013): 61-69.
  31. Das, Debjyoti. & Keshri, J.P. "Desmids from South Sikkim, India." *Nelumbo*, 55 (2013): 172-180.
  32. Das, Debjyoti. & Keshri, J.P. "Desmids of Eastern Himalaya." *Bibliotheca Phycologica*, Vol. 119, J. Cramer in Borntraeger Science Publishers, Stuttgart. (2016): 1-260.
  33. Das, R.N. & Purty, N. "Desmids from Dhunti, Ranchi." *Phykos*, 29.1&2 (1990): 127-128.
  34. Dash, S.R., Biswajita, P., Chhandashree, B. and Mrutyunjay, J. "Algal Diversity of Kanjiahata Lake, Nandankanan, Odisha, India." *J. Indian bot. Soc.*, 99.1&2 (2020): 11-24.
  35. Deka, S.J., Sarma, G.C. & Deka, S.P. "Preliminary Checklist of desmids of Urapad Beel (Wetland), Goalpara District, Assam, India." *Asian J Exp Biol. Sci.*, 2.3 (2011): 391-398.
  36. Dhande, J.S. & Jawale, A.K. "Genus *Cosmarium* Corda from Hartala lake, district Jalgaon, Maharashtra." *Shodh, Samiksha and Mulyankan*, 2.7 (2009): 196-198.
  37. Dhurve, S., Shah, K.W., P. Patil. & R. Upadhyay. "Occurrence of Genus *Cosmarium* in Machagora Dam, Chhindwara District, Madhya Pradesh, India." *Flora and Fauna*, 28.2 (2022): 212-216.
  38. Dwivedi, R.K. & Misra, P.K. "Genus *Cosmarium* Corda ex Ralf from freshwater habitats of Central and Western Uttar Pradesh." *J. Econ. Taxon. Bot.*, 31 (2007): 387-397.
  39. Dwivedi, R.K., Shukla, C.P., Misra, P.K., Shukla, S.K. & Seth, M.K. "On Desmids of Southern Himachal Pradesh of Indo-

- Western Himalaya." *Feddes Repertorium*, 3.4 (2009): 236-249.
40. Freitas, J.F. & Kamat, N.D. "Desmidiaceae of Nagpur." *Phykos*, 18.1&2 (1979): 97-103.
41. Groenblad, R., Scott, A.M. & Croasdale, H. "Desmids from Uganda and Lake Victoria." *Acta Bot. Fenn.*, 66 (1964): 1-57.
42. Groenblad, R. & Croasdale, H. "Desmids from Namibia (S.W.Africa)." *Acta Bot. Fennica*, 93 (1971): 1-40.
43. Guiry, M.D. & Guiry, G.M. "Algae Base World-wide electronic publication National University of Ireland, Galway. <https://www.algaebase.org> : search on 20 November 2023
44. Gupta, R.K. "Algae of India vol-2. A checklist of Chlorophyceae, Xanthophyceae, Chrysophyceae and Euglenophyceae." *Botanical Survey of India, Kolkata*, (2012): 1-428.
45. Gurudeva, M.R., Govindappa, D.A. & Somashekar, R.K. "Desmid flora of Savandurga, Karnataka." *Phykos*, 22.1&2 (1983): 48-56.
46. Habib, I. "Contribution to Desmids of Rohilkhand division U.P., India." *Geophytology*, 23.1 (1993): 177-179.
47. Habib, I. "Contribution to Desmids of Sitapur, U.P." *New Botanist*, 34.1-4 (2007): 149-160.
48. Habib, I., Pandey, U.C. & Chaturvedi, U.K. "Desmids of Bareilly-VI." *Ad. Plant. Sci.*, 3.1 (1990): 43-46.
49. Habib, I. & Chaturvedi, U.K. "Contribution to Desmids of Rohilkhand division U.P., India." *Phykos*, 32.1&2 (1993): 51-54.
50. Hegde, G.R. "New records of Desmids from Karnataka State-I." *Phykos*, 25.1&2 (1986): 117-122.
51. Hegde, G.R. "Additions to the knowledge of zygospores of South Indian Desmids." *Phykos*, 26 (1987): 27-31.
52. Hegde, G.R. & Isaacs, S.W. "Certain interesting desmid taxa from Uttara Kannada district of Karnataka State." *Phykos*, 27.1&2 (1986): 8-12.
53. Hegde, G.R. & Isaacs, S.W. "Freshwater algae of Karnataka State-I." *Phykos*, 27.1&2 (1988): 96-103.
54. Hirano, M. "Flora Desmidiarum Japonicarum-II." Contributions from the Biological Laboratory, Kyoto University, 5(1956): 1-58.
55. Hirano, M. "Flora Desmidiarum Japonicarum-III." Contributions from the Biological Laboratory, Kyoto University, 4(1957): 1-107.
56. Hirano, M. "Flora Desmidiarum Japonicarum-IV." Contributions from the Biological Laboratory, Kyoto University, 5(1957): 1-166.
57. Isaacs, S.W. & Hegde, G.R. "Freshwater algae of Uttara Kannada District, Karnataka State." *Phykos*, 25.1&2 (1986): 102-107.
58. Isaacs, S.W. & Hegde, G.R. "Freshwater algae of Karnataka State: Certain taxa from Uttara Kannada District new to the flora of Karnataka." *Phykos*, 26.1&2 (1987): 123-129.
59. Jadhwar, P.B. & Papdiwal, P.B. "Diversity of desmids at Nathsagar water reservoir." *Bioinfolet*, 8.3 (2011): 280-284.
60. Jadhwar, P.B. & Papdiwal, P.B. "Some desmids from Nathsagar water reservoir, Paithan, Maharashtra." *J. Indian Bot. Soc.*, 91.4 (2012): 317-322.
61. Jadhwar, P.B. & Papdiwal, P.B. "*Cosmarium* Corda ex Ralfs (Desmidiales, Charophyta) at Nathsagar Water Reservoir (Paithan), Maharashtra." *Indian Hydrobiology*, 21.1 (2022): 53-58.
62. Jawale, A.K., Kumawat, D.A. & Dhande, J.S. "Desmids from fish ponds at Anjale, district Jalgaon (M.S.), India." *Proc. Nal. Conf. Plant Sci., Pravaranagar* (2005): 472-478.
63. Jena, M., Ratha, S.K. & Adhikary, S.P. "Desmids (Zygnematales, Chlorophyceae)

- of Orissa state and neighbouring regions, India." *Algological Studies*, 122 (2006): 17-34.
64. Jena, M. & Adhikary, S.P. "Algal diversity of Loktak lake, Manipur." *Nelumbo*, 53 (2011): 21-48.
65. Jose, Dhanya, Antony Ignatius, Varghese Anto Puthur, & Paul Tessa Parappully. "Taxonomy and distribution of desmids in Karapuzha Dam, Western Ghats, Kerala." *Feddes Repertorium*, 133.2 (2022): 89-102.
66. Kamat, N.D. "Chlorophyceae of Ahmedabad, India." *Hydrobiologia*, 20.3 (1962): 248-279.
67. Kamat, N.D. "The algae of Kolhapur, India." *Hydrobiologia*, 22.3-4(1963):209-305.
68. Kamat, N.D. "Algae of Simla." *J. Bombay Nat. Hist. Soc.*, 65.1 (1968): 271-277.
69. Kamat, N.D. "Algae of Alibag, Maharashtra." *J. Bombay Nat. Hist. Soc.*, 65.1 (1968): 88-104.
70. Kamat, N.D. "Desmids of Marathwada, Maharashtra." *J. Bombay Nat. Hist. Soc.*, 72.2 (1975): 616-618.
71. Kamat, N.D. & Tiwari, S.R. "Desmids of Nagpur, Maharashtra." *J. Bombay Nat. Hist. Soc.*, 74.3 (1978): 577-579.
72. Kant, S. & Gupta, P. "Algal flora of Ladakh." Scientific Publication, Jodhpur, India (1998): 1-341.
73. Kant, S. & Vohra, S. "Algal flora of J. and K. State." *J. Indian bot. Soc.*, 78.1-2 (1999): 51-64.
74. Kerkar, V. & Lobo, A. "Desmid diversity for Northern Goa, India." *Proceedings of International Conference on Algal Biomass, Resources and Utilization* (2009): 132-141.
75. Khatkar, J. I. S., Singh, D.P. & Singh, Y. "New records of desmids from Ropar wetland (a Ramsar Site) of Punjab, India." *Plant Science Today*, 8.4(2021):1037-1048.
76. Kouwets, F.A.C. "Desmids from the Auvergne (France)." *Hydrobiologia*, 146.3 (1987): 193-263.
77. Krieger, W. & Gerloff, J. "Die Gattung *Cosmarium*. Lief. 1." J. Cramer, Weinheim, (1962): 112.
78. Mahajan, S.R. "Diversity of desmids at Jalgaon, North Maharashtra." *Bioinfolet*, 8.1 (2011): 37.
79. Mhaske, T.K. & Talwankar, D.S. "Occurrence of *Cosmarium* species in Khadakpurna reservoir, Buldana district, Maharashtra, India." *GSC Biological and Pharmaceutical Sciences*, 05.03 (2018): 020-024.
80. Misra, P.K. & Srivastava, A.K. "Some desmids from North-Eastern Uttar Pradesh." *J. Indian Bot. Soc.*, 82.1&4 (2003): 85-92.
81. Misra, P.K., Misra, P., Shukla, M. & Jai Prakash. "Some Desmids from Garhwal Region of India." *Algae*, 23.3 (2008): 177-186.
82. More, R.R. "Desmids Diversity and variation in Shivan Dam of Nandurbar District (MS) India." *Journal of All Research Education and Scientific Methods*, 8.9 (2020): 956-959.
83. Nandan, S.N. & Jain, D.S. "Biodiversity of desmids in Sonvad project dam and Devbhane dam of Dhule district of Maharashtra." *Plant Diver. and Biotech.* (2004): 79-85.
84. Nandi, Camellia, Bhowmick, Sucharita, Prakash Chandra Gorain, & Pal, Ruma. "New and Rare Records of *Cosmarium* (Desmidiaceae, Zygnematales) from India." *Phytomorphology*, 69.1&2 (2019): 41-49.
85. Nath, S. & Pratim, P.B. "Algal Diversity in Chandubi Beel, a tectonic water body of North East India." *Nelumbo*, 62.1 (2020): 68-89.

86. Pal, U.C. & Santra, S.C. "Algal flora of Midnapore, III. Desmidiaceae." *Phykos*, 32.1&2 (1993): 147-158.
87. Pandey, U.C. & Pandey, U.K. "Additions to the algal flora of Allahabad-III Desmids." *Phykos*, 19.1 (1980): 71-81.
88. Pandey, U.C. & Pandey, U.K. "Additions to the Algal-flora of Allahabad-V, Desmids." *Phykos*, 19.2 (1980): 161-170.
89. Pandey, U.K., Chaturvedi, U.C., Habib, I., Shukla, H.M. & Agnihotri, A.K. "Some Desmids New to Bareilly." *J. Indian bot. Soc.*, 67 (1987): 71-73.
90. Patel, R.J. "Miscellaneous note 27. On desmids of Gujarat." *J. Bombay Nat. Hist. Soc.*, 66.2 (1969): 414-419.
91. Patil, J. & Kumawat, D.A. "Algal genus *Cosmarium* corda species from North Maharashtra region of Maharashtra State." *Research Journey Special Issue*, 134 (2019): 191-200.
92. Patil, S.A. "Biodiversity of genus *Cosmarium* corda from Mangrul dam of Jalgaon district, Maharashtra." *Inter. Jour. of Research and Analytical Reviews*, 6.1 (2019a):201-209.
93. Patil, S.A. "Diversity of genus *Cosmarium* corda from Mangrul dam of Jalgaon district, Maharashtra." *Research Journey Special Issue*, 134 (2019b): 168-173.
94. Patil, S.A. & Jawale, A.K. "Desmids from Mangrul dam district Jalgaon, Maharashtra." *Inter. Jour. of Geology, Earth and Environmental Sciences*, 4.1 (2014):137-146.
95. Patil, S.B. & Kumawat, D.A. "Diversity of genus *Cosmarium* corda from Abhora dam of district Jalgaon, Maharashtra." *Inter. Jour. of Geology, Earth and Environmental Sci.*, 4.1 (2014): 109-114.
96. Patil, S.B. & Kumawat, D.A. "Desmids from Abhora dam of Raver Tahsil of Jalgaon district of Maharashtra." *Jour. of Microbiology*, 4.1 (2015): 28-37.
97. Patil, K.P. (Behere), & Deore, L.T. "Biodiversity of genus *Cosmarium* from district Nashik (MS) India." *Phykos*, 47.1 (2017): 133-152.
98. Paul, T.P. & Sreekumar, R. "Genus *Cosmarium* Corda from Thrissur Kole Land, Kerala." *Recent Research in Science and Technology*, 1 (2015): 19.
99. Perumal G.M. & Anand N. "Manual of Freshwater Algae of Tamil Nadu". *Bishen Singh Mahendrapal Singh Publishers, Dehradun*, PP (2008): 1-133.
100. Phukan, S. & Bora, S. P. "Preliminary report of Desmids (Algae, Chlorophyceae) from Sivsagar District of Assam". *Jour. of Frontline Research in Arts and Science* 2, pp (2012):134- 141.
101. Prasad, B. N., Srivastava, M. N. & Khanna, P. "The Genus *Cosmarium* Corda from Crop-Fields of Kumaon Hills, U. P., India". *Nelumbo* 29. 1&4 (1987):19-25.
102. Prasad, B. N. & Mehrotra R. K. "Desmid flora of North Indian Paddy fields". *New Botanist* 4.1&4 (1977):49-74.
103. Prasad, B. N. & Misra , P. K."Fresh water algal flora of Andaman and Nicobar Islands-II". *Bishen Singh Mahendra Pal Singh Publ., Dehradun.*, (1992)PP:1-284
104. Prasad, B. N. & Misra , R. "Desmid flora of Sikkim-I" *Geophytology* 17.2 (1987):163-173
105. Prasad, B. N. & Misra, P. K. "Some new taxa of desmids from Andaman Islands". *Hydrobiologia* 109.2 (1984):149-158.
106. Prasad, B. N. & Misra, P. K. "Some taxa of *Cosmarium* Link New to Indian Desmid flora". *J. Indian bot. Soc.*, 64.4 (1985):343-347.
107. Reynolds, C.S. "Ecology of phytoplankton" *Cambridge University Press*. (2006):1-535.
108. Reddy, M. B. & Chaturvedi, A. "Desmids from the rivers of Chandrapur district, Maharashtra". *NeBIO* 8.1 (2017) :25-34.



109. Saha L.C. & Choudhary S.K. "Desmids of Bhagalpur, Bihar" *J. Econ. Tax. Bot.*, 5.4 (1984):987-988
110. Saini Amrish, Singh Jyoti, Sarma Kuntal, Kour Nirlep & Kant Rama. "Diversity of the Genus *Cosmarium* (Desmidiaceae) from Saharanpur". *Bulletin of Pure and Applied Sciences* 42 B.1 (2023):36-43.
111. Scott, A. M. & Prescott, G. W. "Indonesian desmids". *Hydrobiologia* 17.1&2 (1961):1-132.
112. Shaji C. & Patel, R. J. "Desmids new to Kerala". *Feddes Repertorium* 101.5-6 (1990):277-284.
113. Shaji C, Jose L. & Patel R.J. "Addition to desmid flora of Kerala". *Phykos*, 27 .1&2 (1988):32- 37.
114. Shaji C, Jose L. & Patel R.J. "Contribution to Desmids flora of Kerala, India". *Nova Hedwigia* 49.1&2 (1989):169-182.
115. Sharma Abhinav, Toppo Kiran & Gupta Rajan Kumar. "Seasonal variation of desmids diversity (Zygnematales, Zygnemataceae) from Jim Corbett National Park (JCNP), India". *J. Indian bot. Soc.* 102 .1 (2022): 06-29.
116. Shejul Sampada K. & Sawant R. J. "Diversity of *Cosmarium* from Sukhana Dam, Aurangabad" *Life Science Bulletin* 15.1 (2018): 01-05.
117. Shobha Rani B., Sujathamma P., Ramana Naidu B.V. & Prabhakara Raju C. "The genus *Cosmarium* Corda ex Ralfs from Kurnool District, Andhra Pradesh, India". *Indian Hydrobiology*.19. 1&2 (2020):123-130.
118. Shukla, C.P. Singh, D.R. & Yadav, S.R. "Algo floristic Studies of the of Palghar District of Maharashtra, India". *Phykos* 48 .2 (2018):6-12.
119. Shukla, S.K., Shukla C.P. & Misra P.K. "Desmids (Chlorophyceae, Conjugales, Desmidiaceae) from foothills of Western Himalaya" *Algae* 23.1 (2008):1-14.
120. Sindhu, P., & Panikkar, M. V. "Desmid flora of Quilon, Kerala. *Cosmarium Corda*". *J. Econ. Tax. Bot.* 18.3 (1994):711-714.
121. Sindhu, P., & Panikkar, M. V. "Desmids new to Kerala, India-1" *Feddes Repertorium* 106.3-4(1995):317-323
122. Sinha, J. P. & Mishra, G. D. "Some desmids of Ranchi". *Phykos*, 6.1&2 (1967):102-105.
123. Subba Raju, N. & Suxena, M.R. "Algae of Testacea of the Cho Oyu (Himalayas) expedition-II. Cyanophyta, Chlorophyta, Euglenophyta, Chrysophyta and Testaceae". *Hydrobiologia*, 67.2 (1979):141-160.
124. Suseela, M.R. & Toppo, K. "Contribution to the Desmid Flora of Sikkim Himalayas, India". *Bull .Natl. Mus. Nat, Sci. Ser .B*, 33. 3/4 (2007):105-114
125. Suxena M.R. "Algae and Testacea from high altitudes of Himalayas-1 (collected by N. C. C. Punch-Chulli, Expedition W. Himalayas 1970)". *Hydrobiologia*, 65.2 (1979):107-128.
126. Suxena M.R. & Venkateswarlu V. "Desmids of Andhra Pradesh- I. From Pakhal Lake, Warangal". *Hydrobiologia* 28.1 (1966) :49-65.
127. Suxena M.R. & Venkateswarlu V. "Desmids from Kashmir". *Phykos* 7.1-2 (1968):165-185.
128. Suxena M.R. & Venkateswarlu V. "Desmids of Andhra Pradesh II from Dharamsagar Lake, Warangal". *J. Indian Bot. Soc.*, 47.1-2 (1968): 23-45.
129. Suxena M.R. & Venkateswarlu V. "Desmids of Andhra Pradesh IV from Dharamsagar Lake, Warangal" *J. Osman. Univ. (Sci.) Golden Jubilee Special volume* (1968): 179-201.
130. Tarar J.L, Charjan Vaishali & Bodkhe, S. "Contribution to the knowledge of Desmids from Nagpur". *Phykos*, 37.1&2 (1998):59-67.

131. Toppo, K. & Suseela M.R. "Cosmarium diversity of Mani Pokhar pond of Jashpur district in Chhattisgarh State, India". *Ann. For.* 17.1 (2009):117-124.
132. Tripathi, S. K., Misra, U. and Misra, P. K. "Some desmids from Western Uttar Pradesh, India". *Indian Hydrobiology* 15.1 (2012):1-16.
133. Venkateshwarlu M., Shahnawaz A. and Honneshappa K. "A study on plankton dynamics of two wetland systems in Shivamogga District, Karnataka (India)" *Current Biotica* 4.4 (2011):461- 468
134. Verma Digvijay, Bharat Rinku, Singh Vinay Kumar, Shyam Kishore & Lavania Seshu. "Fresh water algal diversity of the Tarai region of Northern Uttar Pradesh: *Cosmarium Corda ex Ralfs*". *Indian Hydrobiology*, 20. 2(2021):373-384.
135. Verma Sushma, Toppo Kiran & Nayaka Sanjeeva. "Comprehensive checklist of algal class Chlorophyceae (sensu Fritsch, 1935) for Uttar Pradesh, India, with updated taxonomic status". *Journal of Threatened Taxa* 13.14 (2021):20218-20248.
136. Vidyashree C. S. & Malammanavr S. G. "Desmids from the ponds of historical fort Kavaledurga, central western ghats, Shivamogga India". *International Journal of Botany Studies* 6.4 (2021): 392-397.
137. Valvi A.B. & Gautam, P.K. "Studies on some desmids of Toranmal Reserve Forest of Satpura Ranges, Nandurbar District, Maharashtra", India. *Journal Aegaeum* 8.4 (2020):355-361
138. West W. & West G.S. "A monograph of the British Desmidiaceae. Vol.-II" *Ray Soc., London*, (1905). PP: 1-204
139. West W.& West G.S. "A monograph of the British Desmidiaceae. Vol.-III" *Ray Soc., London* (1908) , PP:1-272.
140. West W. & West G.S. "A monograph of the British Desmidiaceae. Vol.-IV" *Ray Soc., London*, (1912) , PP: 1-354
141. Yadav S.G. "Species Diversity of Genus *Cosmarium Corda*, (1834) from Marathwada, Maharashtra" *International Journal of Innovative Research In Technology* 11 (2020):606-610.
142. Yasmin F. Buragohain B.B. & Medhi K.K. "Planktonic Desmids Flora of South of the Eastern Himalayas: A systematic Approach on Algae" *International Journal of Botany* 7.2 (2011):154-161.

**Source of support:** Nil;

**Conflict of interest:** The authors declare no conflict of interests.

**Cite this article as:**

Patil Sanjay Bhagwat "Contribution to Desmidiaceae- Genus *Cosmarium Corda ex Ralfs* from Anjani Dam of Jalgaon District-III, Maharashtra." *Annals of Plant Sciences*.13.05 (2024): pp. 6345-6362.