

A systematic study of diversity and distribution of green algal family Selenastraceae from Chandrapur district, Maharashtra, India

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ABSTRACT – (A systematic study of diversity and distribution of green algal family Selenastraceae from Chandrapur district, Maharashtra, India). The family Selenastraceae belongs to the order Chlorococcales of Class Chlorophyceae. It contains elongated cells, which may be straight or variously warped. The present study was conducted in the Chandrapur district of Maharashtra State, India to find out the algal diversity in the major rivers Wardha, Painganga, and Wain Ganga. The paper reveals the diversity and distribution of twenty-four taxa of six genera of the family Selenastraceae in these major rivers of the Chandrapur district.

Keywords: Chandrapur district, Chlorococcales, green algal diversity, major rivers, Painganga, Wain Ganga, Wardha

RESUMO – (Um estudo sistemático da diversidade e distribuição de algas verdes da família Selenastraceae do distrito de Chandrapur, Maharashtra, Índia). A família Selenastraceae pertence à ordem Chlorococcales da classe Chlorophyceae. Ela contém células alongadas, que podem ser retas ou deformadas de várias maneiras. O presente estudo foi conduzido no distrito de Chandrapur, no Estado de Maharashtra, Índia, para descobrir a diversidade de algas nos principais rios Wardha, Painganga e Wain Ganga. O artigo revela a diversidade e distribuição de vinte e quatro táxons de seis gêneros da família Selenastraceae nesses principais rios do distrito de Chandrapur.

Palavras-chave: distrito de Chandrapur, Chlorococcales, diversidade de algas verdes, grandes rios, Painganga, Wain Ganga, Wardha

Introduction

Algae are the producers in the aquatic ecosystem and form the base of its ecological pyramid. The stability of an ecosystem is dependent on the diversity of organisms. The greater the diversity of organisms greater will be the stability of the ecosystem. For understanding the ecosystem and to increase the productivity of an ecosystem, it is very necessary to understand the diversity and the distribution of organisms.

There are several published records of green algae from the country, and more than 7300 species of algae have been reported from India (ENVIS 2021). Several researchers worked on algal diversity of the state and the country and published several new reports and new taxa of algae (Jain & Srivastava 2008, Das & Adhikary 2012, Satpati *et al.* 2013, Toppo & Suseela 2013, Baruah *et al.* 2013, Rajeshwari

& Krishnamurthy 2015, Srivastava *et al.* 2018, Dash *et al.* 2021a, b). But still, the algal flora of the Chandrapur district is under-explored, and only a few taxonomic records of algal diversity are available from the district (Kamat 1975, Reddy & Chaturvedi 2015, 2017, Reddy 2020, 2021).

Chandrapur is the eastern district of the Maharashtra state, located between 18°41' to 20°50' North Latitudes and 78°48' to 80°55' East Longitudes. The present paper is a part of the taxonomic study of micro and macro flora of major rivers of Chandrapur district, Maharashtra. While the study period, the major rivers Wardha, Painganga and Wain Ganga were explored for their biological wealth. Present paper deals with the diversity and distribution of a green algal family Selenastraceae in these major rivers of the district.

The Selenastraceae members are common and widely distributed among the freshwater bodies. They are either solitary or in loose colonies, cells held together by specific

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adhesion at certain points or by mucilaginous envelope. Cells are generally elongated, either straight or variously bent or twisted.

Material and methods

Samples were collected from 21 sites (Table 1) of three major rivers during May, August, November and February months for two consecutive years. From every site, approximately 50 liters of running water is filtered through a phytoplankton net of 20 μ mesh size made of bolting silk. The filtrate was preserved in a 4% formaldehyde solution. Microphotography was done with the help of a Coslab camera inbuilt trinocular microscope.

Plants were identified with the help of standard books, floras, monographs and research publications (Kim 2013, Korshikov 1953, Prescott 1962, Philipose 1967, John et al. 2002, Ramos *et al.* 2012).

Taxonomic enumeration

In present study total 24 Selenastraceae taxa were isolated from the rivers. Their taxonomic details, characters and distribution details are as follows.

1. *Actinastrum aciculare* Playfair 1917.

[Kim 2013, p. 434, f. 17]

Figure 1.1

Colony 8 celled, cells arranged radially from the center. Cells small, needle like, broad at base and gradually taper in to sharp pointed tip. Cells may be straight or slightly curved.

Size: Cells 2 μ -4 μ X 10 μ -20 μ . Occurrence: S1, S2, S5-S7, S9, S10, S15-S20

2. *Actinastrum fluviatile* (J.L.B.Schröder) Fott 1977.

Basionym: *Actinastrum hantzschii* var. *fluviatile* J.B.L.Schröder 1899.

[Korshikov 1953, p. 374; Prescott 1962, p. 282, pl.65, f.1]

Figure 1.2

Colony 8 celled, cells arranged radially from the center. Cells fusiform, cylindrical fusiform with dilated center and pointed tip.

Size: Cells 3 μ -5 μ X 25 μ -35 μ . Occurrence: S6, S7, S10, S11, S19-S21

Table 1. Sampling sites along with GPS coordinates, India.

Site	Place	Coordinates
S1	Pardi	19°44'28.2"N 78°54'46.6"E
S2	Bori	19°48'23.5"N 78°59'58.9"E
S3	GadegaonWirur	19°51'48.5"N 79°07'25.5"E
S4	Dhanora	19°54'13.1"N 79°11'02.3"E
S5	Kadoli	19°52'30.8"N 79°17'16.5"E
S6	Sasti	19°50'01.5"N 79°20'06.9"E
S7	Rajura	19°48'48.5"N 79°22'29.6"E
S8	Koipara	19°45'59.5"N 79°29'24.9"E
S9	Arvi	19°38'01.0"N 79°29'21.5"E
S10	Polsa	19°30'28.9"N 79°35'18.7"E
S11	Tatepalli	19°34'55.0"N 79°42'13.2"E
S12	Gugus	19°57'19.7"N 79°05'56.6"E
S13	Patala	20°07'39.3"N 78°59'48.0"E
S14	Soit	20°16'45.0"N 78°49'05.5"E
S15	Gondpipri	19°40'38.5"N 79°47'07.7"E
S16	Gangapur	19°50'28.0"N 79°45'14.1"E
S17	Saoli	20°00'28.8"N 79°47'10.4"E
S18	Saoli	20°08'05.6"N 79°55'25.0"E
S19	Kudesawali	20°19'24.7"N 79°56'58.1"E
S20	Brahmapuri	20°28'59.0"N 79°56'47.2"E
S21	Brahmapuri	20°37'09.7"N 79°56'24.6"E

3. *Actinastrum gracillimum* G.M.Smith 1916.

[Prescott 1962, p. 281, pl.64, f.5; Philipose 1967, p.318]

Figure 1.3

Colony 4, 8 celled, cells arranged radially from the center. Cells cylindrical with truncated ends. Cells with slight or no dilation in the center.

Size: Cells 2 μ -3 μ X 20 μ -26 μ . Occurrence: S4-S8, S15-S174. *Actinastrum gracillimum* var. *elongatum* (G.M.Smith)

B.Fott 1977.

Basionym: *Actinastrum hantzschii* var. *elongatum* G.M.Smith 1918.

[Prescott 1962, p. 282, pl. 65, f. 2; Philipose 1967, p.218, f.125d]

Figure 1.4

Colony 8 celled, arranged radially from the center. Differs from the type, having long cells.

Size: Cells 4 μ -5 μ X 30 μ -35 μ . Occurrence: S4-S8, S16-S215. *Actinastrum hantzschii* Lagerheim 1882.

[Korshikov 1953, p.374, f.361; Prescott 1962, p. 281, pl.64, f.10, 11; Philipose 1967, p.217, f. 125 a-c]

Figure 1.5

Colony 8 celled, cells arranged radially from the center. Cells fusiform with truncated or somewhat rounded ends. Width at the center is almost double as the width at the tip.

Size: Cells 4 μ -6 μ X 15 μ -25 μ . Occurrence: S4-S216. *Ankistrodes musdensus* Korshikov 1953.Synonym: *Ankistrodesmus spiralis* var. *fasciculatus* G.M.Smith

[Korshikov 1953, p.300, f.262]

Figure 1.6

Colony 2, 4, 8 or many celled, cells twisted around or overlapping each other. Cells cylindrical at their maximum length and suddenly narrow into acute apices.

Size: Cells 3 μ -5 μ X 50 μ -60 μ . Occurrence: S4, S5, S10-S137. *Ankistrodes musfalcatus* (Corda) Ralfs 1848.Basionym: *Micrasterias falcatus* Corda 1835Synonym: *Ankistrodes muslundbergii* Koshikov 1953.

[Korshikov 1953, p.306, f.269 & p. 305, f. 268; Prescott 1962, p. 253, pl.56, f. 5, 6]

Figure 1.7

Colony 2 to many celled, cells arranged in bundle by touching their convex sides. Cells long, acicular, gradually narrow into acute apices. Cells either straight or slightly curved.

Size: Cells 2 μ -3 μ X 50 μ -70 μ . Occurrence: S1-S3, S6-S8, S12-S14, S16-S18, S20, S218. *Ankistrodes musfusiformis* Corda 1838.[Korshikov 1953, p.300, f.263; Philipose 1967, p.211, f. 121a as *A. falcatus*]

Figure 1.8

Colony 2, 4, 8 celled, cells arranged cross wise or right angle to each other. Cells needle like, fusiform, broad in the center and gradually narrowing into acute apices.

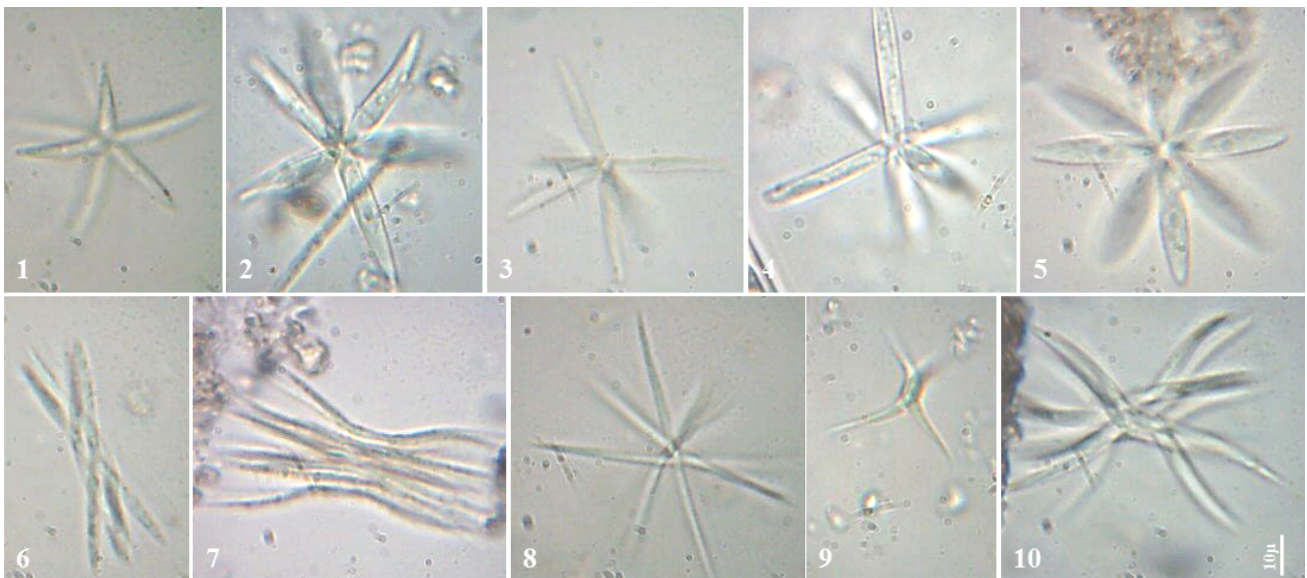


Figure 1. 1. *Actinastrum aciculare*. 2. *A. fluviatile*. 3. *A. gracillimum*. 4. *A. gracillimum* var. *elongatum*. 5. *A. hantzschii*. 6. *Ankistrodesmus musdensus*. 7. *A. falcatus*. 8. *A. fusiformis*. 9. *A. gracilis*. 10. *A. spiralis*.

Size: Cells 2µ-4µ X 20µ-40µ. Occurrence: S1-S3, S8-S16, S19-S21

9. *Ankistrodes musgracilis* (Reinsch) Korshikov 1953.

Basionym: *Selenastrum gracile* Reinsch 1866. *Synonym*: *Selenastrum westii* G.M. Smith 1920.

[Korshikov 1953, p.305, f.267; Prescott 1962, p. 257, pl. 57, f. 10, 12; Philipose 1967, p.221, f. 129]

Figure 1.9

Colony 2 or 4 celled, cells strongly arched and joined in the center by convex sides. Cells fusiform, broad at middle and gradually narrow into pointed apices.

Size: Cells 3µ-5µ X 40µ-60µ. Occurrence: S5-S7, S13, S14, S18-S21

10. *Ankistrodesmus spiralis* (W.B. Turner) Lemmermann 1908.

Basionym: *Rhaphidium spirale* W.B. Turner 1893.

[Korshikov 1953, p.300, f.261; Prescott 1962, p. 254, pl.56, f. 11, 12; Philipose 1967, p. 210, f. 119a-c]

Figure 1.10

Colony two to many celled, cells spirally twisted in the middle and apices apart. Cells fusiform, gradually taper into acute apices.

Size: Cells 3µ-5µ X 40µ-60µ. Occurrence: S1-S3, S6-S8, S10-S14, S18-S20

11. *Kirchneriella aperta* Teiling 1912.

Synonym: *Kirchneriella obesa* var. *aperta* (Teiling)

Brunthaler.

[Korshikov 1953, p. 314, f. 283; Prescott 1962, p. 259, pl. 58, f. 6, 7]

Figure 2.1

Cells nearly circular in outline present single or in colony. Inner cavity 'V' shaped, apices rounded or bluntly pointed.

Size: Cells 8µ-12µ in diameter. Occurrence: S5-S7, S10, S11S19-S21

12. *Kirchneriella diana* (Bohlin) Comas Gonzalez 1980.

Basionym: *Kirchneriella lunaris* var. *diana* Bohlin 1897.

[Korshikov 1953, p. 314, f. 285; Prescott 1962, p. 258, pl. 58, f. 3]

Figure 3.2

Cells elongate lunate arranged in irregular colony. Inner cavity 'U' shaped or oval, sides either parallel or slightly curved. Apices sharply pointed and in different planes.

Size: Cells 10µ-15µ in diameter. Occurrence: S4-S6.

13. *Kirchneriella incurvate* J.H. Belcher & Swale 1962.

[John et. al. 2002, p.361, f. 98G]

Figure 2.2

Colony is of 4 or 8 celled, cells nearly spherical in outline. Sides curved strongly and slightly bent inside, apices rounded.

Size: Cells 7µ-9µ in diameter. Occurrence: S9-S11

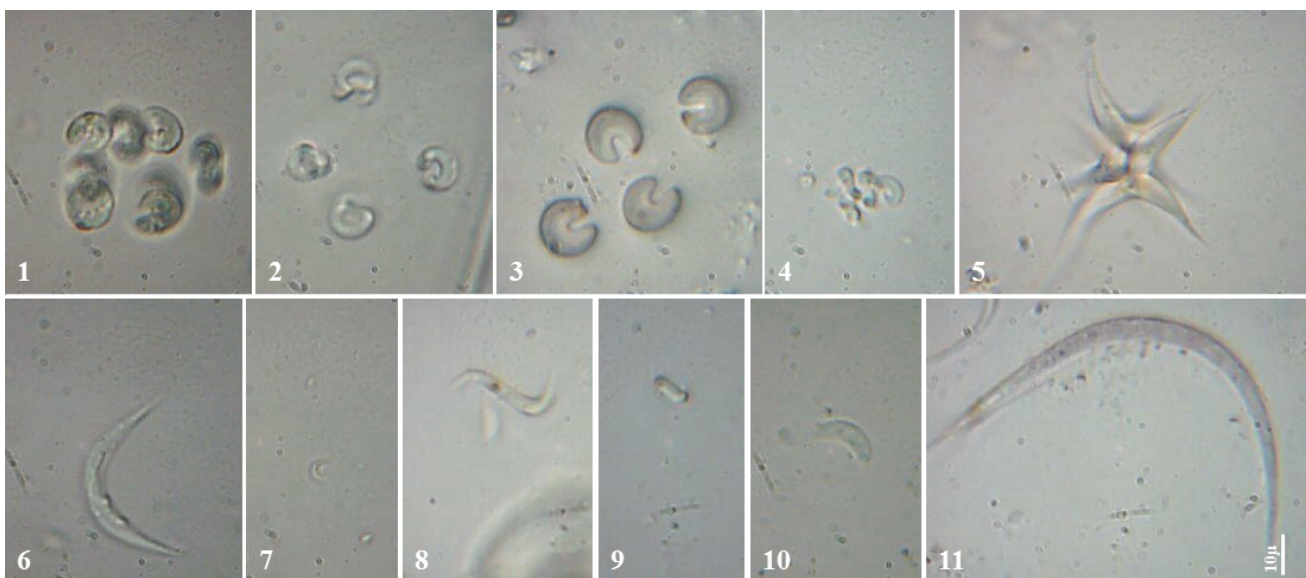


Figure 2. 1. *Kirchneriella aperta*. 2. *K. incurvata*. 3. *K. obesa*. 4. *Raphidocelis contorta*. 5. *Selenastrum bibraianum*. 6. *Monoraphidium arcuatum*. 7. *M. circinale*. 8. *M. contortum*. 9. *M. convolutum*. 10. *M. minutum*. 11. *M. mirabile*.

14. ***Kirchneriella lunaris*** (Kirchner) Möbius 1894.
 Synonym: *Rhaphidium convolutum* var. *lunare* Kirchner 1878.
 [Korshikov 1953, p. 314, f. 284; Prescott 1962, p. 258, pl. 58, f. 2; Philipose 1967, p. 222, f. 131]

Figure 3.3

Colony many celled, Cells almost circular in outline. Sides strongly curved but never bent inside, apices pointed.

Size: Cells 7 μ -9 μ in diameter. Occurrence: S16-S19

15. ***Kirchneriella obesa*** (West) West & G.S. West 1893.
 Basionym: *Selenastrum obesum* West 1892.
 Synonym: *Kirchneriella lunaris* var. *obesa* (G.S. West) Playfair.
 [Korshikov 1953, p. 313, f. 282; Prescott 1962, p. 259, pl. 58, f. 5; Philipose 1967, p. 224, f. 132]

Figure 2.3

Colony is of 4 or 8 nearly circular cells arranged irregularly in gelatinous envelope. Sides not curved, outer margin convex and sides parallel with 'U' shaped inner cavity. Apices rounded or bluntly pointed.

Size: Cells 8 μ -12 μ in diameter. Occurrence: S1-S4, S6, S7, S9-S11, S16-S17, S20-S21

16. ***Monoraphidium arcuatum*** (Korshikov) Hindak 1970.
 Basionym: *Ankistrodesmus arcuatus* Korshikov 1953.
 [Korshikov 1953, p. 296, f. 257; John et. al. 2002, p. 366, f. 90I; Ramos et. al. 2012, p. 427, f. 2g]

Figure 2.6

Cell fusiform, arched, gradually tapers into sharply pointed apices. Sometime slightly twisted.

Size: Cells 2 μ -4 μ X 40 μ -60 μ . Occurrence: S3, S4, S8-S16, S19-S21

17. ***Monoraphidium circinale*** (Nygaard) Nygaard 1979.
 Basionym: *Monoraphidium capricornutum* var. *circinale* Nygaard 1977.
 [Ramos et. al. 2012, p. 428, f. 2i, 2j]

Figure 2.7

Cells arcuated, slightly twisted. Gradually narrows in to pointed apices.

Size: Cells 1 μ -2 μ X 8 μ -10 μ . Occurrence: S8-S10, S12-S14, S16, S17

18. ***Monoraphidium contortum*** (Thuret) Komarkova 1969.
 Basionym: *Ankistrodesmus muscontortus* Thuret in Brébisson 1856.
 Synonym: *Ankistrodesmus pseudomirabilis* var. *spiralis* Korshikov 1953; *Ankistrodesmus musfalcatus* var.

- spirilliformis* G.S West 1904.
 [Korshikov 1953, p. 297, f. 298; John et. al. 2002, p. 366, f. 90J; Ramos et. al. 2012, p. 428, f. 3a]

Figure 2.8

Cells spindle shaped, sigmoid or spirally twisted. Broad at middle and tapers in to pointed apices.

Size: Cells 2 μ -4 μ X 20 μ -30 μ . Occurrence: In all sites

19. ***Monoraphidium convolutum*** (Corda) Legnerova 1942.
 Basionym: *Ankistrodesmus convolutus* Corda 1838.
 [Prescott 1962, p. 253, pl. 55, f. 3; Philipose 1967, p. 213, f. 122; John et. al. 2002, p. 366, f. 90M]

Figure 2.9

Cells spindle shaped, mostly sigmoid or sometimes spirally twisted. From the center gradually narrows into pointed apices.

Size: Cells 2 μ -3 μ X 8 μ -10 μ . Occurrence: S13

20. ***Monoraphidium griffithii*** (Berkeley) Komarkova 1969.
 Synonym: *Ankistrodesmus acicularis* (Braun) Korshikov 1953; *Ankistrodesmus falcatus* var. *acicularis* (A. Braun) G.S. West 1904.

[Korshikov 1953, p. 291, f. 252; Philipose 1967, p. 213, f. 121c; John et. al. 2002, p. 366, f. 90K; Ramos et. al. 2012, p. 429, f. 3c]

Figure 3.1

Cells fusiform, long, much longer than broad. Cells always straight with short spine like pointed apices. Sometimes aggregate to form bunches.

Size: Cells 3 μ -5 μ X 40 μ -60 μ . Occurrence: S6, S7, S11, S12

21. ***Monoraphidium minutum*** (Nägeli) Komarkova 1969.
 Basionym: *Rhaphidium minutum* Nägeli.
 [John et. al. 2002, p. 368, f. 91C; Ramos et. al. 2012, p. 432, f. 3g]

Figure 2.10

Cells reniform or crescent shaped. Slightly attenuated to rounded apices.

Size: Cells 3 μ -5 μ X 10 μ -17 μ . Occurrence: S1, S3, S4, S6-S8, S12-S14, S16, S17, S20, S21

22. ***Monoraphidium mirabile*** (West & G.S. West) Pankow 1976.
 Basionym: *Rhaphidium polymorphum* var. *mirabile* West & G.S. West 1897.

Synonym: *Ankistrodesmus acicularis* var. *mirabilis* (West & G.S. West) Korshikov 1953.
 [Korshikov 1953, p. 293; John et. al. 2002, p. 368]

Figure 2.10



Figure 3. 1. *Monoraphidium griffithii*. 2. *Kirchneriella diana*. 3. *K. lunaris*.

Cells spindle shaped, arched or sickle shaped. Broad in the middle and gradually narrows in to pointed apices.

Size: Cells $4\mu\text{-}6\mu \times 80\mu\text{-}100\mu$. Occurrence: S4, S5, S7, S8, S12-S14

23. ***Raphidocelis contorta*** (Schmidle) Marvan, Komarek & Comas 1984.

Basionym: *Kirchneriella obesa* var. *contorta* Schmidle 1894.

Synonym: *Kirchneriella contorta* (Schmidle) Bohlin 1897.

[Korshikov 1953, p. 317, f. 288; Prescott 1962, p. 258, pl. 57, f. 7, 8; Philipose 1967, p. 224, f. 133]

Figure 2.4

Colony 4 celled, cells vermiform, twisted cylindrical with rounded apices.

Size: Cells 2μ broad and up to 14μ long. Occurrence: S2, S21

24. ***Selenastrum bibraianum*** Reinsch 1866.

Synonym: *Ankistrodesmus bibraianus* (Reinsch) Korshikov 1953; *Kirchneriella bibraiana* (Reinsch) E.G.Williams 1965.

[Korshikov 1953, p. 302, f. 264; Prescott 1962, p. 256, pl. 57, f. 9; Philipose 1967, p. 219, f. 127]

Figure 2.5

Colony 4 celled, cells crescent shaped and joined in the center by convex sides. Apices are pointed.

Size: Cells $5\mu\text{-}7\mu \times 30\mu\text{-}38\mu$. Occurrence: S9-S11, S15, S16, S19-S21

Results

In the present work, 24 taxa of Selenastraceae were successfully isolated and identified from the three major

rivers of the district. From the same rivers of Chandrapur district, Reddy and Chaturvedi (2017) reported six taxa of Selenastraceae, such as *Chlorolobion obtusum*, *Monoraphidium caribeum*, *M. irregulare*, *M. komarkovae*, *M. nanum*, and *M. obtusum*. The present investigation comprises five taxa each of Actinastrum, *Ankistrodesmus*, *Kirchneriella*; seven taxa of *Monoraphidium*, and one taxon each from *Selenastrum* and *Raphidocelis*. Among these isolated taxa, the *Monoraphidium contortum* is widely distributed and constantly present in all the sites, whereas *Chlorolobion obtusum*, *Monoraphidium convolutum* and *M. obtusum* are restricted in their distribution and present at one site only.

Literature cited

- Baruah, P.P., Baruah, R. & Thakuria, J.** 2013. Chlorophycean diversity of Deepor Beel Wildlife sanctuary. *Phykos* 43(2): 33-42.
- Das, S.K. & Adhikary, S.P.** 2012. Freshwater algae of Cherapunjee and Mawsynram, the wettest places on earth. *Phykos* 44(2): 29-43.
- Das, S.K. & Adhikary, S.P.** 2012. Freshwater algae of Nagaland. *Journal of Indian Botanical Society* 91(1-3): 99-123.
- Dash, S.R., Pradhan, B., Behera, C., Nayak, R. & Jena, M.** 2021. Algal Flora of Tampara Lake, Chhatrapur, Odisha, India. *Journal of Indian Botanical Society* 101(1-2):1-15.
- ENVIS.** (2021). http://www.bsienviis.nic.in/Database/Algae_in_India_family_genera_23129.aspx
- Jain, R. & Srivastava, P.** 2008. Taxonomic account of green algae from alwar (Rajasthan) India,-Conjugales-I. *Vegetos* 21(2): 61-80.
- Kamat, N.D.** 1975. Algae of Vidarbha, Maharashtra. *Journal of Bombay Natural History Society* 72(2): 450-476.
- Korshikov, O.A.** 1953. The Freshwater Algae of the Ukrainian SSR. V Protococcinae: Vacuolales and Protococcales. Akad Nauk URSR, Kiev.

- Prescott, G.W.** 1962. Algae of the Western great lakes area. WM. C. Brown Company Publishers, Dubuque, Iowa.
- Rajeshwari, M.S. & Krishnamurthy, S.R.** 2015. Algal flora of the river Bhadra at the outlet of Bhadra Dam, Shivamogga. *Phykos* 45(1): 40-53.
- Ramos, G.J.P., Bicudo, C.E.D.M., Góes, Neto, A. & Moura, C.W.D.N.** 2012. Monoraphidium and Ankistrodesmus (Chlorophyceae, Chlorophyta) from Pantanal dos Marimbus, Chapada Diamantina, Bahia State, Brazil. *Hoehnea* 39(3): 421-434.
- Reddy, B.M. & Chaturvedi, A.** 2015. Scenedesmus and related genera in riverine system of Chandrapur district, Maharashtra, India. *Phykos* 45(2): 19-28.
- Reddy, M. & Chaturvedi, A.** 2017. New records of freshwater algae from India. *Phykos* 47(1): 59-63.
- Reddy, M.** 2020. Taxonomy and diversity of genus Tetradronkützing (chlorophyceae) in the major rivers of Chandrapur district, Maharashtra. *Parishod* 9 (3): 4238-4243.
- Reddy, M.** 2021. New records of freshwater algae for Maharashtra state: Investigation from the major rivers of Chandrapur district. *NeBio* 12(2): <http://nebio.in/2021/05/31/nebio-122-june-2021/>
- Satpati, G.G., Barman, N. & Pal, R.** 2013. A study on green algal flora of Indian Sundarbans mangrove forest with special reference to morphotaxonomy. *Journal of Algal Biomass Utilization* 4(1):26-41.
- Srivastava, N., Suseela, M. R., Toppo, K., & Lawrence, R.** 2018. Fresh water algal diversity of Central India. *International Journal of Research and Development in Pharmacy & Life Science* 7(4): 3039-3049.
- Toppo, K. & Suseela, M.R.** 2013. Enumeration of fresh water algal flora of Ranchi, Jharkhand, India. *Journal of Indian Botanical Society* 92(1-2): 89-96.

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