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Cover: Common Keeled Skink *Eutropis carinata* in oil pastels, colour pencils, & micron pen adapted from photograph by H. Byju © Pooja Ramdas Patil.



Desmids of Brahmaputra valley, a major southern Asian river basin

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Abstract: Inadequate information on the diversity and dispersion of desmids has led to incomplete floristic data in the northeastern region of India. The present study focuses on contributing to the information on the diversity and geographical distribution of desmid in water bodies of the Brahmaputra River basin of the Indian subcontinent. During the period 2019–2022, desmid flora of 91 waterbodies were studied. Two-hundred-and-thirty-one taxa belonging to five families and 25 genera were recorded, out of which 94 were new records for the northeastern India. Desmidiaceae was the dominant family with 195 species and with 69 species *Cosmarium* was the dominant genus.

Keywords: Biomonitoring, Brahmaputra River basin, *Cosmarium*, Charophyta, Desmid diversity, floristic data, geographical distribution, new records, northeastern India, water bodies.

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Author contributions: SN—Conceptualization, visualization, investigation, writing- original draft. PPB—Supervision, conceptualization, writing- review & editing.

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INTRODUCTION

The Indo-Malaya/northern Australia desmid floral region (Coesel 1996) which covers the entire southeastern Asian river basins is one of the 10 desmid floral regions (Krieger 1933, 1937) of the world. The Brahmaputra which originates in Tibet Himalaya and flows through India and Bangladesh up to the Bay of Bengal has the longest and largest river basins in the region covering an area of 2,900 km which includes altogether 180 watersheds, 24 major tributaries, and around 16,037 numbers of large to medium lentic water bodies up to the maximum size of 2,500 ha (Dadhwai et al. 2014). The prevailing eco-climatic conditions is concomitant with the humble and less destructive life styles of the aboriginal people help to maintain the pristine environments in the majority of the water bodies excluding those in urbanised centres/ towns that lead to support a rich desmid flora therein.

Desmids are eukaryotic unicellular creatures belonging to the class Zygnematophyceae of phylum Charophyta under kingdom Plantae (Lewis & McCourt 2004; Komal et al. 2021). All desmids consist of two symmetrical 'semi cells' joined by an isthmus (Das & Keshri 2012) and the majority possess beautiful cell-wall ornamentations (Brook 1981).

The members of this group not only prefer to grow and flourish in pure and less populated water but also quickly respond to the slightest change in pH or nutrient content in the substratum (Borics et al. 1998; Fehér 2003), which makes them ecologically sensitive and are therefore, considered as one of the indicators of good water quality. Recently, the information on desmids is seen to be documented as baseline data for any ecological and biomonitoring investigation in aquatic systems and the conservation of the same as well (Aquino et al. 2017; Paul et al. 2017) in the line of work of Coesel (1998) who proposed to determine the nature conservation value (NCV) based on parameters like species richness, presence of rare taxa, and the occurrence of taxa signifying ecosystem maturity.

Though a good number of workers (Baruah et al. 2009, 2013, 2020; Deka & Sarma 2011; Adhikary & Jena 2012; Bordoloi & Baruah 2015; Nath & Baruah 2020) have documented algal flora in different regions of Brahmaputra river basin in recent days, exclusive information on diversity and distribution of desmids is very much limited from this floristically wealthier sandwich region between Indo-Burma and Himalaya biodiversity hotspots (Bordoloi 1983; Deka et al. 2011; Yasmin et al. 2011; Phukan & Bora 2012; Baruah & Baruah 2013; Das

2020). The present endeavour was therefore undertaken to explore and document the hidden wealth of desmid flora in different lentic and lotic aquatic ecosystems of the Brahmaputra River basin of the Indian subcontinent.

MATERIALS AND METHODS

Sample collection and Identification

A total of 91 waterbodies (Table 1) were randomly explored in the entire reach of the mighty Brahmaputra River (Figure 1) for the collection of desmid samples. The collection of desmids was done by filtering technique using plankton net of mesh size 25 µm from January 2019 to December 2022. The samples were examined freshly under different magnifications (20X, 40X, and 60X) of the compound microscope (Euromex Delphi X Observer series) and photomicrographs were taken with the help of a digital camera (Euromex 20MP). Image view software was used for micrometric measurements of desmids. The remaining samples were preserved in Lugol's iodine solution for further investigations. Identification of desmids were done by following monographs of Croasdale et al. (1983), Prasad & Misra (1992), Lenzenweger (1996, 1997, 1999, 2003), John et al. (2005), Ahmed et al. (2007), and Das & Keshri (2016). Updated nomenclature of the species was given by following Guiry & Guiry (2022) and was systematically arranged following Rugiero et al. (2015).

RESULTS

In the present study, 231 taxa of desmids belonging to 25 genera, under five families, and two orders were recorded from the selected water bodies of the entire Brahmaputra River basin located under the Indian subcontinent. Desmidiaceae was reported to be the dominant family with 195 species, of which *Cosmarium* was recorded as the dominant genus with 69 species.

SYSTEMATIC ENUMERATION

Phylum: Charophyta

Class: Zygnematophyceae

Subclass: Zygnematophycidae

Order: Desmidiales

Family: Closteriaceae

Genus: *Closterium*

Closterium abruptum West 1892: 719, pl. IX [9]: fig. 1

Cells elongate, 8–9 times longer than broad, slightly curved at the centre but more curved towards the extremities, having 64–70° of arc, cell wall smooth, one girdle band present, chloroplast with 2–3 pyrenoids, cells 171–245 µm long and 22–25 µm broad,

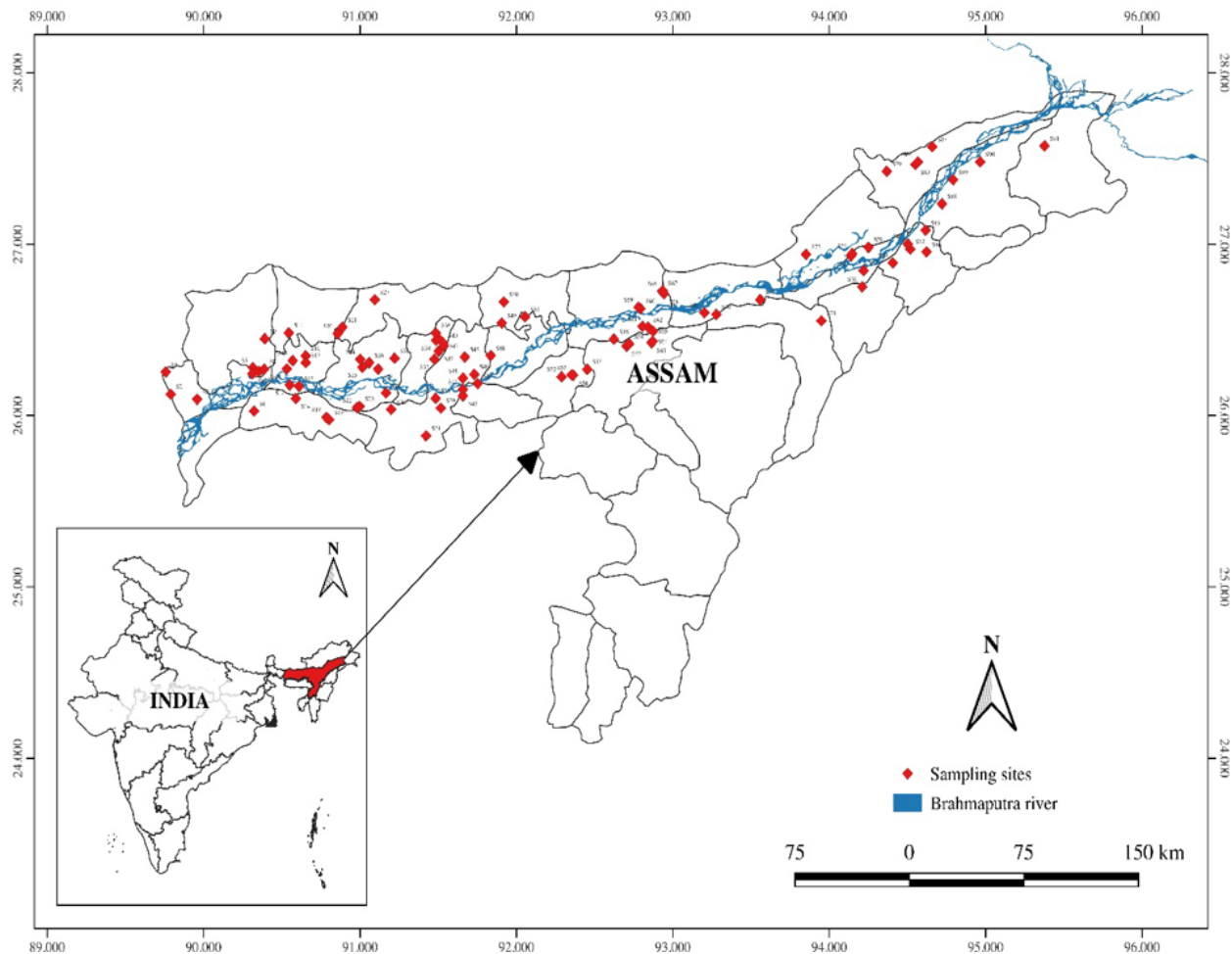


Figure 1. Location map showing desmid collection sites in Brahmaputra valley.

apex 8–9 μm broad.

Site of collection: Dhamar Beel, Goalpara; Sorbhog Pond, Barpeta.

Previous records and distribution in northeastern India: Manmecho Lake, Das & Keshri (2012).

Closterium acutum Brébisson 1848: 177, pl. XXX [30]: figs 5a, 5b, 5d, 5f; pl. XXXV: fig. 5

Cells elongate, 22–23.5 times longer than broad, semi-straight, slightly curved at extremities, cell wall smooth, dorsal margin convex and approximately straight, chloroplast with pyrenoids, 6–8 in number arranged in a series, cells 235–310 μm long and 10–14 μm broad, apex 2–3 μm broad.

Site of collection: Deepor Beel, Kamrup (M), Urapad Beel, Goalpara; Barsola Beel, Jorhat.

Previous records and distribution in northeastern India: Khanajan, Baruah & Baruah (2013); Dachi lake, Hajong & Ramanujam (2018); Deepor Beel, Baruah et al. (2020).

Closterium acutum var. *linea* (Perty) West & G. S. West 1900: 57

Basionym: *Closterium linea* Perty

Cells spindle-shaped, 31–36 times longer than broad, narrow, almost straight, gradually attenuated to acute and slightly curved

poles, chloroplast with 8–10 pyrenoids, arranged in a row, cells 110–155 μm long and 3–5 μm broad, apex 1–1.5 μm broad.

Site of collection: Kusumfula Beel, Goalpara; Dheer Beel, Dhubri.

Previous records and distribution in northeastern India: Sivasagar, Phukan & Bora (2012).

Closterium acutum var. *variabile* (Lemmermann) Willi Krieger 1935: 262, pl. 13: figs 18–22

Basionym: *Closterium pseudospirotaenium* var. *variabile* Lemmermann

Cells sigmoid-shaped, 28–30 times longer than broad, narrow, gradually attenuated towards poles, strongly and irregularly curved, chloroplast with a series of pyrenoids, cells 90–140 μm long and 3–5 μm broad.

Site of collection: Shamaguri Beel, Nagaon.

Previous records and distribution in northeastern India: North-eastern India, Yasmin et al. (2011).

Closterium closterioides (Ralfs) A. Louis & Peeters 1967: 410, pl. 13: fig. 119

Basionym: *Penium closterioides* Ralfs

Cells are straight, elongated, 6–7 times longer than broad, both sides with a slight notch in the mid-region, gradually nar-

Table 1. Desmids collection sites of Brahmaputra valley.

Site no.	Latitude	Longitude	Name of collection site
S1	26.253°N	89.757°E	Goalnani Pond, Dhubri
S2	26.124°N	89.789°E	Konuri Beel, Dhubri
S3	26.094°N	89.958°E	Laokhoa Beel, Dhubri
S4	26.244°N	90.311°E	Gaurangtari Pond, Dhubri
S5	26.279°N	90.315°E	Diplai Beel, Kokrajhar
S6	26.026°N	90.322°E	Dhamar Beel, Goalpara
S7	26.256°N	90.353°E	Dakra Beel, Dhubri
S8	26.270°N	90.387°E	Dheer Beel, Dhubri
S9	26.448°N	90.390°E	Kursakati Pond, Kokrajhar
S10	26.272°N	90.531°E	Dolani Beel, Bongaigaon
S11	26.482°N	90.543°E	Dosomighat Pond, Bongaigaon
S12	26.177°N	90.550°E	Kumri Beel, Goalpara
S13	26.320°N	90.569°E	Tamranga Beel, Bongaigaon
S14	26.099°N	90.588°E	Urpada Beel, Goalpara
S15	26.170°N	90.609°E	Hasila Beel, Goalpara
S16	26.348°N	90.651°E	Deohati Pond, Bongaigaon
S17	26.309°N	90.652°E	Koya Kujia Beel, Bongaigaon
S18	25.988°N	90.785°E	Dudhnoi College Pond, Goalpara
S19	25.975°N	90.802°E	Kusumfula Beel, Goalpara
S20	26.477°N	90.857°E	Sorbhog Pond, Barpeta
S21	26.514°N	90.887°E	Sorbhog Beel, Barpeta
S22	26.045°N	90.980°E	Tiplai Pond, Goalpara
S23	26.053°N	90.997°E	Naitara Choutara Beel, Goalpara
S24	26.327°N	91.001°E	Madhab Choudhury College Pond, Barpeta
S25	26.282°N	91.014°E	Gandhi Beel, Barpeta
S26	26.308°N	91.058°E	Keotkuchi Pond, Barpeta
S27	26.675°N	91.093°E	Raja Beel, Baksa
S28	26.270°N	91.116°E	Akhara Beel, Barpeta
S29	26.132°N	91.165°E	Bejorsuti Pond, Kamrup
S30	26.036°N	91.198°E	Jiyeni Beel, Kamrup
S31	25.881°N	91.421°E	Chandubi Beel, Kamrup
S32	26.334°N	91.220°E	Kapla Beel, Barpeta
S33	26.328°N	91.475°E	Ulabari Pond, Nalbari
S34	26.439°N	91.485°E	Ghunkuchi Beel, Nalbari
S35	26.100°N	91.483°E	Rajapukhuri, Nahira Kamrup
S36	26.481°N	91.484°E	Katara Beel Paikarkuchi, Nalbari
S37	26.376°N	91.502°E	Bogol Road Beel, Nalbari
S38	26.443°N	91.508°E	Rajapukhuri Ghagrapar, Nalbari
S39	26.043°N	91.516°E	Majkuchi Pond, Kamrup
S40	26.424°N	91.530°E	Narpara Pond, Nalbari
S41	26.406°N	91.535°E	Borpukhuri Ghagrapar, Nalbari
S42	26.153°N	91.657°E	Gauhati University Pond, Kamrup (M)
S43	26.114°N	91.657°E	Deepor Beel, Kamrup (M)
S44	26.218°N	91.658°E	Digholi Beel, Kamrup
S45	26.341°N	91.669°E	Borphukhuri, Kamalpur Kamrup
S46	26.240°N	91.730°E	Bornijora Pond, Jalah Kamrup

Site no.	Latitude	Longitude	Name of collection site
S47	26.186°N	91.751°E	Dighalipukhuri, Kamrup (M)
S48	26.349°N	91.835°E	Duminichowki Pond, Kamrup
S49	26.539°N	91.906°E	Lakhimpur puhkuri, Darrang
S50	26.662°N	91.919°E	Pond near Tangla College, Udalguri
S51	26.576°N	92.054°E	Rajapukhuri, Darrang
S52	26.226°N	92.288°E	Charan Beel, Morigaon
S53	26.237°N	92.352°E	Morakolong, Nagaon
S54	26.235°N	92.362°E	Dandua Beel, Morigaon
S55	26.269°N	92.452°E	Kachodhora Beel, Morigaon
S56	26.446°N	92.622°E	Dagaon Pond, Nagaon
S57	26.404°N	92.703°E	Barpeta Beel, Nagaon
S58	26.418°N	92.719°E	Rawmari Beel, Nagaon
S59	26.631°N	92.780°E	Hazarapar Pukhuri, Sonitpur
S60	26.623°N	92.792°E	Padumpukhuri, Sonitpur
S61	26.520°N	92.806°E	Haribhanga Beel, Nagaon
S62	26.514°N	92.841°E	Bhomoraguri Pond, Nagaon
S63	26.424°N	92.863°E	Shamaguri Beel, Nagaon
S64	26.432°N	92.871°E	Gatanga Beel, Nagaon
S65	26.492°N	92.872°E	Sibasthan-Potakollong, Nagaon
S66	26.723°N	92.931°E	Pachi Gaon Pond, Sonitpur
S67	26.728°N	92.934°E	Mohmara Pond, Sonitpur
S68	26.710°N	92.943°E	Panpoor Ghat, Sonitpur
S69	26.599°N	93.201°E	Daphlong Beel, Golaghat
S70	26.891°N	94.405°E	Dighali Beel, Nagaon
S71	26.675°N	93.558°E	Koladuwar Beel, Golaghat
S72	26.940°N	93.851°E	Radhapukhuri, Lakhimpur
S73	26.552°N	93.949°E	Jugi Beel, Golaghat
S74	26.931°N	94.139°E	Bheriki Beel, Jorhat
S75	26.945°N	94.145°E	Chakoli Beel, Majuli
S76	26.750°N	94.210°E	Tinkonia Pukhuri, Jorhat
S77	26.846°N	94.219°E	Barsola Beel, Jorhat
S78	26.981°N	94.250°E	Jor Beel, Jorhat
S79	27.425°N	94.367°E	Bhebeli Pond, Dhemaji
S80	26.891°N	94.405°E	Dighali Beel, Sivasagar
S81	27.000°N	94.502°E	Jogorahabi Beel, Sivasagar
S82	26.971°N	94.517°E	Buka Beel, Sivasagar
S83	27.465°N	94.551°E	Bharalichuk Pond, Dhemaji
S84	27.479°N	94.566°E	Himaticuk Pond, Dhemaji
S85	27.081°N	94.615°E	Moridesang, Sivasagar
S86	26.954°N	94.621°E	Jaysagar Pukhuri, Sivasagar
S87	27.569°N	94.658°E	Sripani Pond, Dhemaji
S88	27.235°N	94.720°E	Gohain Pukhuri, Sivasagar
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S90	27.481°N	94.964°E	Hiloidhari majgao Beel, Dibrugarh
S91	27.573°N	95.376°E	Maguri Motapung Beel, Tinsukia

rowing towards the poles, apices flatly obtuse, chloroplasts with 4–5 longitudinal ridges, each with 2–3 pyrenoids, cell wall smooth, cells 125–170 µm long 20–24 µm broad, apex 5–6 µm broad.

Site of collection: Chandubi Beel, Kamrup; Radhapukhuri, Lakhimpur, Sibasthan Potakollong, Nagaon; Kursakati Pond, Kokrajhar.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Closterium closterioides var. *intermedium* (J. Roy & Bisset) Ruzicka 1973: 199, pl. 2: fig. 23

Basionym: *Penium libellula* var. *intermedium* Roy & Bisset 1894: 252

Cells straight, elongated, 5–6 times longer than broad, dorsal, and ventral sides similarly concave, gradually attenuated towards the truncated poles, cell wall smooth, axial chloroplast with 3–4 pyrenoids, cells 85–120 µm long and 17–20 µm broad, apex 6–7 µm broad.

Site of collection: Urapad Beel, Goalpara; Diplai Beel, Kokrajhar; Deohati Pond, Bongaigaon.

Previous records and distribution in northeastern India: North-eastern India, Yasmin et al. (2011); Urapad Beel, Deka et al. (2011); Kokrajhar, Das (2020).

Closterium cornu Ehrenberg ex Ralfs 1848: 176, pl. XXX [30]: figs 6f, 6g

Cells long, 19–21 times longer than broad, fusiform, straight, or slightly curved, outer margin with the arc of 33–40°, inner margin straight or very slightly concave, gradually attenuating towards narrowly rounded apices, chloroplast with three longitudinal ridges, with 2 pyrenoids, cell wall smooth and colourless, cells 192–237 µm long and 9–12 µm broad, apex 4–5 µm broad.

Site of collection: Jogorahabi Beel, Sivasagar; Dosomighat Pond, Bongaigaon.

Previous records and distribution in northeastern India: Dachi lake, Hajong & Ramanujam (2018).

Closterium cynthia De Notaris 1867: 65, fig. 71; pl. VII [7]

Cells medium-sized, lunate, 10–11 times longer than broad, moderately curved, lateral sides gradually attenuated to obtusely rounded poles, chloroplast axial with 5–6 pyrenoids, cell wall with longitudinal striae, girdle bands visible, cells 68–94 µm long and 6–9 µm broad, apex 1–2 µm broad.

Site of collection: Chandubi Beel, Kamrup; Maguri Motapung Beel, Tinsukia; Tiplai Pond, Goalpara.

Previous records and distribution in northeastern India: Sivasagar, Phukan & Bora (2012); Dachi lake, Hajong & Ramanujam (2018); Chandubi Beel, Nath & Baruah (2020).

Closterium decorum Brébisson 1856: 151, pl. 2: fig. 39

Cells medium-sized, 16–17 times longer than broad, solitary, middle region tubular and slightly curved, cell wall smooth, chloroplast with ridges, 10–13 pyrenoids arranged in an axile row, cells 130–187 µm long and 8–11 µm broad, apex 2–3 µm broad.

Site of collection: Deepor Beel, Kamrup (M); Gauhati University Pond, Kamrup (M).

Previous records and distribution in northeastern India: Khanajan, Baruah & Baruah (2013); Deepor Beel, Baruah et al. (2020).

Closterium diana Ehrenberg ex Ralfs 1848: 168, figs 5a, 5c; pl. XXVIII [28]

Cells medium-sized, lunate, 11.6–13.8 times longer than broad, curved, concave ventral margin, apices smooth, cell wall

yellowish to brownish, chloroplast ridged, pyrenoids 3–4, cells 152–175 µm long and 11–15 µm broad.

Site of collection: Deepor Beel, Kamrup (M); Chandubi Beel, Kamrup; Padumpukhuri, Sonitpur; Pachi Gaon Pond, Sonitpur.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); Khanajan, Baruah & Baruah (2013); Dachi lake, Hajong & Ramanujam (2018); Deepor Beel, Baruah et al. (2020).

Closterium ehrenbergii Meneghini ex Ralfs 1848: 166, pl. XXVIII [28]: fig. 2

Cells large, elongated, about eight times longer than broad, dorsal side curved with an arc of 110–120°, swollen mid region of ventral side gradually attenuating towards broad and rounded apices, parietal chloroplast with a series of ridges, throughout the chloroplast numerous pyrenoids scattered, cell wall smooth, light brown to colourless, cells 430–560 µm long and 50–67 µm broad, apex 6–8 µm broad.

Site of collection: Chakoli Beel, Majuli; Hiloidhari Majgao Beel, Dibrugarh; Jaysagar Pukhuri, Sivasagar

Previous records and distribution in northeastern India: North-eastern India, Yasmin et al. (2011); Meghalaya, Das & Ramanujam (2010); Sivasagar, Phukan & Bora (2012).

Closterium elenkinii Kossinskaja 1936: 415, pl. I: fig. 3

Cells medium-sized, about 12.5–13.7 times longer than broad, slightly swollen in the central region, moderately curved with 70° of arc, tapering abruptly toward slightly produced apices, chloroplast with four longitudinal ridges, each chloroplast with four pyrenoids, cell wall smooth, vibrating granules present in the apices, cells 150–220 µm long and 12–16 µm broad, apex 2–3 µm broad.

Site of collection: Haribhanga Beel, Nagaon; Sorbhog Pond, Barpeta.

New to northeastern India (Image 1).

Closterium gracile Brébisson ex Ralfs 1848: 221, pl. XXI [21]: figs 8–12

Cells medium-sized, 24–35 times longer than broad, almost straight but slightly curved towards the apices, curvature with 37° of arc, lateral margins parallel, gradually tapering toward the apices, poles obtuse, cell wall smooth and colourless, 14 pyrenoids in the chloroplast, cells 140–172 µm long and 4–7 µm broad, apex 1.5–2 µm broad.

Site of collection: Kapla Beel, Barpeta; Sibasthan-Potakollong, Nagaon.

Previous records and distribution in northeastern India: Manmecho lake, Das & Keshri (2012), Arunachal Himalayas, Nath & Baruah (2021).

Closterium incurvum Brébisson 1856: 150, pl. 2: fig. 47

Cells small sized, 7.5–8.7 times longer than broad, strongly curved with 170° of arc, ventral side not inflated, strongly diminished toward apices, poles intensely rounded, axial plate-like chloroplast with a single pyrenoid; cell wall smooth and colourless, cells 70–91 µm long and 8–12 µm broad, apex 1–2 µm broad.

Site of collection: Bejorsuti Pond, Kamrup; Keotkuchi Pond, Barpeta.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); northeastern India, Yasmin et al. (2011); Sivasagar, Phukan & Bora (2012); Arunachal Himalaya, Nath & Baruah (2021).

Closterium kuetzingii Brébisson 1856: 156, pl. 2: fig. 40

Cells long, about 27.5–28.5 times longer than broad, almost straight, apex slightly incurved with 42° of arc, the central region is spindle-shaped, dorsal and ventral sides almost equally convex, diminished abruptly toward the apices to form slightly swollen processes, rounded and slightly inflated poles with the thickened inner wall, cell wall striated and colourless, chloroplasts present only in the mid region, cells 220–314 µm long and 8–11 µm broad, apex 1.5–2 µm broad.

Site of collection: Deepor Beel, Kamrup (M); Urapad Beel, Goalpara; Chandubi Beel, Kamrup; Rawmari Beel, Nagaon; Dighalipukhuri, Kamrup (M).

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); North Eastern India, Yasmin et al. (2011); Urapad Beel Deka et al. (2011); Deepor Beel, Baruah et al. (2020); Arunachal Himalayas, Nath & Baruah (2021).

Closterium libellula var. *sikkimense* J. P. Keshri & D. Das 2016: 77, pl. XVI [16]: figs 314, 315

Cells long, almost straight, 8–9 times longer than broad, 34° of arc, a middle region slightly raised angularly, gradually attenuated towards broadly rounded apices, cell wall smooth and colourless, chloroplast with 6 longitudinal ridges exhibiting 6–9 pyrenoids, cells 176–190 µm long, 19–23 µm broad and apex 3–4.5 µm broad.

Site of collection: Goalnani Pond, Dhubri.

New to northeastern India (Image 2).

Closterium lineatum Ehrenberg ex Ralfs 1848: 173, fig. 1; pl. XXX [30]

Cell semi-straight, 34.5–37 times longer than broad, slightly curved in the apical region with 22–31° of arc, dorsal margin is nearly straight throughout the entire length, ventral margin almost straight, cell wall striated and yellowish to brownish in colour, truncated-rounded poles, axial chloroplast with several numbers of pyrenoids, cells 226–310 µm long and 6–9 µm broad, apex 2–3 µm broad.

Site of collection: Barpeta Beel, Nagaon; Morakolong, Nagaon

Previous records and distribution in northeastern India: Dachi Lake, Hajong & Ramanujam (2018).

Closterium lunula Ehrenberg & Hemprich ex Ralfs 1848: 163, pl. XXVII [27]: fig. 1

Cells large, 5–7 times longer than broad, almost straight, 44° of arc, broad abruptly but slightly attenuated near the truncately rounded poles, dorsal margin more curved than the ventral, ventral margin slightly concave in the mid-region, plate-like axial chloroplast with 4–5 ridges and containing six pyrenoids in a row in each semicell, cell wall smooth and colourless, cells 210–265 µm long, 30–51 µm broad and apex 4–6 µm broad.

Site of collection: Urapad Beel, Goalpara.

Previous records and distribution in northeastern India: Sivasaagar, Phukan and Bora (2012); Urapad Beel, Deka et al. (2011); Arunachal Himalayas, Nath & Baruah (2021).

Closterium minutum var. *indicum* J.P.Keshri & D.Das

Cells small, 6.4–7.2 times longer than broad, moderately curved with 135° of arc, lunate, dorsal and ventral margins equally curved, slightly tapering to bluntly rounded poles, chloroplast axial plate having 3–4 pyrenoids, cell wall smooth and colourless, cells 58–80 µm long, 9–11 µm broad and apex 3–4 µm broad.

Site of collection: Katara Beel Paikarkuchi, Nalbari; Sorbhog Beel, Barpeta

New to northeastern India (Image 3).

Closterium navicula (Brébisson) Lütkenmüller 1905: 337

Basionym: *Penium navicula* Brébisson

Cells small, straight, fusiform, 3.7–5.2 times longer than broad, moderately curved with 78° of arc, dorsal and ventral margins concave, gradually attenuated to widely rounded poles, chloroplast with 8 longitudinal ridges having a few pyrenoids, apical vacuole with granules, cells 30–52 µm long and 8–10 µm broad, apex 4–5 µm broad.

Site of collection: Urapad Beel, Goalpara; Laokhoa Beel, Dhubri; Deohati Pond, Bongaigaon.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011); Arunachal Himalayas, Nath & Baruah (2021).

Closterium parvulum var. *maius* (Schmidle) Willi Krieger 1935: 277, pl. 16: fig. 18

Basionym: *Closterium parvulum* f. *maius* Schmidle

Cells medium-sized, lunate, 11–12 times longer than broad, moderately curved with 122–148° of arc, slightly convex dorsal side, concave ventral side, nearly straight throughout the entire length, without median swelling, pointed-rounded poles, cell wall smooth, hyaline to yellowish in colour, axial chloroplast with 2–3 pyrenoids, arranged in median series, cells 190–285 µm long and 17–23 µm broad, apex 3–4 µm broad.

Site of collection: Urapad Beel, Goalpara.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011).

Closterium planum E. O. Hughes 1952: 284, fig. 35

Cells medium-sized, elongated, about 15–16 times longer than broad, slightly curved near the poles with 37–48° of arc, truncately rounded poles, cell wall smooth and brownish; outer margin slightly more curved than the inner margin; girdle band present, chloroplast having six longitudinal ridges and exhibiting six axial pyrenoids in each, cells 224–282 µm long and 14–18 µm broad, apex 6–7 µm broad.

Site of collection: Borphukhuri, Kamalpur Kamrup; Koladuwar Beel, Golaghat; Akhara Beel, Barpeta; Madhab Choudhury College Pond, Barpeta.

Previous records and distribution in northeastern India: Manmecho Lake, Das & Keshri (2012).

Closterium praelongum var. *brevius* (Nordstedt) Willi Krieger 1935: 324, pl. 25: fig. 29

Basionym: *Closterium praelongum* f. *brevius* Nordstedt

Cells medium-sized, 16–18.5 times longer than broad, dorsal and ventral margins parallel in the middle region, apices slightly recurved, curvature with 18° of arc, ridged chloroplast with 8–10 pyrenoids, cells 112–167 µm long and 7–9 µm broad, apex 4–5 µm broad.

Site of collection: Maguri Motapung Beel, Tinsukia.

New to northeastern India (Image 4).

Closterium pseudocynthia J. P. Keshri & D. Das 2016: 83, pl. XX [20]: figs 365, 366

Cells medium-sized, 13.5–15.2 times longer than broad, moderately curved with 118° of arc, both margins equally curved, gradually attenuated towards the sharply pointed poles, cell wall smooth and yellowish red, ridged chloroplast with 4–6 pyrenoids arranged in axial series, terminal vacuoles granulated, cells 216–320 µm long and 16–21 µm broad, apex 3–4 µm broad.

Site of collection: Chandubi Beel, Kamrup; Gandhi Beel, Barpeta, Morakolong, Nagaon

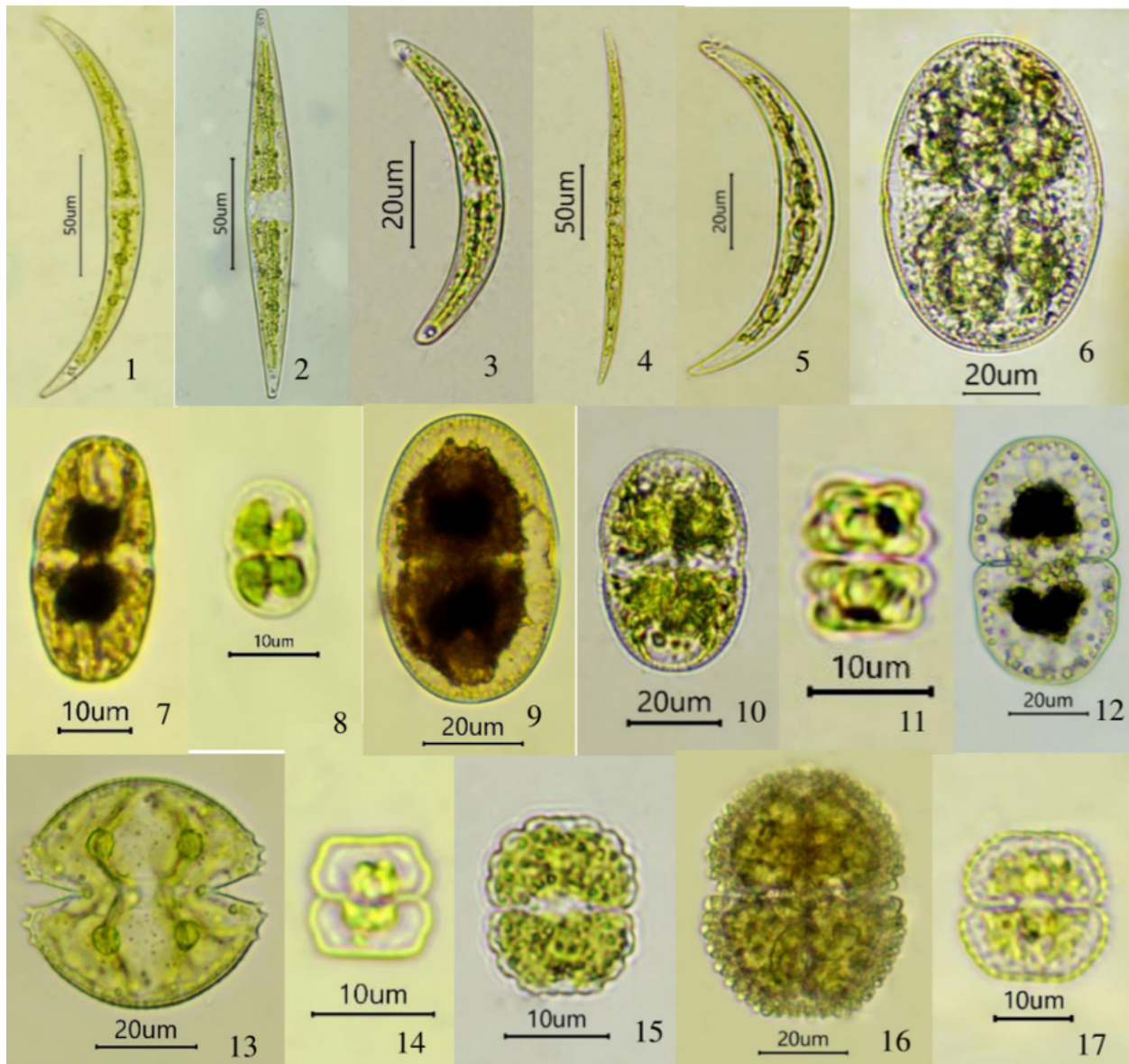


Image 1–17. 1—*Closterium elenkinii* | 2—*Closterium libellula* var. *sikkimense* | 3—*Closterium minutum* var. *indicum* | 4—*Closterium praelongum* var. *brevius* | 5—*Closterium tumidulum* f. *indicum* | 6—*Actinotaenium australe* | 7—*Actinotaenium cucurbitinum* var. *minutum* | 8—*Actinotaenium perminutum* | 9—*Actinotaenium pseudoglobosum* | 10—*Actinotaenium wollei* | 11—*Cosmarium abruptum* | 12—*Cosmarium angulatum* f. *majus* | 13—*Cosmarium auriculatum* | 14—*Cosmarium baffinense* | 15—*Cosmarium blyttii* | 16—*Cosmarium brebissonii* | 17—*Cosmarium calcareum*.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020); Arunachal Himalayas, Nath & Baruah (2021).

Closterium pseudolunula O.Borge 1909: 3, pl. 1: fig. 2

Cells medium-sized, about 8–9 times longer than broad; moderately curved with 48–72° of arc; dorsal margin convex, ventral margin straight for more than two-third of the entire length; apices broadly rounded; chloroplast axial with 4–6 pyrenoids; cell wall smooth and colourless, cells 220–302 µm long and 27–33 µm broad, apex 8–10 µm broad.

Site of collection: Urpada Beel, Goalpara; Hazarapar Pukhuri, Sonitpur.

Previous records and distribution in northeastern India: Urpada Beel, Deka et al. (2011).

Closterium rostratum Ehrenberg ex Ralfs 1848: 175, pl. XXX [30]: fig. 3

Cells large, semi-lunated, 12–13 times longer than broad, slightly curved with 35–50° of arc, both dorsal as well as ventral margins convex, ventral is more curved, fusiform mid-region, gradually narrowed towards the obliquely truncate poles, setaceous apical processes and slightly curved; striated cell wall, axial chloroplast with 3–7 lamellae exhibiting 3–6 pyrenoids, cells 362–490 µm long and 30–36 µm broad, apex 6–7 µm broad.

Site of collection: Chandubi Beel, Kamrup; Naitara Choutara

Beel, Goalpara; Keotkuchi Pond, Barpeta.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020); Arunachal Himalayas, Nath & Baruah (2021).

Closterium tumidulum f. *indicum* J.P.Keshri & D.Das 2016: 91, pl. XVI [16]: figs 316, 317

Cells medium-sized, 7–8 times longer than broad, strongly curved with 159° of arc, dorsal margin convex, ventral margin with slightly tumid mid-region, gradually narrowed towards the apices forming rounded poles, cell wall smooth and colourless, chloroplasts with 4 ridges, cells 114–130 µm long and 14–18 µm broad, apex 2–4 µm broad.

Site of collection: Gauhati University Pond, Kamrup (M).

New to northeastern India (Image 5).

Family: Desmidiaceae

Genus: *Actinotaenium*

Actinotaenium australe (Raciborski) Croasdale 1981: 4

Basionym: *Penium australe* Raciborski

Cells medium-sized, broadly elliptical in outline, about 1.5 times longer than broad, slightly constricted at the isthmus, very slight tapering towards the poles with broadly rounded apices, chloroplast with 6 longitudinal lamellae and a centrally placed large pyrenoid, cell wall punctate and colourless, cells 82–94 µm long, 57–64 µm broad and isthmus 54–56 µm broad.

Site of collection: Dhamar Beel, Goalpara.

New to northeastern India (Image 6).

Actinotaenium cucurbitinum var. *minutum* (Prescott) Tomaszewicz 1988: 44

Basionym: *Penium cucurbitinum* var. *minutum* Prescott

Cells small sized, about 2 times longer than broad, sinus a shallow notch, both lateral margins convex and slightly narrowing towards broadly rounded apices, punctate cell wall, axial chloroplast, cells 33–38 µm long, 16–18 µm broad and isthmus 14–15 µm broad.

Site of collection: Dheer Beel, Dhubri.

New to northeastern India (Image 7).

Actinotaenium cucurbita var. *rotundatum* (Willi Krieger) Teiling 1954: 407

Basionym: *Cosmarium cucurbita* f. *rotundatum* Krieger

Cells small sized, about 1.7–1.8 times longer than broad; sinus has a shallow notch; both lateral margins are convex, margins are slightly attenuated towards the poles, poles broadly rounded, cell wall with randomly organized fine punctate, axial chloroplast with longitudinal lamellae, cells 28–33 µm long, 15.7–18 µm broad and isthmus 14–16.5 µm broad.

Site of collection: Chandubi Beel, Kamrup; Koya Kujia Beel, Bongaigaon.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Actinotaenium globosum (Bulnheim) Kurt Förster ex Compère 1976: 456

Basionym: *Cosmarium globosum* Bulnheim

Cells small sized, about 1.5 times longer than broad, slightly constricted at the middle region, semicells semicircular, lateral sides convex, apices broadly rounded, cell wall with fine punctae, axial chloroplast with a centrally placed pyrenoid, cells 28–33 µm long, 19–22 µm broad and isthmus 17–18 µm broad.

Site of collection: Chandubi Beel, Kamrup; Bheriki Beel, Jorhat

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Actinotaenium perminutum (G. S. West) Teiling 1954: 410, fig. 60

Basionym: *Cosmarium perminutum* G. S. West

Cells very small sized, about 1.4 times longer than broad, sinus a shallow notch, lateral margins slightly attenuated towards broadly rounded poles, cell wall punctate, axial chloroplast with a centrally placed pyrenoid, cells 13–16 µm long, 9–11 µm broad and isthmus 7–8 µm broad.

Site of collection: Maguri Motapung Beel, Tinsukia.

New to northeastern India (Image 8).

Actinotaenium pseudoglobosum Kurt Förster 1981: 237; pl. 2, fig. 20

Cells medium-sized, about 1.6–1.7 times longer than broad, sinus a slight notch, broadly elliptical semicells with rounded apex, cell wall with fine punctae, radiated chloroplast with pyrenoids, cells 58–84 µm long, 36–50 µm broad and isthmus 34–46 µm broad.

Site of collection: Haribhanga Beel, Nagaon.

New to northeastern India (Image 9).

Actinotaenium subglobosum (Nordstedt) Teiling 1954: 397

Basionym: *Cosmarium subglobosum* Nordstedt

Cells medium-sized, about 1.7 times longer than broad, sinus shallow notch, both apices and lateral margins broadly rounded, cell wall sparsely punctate, stellate axial chloroplast, having six longitudinal lamellae, cells long and broad, cells 65–87 µm long, 39–50 µm broad and isthmus 37–42 µm broad.

Site of collection: Chandubi Beel, Kamrup; Hasila Beel, Goalpara; Bhebeli Pond, Dhemaji.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Actinotaenium wollei (West & G. S. West) Teiling ex Ruzika & Pouzar 1978: 61

Basionym: *Cosmarium globosum* var. *wollei* West & G. S. West

Cells medium-sized, about 1.7–1.8 times longer than broad; sinus notched, elliptical semicells with rounded apex, cell wall with punctae, stellate chloroplast, cells 55–76 µm long and 30–44 µm broad and isthmus 27–40 µm broad.

Site of collection: Kapla Beel, Barpeta; Ulabari Pond, Nalbari.

New to northeastern India (Image 10).

Genus: *Bambusina*

Bambusina borreri (Ralfs) Cleve 1864: 496

Basionym: *Desmidium borreri* Ralfs

Cells barrel-shaped, slightly constricted at midregion, sinus a notch of shallow depth, semicells circular in top view, occasionally with 2 opposite mammillae, small basal inflation on both sides of isthmus, lateral sides straight towards apices, apices broadly truncate, cell wall with very slight longitudinal striations at poles, cells 20–27 µm long, 14–17 µm broad and apex 8–10 µm broad.

Site of collection: Urapad Beel, Goalpara; Naitara Choutara Beel, Goalpara; Bhebeli Pond, Dhemaji.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011).

Genus: *Cosmarium*

Cosmarium abruptum P. Lundell 1871: 43, pl. 2: fig. 22

Cells very small sized, almost as long as broad, median constriction deep, sinus open, pyramidal semicells with faintly un-

dulate apex, cell wall smooth, axial chloroplast with a centrally placed pyrenoid in each semicell, cells 11–15 µm long, 10–12 µm broad and isthmus 5–6 µm broad.

Site of collection: Dudhnoi College Pond, Goalpara.

New to northeastern India (Image 11).

Cosmarium angulatum f. *majus* (Grunow) W. B. Turner 1893: 56 (as 'major')

Basionym: *Euastrum angulatum* f. *major* Grunow

Cells medium-sized, about 1.5–1.6 times longer than broad, deeply constricted at midregion, isthmus thin with closed sinus, semicells 6-angled, basal angles rounded, lateral sides slightly convex above the basal angles and broadly rounded upper, lateral angles, then tapering and retuse to a narrow truncate apex, cell wall smooth, two chloroplasts in each semicells with two pyrenoids, cells 54–70 µm long, 35–43 µm broad and isthmus 11–15 µm broad.

Site of collection: Lakhimpur Pukhuri, Darrang.

New to northeastern India (Image 12).

Cosmarium angulosum Brébisson 1856: 127, pl. I [1]: fig. 17

Cells small sized, about 1.4–1.5 times longer than broad, median constriction deep, sinus open, subrectangular semicells, angular-elliptical in apical view, subcircular in lateral view, straight or very slightly convex lateral sides, apices truncately rounded, cell wall with punctae, single chloroplast with one pyrenoid, cells 12–18 µm long, 10–12 µm broad and isthmus 4–5 µm broad.

Site of collection: Jugi Beel, Golaghat.

Previous records and distribution in northeastern India: Dachi Lake, Hajong & Ramanujam (2018).

Cosmarium auriculatum Reinsch 1875: 83, Chlorophyllophyceae, pl. XIV [14]: fig. 5

Cells medium-sized, almost as long as broad, median constriction deep, sinus widely open, semicells transversely elliptic or slightly pyramidal with broadly rounded apices, apical notch absent, semicells circular in side view and elliptical in top view, basal angles of the semicells equipped with 3 stout processes, cell wall punctate, chloroplast with 2 pyrenoids in each semicell, cells 44–47 µm long, 45–49 µm broad and isthmus 22–24 µm broad.

Site of collection: Laokhoa Beel, Dhubri.

New to northeastern India (Image 13).

Cosmarium baffinense R. M. Whelden 1947: 73, pl. VI: fig. 2 (as 'baffinensis')

Cells very small sized, almost as long as broad, hexagonal semicells with nearly rounded angles, deeply constricted at mid-region, linear and closed sinus, lateral margins angularly concave, apex broad and flat, cell wall with fine punctae, cells 9–11 µm long, 10–11 µm broad and isthmus 3–4 µm broad.

Site of collection: Chakoli Beel, Majuli.

New to northeastern India (Image 14).

Cosmarium blyttii Wille 1880: 25, pl. 1: fig. 7

Cells very small sized, about 1.2–1.3 times longer than broad, median constriction deep, sinus closed, semi-cells subrectangular, chloroplasts with pyrenoids in each semicell, cell wall granular, cells 15–20 µm long, 12–15 µm broad and isthmus 4–6 µm broad.

Site of collection: Morakolong, Nagaon; Gandhi Beel, Barpeta.

New to northeastern India (Image 15).

Cosmarium botrytis Meneghini ex Ralfs 1848: 99, pl. XVI [16]: fig. 1

Cells medium-sized, about 1.2–1.4 times longer than broad, deeply constricted at mid-region, sinus narrowly linear, semicells ovate-pyramidal, lateral margins convex, apex truncate with rounded angles, cell wall equipped with concentric series of radiating granules, granules absent in the apices, cells 37–52 µm long, 29–36 µm broad and isthmus 12–16 µm broad.

Site of collection: Chandubi Beel, Kamrup; Sibasthan-Potakol-long, Nagaon.

Previous records and distribution in northeastern India: Urpadi Beel, Deka et al. (2011); Dachi Lake, Hajong. & Ramanujam (2018); Chandubi Beel, Nath & Baruah (2020).

Cosmarium brebissonii Meneghini ex Ralfs 1848: 100, pl. XVI [16]: fig. 3 a, b

Cells medium-sized, about 1.2–1.4 times longer than broad, deeply constricted at mid-region, sinus closed, semicells semicircular, lateral margins convex, apex broadly truncate with rounded angles, entire cell wall furnished with concentric series of stout granules including the apices, cells 32–46 µm long, 26–31 µm broad and isthmus 7–9 µm broad.

Site of collection: Dakra Beel, Dhubri.

New to northeastern India (Image 16).

Cosmarium calcareum Wittrock 1872: 58, pl. 4: fig. 13

Cells small sized, almost as long as broad, median constriction deep, sinus narrowly linear, semicells trapezoid, basal angles sub rectangular, lateral sides with 4–6 crenations, apex truncate with 5–6 faint and minute crenations, cell wall furnished with minute granules and a small granulate tumour in the centre, cells 19–21 µm long, 18–19 µm broad and isthmus 5–6 µm broad.

Site of collection: Rajapukhuri Ghagrapar, Nalbari.

New to northeastern India (Image 17).

Cosmarium coarctatum West 1892: 724, pl. IX [9]: fig. 11

Cells very small sized, about 1.3–1.4 times longer than broad, with shallow median constriction, sinus 'V' shaped notch and open outwardly, semicells rectangular, basal angles rounded, lateral sides almost parallel to a flat truncate apex, cell wall smooth, cells 12–14 µm long, 9–10 µm broad and isthmus 5–6 µm broad.

Site of collection: Bogibil Ghat, Dibrugarh.

New to northeastern India (Image 18).

Cosmarium connatum Brébisson ex Ralfs 1848: 108, pl. XVII [17]: fig. 10

Cells medium-sized, about 1.4 times longer than broad, shallow median constriction, sinus widely open, semicells transversely sub-elliptic, with a broad base, apex slightly flattened, cell wall with fine punctae, chloroplast with 2 large pyrenoids in each semicell, cells 59–66 µm long, 40–47 µm broad and isthmus 34–37 µm broad.

Site of collection: Diplai Beel, Kokrajhar; Akhara Beel, Barpeta; Bornijora Pond, Jalah Kamrup.

Previous records and distribution in northeastern India: Kokrajhar, Das (2020).

Cosmarium contractum var. *minutum* (Delponte) Coesel 1989: 183, pl. 2: fig. 4

Basionym: *Cosmarium minutum* Delponte

Cells small sized, about 1.4 times longer than broad, deeply constricted at midregion, sinus V-shaped and widely open, semicells almost circular, axial chloroplast with a centrally placed pyre-

noid, cell wall smooth, cells 27–32 µm long, 19–22 µm broad and isthmus 4–5 µm broad.

Site of collection: Chandubi Beel, Kamrup; Rawmari Beel, Nagaon; Borphukhuri Ghagrapar, Nalbari.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020); Kokrajhar, Das (2020).

Cosmarium cycladatum W. B. Turner 1893: 54, pl. VIII [8]: fig. 12

Cells medium-sized, about 1.3–1.4 times longer than broad, deeply constricted at middle region with closed sinus, semicells semicircular, basal angles thin, lateral sides moderately convex then gradually tapering to form broadly rounded apices, lateral sides granulate-crenate, crenulations broad with two-minute projections at two angles each, the face of the semicells with a group of elongate thickenings extending below the apex, cell wall otherwise smooth, cells 40–55 µm long, 29–37 µm broad and isthmus 10–13 µm broad.

Site of collection: Dheer Beel, Dhubri; Ghunkuchi Beel, Nalbari.

Previous records and distribution in northeastern India: Kokrajhar, Das (2020).

Cosmarium cyclicum var. *arcticum* (Nordstedt) Gutwinski 1897: 147

Basionym: *Cosmarium cyclicum* subsp. *arcticum* Nordstedt

Cells medium-sized, almost as long as broad, subcircular or slightly hexagonal-circular, median constriction deep, sinus linear, semicells semicircular and margins with crenations, within the margin bigranulate, ornamental granules in a series of radial and concentric series, cells 38–43 µm long, 41–45 µm broad and isthmus 13–15 µm broad.

Site of collection: Lakhimpur pukhuri, Darrang.

New to northeastern India (Image 19).

Cosmarium cyclicum var. *crassum* R. M. Whelden 1947: 78, pl. V [5]: fig. 8

Cells moderately large, about 1.1 times longer than broad, circular-elliptic, median constriction deep, the sinus narrowly linear with dilated outwardly, semicells semi-circular with rounded basal angles, cell wall uniformly crenate with about 18 crenae and with one row of small furrows within the margin, axial chloroplast, two pyrenoids per semicells, cells 68–81 µm long, 60–68 µm broad and isthmus 20–23 µm broad.

Site of collection: Jogorahabi Beel, Sivasagar.

New to northeastern India (Image 20).

Cosmarium decoratum West & G. S. West 1895: 61, pl. VII [7]: fig. 21

Cells medium-sized, about 1.2–1.3 times longer than broad, median constriction very deep, sinus narrow and linear, semicells semi-elliptic, apices flat and truncate with broadly rounded angles, crenations at the margin, each semicell with two chloroplasts and two pyrenoids, cells 49–63 µm long, 40–47 µm broad and isthmus 13–16 µm broad.

Site of collection: Chandubi Beel, Kamrup; Chakoli Beel, Majuli; Kursakati Pond, Kokrajhar.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020); Kokrajhar, Das (2020).

Cosmarium densegranulatum Skuja 1928: 154, pl. III [3]: figs 17–20

Cells small sized, about 1.1 times broader than long, median

constriction deep, sinus narrow and linear, semicells elliptic, both basal as well as apical angles rounded, lateral sides with denticulations, cell wall granulated, parietal chloroplast, single per semicell, cells 22–25 µm long, 19–22 µm broad and isthmus 6–7 µm broad.

Site of collection: Chandubi Beel, Kamrup; Dolani Beel, Bongaigaon.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Cosmarium dorsitruncatum var. *pseudoscenedesmus* (West & G. S. West) Willi Krieger & Gerloff 1962: 26

Basionym: *Cosmarium pseudoscenedesmus* West & G. S. West

Cells small sized, about 1.2 times broader than long, median constriction very deep, sinus open outwardly, semicells trapeziform, apices flatly truncate and basal angles rounded, chloroplast axial, with one pyrenoid in each semicell, cells 18–23 µm long, 23–28 µm broad and isthmus 6–8 µm broad.

Site of collection: Chandubi Beel, Kamrup; Borphukhuri, Kamalpur Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Cosmarium forceps Brühl & Biswas 1926: 286, pl. 15: fig. 86

Cells medium-sized, about 1.2–1.3 times broader than long, almost circular, moderately constricted at midregion, broad isthmus, sinus open outwardly, semicells sub-semicircular, apices rounded, cell wall smooth, parietal chloroplast, pyrenoids 2 in number, cells 34–45 µm long, 42–59 µm broad and isthmus 20–24 µm broad.

Site of collection: Chandubi Beel, Kamrup; Bhomoraguri Pond, Nagaon; Dighali Beel, Sivasagar; Kumri Beel, Goalpara; Naitara Choutara Beel, Goalpara; Barpeta Beel, Nagaon; Tamranga Beel, Bongaigaon; Katara Beel Paikarkuchi, Nalbari; Deepor Beel, Kamrup (M); Kusumfula Beel, Goalpara; Jor Beel, Jorhat; Lakhimpur pukhuri, Darrang; Pond near Tangla College, Udalguri; Koladuwar Beel, Golaghat; Chakoli Beel, Majuli; Maguri Motapung Beel, Tinsukia; Sripani Pond, Dhemaji; Pachi Gaon Pond, Sonitpur; Majkuchi Pond, Kamrup; Kachodhora Beel, Morigaon; Diplai Beel, Kokrajhar; Dakra Beel, Dhubri; Koya Kujia Beel, Bongaigaon; Sorbhog Beel, Barpeta; Keotkuchi Pond, Barpeta; Raja Beel, Baksa; Jiyeni Beel, Kamrup; Goalnani Pond, Dhubri; Shamaguri Beel, Nagaon; Kapla Beel, Barpeta; Ulabari Pond, Nalbari.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); Chandubi Beel, Nath & Baruah (2020); Arunachal Himalayas, Nath & Baruah (2021).

Cosmarium galeritum var. *subtumidum* O. Borge 1903: 95, pl. 3: fig. 14

Cells medium-sized, about 1.2 times longer than broad, median constriction deep, sinus closed, pyramidal semicells, both basal and apical angles approximately rounded, two parietal chloroplasts with several radiating ridges in each semicell, pyrenoids two in number, cells 49–60 µm long, 43–48 µm broad and isthmus 21–24 µm broad.

Site of collection: Chandubi Beel, Kamrup; Madhab Choudhury College Pond, Barpeta; Rajapukhuri, Nahira Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Cosmarium garrolense J. Roy & Bisset 1894: 101, pl. 2: fig. 4

Cells small sized, about 1.3 times longer than broad, median constriction deep, sinus linear and closed, semicells semi-circular, basal angle nearly rounded, lateral walls evenly convex with four undulations on each side of semicells, apex broad and flatly round-

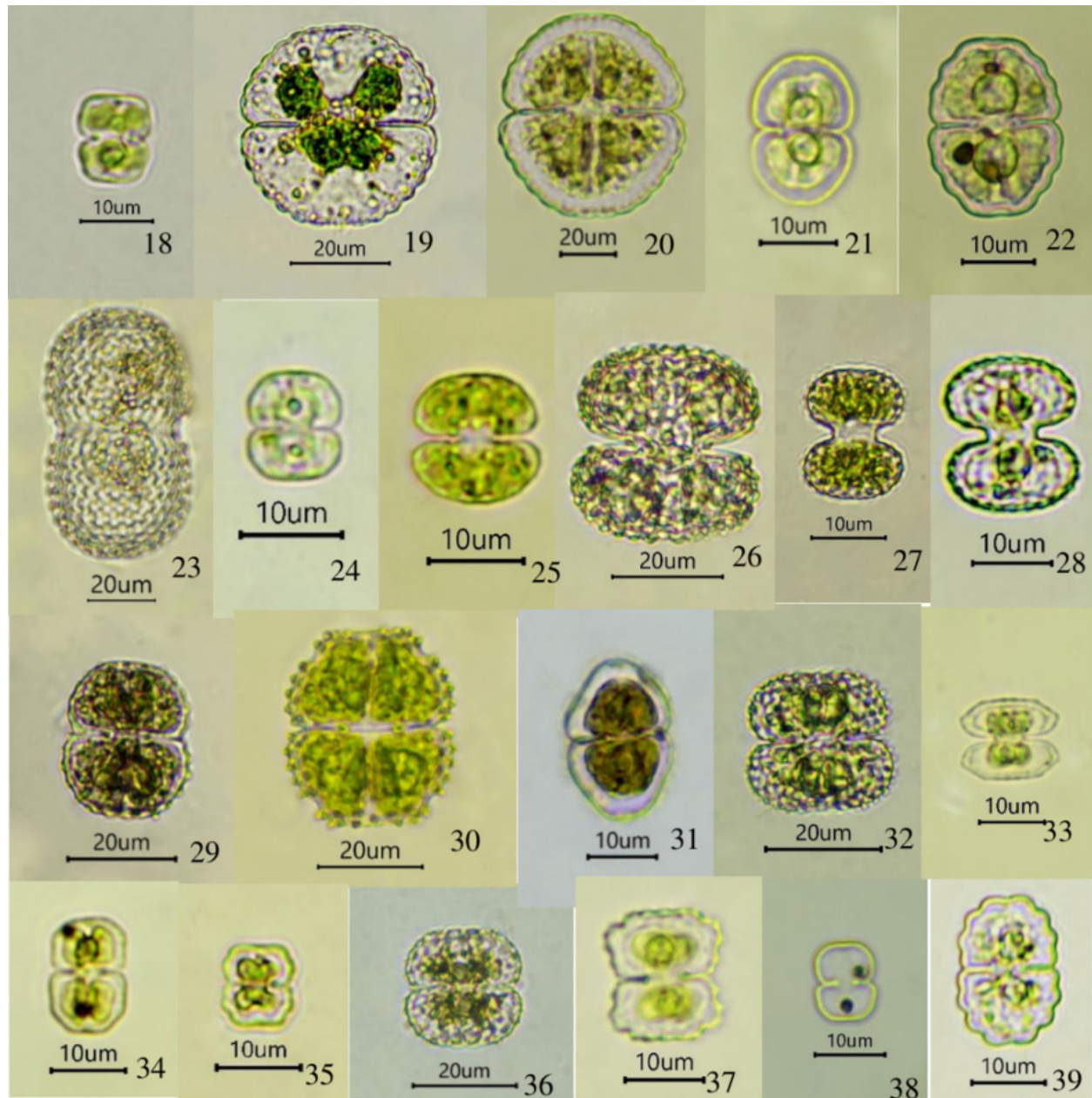


Image 18–39. 18—*Cosmarium coarctatum* | 19—*Cosmarium cyclicum* var. *arcticum* | 20—*Cosmarium cyclicum* var. *crassum* | 21—*Cosmarium granatum* var. *subangulare* | 22—*Cosmarium impressulum* var. *crenulatum* | 23—*Cosmarium mansangense* | 24—*Cosmarium minimum* var. *subrotundatum* | 25—*Cosmarium neodepressum* var. *reniforme* | 26—*Cosmarium ordinatum* | 27—*Cosmarium porteanum* | 28—*Cosmarium porteanum* var. *nephroideum* | 29—*Cosmarium praemorsum* | 30—*Cosmarium pseudoarmatum* | 31—*Cosmarium pseudogranatum* | 32—*Cosmarium punctulatum* var. *depressum* | 33—*Cosmarium pygmaeum* | 34—*Cosmarium rectangulare* var. *cambrense* | 35—*Cosmarium regnellii* var. *minimum* | 36—*Cosmarium reniforme* var. *minus* | 37—*Cosmarium seelyanum* | 38—*Cosmarium sexangulare* var. *minus* | 39—*Cosmarium undulatum* f. *reductum*

ed, cell wall smooth, cells 21–25 µm long, 16–18 µm broad and isthmus 5–6 µm broad.

Site of collection: Dighali Beel, Nagaon; Morakolong, Nagaon.

Previous records and distribution in northeastern India: Urpad Beel, Deka et al. (2011).

Cosmarium granatum Brébisson ex Ralfs 1848: 96, pl. XXXII [32]: fig. 6

Cells small sized, about 1.3–1.5 times longer than broad, elliptic, deeply constricted at midregion, sinus linear and opened outwardly, semicells truncate, pyramidal with rounded basal angles, lateral sides almost straight or slightly convex, chloroplast axile with only one pyrenoid, cells 22–29 µm long, 16–19 µm broad and isthmus 6–7 µm broad.

Site of collection: Urpad Beel, Goalpara; Deepor Beel, Kamrup (M); Digholi Beel, Kamrup; Dighalipukhuri, Kamrup (M).

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011); Khanajan, Baruah & Baruah (2013); Dachi Lake, Hajong & Ramanujam (2018); Deepor Beel, Baruah et al. (2020).

Cosmarium granatum var. *subangulare* West & G. S. West 1895: 54, pl. VIII: fig 4

Cells small sized, about 1.3–1.5 times longer than broad, median constriction deep, sinus closed, semicircular semicells, basal angles rounded, lateral margins convex and gradually slightly tapered towards retuse apex, cell wall smooth, chloroplast axial with a centrally placed pyrenoid in each semicell, cells 19–24 µm long, 14–16 µm broad and isthmus 5–6 µm broad.

Site of collection: Haribhanga Beel, Nagaon; Koya Kujia Beel, Bongaigaon; Dosomighat Pond, Bongaigaon.

New to northeastern India (Image 21).

Cosmarium hammeri Reinsch 1866: 115, pl. XXII [22] B 1: figs 1–10

Cells small sized, about 1.3–1.4 times longer than broad, median constriction deep, sinus linear and closed, semicells trapeziform, both basal as well as apical angles broadly rounded, lateral margins slightly concave and apex broad and truncate, axile chloroplasts with single pyrenoid in each semicell, cells 25–31 µm long, 18–22 µm broad and isthmus 7–8 broad.

Site of collection: Deepor Beel, Kamrup (M); Konuri Beel, Dhubri.

Previous records and distribution in northeastern India: Deepor Beel, Baruah et al. (2020).

Cosmarium impressulum Elfving 1881: 13, pl. I: fig. 9

Cells small sized, about 1.5–1.6 times longer than broad, median constriction deep, sinus narrowly linear and closed, semicells elongate semicircular, with rounded basal angles, lateral walls almost parallel and furnished with four undulations, retuse at apex, cell wall smooth; parietal chloroplast, cells 23–28 µm long, 15–17 µm broad, isthmus 4–5 µm broad.

Site of collection: Chandubi Beel, Kamrup; Bhomoraguri Pond, Nagaon.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Cosmarium impressulum var. *crenulatum* (Nägeli) Willi Krieger & Gerloff 1965: 136, pl. 29: fig. 6

Basionym: *Cosmarium crenulatum* Nägeli

Cells small sized, about 1.2–1.3 times longer than broad, median constriction deep, sinus narrowly linear, outline oval with regularly undulated lateral walls, semicells transversely hexagonal, in apical view elliptical, in lateral view broadly oval, cell wall smooth, axial chloroplast with a centrally placed pyrenoid in each semicell, cells 24–30 µm long, 19–22 µm broad and isthmus 4–5 µm broad.

Site of collection: Rajapukhuri Ghagrapar, Nalbari.

New to northeastern India (Image 22).

Cosmarium impressulum var. *suborthogonum* (Raciborski) Taft 1945: 195, pl. 3: fig. 9 f

Basionym: *Cosmarium suborthogonum* Raciborski

Cells small sized, about 1.4–1.5 times longer than broad; median constriction deep, sinus narrowly linear and closed but slightly dilated at the apex, semicells subsemicircular, the basal angles broadly rounded, the lateral sides in the basal portion of the semicell parallel, the upper lateral sides with two undulations, retuse at the middle, cell wall smooth, cells 17–24 µm long, 12–16 µm

broad and isthmus 5–6 µm broad.

Site of collection: Duminichowki Pond, Kamrup; Dighali Beel, Sivasagar; Gauhati University Pond, Kamrup (M).

Previous records and distribution in northeastern India: Manmecho Lake, Das & Keshri (2012).

Cosmarium javanicum Nordstedt 1880: 7, pl. 1: fig 10

Cells large sized, about 1.8 times longer than broad, median constriction a shallow notch, sinus linear and closed but slightly opened at the end; semicells rounded obovate, lateral walls evenly convex, apex broadly rounded; basal angles narrowly rounded; cell wall striated and with irregularly organized large punctae, cells 138–160 µm long, 72–87 µm broad and isthmus 50–55 µm broad.

Site of collection: Chandubi Beel, Kamrup; Jaysagar Pukhuri, Sivasagar.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Cosmarium lundellii Delponte 1877: 13, pl. 7: figs 62–64

Cells medium-sized, about 1.2–1.3 times longer than broad, median constriction deep, sinus narrowly linear and slightly dilated at the end, semicells sub semi-circular with broadly rounded apices, cell wall punctate, punctate small, chloroplast parietal with large pyrenoids, cells 48–59 µm long, 40–45 µm broad and isthmus 16–19 µm broad.

Site of collection: Chandubi Beel, Kamrup; Bogibil Ghat, Dibrugarh; Narpara Pond, Nalbari; Charan Beel, Morigaon; Dosomighat Pond, Bongaigaon.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020); Arunachal Himalayas, Nath & Baruah (2021).

Cosmarium lundellii var. *corruptum* (W. B. Turner) West & G.S. West 1902: 162

Basionym: *Cosmarium corruptum* W. B. Turner

Cells medium-sized, almost as long as broad, median constriction deep, sinus widely open, semicells sub semi-circular with broadly rounded apices, cell wall with small punctae, chloroplast parietal with two pyrenoids in each semicell, cells 38–45 µm long, 36–40 µm broad and isthmus 16–18 µm broad.

Site of collection: Chandubi Beel, Kamrup; Digholi Beel, Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Cosmarium mansangense West & G. S. West 1908: 209, pl. XIV [14]: fig 15

Cell medium-sized, almost cylindrical, about 1.6 times longer than broad, median constriction shallow, sinus opened, semicells cylindrically-oblong, lateral margins almost straight, basal angles very slightly rotund, the apices broadly rounded, cell wall granulated, granules arranged in vertical series, chloroplast parietal, two pyrenoids per semicell, cells 67–72 µm long, 40–43 µm broad and isthmus 31–34 µm broad.

Site of collection: Shamaguri Beel, Nagaon.

New to northeastern India (Image 23).

Cosmarium minimum var. *subrotundatum* West & G. S. West 1895: 59, pl. VIII: fig 11

Cells very small sized, about 1.2–1.3 times longer than broad, median constriction moderately deep, sinus narrowly linear and nearly closed, elliptical semicells with broadly rounded basal angles, cell wall smooth, axial chloroplast with single pyrenoid in

each semicell, cells 10–12 µm long, 8–9 µm broad and isthmus 4–6 µm broad.

Site of collection: Dolani Beel, Bongaigaon.

New to northeastern India (Image 24).

Cosmarium miscellum Skuja 1964: 222, pl. XXXIX [39]: fig. 11

Cells medium-sized, about 1.2 times longer than broad, median constriction deep, sinus linear but open at extremities, semicells compressed semicircular with 22–26 marginal crenulations, cell wall granulate, granules arranged on periphery, in central tumour granules arranged in vertical series, cells 34–46 µm long, 30–37 µm broad and isthmus 14–16 µm broad.

Site of collection: Deepor Beel, Kamrup (M); Gaurangtari Pond, Dhubri; Koya Kujia Beel, Bongaigaon.

Previous records and distribution in northeastern India: Arunachal Pradesh, Das & Adhikary (2012); Khanajan, Baruah & Baruah (2013); Deepor Beel, Baruah et al. (2020).

Cosmarium neodepressum var. *minutum* (Heimerl) G. J. P. Ramos & C. W. N. Moura 2020: 2

Basionym: *Cosmarium depressum* f. *minutum* Heimerl

Cell small sized, nearly as broad as long, median constriction deep, sinus widely opened with V like notch at extremities, semicells elliptic with truncately rounded apex, chloroplast axial with single pyrenoid in each semicell, cell wall smooth, cells 15–20 µm long, 14–18 µm broad and isthmus 4–5 µm broad.

Site of collection: Chandubi Beel, Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Cosmarium neodepressum var. *reniforme* (West & G. S. West) G. J. P. Ramos & C. W. N. Moura 2020: 2

Basionym: *Cosmarium depressum* var. *reniforme* West & G. S. West.

Cells small sized, slightly longer than broad, median constriction deep, sinus linear and open, reniform semicells with broadly rounded apex, chloroplast axial with single pyrenoids in each semicell, cells 21–27 µm long, 19–23 µm broad and isthmus 4–5 µm broad.

Site of collection: Raja Beel, Baksa; Ulabari Pond, Nalbari.

New to northeastern India (Image 25).

Cosmarium nitidulum De Notaris 1867: 42, pl. III [3]: fig. 26

Cells small sized, about 1.3–1.4 times longer than broad, median constriction deep, sinus narrowly linear and slightly opened at the extremities, semicells truncate semicircular with broadly rounded basal as well as apical angles, lateral sides slightly convex, apex truncately rounded, cell wall minutely punctate, two axial chloroplasts in each semicell with single central pyrenoid, cells 28–37 µm long, 21–25 µm broad and isthmus 7–8 µm broad.

Site of collection: Dagaon Pond, Nagaon; Dudhnoi College Pond, Goalpara; Borphukhuri, Kamalpur Kamrup.

Previous records and distribution in northeastern India: Naga-land, Das & Adhikary (2012).

Cosmarium norimbergense Reinsch 1867: 117, pl. 22: figs A-IV: 1–11

Cells small sized, about 1.2–1.3 times longer than broad, median constriction deep, sinus narrow, linear, closed, semicells subrectangular with an undulation just above the rounded basal angles, apex with rounded angles and almost straight border, cell wall smooth, axial chloroplast with single pyrenoid in each semicells, cells 12–16 µm long, 10–12 µm broad and isthmus 4–5 µm broad.

Site of collection: Gandhi Beel, Barpeta; Bheriki Beel, Jorhat; Sripani Pond, Dhemaji; Shamaguri Beel, Nagaon.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); Arunachal Himalayas, Nath & Baruah (2021).

Cosmarium norimbergense var. *depressum* (West & G. S. West) Willi Krieger & Gerloff 1969: 292, pl. 48: fig. 1

Basionym: *Cosmarium norimbergense* f. *depressum* West & G.S. West.

Cells very small sized, almost as long as broad, deeply constricted at middle, sinus narrowly linear and slightly opened at extremities, semicell subrectangular, lateral margins without undulations, apex with rounded angles and almost straight border, cell wall smooth, axial chloroplast with one pyrenoid in each cell, cells 7–10 µm long, 7–9 µm broad and isthmus 3–4 µm broad.

Site of collection: Dandua Beel, Morigaon; Hasila Beel, Goalpara; Ghunkuchi Beel, Nalbari.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); Arunachal Himalayas, Nath & Baruah (2021).

Cosmarium obsoletum (Hantzsch) Reinsch 1867: 142, pl. 22:D:1: figs 1–4

Basionym: *Arthrodesmus obsoletus* Hantzsch

Cells medium-sized, transversely elliptic, almost as long as broad, median constriction deep, sinus narrow linear, closed except the extremities, semicells semicircular, apices broadly rounded, basal angles mammillately condensed, side angles slightly convex, 2 axial chloroplasts in each semicells with a centrally placed pyrenoid, cell wall punctate, cells 62–65 µm long, 61–63 µm broad and isthmus 32–34 µm broad.

Site of collection: Deepor Beel, Kamrup (M); Bharalichuk Pond, Dhemaji; Radhapukhuri, Lakhimpur; Sibasthan-Potakollong, Nagaon.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); North Eastern India, Yasmin et al. (2011); Khanajan, Baruah & Baruah (2013); Deepor Beel, Baruah et al. (2020).

Cosmarium ordinatum (Børgesen) West & G. S. West 1896: 251, pl. 15: fig. 14

Basionym: *Cosmarium brasiliense* var. *ordinatum* Børgesen

Cells medium-sized, almost as long as broad, semicells slightly reniform, median constriction deep, sinus open and V shaped, cell wall verrucate, verrucae arranged in groups of 2–4 or 6–7 parallel rows in the middle of semicells, cells 35–39 µm long, 32–34 µm broad and isthmus 12–14 µm broad.

Site of collection: Naitara Choutara Beel, Goalpara.

New to northeastern India (Image 26).

Cosmarium pakistanicum A. K. Islam 1971: 926, pl. XIV [14]: fig. 2; pl XXIII [23]: figs 1–10

Cells large sized, about 1.6–1.8 times longer than broad, shallow constriction at the middle, sinus narrowly linear and closed, semicells broadly elliptic-pyramidal, basal angles narrowly rounded, lateral sides slightly retuse in the basal half then again slightly convex, apex broadly rounded, chloroplast with 10 longitudinal ridges, cell wall punctate, punctae irregularly arranged, cells 103–125 µm long, 62–69 µm broad and isthmus 47–50 µm broad.

Site of collection: Dheer Beel, Dhubri; Gaurangtari Pond, Dhubri; Borpukhuri Ghagrapar, Nalbari; Gauhati University Pond, Kamrup (M).

Previous records and distribution in northeastern India: Kokrajhar, Das (2020).

Cosmarium porteanum W. Archer 1860: 49, pl. I [1]: fig. 8, 9 (as 'Portianum')

Cells small sized, about 1.4–1.5 times longer than broad, deeply constricted at the middle, sinus widely opened, semicells elliptic, cell wall granulate, rounded granules arranged in vertical series, axial chloroplast with single pyrenoid in each semicell, cells 17–23 µm long, 12–15 µm broad and isthmus 6–7 µm broad.

Site of collection: Sorbhog Beel, Barpeta; Tinkonia Pukhuri, Jorhat; Akhara Beel, Barpeta; Bornijora Pond, Jalah Kamrup.

New to northeastern India (Image 27).

Cosmarium porteanum f. *pseudoporteanum* J. P. Keshri & D. Das 2016: 116, pl. VI [6]: figs 187, 188

Cells small sized, about 1.4–1.5 times longer than broad, median constriction deep, sinus widely open with rounded margins, semicells circular, cell wall granulate, rounded granules arranged in seven vertical series, axial chloroplast with single pyrenoid in each semicell, cells 21–25 µm long, 14–17 µm broad and isthmus 7–8 µm broad.

Site of collection: Jiyeni Beel, Kamrup; Konuri Beel, Dhubri.

Previous records and distribution in northeastern India: Arunachal Himalayas, Nath & Baruah (2021).

Cosmarium porteanum var. *nephroideum* Wittrock 1872: 57 (as 'portianum' var. *nephroideum*)

Cells small sized, about 1.1–1.3 times longer than broad, median constriction deep, sinus broadly open, semicells semicircular-elliptic, cell wall with granules arranged in 7 longitudinal series, cells 19–24 µm long, 16–18 µm broad and isthmus 6–8 µm broad.

Site of collection: Kapla Beel, Barpeta; Dolani Beel, Bongaigaon.

New to northeastern India (Image 28).

Cosmarium praemorsum Brébisson 1856: 128, pl. I: fig. 8

Cells medium-sized, about 1.2 times longer than broad, median constriction deep, sinus narrowly linear, Semicells subcircular with flattened apex, cell wall granulate, granules on the face of the semicells are small and disposed roughly in concentric series, but gradually diminishing towards the center, in top view semicell rhomboid-elliptic and slightly tumid at the middle on each margin, center of the semicell is devoid of granules, axile chloroplast with single pyrenoid in each semicell, cells 29–40 µm long, 24–31 µm broad, and isthmus 8–11 µm broad.

Site of collection: Barsola Beel, Jorhat.

New to northeastern India (Image 29).

Cosmarium pseudoamoenum Wille 1884: 18, pl. I [1]: fig. 37

Cells medium-sized, about 2 times longer than broad, median constriction a shallow notch, oblong semicells with slightly convex lateral sides, cell wall with concentric series of small granules, chloroplast with single pyrenoid in each semicell, cells 60–76 µm long, 30–36 µm broad and isthmus 19–22 µm broad.

Site of collection: Mohmara Pond, Sonitpur.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011).

Cosmarium pseudoarmatum A. M. Scott & Prescott 1958: 49, fig. 14: 3

Cells medium-sized, about 1.3 times longer than broad, sinus narrowly linear and slightly dilated at extremities, semicells hemi-

spherical with an undulation near the apex, apex almost flat, cell wall furnished with series of stout granules, cells 38–45 µm long, 29–33 µm broad and isthmus 11–13 µm broad.

Site of collection: Pond near Tangla College, Udalguri.

New to northeastern India (Image 30).

Cosmarium pseudoconnatum Nordstedt 1870: 214, pl. III [3]: fig. 17

Cells small sized, about 1.2–1.3 times longer than broad, median constriction deep, sinus closed, semicells pyramidal, lateral margins convex with truncate-rounded apex, cell wall with minute punctae, chloroplast with single pyrenoid in each semicell, cells 20–24 µm long, 16–18 µm broad and isthmus 4–5 µm broad.

Site of collection: Jogorahabi Beel, Sivasagar; Dagaon Pond, Nagaon.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011).

Cosmarium pseudogranatum Nordstedt 1870: 211, pl. III [3]: fig. 27

Cells small sized, about 1.2–1.3 times longer than broad, median constriction deep, sinus closed, semicells pyramidal, lateral margins convex with truncate-rounded apex, cell wall with minute punctae, chloroplast with single pyrenoid in each semicell, cells 20–24 µm long, 16–18 µm broad and isthmus 4–5 µm broad.

Site of collection: Maguri Motapung Beel, Tinsukia.

New to northeastern India (Image 31).

Cosmarium punctulatum Brébisson 1856: 129, pl. I [1]: fig. 16

Cells small sized, about 1.1 times longer than broad, median constriction very deep, sinus closed but slightly dilated at extremities, semicells oblong-trapeziform with rounded basal angles, apex broadly truncate, in side view semicells circular, in top view cell elliptic, cell wall furnished with small granules, axial chloroplasts with single pyrenoid in each semicell, cells 20–26 µm long, 18–21 µm broad and isthmus 7–8 µm broad.

Site of collection: Jor Beel, Jorhat; Jugi Beel, Golaghat; Shama-guri Beel, Nagaon.

Previous records and distribution in northeastern India: Sivasagar, Phukan & Bora (2012); Urapad Beel Deka et al. (2011).

Cosmarium punctulatum var. *depressum* W. B. Turner

Cell small sized, almost as long as broad, median constriction deep, sinus narrowly linear but slightly dilated at extremities, semicells elliptical and slightly truncated, cell wall furnished with granules on horizontal series, axial chloroplasts with single pyrenoid in each semicell, cells 23–27 µm long 26–30 µm broad and isthmus 9–10 µm broad.

Site of collection: Gatanga Beel, Nagaon.

New to northeastern India (Image 32).

Cosmarium pygmaeum W. Archer 1864: 174, pl. 6: figs. 45–49 (as 'pygmæum')

Cells very small sized, slightly broader than long, median constriction deep, sinus narrowly linear but widely open at extremities, semicells oblong hexagonal, both basal as well as apical angles sharp, apex widely truncate with straight margins, a faint swelling at the center of each semicell, cell wall smooth, chloroplast with single pyrenoid in each semicell, cells 12–14 µm long, 14–16 µm broad and isthmus 4–5 µm broad.

Site of collection: Dheer Beel, Dhubri.

New to northeastern India (Image 33).

Cosmarium pyramidatum Brébisson ex Ralfs 1848: 94, pl. XV [15]: fig. 4

Cells large sized, about 1.5–1.8 times longer than broad, median constriction shallow, sinus narrow, pyramidal semicells, lateral sides somewhat convex, gradually attenuated towards truncate apex with rounded angles, basal angles acutely rounded, cell wall with two types of punctae, fine and slightly bigger punctae, intermixed with each other, cells 90–123 µm long, 59–68 µm broad and isthmus 48–52 µm broad.

Site of collection: Kumri Beel, Goalpara.

Previous records and distribution in northeastern India: Sivasagar, Phukan & Bora (2012); Urapad Beel Deka et al. (2011).

Cosmarium quadrum P. Lundell 1871: 25, pl. II [2]: fig. 11

Cells medium-sized, almost as long as broad, median constriction deep, sinus narrowly linear and slightly opened at margins, semicells quadrate, flattened, slightly depressed at the middle, lateral sides slightly convex, apex very slightly retuse, cell wall furnished with densely organised sloid granules, chloroplast axile with two pyrenoids per semicell, cells 48–53 µm long, 47–51 µm broad and isthmus 13–15 µm broad.

Site of collection: Narpara Pond, Nalbari; Deepor Beel, Kamrup (M); Digholi Beel, Kamrup; Dighalipukhuri, Kamrup (M).

Previous records and distribution in northeastern India: North Eastern India, Yasmin et al. (2011); Urapad Beel Deka et al. (2011); Sivasagar, Phukan & Bora (2012); Khanajan, Baruah & Baruah (2013); Deepor Beel, Baruah et al. (2020).

Cosmarium quadrum var. *minus* Nordstedt 1873: 11

Cells small sized, slightly broader than long, deeply constricted at the middle, narrowly linear sinus with a slightly opened extremity, semicells sub rectangular, rounded basal angles, broadly rounded apical angles, lateral walls slightly convex, apex slightly retuse, cell wall densely granulated with solid granules arranged in decussating sequence, at the margins of the semicells 23 granules are shown, in the middle of the apex the size of granules is slightly reduced, axile chloroplasts with two pyrenoids per semicell, cells 27–31 µm long, 30–34 µm broad and isthmus 9–11 µm broad.

Site of collection: Deepor Beel, Kamrup (M); Panpoor Ghat, Sonitpur; Dagaon Pond, Nagaon.

Previous records and distribution in northeastern India: Deepor Beel, Baruah et al. (2020); Urapad Beel Deka et al. (2011).

Cosmarium rectangulare var. *cambrense* (W. B. Turner) West & G. S. West 1896: 379

Basionym: *Cosmarium gotlandicum* var. *cambrense* W.B. Turner

Cells very small sized, about 1.5 times longer than broad, median constriction deep, sinus linear and slightly open towards the extremities, oblong semicells, lateral walls almost parallel with broadly rounded apical angles, cell wall punctate, punctae are densely scattered, axial chloroplasts with single or sometimes with two pyrenoids in each semicell, cells 15–18 µm long, 10–12 µm broad and isthmus 3–4 µm broad.

Site of collection: Lakhimpur pukhuri, Darrang.

New to northeastern India (Image 34)

Cosmarium regnellii var. *minimum* Eichler & Gutwinski 1894: 164, pl. IV [4]: fig. 6

Cells very small sized, about 1.1–1.2 longer than broad, median constriction deep, sinus narrowly linear and slightly dilated at the extremities, trapeziform to hexagonal semicells, lateral margins slightly convex, cell wall smooth, chloroplasts with single pyrenoid in each semicell, cells 9–12 µm long, 8–10 µm broad and

isthmus 3–4 µm broad.

Site of collection: Jor Beel, Jorhat.

New to northeastern India (Image 35).

Cosmarium regnesi Reinsch 1866: 116, pl. XXII [22]: A; III [3]

Cells very small sized, almost as long as broad, median constriction deep, sinus widely open, semi-cells rectangular with broadly truncate, rounded apical angles and wide sunken vertex, wall of the semicell with 6 small granules, 2 apical and 2 lateral, another two granules on the face of the semicells, chloroplasts with single pyrenoid in each semicell, cells 12–15 µm long, 10–12 µm broad and isthmus 4–5 µm broad.

Site of collection: Naitara Choutara Beel, Goalpara; Dudhnoi College Pond, Goalpara; Shamaguri Beel, Nagaon; Dolani Beel, Bongaigaon.

Previous records and distribution in northeastern India: Arunachal Himalayas, Nath & Baruah (2021).

Cosmarium reniforme var. *minus* Irénée-Marie

Cell small sized, almost as long as broad, median constriction deep, the sinus narrowly linear and closed, semicells reniform, cell wall with solid round granules arranged in obliquely decussating series, about 15–16 granules at the margins of the semicells, cells 20–24 µm long, 19–22 µm broad and isthmus 5–6 µm broad.

Site of collection: Hiloidhari majgao Beel, Dibrugarh; Koya Kujia Beel, Bongaigaon.

New to northeastern India (Image 36).

Cosmarium rosae Ruzicka 1949: 84, figs 1–9; pl. XV [15]

Cells medium-sized, about 1.1 times longer than broad, median constriction deep, sinus linear and closed except at the extremities, semicells elliptic-reniform, lateral walls with minute undulations, 5 undulations in each lateral side; apex broadly rounded, cell wall punctate, axial chloroplast with single pyrenoid in each semicell, cells 28–33 µm long, 25–28 µm broad and isthmus 10–12 µm broad.

Site of collection: Gohain Pukhuri, Sivasagar; Padumpukhuri, Sonitpur; Ulabari Pond, Nalbari.

Previous records and distribution in northeastern India: Arunachal Himalayas, Nath & Baruah (2021).

Cosmarium seelyanum Wolle 1883: 16, pl. XXVII [27]: figs 14, 14 a

Cells small sized, about 1.1–1.2 times longer than broad, median constriction deep, sinus narrow, linear and closed, Semicell oblong, apex with 4 undulations; lateral walls with 2–3 undulations in each side, cell wall granulate, semicircular in side view and elliptic in top view, chloroplast with single pyrenoid in each semicell, cells 17–22 µm long, 15–17 µm broad and isthmus 5–7 µm broad.

Site of collection: Dakra Beel, Dhubri.

New to northeastern India (Image 37).

Cosmarium sexangulare var. *minus* Roy & Bisset 1886: 195

Cells very small sized, about 1.2–1.3 times longer than broad, median constriction deep, sinus narrowly linear and open at extremities, semicells elliptic-hexagonal, basal and apical angles rounded, apex slightly concave, cell wall smooth, cells 10–13 µm long, 8–10 µm broad and isthmus 3–4 µm broad.

Site of collection: Rajapukhuri Ghagrapar, Nalbari.

New to northeastern India (Image 38).

Cosmarium sexnotatum Gutwinski 1893: 123, pl. II [2]: fig. 7

Cells small sized, slightly longer than broad, deep median con-

striction, sinus narrowly linear with slightly dilated extremities, semicells subquadrangular with rounded angles, lateral walls with 3 broad undulations, apex truncate with straight margins, cell wall granulate, granules arranged in 2–3 horizontal series in the margin, elliptic in vertical view; chloroplast axile with a centrally placed pyrenoid in each semicell, cells 15–22 µm long, 13–17 µm broad and isthmus 4–5 µm broad.

Site of collection: Bejorsuti Pond, Kamrup; Himatichuk Pond, Dhemaji; Mohmara Pond, Sonitpur.

Previous records and distribution in northeastern India: Khanajan, Baruah & Baruah (2013); Deepor Beel, Baruah et al. (2020).

Cosmarium subcrenatum Hantzsch 1868: 164

Cells medium-sized, about 1.3–1.4 times longer than broad, median constriction deep, sinus narrow, linear and closed, pyramidal or trapezoid semicells with flattened apex, apical angle rounded, cell wall uniformly granulated, axial chloroplast with 2 pyrenoids in each semicell, cells 32–35 µm long, 23–25 µm broad and isthmus 8–10 µm broad.

Site of collection: Deepor Beel, Kamrup (M); Deohati Pond, Bongaigaon.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011); Khanajan, Baruah & Baruah (2013); Meghalaya, Siangbood and Ramanujam (2014); Deepor Beel, Baruah et al. (2020).

Cosmarium subcostatum Nordstedt 1876: 37, pl. XII [12]: fig. 13

Cells medium-sized, about 1.3–1.4 times longer than broad, median constriction deep, sinus narrow, linear and closed, pyramidal or trapezoid semicells with flattened apex, apical angle rounded, cell wall uniformly granulated, axial chloroplast with 2 pyrenoids in each semicell, cells 32–35 µm long, 23–25 µm broad and isthmus 8–10 µm broad.

Site of collection: Urapad Beel, Goalpara.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011).

Cosmarium tithophorum Nordstedt 1880: 6, fig. 6

Cells small sized, almost as long as broad, median constriction deep, sinus broadly open, semicells elliptic, semicells diagonally elliptic with basal angles narrowly rounded, apex rounded, cell wall smooth except a median mamilli at the face of each semicell, chloroplast axial with single pyrenoid in each semicell, cells 19–22 µm long, 18–20 µm broad and isthmus 4–5 µm broad.

Site of collection: Chandubi Beel, Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Cosmarium undulatum f. *reductum* Croasdale 1956: 59, pl. 3: fig. 9 (as 'var. *alaskanum* f. *reductum*')

Cells small sized, about 1.4 times longer than broad, deep constriction at the middle, sinus narrow, linear and closed, semicells pyramidal with convex lateral sides, entire margins with apex undulate regularly, 8 undulations in each semicell, cell wall smooth, chloroplasts with single pyrenoid in each semicell, cells 20–25 µm long, 14–17 µm broad and isthmus 4–5 µm broad.

Site of collection: Raja Beel, Baksa; Bornijora Pond, Jalah Kamrup.

New to northeastern India (Image 39).

Cosmarium undulatum var. *indicum* J. P. Keshri & D. Das 2016: 128, pl. VI [6]: figs 169, 170

Cells medium-sized, about 1.4–1.5 times longer than broad; median constriction deep, sinus narrow, linear and closed, semicells semi-circular, slightly elongate, lateral walls convex with broadly rounded apical angles, cell wall undulate with 16–17 smooth and equal undulations; basal angles acute, another 2 series of concentric undulations just below the margin, face of the semicells with 4 concentric granules arranged semicircularly, single axial chloroplast with a centrally placed pyrenoid in each semicell, cells 35–41 µm long, 24–27 µm broad and isthmus 10–12 µm broad.

Site of collection: Jiyeni Beel, Kamrup.

New to northeastern India (Image 40).

Cosmarium undulatum var. *minutum* Wittrock 1869: 11, pl. I [1]: fig. 3

Cells small sized, about 1.2 times longer than broad, median constriction deep, sinus linear and closed, semicells sub-semicircular with convex lateral walls, apex flat with rounded angles, entire margins including apex with faint undulations, 9 undulations in each semicells, cell wall smooth, single axial chloroplast with a central pyrenoid in each semicell, cells 18–25 µm long, 15–20 µm broad and isthmus 5–7 µm broad.

Site of collection: Deepor Beel, Kamrup (M); Rajapukhuri, Darrang; Dakra Beel, Dhubri.

Previous records and distribution in northeastern India: Deepor Beel, Baruah et al. (2020).

Genus: *Desmidium*

Desmidium aptogonum Brébisson ex Kützing 1849: 190

Cells medium-sized, triangular, attached one another to form a long filament, about 1.8 times broader than long, median constriction shallow, sinus widely open, semicells transversely oblong with a small basal swelling around the isthmus, then gradually narrowed towards the apex, apex is broad and concave in the midregion, apex produced at the angles to form connecting processes, cells 13–16 µm long, 24–29 µm broad and isthmus 18–20 µm broad.

Site of collection: Tiplai Pond, Goalpara; Urapad Beel, Goalpara; Akhara Beel, Barpeta.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011); Sivasagar, Phukan & Bora (2012); Kokrajhar, Das (2020).

Desmidium baileyi f. *tetragonum* Nordstedt 1870: 220

Cells medium-sized, almost as long as broad, connected one another to form a long filament, shallow median constriction, semicells trapezoid, lateral walls parallel, apices with deep semi elliptic depression at the middle, tetra radiate axial chloroplast, cells 20–25 µm long and 19–22 µm broad.

Site of collection: Pond near Tangla College, Udalguri; Chandubi Beel, Kamrup; Shamaguri Beel, Nagaon.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Desmidium bengalicum W. B. Turner 1893: 147, pl. XIX [19]: figs 1–3 (as 'Bengalicum')

Cells medium-sized, closely united to form a straight filament, about 1.5 times broader than long, enclosed in thick gelatinous sheath, median constriction shallow, sinus open, semicells narrowly elliptic with straight or slightly retuse apices, lateral walls more or less convex, cell wall smooth, cells 19–23 µm long and 30–36 µm broad.

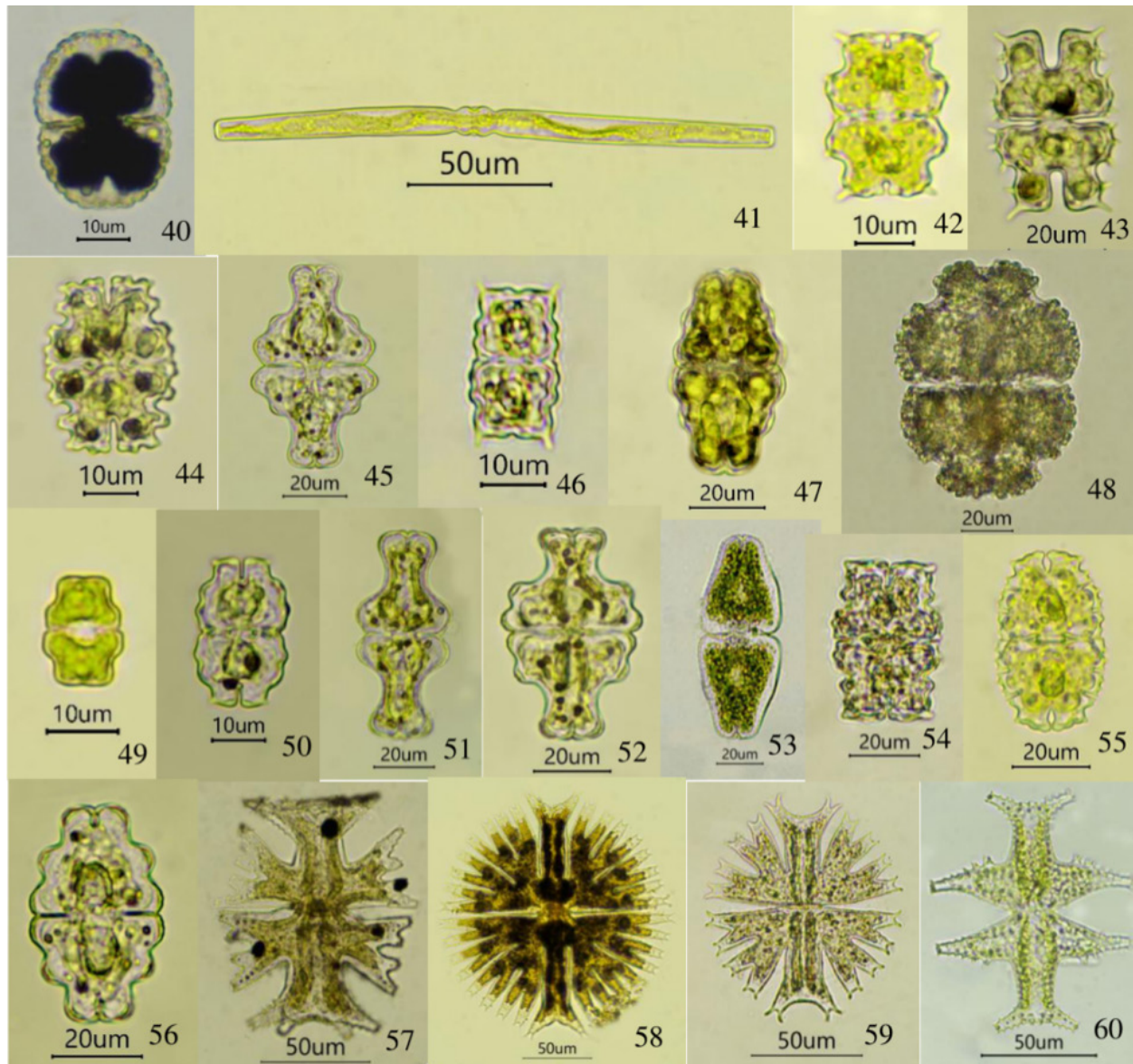


Image 40–60. 40—*Cosmarium undulatum* var. *indicum* | 41—*Docidium baculum* | 42—*Euastrum acanthophorum* | 43—*Euastrum ciastonii* | 44—*Euastrum coralloides* var. *trigibberum* | 45—*Euastrum didelta* var. *capitatum* | 46—*Euastrum exile* | 47—*Euastrum gnathophorum* var. *bulbosum* | 48—*Euastrum horikawae* | 49—*Euastrum insulare* | 50—*Euastrum lapponicum* | 51—*Euastrum longicolle* | 52—*Euastrum neosinuosum* var. *hakebukiense* | 53—*Euastrum obesum* | 54—*Euastrum paradoxum* | 55—*Euastrum serratum* | 56—*Euastrum sinuosum* var. *scrobiculatum* | 57—*Micrasterias americana* | 58—*Micrasterias lux* | 59—*Micrasterias radians* | 60—*Micrasterias tropica*.

Site of collection: Barpeta Beel, Nagaon; Deepor Beel, Kamrup (M); Dakra Beel, Dhubri; Gauhati University Pond, Kamrup (M).

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); Urapad Beel, Deka et al. (2011); Khanajan, Baruah & Baruah (2013); Deepor Beel, Baruah et al. (2020).

Desmidium coarctatum Nordstedt 1887: 155

Cells medium-sized, rectangular, about 1.3 times broader than long, median constriction shallow, sinus linear and slightly opened, rounded basal angles, apex flat and broad, cells 17–24 µm long and 22–33 µm broad.

Site of collection: Jogorahabi Beel, Sivasagar; Mohmara Pond, Sonitpur.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011); Sivasagar, Phukan & Bora (2012); Kokrajhar, Das (2020).

Desmidium grevillei (Kützing ex Ralfs) De Bary 1858: 76, pl. 4: figs 30, 31

Basionym: *Didymoprium grevillei* Kützing ex Ralfs

Cells medium-sized, about 1.1–1.2 times broader than long, median constriction a shallow notch, sinus open, semicells oblong with rounded lateral walls, filament straight, cell wall smooth, axial

chloroplast, cells 18–22 µm long and 20–27 µm broad.

Site of collection: Dandua Beel, Morigaon.

Previous records and distribution in northeastern India: Dachi Lake, Hajong & Ramanujam (2018).

Desmidium swartzii C. Agardh ex Ralfs 1848: 61, pl. IV [4]: figs a–f

Cells medium-sized, narrowly rectangular, about 2.2–2.4 times broader than long, median constriction moderately deep, sinus linear but open at extremities, semicells narrowly oblong, lateral walls obliquely truncate with upper angle protruded toward the apex, apex somewhat straight without any depression, cell wall smooth, chloroplast axial, cells 13–17 µm long and 32–38 µm broad.

Site of collection: Katara Beel Paikarkuchi, Nalbari; Shamaguri Beel, Nagaon.

Previous records and distribution in northeastern India: Sivasagar, Phukan & Bora (2012); Kokrajhar, Das (2020).

Genus: *Docidium*

Docidium baculum Brébisson ex Ralfs 1848: 158, pl. XXXIII [33]: fig. 5a, b

Cells long, straight, cylindrical or very slightly narrowing towards extremities, median constriction shallow, sinus widely open, apex smooth, rounded-truncate, base of semicells with single inflation, cells 197–209 µm long, 11–13 µm broad, isthmus 7–7.5 µm broad and apex 6–7 µm broad.

Site of collection: Dheer Beel, Dhubri.

New to northeastern India (Image 41).

Genus: *Euastrum*

Euastrum acanthophorum W. B. Turner 1893: 82, pl. X [10]: fig. 53

Cells small sized, about 1.4 times longer than broad, pyramidal semicells with broad basal lobe and truncate apical lobe, apex inflated, furnished with acute granules at the lateral walls and apical lobes, three large warts and three scrobicles at the central protrusion, median constriction deep, sinus linear, narrow, almost closed inside but open towards extremities, terminal lobes contain projected long stout spines, cell wall punctate, chloroplast with single pyrenoid in each semicell, cells 26–32 µm long, 18–22 µm broad and isthmus 6–7 µm broad.

Site of collection: Naitara Choutara Beel, Goalpara; Rajapukhuri, Nahira Kamrup.

New to northeastern India (Image 42).

Euastrum ampullaceum var. *incavatum* W. B. Turner 1893: 78, pl. X [10]: fig. 59

Cells medium-sized, narrowly elliptic in outline, about 1.6 times longer than broad, shallow median constriction, sinus V shaped, semicells pyramidal, basal lobes broad and slightly bilobed, apex flatly rounded, lateral walls concave, face of semicells with six protuberances, cell wall smooth, cells 61–66 µm long, 38–40 µm broad and isthmus 21–23 µm broad.

Site of collection: Chandubi Beel, Kamrup; Dakra Beel, Dhubri.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Euastrum ansatum Ehrenberg ex Ralfs 1848: 85, pl. XIV [14]: fig. 2 a–f

Cells medium-sized, narrowly oval in outline, about 2 times longer than broad, semicells triangular-pyramidal, median constriction deep, sinus linear and closed at extremities, basal angles broadly rounded, lateral margins forming low, rounded lateral

lobes, then converging to flat apex with rounded angles, apical notch short, semicells with 3 short basal swellings and one mucilage pore on either side at the midregion, cell wall with fine punctae, cells 64–77 µm long, 32–38 µm broad and isthmus 12–14 µm broad.

Site of collection: Urapad Beel, Goalpara; Bharalichuk Pond, Dhemaji; Morakolong, Nagaon.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011); Dachi Lake, Hajong & Ramanujam (2018); Chandubi Beel, Nath & Baruah (2020).

Euastrum bidentatum Nägeli 1849: 122, pl. VIID [7D]: fig. 1 a–f

Cells small sized, about 2 times longer than broad, median constriction deep, sinus almost closed but slightly dilated at the ends, tri-lobed semi-elliptical semicell, shallow interlobar incisions, lateral lobes ends with apex with slight indentations, polar lobe with deep V-shaped incision at the middle of apex, angular margins of the polar lobes with a wavy process, cell wall smooth, cells 55–68 µm long, 28–34 µm broad and isthmus 8–9 µm broad.

Site of collection: Buka Beel, Sivasagar; Ghunkuchi Beel, Nalbari.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011).

Euastrum binale Ehrenberg ex Ralfs 1848: 90, pl. XIV [14]: fig. 8

Cells small sized, about 1.7–1.8 times longer than broad, median constriction deep, sinus narrow, linear and closed, both basal and apical angles broadly rounded and lateral walls rather deeply concave, apex with a shallow incision at the middle and furnished with a small submarginal granule on both sides, cells 17–22 µm long, 10–12 µm broad and isthmus 4–5 µm broad.

Site of collection: Charan Beel, Morigaon; Dolani Beel, Bongaigaon.

Previous records and distribution in northeastern India: Dachi Lake, Hajong & Ramanujam (2018).

Euastrum ceylanicum (West & G. S. West) Willi Krieger 1937: 627, pl. 90: figs 16, 17

Basionym: *Euastrum sinuosum* var. *ceylanicum* West & G. S. West

Cells medium-sized, about 1.2–1.3 times longer than broad, median constriction deep, sinus narrow, linear and closed except at extremities, tri-lobed semi cells, subcuneate apical lobe with a median shallow apical notch, lateral lobes prizonal, cell wall furnished with denticulations mostly distributed towards the distal regions of the lobes, axile chloroplasts with single pyrenoid per semicell, cells 40–51 µm long, 31–37 µm broad and isthmus 8–10 µm broad.

Site of collection: Dighali Beel, Nagaon; Dosomighat Pond, Bongaigaon.

Previous records and distribution in northeastern India: North Eastern India, Yasmin et al. (2011); Kokrajhar, Das (2020).

Euastrum ciastonii Raciborski 1892: 387, pl. VII [7]: fig. 28

Cells medium-sized, about 1.5–1.7 times longer than broad, median constriction deep, sinus angular and open widely towards extremities, basal lobes broadly rounded and furnished with several small teeth, lateral walls retuse to the slightly inflated polar lobes, apical sides slightly elevated to a narrow and very deep median cut, apical angles furnished with a short and sharp spine, face of the semicells with two circles of four granules, both the upper as well as lower lobes possess a patch of sub-marginal granules, rest of the cell wall smooth, cells 38–43 µm long, 22–27 µm broad

and isthmus 6-7 μm broad.

Site of collection: Maguri Motapung Beel, Tinsukia.

New to northeastern India (Image 43).

Euastrum clavatum W. B. Turner 1893: 85, pl. XI [11]: fig. 18

Cells medium-sized, about 1.5 times longer than broad, deep median constriction, sinus linear and open, semicells truncated-pyramidal, basal angles broadly rounded and furnished with 3-5 stout spines, apical angles with a stout spine and the apical margin of polar lobe with a U-shaped deep incision at the middle, slightly lower to the lateral side of spiral angles with small spines, apex of polar lobe emarginate, cell wall smooth, cells 36-45 μm long, 24-29 μm broad and isthmus 6.5-8 μm broad.

Site of collection: Diplai Beel, Kokrajhar.

Previous records and distribution in northeastern India: Kaziranga National Park and Majuli River Island, Adhikary & Jena (2012).

Euastrum coralloides Joshua 1886: 639, pl. 23: fig. 10

Cells medium-sized, about 1.5 times longer than broad, median constriction deep, sinus narrow, linear and closed, semicells tri-lobed, polar lobe short and broad with deep and narrow median incision at the apex, lateral lobes bilobulate, cells 36-43 μm long, 23-28 μm broad and isthmus 6-8 μm broad.

Site of collection: Bogol Road Beel, Nalbari; Deepor Beel, Kamrup (M)

Previous records and distribution in northeastern India: Khanajan, Baruah & Baruah (2013); Deepor Beel, Baruah et al. (2020).

Euastrum coralloides var. *trigibberum* Lagerheim 1888: 3, pl. I [1]

Cells medium-sized, about 1.5 times longer than broad, nearly sub-rectangular in outline, median constriction deep, sinus narrowly linear and almost closed, semicells sub-pyramidal, 5-facial swellings, broader basal lobe with bilobed lateral walls, polar lobe bi-lobed, lower one short and upper one with single angular spine on each side, apical margin with undulations, somewhat lobed with a 'U' shaped long median open notch, on each side of notch two prominent swellings, 3 swellings arranged in one row within basal lobe, cells 33-39 μm long, 21-25 μm broad and isthmus 6-7 μm broad.

Site of collection: Kapla Beel, Barpeta.

New to northeastern India (Image 44).

Euastrum denticulatum F. Gay 1884: 335

Cells small sized, about 1.3 times longer than broad, median constriction deep with narrowly linear and closed sinus, semicells 3-lobed and subtrapeziform in shape, each angle furnished with tiny spine, apical lobes appear wide with a deep V-shaped incision at the middle, cells 25-27 μm long, 18-20 μm broad and isthmus 5-6 μm broad.

Site of collection: Hazarapar Pukhuri, Sonitpur.

Previous records and distribution in northeastern India: Dachi Lake, Hajong & Ramanujam (2018).

Euastrum denticulatum var. *quadrifarium* Willi Krieger 1937: 585, pl. 80: figs 20, 21

Cells small sized, about 1.4 times longer than broad, median constriction deep, sinus narrow, linear and closed, semicells sub quadrate, apical lobes short and angles furnished with a short spine, apex flat and with a median notch, cell wall granulated, cells 27-31 μm long, 19-21 μm broad and isthmus 5-6 μm broad.

Site of collection: Chandubi Beel, Kamrup; Sorbhog Beel, Barpeta; Bogol Road Beel, Nalbari.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020); Kokrajhar, Das (2020); Arunachal Himalayas, Nath & Baruah (2021).

Euastrum didelta Ralfs 1848: 84, pl. XIV [14]: fig. 1

Cells large sized, about 1.7-1.8 times longer than broad, median constriction deep, sinus narrow, linear and closed except at extremities, pyramidal semicells with rounded lateral margin, polar lobe with truncated apex, forming a lip, cell wall punctate, cells 97-125 μm long, 55-68 μm broad and isthmus 18-22 μm broad.

Site of collection: Naitara Choutara Beel, Goalpara; Dagaon Pond, Nagaon.

Previous records and distribution in northeastern India: North Eastern India, Yasmin et al. (2011).

Euastrum didelta var. *capitatum* (A. M. Scott & Prescott) Anisimova & Guiry 2021: 1

Basionym: *Euastrum sinuosum* var. *capitatum* A. M. Scott & Prescott

Cells medium-sized, about 1.5-1.6 times longer than broad, deep median incision, sinus narrow, linear and closed outside, semicells truncate pyramidal, basal lobes broadly rounded, lateral margins retuse to polar lobe, apex slightly inflated, apical angles broadly rounded, apical margin flat and with a short median notch, a mucilage pore present at middle of each semicell, cells 62-74 μm long, 38-47 μm broad and isthmus 9-11 μm broad.

Site of collection: Barsola Beel, Jorhat.

New to northeastern India (Image 45).

Euastrum dubium Nägeli 1849: 122, pl. VIID [7D]: fig. 2

Cells small sized, about 1.2-1.3 times longer than broad, median constriction deep, sinus narrow, linear and dilated at ends, pyramidal semicells with broad basal lobe and short apical lobe, apical lobes with a median incision and angles furnished with a stout spine, axile chloroplast with single pyrenoid in each semicell, cells 21-26 μm long, 17-20 μm broad and isthmus 5-6 μm broad.

Site of collection: Gatanga Beel, Nagaon.

Previous records and distribution in northeastern India: Meghalaya, Das & Ramanujam (2010).

Euastrum elegans Ralfs 1848: 89, pl. XIV [14]: figs 7b-d

Cells small sized, about 1.6-1.7 times longer than broad, median constriction deep, sinus linear and closed, semicells sub ovoid, 2 firm lateral projections at each side of semicell, semicells slightly narrowed towards the poles, apex with a narrow and deep incision at the middle, cells 27-33 μm long, 16-19 μm broad and isthmus 5-6 μm broad.

Site of collection: Chandubi Beel, Kamrup; Koladuwar Beel, Golaghat; Gaurangtari Pond, Dhubri.

Previous records and distribution in northeastern India: North Eastern India, Yasmin et al. (2011); Chandubi Beel, Nath & Baruah (2020); Arunachal Himalayas, Nath & Baruah (2021).

Euastrum exile var. *kaliganjense* A. K. Islam & Begum, 1991: 75

Cells small sized, almost rectangular in outline, about 2.2-2.4 times longer than broad, median constriction deep, sinus narrow, linear and slightly dilated inside and outside, lateral walls with 3 undulations, basal lobe slightly broader than the apical lobe, apical angles furnished with an stout and erect spine, apical margin undulate with a shallow median incision, semicells with a median swelling, cell wall ornamented with 4 large marginal and 4 small

internal crescentic processes, cells 27-31 μm long, 11-14 μm broad and isthmus 4-5 μm broad.

Site of collection: Kachodhora Beel, Morigaon.

New to northeastern India (Image 46).

Euastrum gnathophorum var. *bulbosum* A. M. Scott & Prescott 1961: 28, pl. 9: figs 9, 10

Cells medium-sized, about 1.6-1.7 times longer than broad, median constriction deep, sinus linear and closed, pyramidal semi-cells and tri-lobed, basal and apical angles broadly rounded, apex with a short median incision, chloroplast parietal, cells 48-61 long 30-35 broad and isthmus 10-12 μm broad.

Site of collection: Gandhi Beel, Barpeta.

New to northeastern India (Image 47).

Euastrum horikawae T. Hinode 1960: 113, photo 1: fig. 3: 16-18 (as 'Horikawae')

Cells large sized, about 1.3-1.4 times longer than broad, median constriction deep, sinus narrow, linear and slightly opened at extremities, semicells semicircular and bilobed, basal lobes very large, angles broadly rounded, bearing on each lateral margin 6-10 bifid to quadrid verrucae, separated from apical lobe by a small semicircular cleft, apical lobe wide, angles broadly rounded with 4-6 trifid verrucae at the margin, apex truncate with a broad shallow median incision, just below center of face a large elliptical ornament bounded by 12-18 emarginated verrucae, lateral lobes each bearing about 24 or more bifid to multifid verrucae, 7-12 alike verrucae on each of apical lobules, cells oblong in side view, broadly elliptical in vertical view, in center of apical lobe an elliptical group of large pores present, cells 91-114 μm long, 67-78 μm broad and isthmus 17-20 μm broad.

Site of collection: Shamaguri Beel, Nagaon.

New to northeastern India (Image 48).

Euastrum insulare (Wittrock) J. Roy 1877: 70

Basionym: *Euastrum binale* var. *insulare* Wittrock

Cells very small sized, about 1.6-1.7 times longer than broad, median constriction deep, sinus narrowly linear and closed, semi-cell trapeziform, lateral walls undulate, apex with a shallow median notch, oval in side view, cell wall smooth, chloroplast with one pyrenoid in each semicell, cells 14-18 μm long, 8-11 μm broad and isthmus 2.5-3.5 μm broad.

Site of collection: Katara Beel Paikarkuchi, Nalbari; Rajapukhuri, Nahira Kamrup.

New to northeastern India (Image 49).

Euastrum lapponicum Schmidle 1898: 47, pl. I [1]: fig. 29 (as 'Lapponicum')

Cells small sized, about 1.6-1.7 times longer than broad, median constriction deep, sinus narrow, linear and closed, broad basal lobes with undulate lateral walls, polar lobes short, broad with parallel margins, apical margin flat, angles furnished with a short spine, apex with a short median notch, face of semicell with a prominent protuberance bearing a pair of large granules, cell wall granulate, oval in vertical view, poles knob like with a subapical swelling on either side, oval or broadly elliptical in side view, cells 27-31 μm long, 16-18 μm broad and isthmus 6-7 μm broad.

Site of collection: Mohmara Pond, Sonitpur; Tinkonia Pukhuri, Jorhat.

New to northeastern India (Image 50).

Euastrum longicolle Nordstedt 1887: 156 (as 'ß longicolle')

Cells medium-sized, elongate, about 2.2 times longer than

broad, median constriction deep, sinus narrow linear and closed except at extremities, semicells vase-shaped, tri-lobed, basal lobes high, somewhat angular on margins, sharply retuse to a long, columnar polar lobe with slightly diverging sides, apex inflated with rounded angles, apical margin flat but with a short and narrow median notch, face of semicell with 2-transverse rows of protuberances, cell wall punctate, subrectangular in side view with truncately rounded at apex, margins sloping outwardly to basal swelling, cells 69-78 μm long, 31-35 μm broad and isthmus 9-11 μm broad.

Site of collection: Koya Kujia Beel, Bongaigaon.

New to northeastern India (Image 51).

Euastrum luetkemulleri F. Duce 1918: 134, fig. 123 a (as 'lüttemüllerii')

Cells small sized, truncate oval, about 1.3-1.4 times longer than broad, median constriction deep, sinus linear and closed, semicells truncate-pyramidal, basal lobes with narrowly rounded angles, lateral margins retuse and converging to the apex, polar lobe nearly rectangular with bluntly pointed angles, the apical margin flat but with a shallow median notch, face of the semicells with a broad swelling, cell wall smooth, cells 22-27 μm long, 16-19 μm broad and isthmus 4-5 μm broad.

Site of collection: Tiplai Pond, Goalpara; Narpara Pond, Nalbari; Shamaguri Beel, Nagaon.

Previous records and distribution in northeastern India: Arunachal Himalayas, Nath & Baruah (2021).

Euastrum neosinuosum var. *hakalukiense* (A. K. Islam & Haroon) Anissimova & Guiry 2021: 2

Basionym: *Euastrum sinuosum* var. *hakalukiense* A. K. Islam & Haroon

Cells medium-sized, about 1.6-1.7 times longer than broad, median constriction deep, sinus closed, basal lobes with two swellings on each side near margins, apical lobe is extended with almost parallel margins, apex flat, truncate with a short median notch, two swellings one on each side of the apical notch near corners, two mucilage pores present at middle of apical lobes, cells 55-66 μm long, 33-37 μm broad and isthmus 8-10 μm broad.

Site of collection: Deohati Pond, Bongaigaon.

New to northeastern India (Image 52).

Euastrum obesum Joshua 1886: 638, pl. 23: figs 19, 20

Cells moderately large sized, about 2.4-2.6 times longer than broad, median constriction deep, sinus narrow and open at ends, semicells pyramidal with truncate apex, basal lobes with narrowly rounded angles, apical angles rounded, apes flat with a short and narrow median notch, lateral margins retuse slightly, cell wall smooth, cells 86-92 μm long, 32-38 μm broad and isthmus 11-12 μm broad.

Site of collection: Duminichowki Pond, Kamrup; Jugi Beel, Golaghat.

New to northeastern India (Image 53).

Euastrum obesum var. *subangulare* West & G. S. West 1895: 50, pl. 6: fig. 15

Cells moderately large sized, narrowly elliptic in outline, about 2.4-2.6 times longer than broad, median constriction deep, sinus linear and closed, semicells pyramidal with truncate apex, basal lobes narrowly rounded, apical angles rounded, apex with a short median notch, lateral margins retuse slightly then converging towards the apex, cell wall smooth, cells 90-97 μm long, 34-40 μm broad and isthmus 14-16 μm broad.

Site of collection: Moridesang, Sivasagar; Borpukhri Gha-grapar, Nalbari; Gauhati University Pond, Kamrup (M).

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Euastrum paradoxum W. B. Turner 1893: 83, pl. XI [11]: fig. 4

Cells medium-sized, quadrangular in outline, about 1.4-1.5 times longer than broad, median constriction deep, sinus linear and closed but slightly open at the ends, semicells tri-crenulate on lateral walls, truncate at the apex with a apical notch, apical angles furnished with a short teeth, cell wall granulated, slightly constricted in side view, ovate-lanceolate, cells 41-49 µm long, 28-32 µm broad and isthmus 9-10 µm broad.

Site of collection: Dighali Beel, Sivasagar.

New to northeastern India (Image 54).

Euastrum serratum Joshua 1886: 639, pl. 23: figs 1, 2

Cells medium-sized, ellipsoid in outline, about 1.7 times longer than broad, median constriction deep, sinus linear and closed, semicell semipyramidal, lateral margins serrated, basal lobes divided into 2 short lobules, each lobule with a shallow notch at the tip, incision between apical lobe and upper basal lobe fairly deep, above this incision a single subapical lobule of polar lobe with depressed tip present, upper lobule of polar lobe broadly truncated, apex undulate with a deep and open median notch, apical angles furnished with a small horizontal spine, at base of each basal, lateral, and polar lobes in all 6 small processes present, cells 42-49 µm long, 24-28 µm broad and isthmus 7.5-9 µm broad.

Site of collection: Dheer Beel, Dhubri; Gohain Pukhuri, Sivasagar; Majkuchi Pond, Kamrup.

New to northeastern India (Image 55).

Euastrum sinuosum var. *scrobiculatum* (Nordstedt) Willi Krieger 1937: 503, pl. 63: figs 2, 3

Basionym: *Euastrum sinuosum* f. *scrobiculatum* Nordstedt

Cells medium-sized, about 1.8-1.9 times longer than broad, median constriction deep, sinus narrowly linear and closed, semicell pyramidal, lateral margins undulate, basal lobes broad and large with rounded angles, apical lobe short with rounded angles, apex nearly flat with a short median incision, cells 45-58 µm long, 25-30 µm broad and isthmus 10-11 µm broad.

Site of collection: Sorbhog Beel, Barpeta.

New to northeastern India (Image 56).

Euastrum subhypochondrum F. E. Fritsch & M. F. Rich 1937: 176, fig. 10 A-E

Cells medium-sized, almost as long as broad, median constriction deep, sinus 'V' shaped and open outwardly, semicells with very broad basal and narrow apical lobes, apex with undulation, apical angles furnished with two stout spines, angles of basal lobes also furnished with small spines but more in numbers, cell wall granulated, cells 49-58 µm long, 45-50 µm broad and isthmus 12-14 µm broad.

Site of collection: Chandubi Beel, Kamrup; Gandhi Beel, Barpeta; Bornijora Pond, Jalah Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Euastrum spinulosum var. *burmense* (West & G. S. West) Willi Krieger 1937: 636

Basionym: *Euastrum inermius* var. *burmense* West & G. S. West

Cells medium-sized, about 1.2-1.3 times longer than broad, quadrangular in outline, deeply constricted at middle, sinus linear

and closed, semicells 5-lobed, lobes furnished with small spines, cell wall granulated, granules organized in circular pattern, median region of each semicell furnished with larger granules, cells 47-60 µm long, 39-45 µm broad and isthmus 10-12 µm broad.

Site of collection: Chandubi Beel, Kamrup; Barpeta Beel, Nagaon.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Euastrum spinulosum var. *lindiae* Grönblad & A. M. Scott 1958: 17: pl. VII [7]: figs 84-88, photo 347

Cells medium-sized, quadrate in outline, about 1.1-1.2 times longer than broad, median constriction deep, sinus linear and closed, basal angles narrowly rounded and produced, lateral walls retuse forming 'V'-shaped incision and forming narrowly rounded lateral lobes, apical lobes more produced than the typical, apex slightly retuse near the midregion, lobes furnished with short blunt spines, face of the lobes with scattered spines, face of the semicells with granules arranged in circle at the middle, cell wall otherwise smooth, cells 44-55 µm long, 37-43 µm broad and isthmus 10-12 µm broad.

Site of collection: Kapla Beel, Barpeta; Daphlong Beel, Golaghat; Majkuchi Pond, Kamrup.

Previous records and distribution in northeastern India: Kokrajhar, Das (2020); Arunachal Himalayas, Nath & Baruah (2021).

Euastrum turgidum var. *grunovii* W. B. Turner 1893: 75, pl. X [10]: fig. 29 (as 'ß grunovii')

Cells large sized, almost rectangular in outline, about 1.2-1.3 times longer than broad, median constriction deep, sinus narrow but open outwardly at extremities, semicells bilobed, polar lobe with truncate apex, only one ornate central swelling or tumour, each semicell with broad basal lobe, lateral margins slightly depressed at the middle by shallow sinus, apical lobe with the truncate apical wall, cell wall punctate, cells 105-121 µm long, 81-91 µm broad and isthmus 32-35 µm broad.

Site of collection: Chakoli Beel, Majuli.

Previous records and distribution in northeastern India: Kaziranga National Park and Majuli River Island, Adhikary & Jena (2012).

Genus: *Haplotaenium*

Haplotaenium minutum (Ralfs) Bando 1988: 176

Basionym: *Docidium minutum* Ralfs

Cells long, cylindrical, about 13-15 times longer than broad, median constriction a shallow notch, sinus open, lateral walls retuse and parallel, apical margins rounded, cell walls smooth, chloroplast axial with 2-8 pyrenoids in each semicell, cells 120-143 µm long, 8-10.5 µm broad and apex 3-4 µm broad.

Site of collection: Chandubi Beel, Kamrup; Shamaguri Beel, Nagaon.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011).

Haplotaenium minutum var. *gracile* (Wille) Bando 1988: 176

Basionym: *Penium minutum* var. *gracile* Wille

Cells long, cylindrical, about 16-20 times longer than broad, median constriction a minute notch, lateral walls parallel but very slightly tapering at the apices, apex truncate with rounded angles, cell wall punctate and punctae arranged in oblique series, chloroplast axial, cells 146-188 µm long, 6-9 µm broad and apex 3-4 µm broad.

Site of collection: Chandubi Beel, Kamrup; Diplai Beel, Kokrajhar.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Genus: *Hyalotheca*

Hyalotheca dissiliens Brébisson ex Ralfs 1848: 51, pl. I [1]: fig. 1 a–i

Cells small sized, about 1.2 times broader than long, united one another to form long filaments, sinus a very slight median depression in the lateral walls, semicells cylindrical-discoidal, the lateral walls slightly convex, the apices broadly truncate, cylindrical in vertical view, one axial chloroplast in each semicell with a centrally placed pyrenoid, and several radiating ridges flattened at extremities, cells 12–15 µm long 15–19 µm broad and isthmus 14–16 µm broad.

Site of collection: Urapad Beel, Goalpara; Hasila Beel, Goalpara.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011); Dachi Lake, Hajong & Ramanujam (2018).

Hyalotheca mucosa Ralfs 1848: 53, pl. I [1]: fig. 2

Basionym: *Conferva mucosa* Mertens

Cells small sized, almost as long as broad, attached end to end to form a short filament, no median depression, very slightly constricted at the joints; semicells transversely sub-rectangular, lateral walls almost parallel, convex with broadly rounded apical angles, apex broad and truncate, cell wall smooth except two series of tiny granules just beneath the apices, cells 12–16 µm long and 13–15 µm broad.

Site of collection: Haribhanga Beel, Nagaon.

Previous records and distribution in northeastern India: South Sikkim, Das & Keshri (2013).

Genus: *Micrasterias*

Micrasterias alata Wallich 1860: 279, pl. XIII [12]: fig. 11

Cells large sized, almost as long as broad, median constriction deep, sinus widely open towards extremities, the upper margin of the upper member extends vertically, parallel to the polar lobe, and is divided from it by a deep and narrow incision, lateral lobes were once divided, the lower member was simple, and all divisions were deep, lobules were swollen at the base before abruptly and narrowly tapering to tridentate extremities, polar lobe slender with parallel sides, abruptly branching at apex into 2 slender diverging processes, cell wall smooth, cells 125–157 µm long, 121–134 µm broad and isthmus 18–21 µm broad.

Site of collection: Chandubi Beel, Kamrup; Moridesang, Sivasagar.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); South Sikkim, Das & Keshri (2013); Chandubi Beel, Nath & Baruah (2020); Kokrajhar, Das (2020).

Micrasterias americana Ehrenberg ex Ralfs 1848: xix [Errata and Addenda]

Cells large sized, about 1.1–1.2 times longer than broad, median constriction deep, sinus open, acute towards apex, semicells semielliptical 5-lobed with conspicuously protruding polar lobe, retuse apex and angles produced into stout, diverging narrow incision processes with ends truncate and denticulate, from the base of each process arise 2 similar accessory processes, one on each side, lateral lobes divided into 2 lobules single spine or with comparatively shallow incisions dissecting them, cell wall granulate, granules scattered, cells 110–132 µm long, 92–108 µm broad and isthmus 23–26 µm broad.

Site of collection: Dhamar Beel, Goalpara.

New to northeastern India (Image 57).

Micrasterias ceratofera Joshua 1885: 34, pl. 254: fig. 4

Cells large sized, about 1.4–1.5 times longer than broad, median constriction deep, sinus widely open, acute-angled, semicells pyramidal-hexagonal, basal lobes broad, once divided, furnished with single long and blunt spine on each angle, spines oppositely directed, upper lobe elongate, lateral walls very slight attenuate, apex retuse with two long and diverging blunt spines, cell wall smooth, cells 182–215 µm long with spines, 126–140 µm broad with spines and isthmus 22–25 µm broad.

Site of collection: Chandubi Beel, Kamrup; Dagaon Pond, Nagaon.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Micrasterias foliacea Bailey ex Ralfs 1848: 210, pl. XXXV [35]: fig. 3

Cells medium-sized, sometimes occur singly or united with one another to form filaments, cells rectangular, about 1.4 times broader than long, median constriction deep, sinus linear, lateral lobes divided to the second and third order, different, the lower lobules horizontal, the upper lobules diverging, its upper part reduced to a conical projection, polar lobe very distinctive, basal part narrow with erect parallel margins, the middle of the apex features a very broad, deep subrectangular excavation, with the upper three-quarters of the lobe significantly extended, angles stout, ending in 2 widely divergent teeth, a depressed portion of the apex bearing two unequal stout spines on each side, cells 50–56 µm long, 71–80 µm broad and isthmus 13–15 µm broad.

Site of collection: Chandubi Beel, Kamrup; Katara Beel Paikarkuchi, Nalbari; Kapla Beel, Barpeta; Urapad Beel, Goalpara; Pond near Tangla College, Udalguri; Bogibil Ghat, Dibrugarh; Panpoor Ghat, Sonitpur; Naitara Choutara Beel, Goalpara; Dheer Beel, Dhubri; Gauhati University Pond, Kamrup (M); Dhamar Beel, Goalpara; Kumri Beel, Goalpara; Dudhnoi College Pond, Goalpara; Kusumfula Beel, Goalpara; Jor Beel, Jorhat; Bheriki Beel, Jorhat; Dighali Beel, Nagaon; Jaysagar Pukhuri, Sivasagar; Jogorahabi Beel, Sivasagar; Lakhimpur pukhuri, Darrang; Hazarapar Pukhuri, Sonitpur; Daphlong Beel, Golaghat; Chakoli Beel, Majuli; Maguri Motapung Beel, Tinsukia; Himatichuk Pond, Dhemaji; Radhapukhuri, Lakhimpur; Duminichowki Pond, Kamrup; Shamaguri Beel, Nagaon; Morakolong, Nagaon; Rawmari Beel, Nagaon; Kachodhora Beel, Morigaon; Diplai Beel, Kokrajhar; Konuri Beel, Dhubri; Laokhoa Beel, Dhubri; Dolani Beel, Bongaigaon; Tamranga Beel, Bongaigaon; Akhara Beel, Barpeta; Sorbhog Beel, Barpeta; Borpukhuri Gharapar, Nalbari; Jiyeni Beel, Kamrup; Deepor Beel, Kamrup (M)

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); Urapad Beel, Deka et al. (2011); Sivasagar, Phukan & Bora (2012); Khanajan, Baruah & Baruah (2013); South Sikkim, Das & Keshri (2013); Chandubi Beel, Nath & Baruah (2020); Kokrajhar, Das (2020); Arunachal Himalayas, Nath & Baruah (2021).

Micrasterias lux Joshua 1886: 636, pl. XXII [22]: fig. 12

Cells large sized, spherical or subspherical shaped, almost as long as broad, median constriction very deep, sinus closed inside and open towards extremities, semicell 3-lobed, each of 2 main lateral lobes further divided into 4 lateral lobelets, each lobelet into 2-lobules having emarginated apices or spines (total 8 lobules in each side of semicell), lobules long and stout, apical lobe with a shallow and broad median notch, 2 lobules having spiny tips, cell wall punctate, cells 173–191 µm long, 159–170 µm broad and isthmus 23–26 µm broad.

Site of collection: Maguri Motapung Beel, Tinsukia.

New to northeastern India (Image 58).

Micrasterias mahabuleshwariensis J. Hobson 1863: 169, first fig. (as 'Mahabuleshwariensis')

Cells large sized, about 1.2 times longer than broad, median constriction very deep, sinus widely open, polar lobe in lower half quadrate, above widely expanding into narrow diverging processes at the angles, with more nearly erect accessory processes at their base, arising asymmetrically, one at the front and one at the back of the apex, apex nearly straight, lateral lobes once divided into narrow and tapering processes, processes with serrated walls, ends tri-denticulate, semicells with a row of acute intra-marginal granules along the inner part of the major incisions, with a small granulate central protuberance above the isthmus, cells 140–165 μ m long, 118–133 μ m broad and isthmus 26–28 μ m broad.

Site of collection: Ghunkuchi Beel, Nalbari.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011).

Micrasterias pinnatifida Ralfs 1848: 77, pl. X [10]: fig. 3

Cells medium-sized, slightly broader than long, very deeply constricted at middle, sinus closed inside but widely open towards extremities, broad basal lobes, undivided, conical, horizontally extended, somewhat constrict just before the bifid extremity, apical lobes horizontally spreading, apex very slightly convex, polar extension smaller than the basal lobes, bifid at the extremities, cell wall smooth, chloroplast with few pyrenoids, cells 53–59 μ m long, 62–67 μ m broad and isthmus 10–11 μ m broad.

Site of collection: Chandubi Beel, Kamrup; Urapad Beel, Goalpara; Naitara Choutara Beel, Goalpara; Dheer Beel, Dhubri; Maguri Motapung Beel, Tinsukia; Kapla Beel, Barpeta; Jiyeni Beel, Kamrup; Radhapukhuri, Lakhimpur; Kusumfula Beel, Goalpara; Kumri Beel, Goalpara; Tiplai Pond, Goalpara; Barsola Beel, Jorhat; Buka Beel, Sivasagar; Jaysagar Pukhuri, Sivasagar; Gohain Pukhuri, Sivasagar; Rajapukhuri, Darrang; Padumpukhuri, Sonitpur; Koladuwar Beel, Golaghat; Chakoli Beel, Majuli; Hiloidhari majgao Beel, Dibrugarh; Bhebeli Pond, Dhemaji; Mohmara Pond, Sonitpur; Dagaon Pond, Nagaon; Haribhanga Beel, Nagaon; Shamaguri Beel, Nagaon; Rawmari Beel, Nagaon; Charan Beel, Morigaon; Diplai Beel, Kokrajhar; Goalnani Pond, Dhubri; Deohati Pond, Bongaigaon; Tamranga Beel, Bongaigaon; Laokhoa Beel, Dhubri; Sorbhog Beel, Barpeta; Bogol Road Beel, Nalbari; Digholi Beel, Kamrup; Deepor Beel, Kamrup (M)

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); North Eastern India, Yasmin et al. (2011); Urapad Beel, Deka et al. (2011); Sivasagar, Phukan & Bora (2012); Chandubi Beel, Nath & Baruah (2020); Kokrajhar, Das (2020); Arunachal Himalayas, Nath & Baruah (2021).

Micrasterias radians W. B. Turner 1893: 91, pl. V [5]: fig. 6 a

Cells large sized, about 1.2 times longer than broad, median constriction very deep, sinus open throughout, lateral lobes evenly twice divided, lobules slightly swollen at the base, terminating in a pair of divergent teeth, polar lobe slightly exerted, the lower walls parallel, the upper part diverging and apex deeply concave between the 2 short bi-dentate processes, all incision widely open, cell wall smooth, cells 103–122 μ m long, 83–94 μ m broad and isthmus 16–18 μ m broad.

Site of collection: Dolani Beel, Bongaigaon.

New to northeastern India (Image 59).

Micrasterias thomasiana W. Archer 1862: 239, pl. XII [12]: figs 1–10 (as 'Thomasiana')

Cells large sized, slightly longer than broad, outline sub-circular, median constriction deep, sinus narrow and linear, semicells 5-lobed with closed linear incisions between lobes, polar lobe narrow, wedge-shaped with concave lateral margins and with a moderately deep median notch, on each side is an apiculate, emarginate swelling, outer angles with 1 or 2 small spines, lateral lobes almost equal with a deep and closed incision dividing each into 2 equal lobules, each lobule with a less deep and V-shaped secondary incision and usually with 2 further divisions, the extremities furnished with tooth-like outgrowth, cells 157–184 μ m long, 140–157 μ m broad and isthmus 24–26 μ m broad.

Site of collection: Dighali Beel, Nagaon.

Previous records and distribution in northeastern India: North Eastern India, Yasmin et al. (2011).

Micrasterias tropica Nordstedt 1870: 219, pl. 2: fig 15

Cells large sized, about 1.3 times longer than broad, median constriction very deep, sinus widely open, polar lobe with erect, parallel-sided lower part and a diverging upper part, the apex flat between the long and spreading processes, lateral lobe undivided, horizontally extended, strongly tapered; with small stout marginal spines toward the ends of the lateral lobes and polar processes, and similar spines within the margins of all but the extremities, spines paired at the depressed apex, in top view semicells fusiform, marginal and inter-marginal spines present, cells 101–122 μ m long, 85–93 μ m broad and isthmus 17–19 μ m broad.

Site of collection: Tamranga Beel, Bongaigaon; Rawmari Beel, Nagaon; Rajapukhuri, Darrang.

New to northeastern India (Image 60).

Micrasterias zeylanica F. E. Fritsch 1907: 246, fig. 4 C

Cells medium-sized, almost as long as broad, median constriction deep, sinus open at extremities, semicells 3-lobed, lobes separated by incisions, ends of terminal lobe bluntly pointed, lateral lobes with two blunt processes, separated by a narrow and shallow depression, the processes next to the sinus being horizontal, the other bent down toward the sinus, polar lobe widely spreading, slightly drawn out at each extremity into a horizontal or deflected process, apex flatly convex, cell wall smooth, cells 49–55 μ m long, 50–57 μ m broad and isthmus 8–9.5 μ m broad.

Site of collection: Dighali Beel, Nagaon; Deepor Beel, Kamrup (M).

Previous records and distribution in northeastern India: North Eastern India, Yasmin et al. (2011); Khanajan, Baruah & Baruah (2013); Deepor Beel, Baruah et al. (2020); Kokrajhar, Das (2020).

Genus: *Onychonema*

Onychonema uncinatum Wallich 1860: 195, pl. VIII [8]: figs 7–11

Cells small sized, rectangular in outline, about 1.5 times broader than long, deeply constricted, sinus linear inside, and open towards extremities, cells attached by a cellular extension called cornua and form a long filament, a row of minute teeth present between cornua, cells 12–16 μ m long, 18–24 μ m broad and isthmus 4–5 μ m broad.

Site of collection: Chandubi Beel, Kamrup; Deepor Beel, Kamrup (M); Dakra Beel, Dhubri.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); Chandubi Beel, Nath & Baruah (2020); Deepor Beel, Baruah et al. (2020).

Genus: *Pleurotaenium*

Pleurotaenium ehrenbergii (Ralfs) De Bary 1858: index, 75

Basionym: *Docidium ehrenbergii* Ralfs

Cells straight, long with truncate apices, about 11 times longer than broad, median constriction a shallow notch, semicell's lateral walls slightly tapering to a rounded truncate apex, cell wall smooth, chloroplast parietal, cells 221–278 µm long, 20–24 µm broad and apex 14–16 µm broad.

Site of collection: Chandubi Beel, Kamrup; Dandua Beel, Morigaon; Bharalichuk Pond, Dhemaji.

Previous records and distribution in northeastern India: North Eastern India, Yasmin et al. (2011); Sivasagar, Phukan & Bora (2012); South Sikkim, Das & Keshri (2013); Chandubi Beel, Nath & Baruah (2020).

Pleurotaenium ehrenbergii var. *elongatum* (West) West 1892: 119

Basionym: *Docidium ehrenbergii* var. *elongatum* West

Cells straight, very long, about 20 times longer than broad, shallow constriction at the middle, semicells with prominent basal inflation with 1 or 2 smaller swelling beyond, walls slightly tapering to a rounded truncate apex, in face view six tubercles visible, cell wall finely punctate, band like parietal chloroplast with several pyrenoids in each semicell, cells 397–465 µm long, 20–24 µm broad and apex 13–15 µm broad.

Site of collection: Chandubi Beel, Kamrup; Katara Beel Paikarkuchi, Nalbari.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Pleurotaenium kayei (W. Archer) Rabenhorst 1868: 439

Basionym: *Docidium kayei* W. Archer

Cells cylindrical, about 4.6 times longer than broad, median constriction prominent, sinus widely open, each semicell broader at the base and gradually tapering towards the apex, lateral walls undulate up to the base of the apex and furnished with 5-ring-like whorls of spiny outgrowths from the base of semicell up to below the apex, apex flatly truncate with a ring of 10–12 short spines, cells 277–318 µm long, 59–68 µm broad, isthmus 30–32 µm broad and apex 40–44 µm broad with spines.

Site of collection: Dakra Beel, Dhubri.

New to northeastern India (Image 61).

Pleurotaenium nodosum (Bailey ex Ralfs) P. Lundell 1871: 90

Basionym: *Docidium nodosum* Bailey ex Ralfs

Cells straight, long, crenate in face view, about 4.7–5 times longer than broad, semicells with nodulose margins caused by 4 evenly spaced rings of bulbous nodules, semicells tapering very slightly towards the slightly dilated apex, apex furnished with a crown of 6 conical teeth like projections, cell wall smooth, chloroplast with parietal bands, cells 128–164 µm long, 27–33 µm broad and apex 14–16 µm broad.

Site of collection: Naitara Choutara Beel, Goalpara.

New to northeastern India (Image 62).

Pleurotaenium trabecula Nägeli 1849: 104

Cells cylindrical, straight and long, about 10–12 times longer than broad, with slight but definite basal inflation, lateral walls straight, parallel and slightly narrowing towards the truncate poles with rounded angles, cell wall with fine punctae, chloroplasts with 3–4 lateral bands and with several scattered pyrenoids, cells 461–555 µm long, 31–35 µm broad and apex 19–22 µm broad.

Site of collection: Chandubi Beel, Kamrup.

Previous records and distribution in northeastern India: North Eastern India, Yasmin et al. (2011); Sivasagar, Phukan & Bora

(2012); Chandubi Beel, Nath & Baruah (2020).

Pleurotaenium trochiscum West & G. S. West 1896: 235, pl. 13: figs 4, 5

Cells cylindrical, straight and long, about 7–9.8 times longer than broad, lateral walls undulate and slightly attenuated towards the apex, the base of semicells flattened, margin incised, cells 220–354 µm long, 31–36 µm broad and apex 16–18 µm broad.

Site of collection: Raja Beel, Baksa; Borpukhri Ghagrapar, Nalbari.

New to northeastern India (Image 63).

Genus: *Sphaerosozma*

Sphaerosozma laeve var. *latum* (West & G. S. West) Kurt Förster 1973: 580

Basionym: *Onychonema laeve* var. *latum* West & G. S. West

Cells medium-sized, compressed, subrectangular, about 1.5–1.6 times broader than long, median constriction very deep and narrow, sinus open at extremities, the lateral angles furnished with a long stout converging spine, apical processes about as long as the spines, the apex slightly raised and undulate, cells joined end to end forming long pseudofilament, cells 14–17 µm long, 22–28 µm broad and isthmus 5–6 µm broad.

Site of collection: Dheer Beel, Dhubri.

New to northeastern India (Image 64).

Sphaerosozma laeve var. *micracanthum* (Nordstedt) Thomasson (as 'micracantha')

Basionym: *Onychonema laeve* var. *micracanthum* Nordstedt

Cells small sized, about 1.2–1.3 times broader than long, with median constriction very deep and narrow, sinus linear, semicells oblong-reniform, the lateral angles furnished with a very short spine, apices flat, cells joined end to end forming long pseudofilament, cells 12–14 µm long, 15–19 µm broad and isthmus 3–5 µm broad.

Site of collection: Jor Beel, Jorhat.

New to northeastern India (Image 65).

Sphaerosozma vertebratum Brébisson ex Ralfs 1848: 65, pl. VI [6]: fig. 1; pl. XXXII [32]: fig. 2

Cells small sized, compressed, about 1.5 times broader than long, median constriction deep, sinus narrowly linear and open outwardly, the apical process of the semicells very short, often tuberculate and does not overlap the adjoining cells, chloroplast with single pyrenoid in each semicell, cells 10–12 µm long, 13–18 µm broad and isthmus 5–6 µm broad.

Site of collection: Shamaguri Beel, Nagaon.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011).

Genus: *Spondylosium*

Spondylosium planum (Wolle) West & G. S. West 1912: 430, pl. 19: figs 5–8

Basionym: *Sphaerosozma pulchrum* var. *planum* Wolle

Cells small sized, almost as long as broad, sub-cylindrical in outline with rounded angles, median constriction deep, sinus widely open, apex flat with rounded angles, cells united to form a long filament, cell wall smooth, chloroplast parietal with single pyrenoid per semicell, cells 10–12 µm long, 11–15 µm broad and isthmus 6–7 µm broad.

Site of collection: Chandubi Beel, Kamrup; Himatichuk Pond, Dhemaji; Gandhi Beel, Barpeta.

Previous records and distribution in northeastern India: Urap

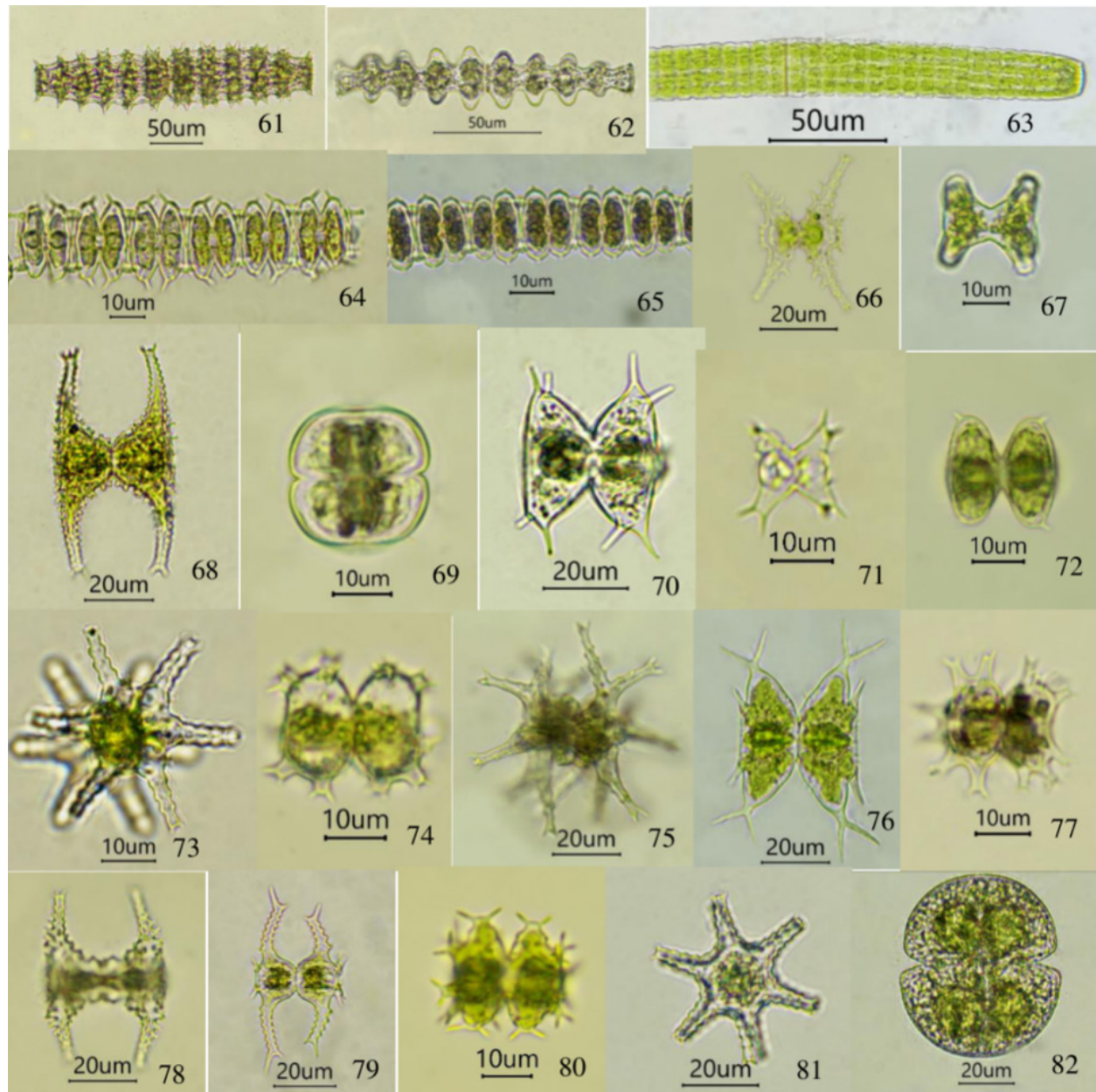


Image 61–82. 61—*Pleurotaenium kayei* | 62—*Pleurotaenium nodosum* | 63—*Pleurotaenium trochiscum* | 64—*Sphaeroszma laeve* var. *latum* | 65—*Sphaeroszma laeve* var. *micracanthum* | 66—*Staurastrum acanthocephalum* | 67—*Staurastrum alternans* | 68—*Staurastrum bengalense* | 69—*Staurastrum bieneanum* | 70—*Staurastrum bifidum* | 71—*Staurastrum botanense* | 72—*Staurastrum brevispinia* | 73—*Staurastrum coroniferum* | 74—*Staurastrum duplex* | 75—*Staurastrum elegans* var. *bidentatum* | 76—*Staurastrum freemanii* | 77—*Staurastrum furcatum* | 78—*Staurastrum johnsonii* | 79—*Staurastrum saltans* | 80—*Staurastrum simonyi* | 81—*Staurastrum willsii* | 82—*Staurastrum zahlbruckneri*.

Beel, Deka et al. (2011); Sivasagar, Phukan & Bora (2012); Chandubi Beel, Nath & Baruah (2020).

Spondylosium nitens var. *triangulare* W. B. Turner 1893: 44, pl. XVII [17]: fig. 17 a, c

Cells small sized, almost as long as broad, with deep median constriction, sinus widely open and U-shaped, cells united to form a long unbranched filament, semicells flatly triangular to oblong, apical and lateral angles rounded; cell wall smooth; chloroplast axial with single pyrenoid per semicell, cells 22–25 µm long and

25–28 µm broad, isthmus 7–8 µm broad.

Site of collection: Chandubi Beel, Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Genus: *Staurastrum*

Staurastrum acanthocephalum Skuja 1949: 151, pl. XXXIV [34]: fig. 25

Cells medium-sized, about 1.9–2 times broader than long,

median constriction deep, sinus widely open, semicells bi-lobed, broad basal lobe and small apical lobe, two arms in each pole with distinct spines in arm tip, one longer spine present in the base of each arm, cells 18–21 µm long, 35–42 µm broad and isthmus 7–9 µm broad.

Site of collection: Dosomighat Pond, Bongaigaon.
New to northeastern India (Image 66).

Staurostrum alternans Brébisson 1848: 132, pl. XXI [21]: fig. 7

Cells small sized, almost as long as broad, median constriction deep, sinus widely open, torsion of the cell in the region of the isthmus, 3-angled in apical view, concave angles, cell wall furnished with irregularly arranged granules, cells 20–22 µm long, 20–23 µm broad and isthmus 8–9 µm broad.

Site of collection: Pachi Gaon Pond, Sonitpur.
New to northeastern India (Image 67).

Staurostrum bengalense W. B. Turner 1893: 124, no fig. (as 'Bengalense')

Cells medium-sized, compressed, about 2 times broader than long, median constriction deep, sinus widely open, semicells wedged with converging processes, with a serrate-toothed margin at the apex of the trifold, base and the apex of the semicells with 3 series of transversely arranged verrucae, basal part of each side emarginate with 4 or 8 short projections placed vertically (2, 2) decorated, fusiform in top view, cells 32–36 µm long, 64–75 µm broad and isthmus 9–10 µm broad.

Site of collection: Sorbhog Beel, Barpeta.
New to northeastern India (Image 68).

Staurostrum bieneanum Rabenhorst 1862: no. 1410

Cells small sized, almost as broad as long, median constriction deep, sinus slightly open at ends, semicells transversely elliptic, lateral margins convex and slightly tapering towards the apex, apical angles are sharply rounded, the apical margin convex, cell wall punctate, cells 24–27 µm long, 23–25 µm broad and isthmus 7–8 µm broad.

Site of collection: Gatanga Beel, Nagaon.
New to northeastern India (Image 69).

Staurostrum bifidum Brébisson ex Ralfs 1848: 215

Cells medium-sized, about 1.5–1.6 times broader than long, median constriction moderately deep, the sinus widely open, semicells semielliptical, the basal margins symmetrically convex to acutely rounded apical angles which bear two long sharp and superimposed spines, the apical margin broadly convex, cell wall smooth, cells triangular in top view, the margins concave, the poles bifurcate and furnished with 2 long and stout spines, cells 30–35 µm long, 48–55 µm broad and isthmus 10–12 µm broad.

Site of collection: Katara Beel Paikarkuchi, Nalbari; Shamaguri Beel, Nagaon; Dakra Beel, Dhubri.

New to northeastern India (Image 70).

Staurostrum botanense Playfair 1907: 191, pl. IV [4]: fig. 19

Cells small sized, about 1.2 times broader than long, median constriction deep, the sinus widely open, semicells triangular, apical lobes produced and bearing two superimposed spines, the lower bifid, the basal margin convex and diverging, the apical margin truncate and straight, cells triangular in top view, the margins slightly concave, the poles rounded and bearing 2 superimposed spines, cells 15–18 µm long, 18–22 µm broad and isthmus 6–7 µm broad.

Site of collection: Konuri Beel, Dhubri.

New to northeastern India (Image 71).

Staurostrum brevispina Brébisson 1848: 124, pl. XXXIV [34]: fig. 7

Cells small sized, almost as long as broad, median constriction deep, sinus 'V' shaped and widely open, semicells broadly elliptic with a short spine at each rounded corner, cells in top view triangular with rounded angles and concave sides, cell wall punctate, cells 21–25 µm long, 23–28 µm broad and isthmus 6–7 µm broad.

Site of collection: Tamranga Beel, Bongaigaon; Gauhati University Pond, Kamrup (M).

New to northeastern India (Image 72).

Staurostrum coroniferum W. B. Turner 1893: 114, pl. XIII [13]: fig. 21

Cells medium-sized, almost as long as broad, sinus open, semicells spindle shaped, regularly and greatly inflated from the base, with small quadrangular warts at the truncated apex, a 6-star view from the top, corners in thick straight processes 6 transversely granulate-striated produced, the central part of a hexagon, with rounded corners, tips of the processes are granuliferous, cells 42–46 µm long, 45–50 µm broad and isthmus 10–12 µm.

Site of collection: Jiyeni Beel, Kamrup.

New to northeastern India (Image 73).

Staurostrum crenulatum (Nägeli) Delponte 1877: 68 [reprint p. 164], pl. 12: figs 1–11

Basionym: *Phycastrum crenulatum* Nägeli

Cells medium-sized, slightly longer than broad, sinus open, processes with short spine at the extremities, apex flat with spines at the angles, cells 25–31 µm long, 27–36 µm broad, and isthmus 6–7 µm broad.

Site of collection: Urpada Beel, Goalpara; Diplai Beel, Kokrajhar.

Previous records and distribution in northeastern India: Urpada Beel, Deka et al. (2011); Sivasagar, Phukan & Bora (2012); Khanajan, Baruah & Baruah (2013); Deepor Beel, Baruah et al. (2020); Kokrajhar, Das (2020).

Staurostrum duplex Wolle 1883: 29, pl. XXVII: fig. 10, 10a

Cells small sized, about 1.2 times longer than broad, median constriction moderately deep, sinus open, semicells transversely rectangular, the vertical margin convex and then concave into lower, bi-spinate basal processes, lateral walls parallel to the upper angles which are similarly extended into short, truncate, bi-spinate processes, the apical margin broadly convex, cell wall smooth, cells triangular in top view, the margins broadly concave, the angles protracted into bifurcate and bi-spinate processes, cells 24–28 µm long, 20–23 µm broad and isthmus 9–10 µm broad.

Site of collection: Dakra Beel, Dhubri.

New to northeastern India (Image 74).

Staurostrum elegans var. *bidentatum* (R. Gutwinski) Thomasson 1986: 347

Basionym: *Staurostrum sexangulare* var. *bidentatum* Gutwinski

Cells medium-sized, almost as broad as long, median constriction moderately deep, sinus open, semicells depressed and globose shaped, furnished with long paired processes arranged in 2 whorls, divergent upper whorl and lower horizontal, not overlapping each other, walls of processes with 3–4 denticulations, end of processes with 3–4 spines, cells 53–59 µm along with processes, 58–66 µm broad with processes and isthmus 11–13 µm broad.

Site of collection: Bhebeli Pond, Dhemaji.

New to northeastern India (Image 75).

Staurostrum freemanii West & G. S. West

Cells medium-sized, subfusiform, about 1.6–1.7 times broader than long, median constriction deep, sinus acute and widely open, lateral angles produced to form moderately long, stout and tapering divergent processes furnished with 2 stout spines at the end, apex slightly convex, rarely flat, cell wall granulated, a pair of additional spines alternately located on each semicell, cells 38–45 µm long, 65–76 µm broad and isthmus 12–13 µm broad.

Site of collection: Akhara Beel, Barpeta.

New to northeastern India (Image 76).

Staurostrum furcatum Brébisson 1856: 136

Cells medium-sized, almost as broad as long, median constriction deep, sinus widely open, semicells transversally oval to subglobose, apical margin broadly convex and angles furnished with a pair of stout, bi-spinate processes, dorsal as well as ventral walls almost equally convex, basal margins convex towards lateral angles and each with a stout bi-spinate process, cell wall smooth, cells 25–29 µm long, 27–33 µm broad and isthmus 6–7 µm broad.

Site of collection: Barpeta Beel, Nagaon.

New to northeastern India (Image 77).

Staurostrum gracile Ralfs ex Ralfs 1848: 136, pl. XXII [22]: fig. 12 a-d

Cells medium-sized, about 1.3 times broader than long, sinus open, semicells slightly broadening towards the faintly convex apex, angles produced to form long processes, processes furnished with several concentric series of denticulations and three small spines at the tip, triangular in top view, chloroplast axial, one pyrenoid per semicell, cells 28–34 µm long, 39–45 µm broad and isthmus 7–8 µm broad.

Site of collection: Chandubi Beel, Kamrup; Dheer Beel, Dhubri; Shamaguri Beel, Nagaon.

Previous records and distribution in northeastern India: Arunachal Pradesh, Das & Adhikary (2012); Khanajan, Baruah & Baruah (2013); Chandubi Beel, Nath & Baruah (2020).

Staurostrum gracile var. *coronulatum* Boldt 1885: 116, pl. V [5]: fig. 28

Cells medium-sized, about 1.2–1.3 times broader than long, median constriction shallow, sinus with an acute notch, semicells gradually broadened towards the apices, apical margin convex and undulate, having emarginate processes, triangular in top view, processes furnished with 2–3 minute spines at the tip and showing dentations within lateral walls, cells 60–65 µm long and 74–85 µm broad, and isthmus 11–12 µm broad.

Site of collection: Chandubi Beel, Kamrup; Dandua Beel, Morigaon; Konuri Beel, Dhubri.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020)

Staurostrum johnsonii West & G. S. West 1896: 266, pl. 17: fig. 16

Cells medium-sized, about 1.5 times broader than long, median constriction shallow, sinus a notch and open, semicells gradually broadened towards the apices, apical margins slightly convex and undulate, each undulation with 2 very small spines at the tip, triangular in top view, lateral margins undulate too, lateral processes furnished with 3-minute spines at the tip, cells 33–38 µm long and 51–57 µm broad and isthmus 10–11 µm broad.

Site of collection: Raja Beel, Baksa.

New to northeastern India (Image 78).

Staurostrum longibrachiatum (Borge) Gutwinski 1902

Basionym: *Staurostrum bicornne* var. *longebrachiatum* O. Borge

Cells medium-sized, about 1.7 times broader than long, median constriction shallow, sinus a notch and open widely, semicells bowl shaped, margins gradually diverging into apical processes, processes with two bi-spinate protrusions at the base, also furnished with a series of denticulations on ventral margin and series of incisions and verrucae at the margins of semicell, apical angles protracted into horizontally directed long and slender processes with 2 small spines at the tip, apical margins truncate and furnished with a series of verrucae, cells 35–40 µm long and 61–69 µm broad and isthmus 7–9 µm broad.

Site of collection: Kumri Beel, Goalpara; Chandubi Beel, Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Staurostrum margaritaceum Meneghini ex Ralfs 1848: 134, pl. XXI [21]: fig. 9 a–e

Cells medium-sized, almost as long as broad, shallow median constriction, sinus widely open, semicells cup-shaped, convex apical and basal margins with horizontally directed truncate lateral projections, projections furnished with vertical series of granules, appear five rayed in vertical view, margins strongly concave, transverse series of granules distributed all over the body excluding the mid-region, cells 38–42 µm long, 40–46 µm broad and isthmus 10–12 µm broad.

Site of collection: Chandubi Beel, Kamrup; Urapad Beel, Goalpara; Maguri Motapung Beel, Tinsukia; Sripani Pond, Dhemaji.

Previous records and distribution in northeastern India: Dachi Lake, Hajong & Ramanujam (2018); Chandubi Beel, Nath & Baruah (2020); Arunachal Himalayas, Nath & Baruah (2021).

Staurostrum polytrichum (Perty) Rabenhorst 1868: 214

Basionym: *Phycastrum polytrichum* Perty

Cells medium-sized, slightly longer than broad, median constriction deep, sinus acute and open, semicells elliptical, margins broadly oval and furnished with moderately long, acute spines arranged in concentric circles around the angles and gradually becoming shorter towards the apex, cells triangular in vertical view with slightly concave lateral sides, cell wall punctate, cells 33–40 µm long, 26–32 µm broad and isthmus 8–9 µm broad.

Site of collection: Tiplai Pond, Goalpara; Rajapukhuri Gharapar, Nalbari; Gauhati University Pond, Kamrup (M).

Previous records and distribution in northeastern India: North Eastern India, Yasmin et al. (2011).

Staurostrum punctulatum Brébisson 1848: 133, pl. XXII [22]: fig. 1

Cells small sized, almost as long as broad, median constriction deep, sinus acute and broadly open, semicells angularly elliptical with dorsal as well as ventral walls equally convex, angles acutely rounded, triangular in top view, cell wall granulate, granules flattened and arranged in uniform series encircling the angles, cells 25–29 µm long, 26–31 µm broad and isthmus 8–9 µm broad.

Site of collection: Urapad Beel, Goalpara; Barsola Beel, Jorhat.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011); Meghalaya, Siangbood & Ramanujam (2014).

Staurostrum pseudotetracerum (Nordstedt) West & G.S. West 1895: 79, pl. 8: fig. 39

Basionym: *Staurostrum contortum* var. *pseudotetrace-*

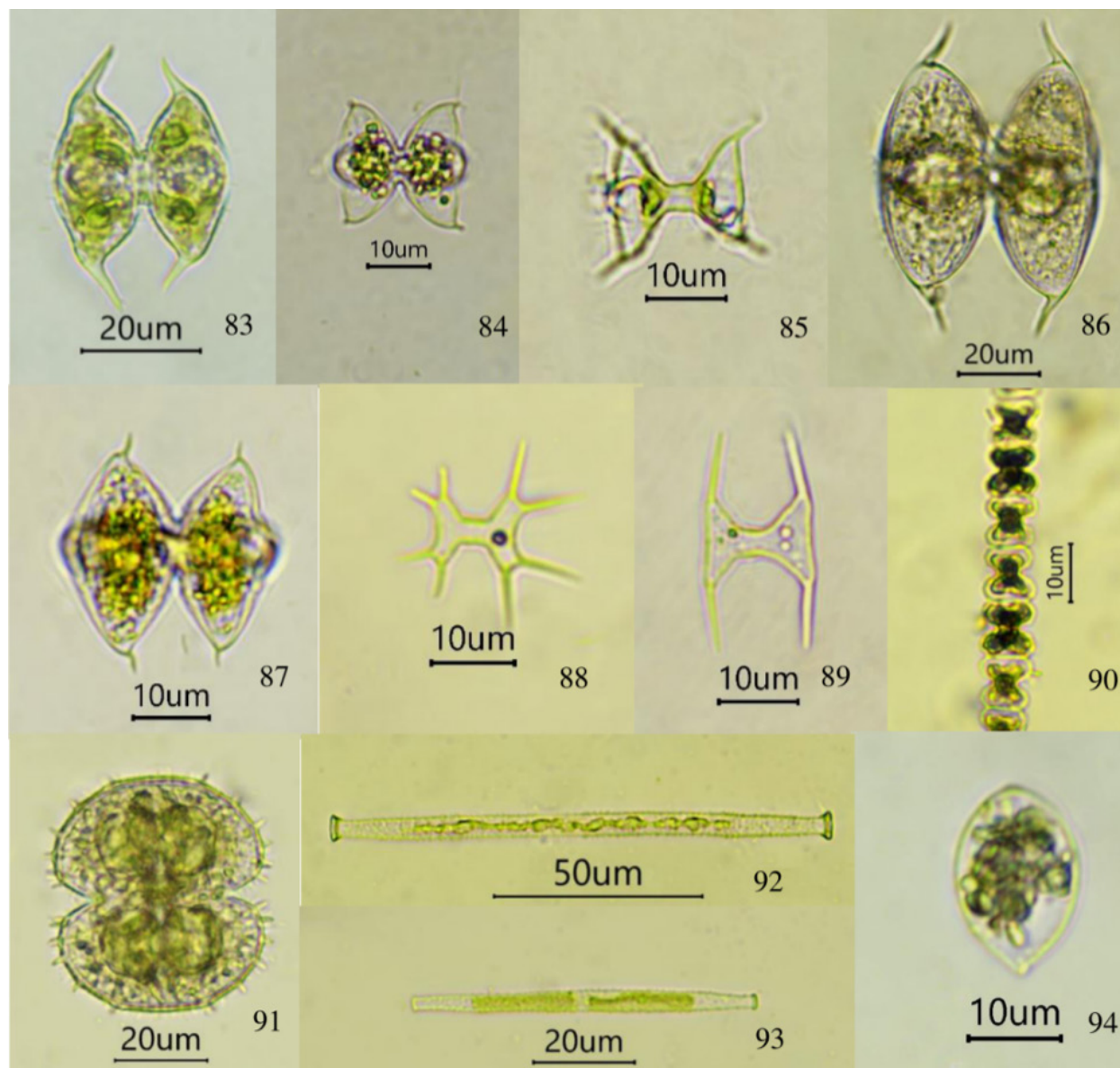


Image 83–94. 83—*Staurodesmus cuspidicurvatus* | 84—*Staurodesmus dejectus* | 85—*Staurodesmus dejectus* var. *apiculatus* | 86—*Staurodesmus dickiei* | 87—*Staurodesmus megacanthus* | 88—*Staurodesmus octocornis* | 89—*Staurodesmus unicornis* | 90—*Teilingia excavata* | 91—*Xanthidium pulchrum* | 92—*Gonatozygon brebissonii* | 93—*Gonatozygon brebissonii* var. *minutum* | 94—*Mesotaenium chlamydosporum*.

rum Nordstedt

Cells small sized, slightly broader than long, with deep median constriction, sinus triangular in outline and widely open towards extremities, semicells cuneate, apex slightly convex, lateral angles emarginated to form strongly deviating processes with three very small spines at the tip, triangular in vertical view with slightly concave margins, cells 23–26 µm long, 25–29 µm broad and isthmus 6–7 µm broad.

Site of collection: Chandubi Beel, Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Staurostrum recurvatum W. B. Turner 1893: 128, pl. XVI [16]: fig. 16

Cells small sized, about 1.2 times broader than long, median constriction deep, sinus broadly open towards extremities, semicells fusiform shaped, angles produced into short and strong processes ornamented with 5–6 concentric series of denticulations, chloroplast axial, one pyrenoid per semicell, cells 23–26 µm long, 28–32 µm broad and isthmus 5–6 µm broad.

Site of collection: Chandubi Beel, Kamrup; Goalnani Pond, Dhubri; Daphlong Beel, Golaghat.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Staurostrum saltans W. Joshua 1882: 641, pl. XXIII [23]: fig. 21

Cells medium-sized, about 1.7–1.8 times broader than long, median constriction shallow, sinus widely open, semicells nearly

circular with angles produced into long processes, the entire margin of processes with continuous small undulations and tips with 2 stout, unequal, divergent spines, apex flat and with another 2 pairs of oppositely directed spines in each semicell, cells 25–31 µm long, 46–54 µm broad and isthmus 7–8 µm broad.

Site of collection: Kachodhora Beel, Morigaon; Bogol Road Beel, Nalbari.

New to northeastern India (Image 79).

Staurostrum simonyi Heimerl 1891: 67, pl. V [5]: fig. 23

Cells small sized, almost as long as broad, median constriction deep, sinus acute and widely open, semicells sub-fusiform or sub semi-circular, dorsal and ventral margins equally convex, lateral angles truncate and provided with 2–4 small spines, apical margin with a series of 4 spines between each pair of consecutive angles, the two median ones being the largest and projecting conspicuously from the apex, further with an occasional series of 4 smaller spines beneath the first series, triangular in top view, lateral walls straight or slightly concave or convex, angles obtusely rounded and furnished with 2–4 small spines, angles occasionally with traces of about 2 or 3 concentric series of minute distant denticulations, cells 24–28 µm long, 23–26 µm broad and isthmus 8–9 µm broad.

Site of collection: Rajapukhuri, Nahira Kamrup.

New to northeastern India (Image 80).

Staurostrum striolatum f. *brasiliense* W. B. Turner 1893: 109, pl. XIII [13]: fig. 15 (as 'brasiliensis')

Cells small sized, almost identical in length and breadth, median constriction shallow, sinus widely opened towards extremities, semicells sub elliptic, 4 radiated in top view, margins greatly convex, processes parallel, with blunt ends and rounded angles, lateral margins of processes equipped with series of granules, apex truncate, cell wall smooth, cells 21–24 µm long, 22–25 µm broad and isthmus 11–12 µm broad.

Site of collection: Chandubi Beel, Kamrup; Dheer Beel, Dhubri.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Staurostrum talisheekense A. M. Scott & Grönblad 1957: 47, pl. 28: figs 16–18

Cells medium-sized, nearly as long as broad, median constriction shallow, sinus a notch and open widely towards extremities, semicells bowl shaped, with six short radiating processes, processes slightly tapering towards the apex, apices with 4–5 small spines, margins concave between processes, lateral processes furnished with three rows of granules, apical margins slightly convex, cell wall smooth, cells 35–41 µm long 37–44 µm broad and isthmus 12–13 µm broad.

Site of collection: Chandubi Beel, Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Staurostrum teliferum var. *gladiosum* (W. B. Turner) Coesel & Meesters 2013: 157, pl. 44: figs 1–9

Basionym: *Staurostrum gladiosum* W. B. Turner

Cells medium-sized, almost as long as broad, median constriction deep, sinus acute and open widely, semicells broadly elliptic, entire cell wall irregularly furnished with short and stout spines, chloroplast axial, single pyrenoid in each semicell, cells 46–53 µm long, 45–51 µm broad and isthmus 18–20 µm broad.

Site of collection: Chandubi Beel, Kamrup; Naitara Choutara Beel, Goalpara.

Previous records and distribution in northeastern India: Chan-

dubi Beel, Nath & Baruah (2020); Kokrajhar, Das (2020).

Staurostrum tetracerum Ralfs ex Ralfs 1848: 137, pl. XXIII [23]: fig. 7 a–f

Cells small sized, almost as long as broad, median constriction shallow, sinus a small notch and open outwardly, semicells triangular, angles produced into processes, processes tapering towards the tip, margins of processes furnished with granules, cells 18–21 µm long, 20–22 µm broad and isthmus 5–6 µm broad.

Site of collection: Deepor Beel, Kamrup (M).

Previous records and distribution in northeastern India: Khanajan, Baruah & Baruah (2013); Deepor Beel, Baruah et al. (2020).

Staurostrum tohopekaligense Wolle 1885: 128, pl. LI [51]: figs 4, 5

Cells medium-sized, about 1.4–1.6 times broader than long, median constriction deep, sinus widely open towards extremities, semicells oval, lateral angles produced into long slender processes, 9 in each semicell, a pair of short and divergent spines at the tip of processes, cells 39–47 µm long, 63–70 µm broad and isthmus 17–19 µm broad.

Site of collection: Chandubi Beel, Kamrup; Urapad Beel, Goalpara; Kapla Beel, Barpeta.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); Urapad Beel, Deka et al. (2011); Chandubi Beel, Nath & Baruah (2020).

Staurostrum willsii W. B. Turner

Cells medium-sized, almost as long as broad, median constriction shallow, sinus a small notch and open widely, semicells broadly wedge-shaped, angular straight bases, lateral angles produce into moderately long processes, 6 seen in top view, margins between processes slightly concave, process substriated-granulated, apex truncate, furnished with warts in pairs at the base, cell wall in the lower part of the semicells smooth, from the top center of a hexagon, with bi-emarginate-rounded corners, furnished with 3 small warts arranged hexagonally, cells 43–49 µm long, 46–53 µm broad and isthmus 15–17 µm broad.

Site of collection: Ulabari Pond, Nalbari.

New to northeastern India (Image 81).

Staurostrum zahlbruckneri Lütkenmüller 1900: 125, pl. 6: figs 41–43

Cells medium-sized, about 1.1–1.2 times longer than broad, elliptical in outline, median constriction moderately deep, sinus narrowly linear inside and widely open at ends, semicells semicircular, angles subtended, lateral margins subparallel and converging to a broadly rounded apex, triangular in top view with gently convex margins with rounded angles, bilobed from the base or obliquely viewed at the corners, cell wall thick and punctate, parietal chloroplast, cells 65–75 µm long, 56–62 µm broad and isthmus 24–26 µm broad.

Site of collection: Digholi Beel, Kamrup.

New to northeastern India (Image 82).

Genus: *Staurodesmus*

Staurodesmus convergens (Ehrenberg ex Ralfs) S. Lillieroth 1950: 264

Basionym: *Arthrodesmus convergens* Ehrenberg ex Ralfs

Cells medium-sized, slightly broader than long, median constriction very deep, sinus open widely at extremities, semicells transversely elliptic, apical as well as basal margins convex, lateral

angles furnished with the downwardly directed stout spine, cell wall smooth, chloroplast axial with single pyrenoid per semicell, cells 47–54 μm long, 50–58 μm broad and isthmus 16–18 μm broad.

Site of collection: Urapad Beel, Goalpara; Pachi Gaon Pond, Sonitpur; Majkuchi Pond, Kamrup.

Previous records and distribution in northeastern India: Urapad Beel, Deka et al. (2011); Sivasagar, Phukan & Bora (2012); Dachi Lake, Hajong & Ramanujam (2018); Chandubi Beel, Nath & Baruah (2020).

Staurodesmus cuspidatus (Brébisson) Teiling 1967: 534, pl. 9: figs 10, 11, 13–15, 19

Basionym: *Staurostrum cuspidatum* Brébisson

Cells small sized, slightly broader than long, median constriction deep, isthmus elongated, sinus widely open outwardly, semicells elliptic and projected into one long spine in each angle, glabrous, apical margins slightly convex, median portion of cell wall granulated, cells 20–23 μm long, 22–26 μm broad and isthmus 4–5 μm broad.

Site of collection: Kusumfula Beel, Goalpara; Keotkuchi Pond, Bapeta.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011).

Staurodesmus cuspidicurvatus Coesel & Meesters 2013: 22, pl. 12: figs 1–7

Cell medium-sized, about 1.4 times broader than long, median constriction deep, sinus open widely, lateral angles produced into processes with a long, stout, and inwardly bent spine at tips, apical margins convex, chloroplast axial with pyrenoids, cell wall smooth, cells 30–34 μm long, 43–50 μm broad and isthmus 9–10 μm broad.

Site of collection: Moridesang, Sivasagar.

New to northeastern India (Image 83).

Staurodesmus dejectus (Brébisson) Teiling 1954: 128

Basionym: *Staurostrum dejectum* Brébisson

Cells small sized, triradiate in top view, almost as broad as long, median constriction deep, sinus widely open and V-shaped, isthmus slightly elongated, semicells cup-shaped, lateral angles furnished with a very short and divergent spine, cell wall smooth, cells 20–23 μm long, 22–25 μm broad and isthmus 5–6 μm broad.

Site of collection: Hasila Beel, Goalpara.

New to northeastern India (Image 84).

Staurodesmus dejectus var. *apiculatus* (Brébisson) Croasdale 1957: 128

Basionym: *Staurostrum apiculatum* Brébisson

Cells small sized, triradiate in top view, slightly broader than long, median constriction deep, sinus widely open, isthmus prominently elongated, semicells cup-shaped, apical margins flat, lateral angles furnished with a moderately long and vertically directed spine, cell wall smooth, cells 16–19 μm long, 19–23 μm broad and isthmus 3–4 μm broad.

Site of collection: Kusumfula Beel, Goalpara.

New to northeastern India (Image 85).

Staurodesmus dickiei Hinde 1971: 123, fig. XI [11]: 1; pl. V [5]: fig. 9

Cells medium-sized, about 1.4 times broader than long, triradiate in top view, median constriction deep, sinus V-shaped and widely open outwardly, semicells elliptical, both upper and lower margins equally convex, lateral angles with short, convergent and

incurved spines, cell wall smooth, cells 50–58 μm long, 70–81 μm broad and isthmus 11–12 μm broad.

Site of collection: Koya Kujia Beel, Bongaigaon.

New to northeastern India (Image 86).

Staurodesmus megacanthus (P.Lundell) Thunmark 1948: 686

Basionym: *Staurostrum megacanthum* P.Lundell

Cells small sized, tri-radiate in top view, slightly broader than long, median constriction deep, sinus widely open, semicells transverse spindle shaped, apical and basal margins convex, lateral angles furnished with a short, parallel or divergent spine, chloroplast axial, cells 25–29 μm long, 28–33 μm broad and isthmus 4–5 μm broad.

Site of collection: Goalnani Pond, Dhubri.

New to northeastern India (Image 87).

Staurodesmus octocornis (Ehrenberg ex Ralfs) Stastny, Skaloud & Neustupa 2013: 414

Basionym: *Xanthidium octocorne* Ehrenberg ex Ralfs

Cells small sized, slightly broader than long, median constriction deep, sinus widely open, isthmus elongated, lateral walls and apices of semicells concave with rounded upper and lower angles furnished with a long spine, cell wall smooth, cells 17–20 μm long, 21–23 μm broad and isthmus 3–4 μm broad.

Site of collection: Rajapukhuri Ghagrapar, Nalbari; Hasila Beel, Goalpara.

New to northeastern India (Image 88).

Staurodesmus unicornis var. *gracilis* (M. O. P. Iyengar & Vimala) Teiling 1967: 540, pl. 11: figs 3, 5, 9, 10

Basionym: *Staurostrum unicornis* var. *gracile* M. O. P. Iyengar & Vimala Bai

Cells small sized, about 1.4 times broader than long, median constriction very deep, isthmus elongated, sinus widely open, semicells triangular, apical margins slightly curved, each apical angle furnished with a long, stout, and incurved spine, cells 18–20 μm long, 26–29 μm broad and isthmus 4–5 μm broad.

Site of collection: Chandubi Beel, Kamrup; Panpoor Ghat, Sonitpur.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Staurodesmus unicornis (W. B. Turner) Coesel & Van Geest 2016: 104, figs 1 H, 3 C

Basionym: *Staurostrum unicornis* W. B. Turner.

Cells small sized, almost twice as long as broad, median constriction very deep, sinus widely open, isthmus elongated, semicells triangular, apical margins slightly concave, each apical angle furnished with a long, stout, and slightly incurved spine, cells 14–17 μm long, 25–29 μm broad with spines and isthmus 2–3 μm broad.

Site of collection: Jaysagar Pukhuri, Sivasagar; Dudhnoi College Pond, Goalpara.

New to northeastern India (Image 89).

Genus: *Streptonema*

Streptonema trilobatum Wallich 1860: 196, pl. VIII [8]: figs 1–6

Cells medium-sized, about 1.7 times broader than long, united one another to form a long filament, median constriction deep, angles rounded, semicells with 3 inflated lobes in vertical view, cells 23–27 μm long, 41–47 μm broad and isthmus 8–10 μm broad.

Site of collection: Chandubi Beel, Kamrup.

Previous records and distribution in northeastern India: Lok-

tak Lake, Jena & Adhikary (2011); Chandubi Beel, Nath & Baruah (2020).

Genus: *Teilingia*

Teilingia excavata (Ralfs ex Ralfs) Bourrelly 1964: 190, fig. 10

Basionym: *Sphaeroszma excavatum* Ralfs ex Ralfs

Cells very small sized, almost as broad as long, cells joined end to end loosely by connecting processes forming a short pseudo-filament, shallow median constriction, sinus openly wide with obtuse-angle, semicells oval-elliptic, oval in face view, apex flattened with 4 very small granule like connecting processes, cell wall smooth, cells 9–11 µm long, 8–10 µm broad and isthmus 5–6 µm broad.

Site of collection: Pond near Tangla College, Udalguri.

New to northeastern India (Image 90).

Teilingia granulata (J. Roy & Bisset) Bourrelly 1964: 190, fig. 9

Basionym: *Sphaeroszma granulatum* J. Roy & Bisset

Cells very small sized, almost as broad as long, cells attached one another to form a long filament, sub-cylindrical with rounded angles, median constriction deep, sinus widely open, apex flatly rounded and furnished with four granules, semicells oblong, lateral walls rounded, furnished with three marginal granules, cell wall smooth otherwise, cells 8–11 µm long, 10–13 µm broad and isthmus 3–4 µm broad.

Site of collection: Chandubi Beel, Kamrup; Naitara Choutara Beel, Goalpara; Maguri Motapung Beel, Tinsukia.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Genus: *Triploceras*

Triploceras gracile Bailey 1851: 38, pl. 1: fig. 10

Cells elongate, about 11 times longer than broad, semicells gradually tapering towards apices, with 9 whorls of 13 short, mammillate spine, spines in upper few whorls upwardly directed, in lower whorls outward or straight, apex divided into 3 short protuberances each furnished with paired short spines at the tip, usually a pair of blunt spines between the primary splits, cells 304–332 µm long and 26–29 µm broad and apex 13–14 µm broad.

Site of collection: Chandubi Beel, Kamrup; Diplai Beel, Kokrajhar; Konuri Beel, Dhubri; Ulabari Pond, Nalbari.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020); Kokrajhar, Das (2020).

Genus: *Xanthidium*

Xanthidium acanthophorum Nordstedt 1880: 11, pl. I [1]: fig. 20

Cells medium-sized, slightly longer than broad, semicells oval, deep median constriction, sinus open and acute-angled, lateral walls convex and somewhat attenuated at the apex, equipped with two pairs of long, blunt, slightly curved spines on each side, apical margin flat and furnished with four straight long blunt spines, cell wall with scattered punctae, two chloroplasts per semicell, cells 49–55 µm long, 45–49 µm broad and isthmus 9–10 µm broad.

Site of collection: Chandubi Beel, Kamrup; Dheer Beel, Dhubri; Urapad Beel, Goalpara; Tinkonia Pukhuri, Jorhat.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Xanthidium antilopaeum Kützing 1849: 177

Cells medium-sized, almost as long as broad, median constriction deep, sinus linear and slightly dilated outwardly, semicells subelliptic-hexagonal with slightly rounded angles, each angle fur-

nished with two straight and long spines, cell wall smooth, cells 55–62 µm long, 62–67 µm broad and isthmus 20–22 µm broad.

Site of collection: Chandubi Beel, Kamrup; Ghunkuchi Beel, Nalbari.

Previous records and distribution in northeastern India: Sivasagar, Phukan & Bora (2012); Chandubi Beel, Nath & Baruah (2020).

Xanthidium antilopaeum f. *javanicum* (Nordstedt) Coesel 2007: 12, fig. 28 (as 'var. hebridarum f. javanicum')

Basionym: *Xanthidium antilopaeum* var. *javanicum* Nordstedt

Cells medium-sized, about 1.2 times longer than broad, median constriction deep, sinus V-shaped and widely open, semicells subelliptic-hexagonal, apical margin straight or slightly convex, lateral margins concave, a pair of long and stout spines of equal size located at apical angles, basal margins concave, angles furnished with two identical, long and strong spines, arranged horizontally, cell wall hyaline and punctate, chloroplasts axial, cells 42–47 µm long, 54–60 µm broad and isthmus 11–13 µm.

Site of collection: Diplai Beel, Kokrajhar.

Previous records and distribution in northeastern India: Kokrajhar, Das (2020).

Xanthidium pulchrum W. B. Turner 1993: 102, pl. XIII [13]: fig. 10

Cells medium-sized, cosmariform, almost as long as broad, median constriction moderately deep, sinus open, semi-cells oval, apical as well as lateral margins furnished with 3 short and thick spines, towards the base equipped with similar 10 spines irregularly arranged, the central region near the isthmus glabrous, and above isthmus furnished with 12–14 transversely arranged small scribbles, ovate ellipsoidal in top view, cells 50–54 µm long, 51–55 µm broad and isthmus 30–32 µm.

Site of collection: Goalnani Pond, Dhubri.

New to northeastern India (Image 91).

Xanthidium superbum var. *centricorne* Prowse ex Levanets & Guiry, nom. inval. 2021: 2

Cells large sized, about 1.2–1.3 times longer than broad, median constriction deep, sinus slender and open at extremities, semi-cells oval, cell wall furnished with numerous firm spines, single chloroplast in each semicell with many pyrenoids, cells 90–103 µm long, 71–77 µm broad and isthmus 32–35 µm.

Site of collection: Chandubi Beel, Kamrup; Borpukhuri Gharapar, Nalbari.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Family: Gonatozygaceae

Genus: *Gonatozygon*

Gonatozygon aculeatum W. N. Hastings 1892: 29

Cells elongated, cylindrical, about 15 times longer than broad, lateral sides straight and parallel but very slightly diverging towards the poles, apices truncate with slightly rounded apical angles, cell wall ornamented with small, straight spines but poles smooth, chloroplast axial with seven pyrenoids, cells 163–195 µm long, 11–13 µm broad and apex 12–15 µm broad.

Site of collection: Chandubi Beel, Kamrup; Koya Kujia Beel, Bongaigaon; Bheriki Beel, Jorhat; Majkuchi Pond, Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Table 2. Region-wise accounts of desmid flora in water bodies of different river basins of the Indian subcontinent.

Region of Indian subcontinent	Algologists	Total number of desmid species	Most speciose genus	Number of species of the most speciose genus
Eastern India	Jena et al. (2006)	45	<i>Cosmarium</i>	19
	Suseela & Toppo (2007)	40	<i>Cosmarium</i>	31
	Mallick & Keshri (2011)	7	<i>Cylindrocystis</i>	07
	Das & Keshri (2016)	272	<i>Cosmarium</i>	81
	Nandi et al. (2019)	34	<i>Cosmarium</i>	34
Western India	Patil & Jawale (2014)	36	<i>Cosmarium</i>	21
	Shahare (2016)	21	<i>Cosmarium</i>	09
	Reddy & Chaturvedi (2017)	45	<i>Cosmarium</i>	26
	Mhaske & Talwankar (2018)	12	<i>Cosmarium</i>	12
	Valvi & Gautam (2020)	18	<i>Cosmarium</i>	10
Northern India	Pandey & Pandey (1980)	10	<i>Cosmarium</i>	07
	Prakash et al. (2005)	10	<i>Cosmarium</i> <i>Euastrum</i> <i>Micrasterias</i> <i>Pleurotaenium</i>	02 02 02 02
	Shukla et al. (2008)	48	<i>Cosmarium</i>	29
	Dwivedi et al. (2009)	39	<i>Cosmarium</i>	28
	Verma et al. (2021)	338	<i>Cosmarium</i>	163
	Komal et al. (2021)	21	<i>Cosmarium</i>	11
	Sarma et al. (2022)	51	<i>Cosmarium</i>	29
Southern India	Kiran (2016)	46	<i>Cosmarium</i>	25
	Babu & Vasanthakumar (2020)	35	<i>Cosmarium</i>	35
Central India	Singh et al. (2011)	49	<i>Cosmarium</i>	29
	Agarker & Agarkar (1977)	68	<i>Cosmarium</i>	30
	Agrawal (2016)	36	<i>Cosmarium</i>	18
Northeastern India	Dickie (1882)	13	<i>Cosmarium</i>	06
	Rao (1963)	01	<i>Cosmarium</i>	01
	Prasad & Misra (1987)	18	<i>Cosmarium</i>	10
	Gupta (2002)	16	<i>Closterium</i>	04
	Kumar & Rai (2005)	07	<i>Closterium</i>	04
	Das et al. (2009)	13	<i>Cosmarium</i>	09
	Bhakta et al. (2010)	05	<i>Cosmarium</i>	04
	Deka et al. (2011)	91	<i>Cosmarium</i>	41
	Yasmin et al. (2011)	38	<i>Cosmarium</i>	10
	Phukan & Bora (2012)	73	<i>Closterium</i> <i>Cosmarium</i>	16 16
	Das & Keshri (2012)	15	<i>Closterium</i>	06
	Das & Keshri (2012)	12	<i>Closterium</i>	05
	Das & Keshri (2013)	12	<i>Micrasterias</i> <i>Pleurotaenium</i> <i>Staurastrum</i>	03 03 03
	Das & Keshri (2013)	16	<i>Cosmarium</i>	6
	Baruah & Baruah (2013)	22	<i>Cosmarium</i>	09
	Das (2020)	71	<i>Cosmarium</i>	16
	Kuotsu & Chaturvedi (2020)	20	<i>Cosmarium</i>	07
Brahmaputra River Basin	Present Study	231	<i>Cosmarium</i>	69

Gonatozygon brebissonii De Bary 1858: 28, 77, pl. IV [4]: figs 26, 27

Cells elongate, narrow, spindle shaped, about 19–22 times longer than broad, margins tapering to slightly swollen capitate apices, margins densely granulate, apex dilated, truncate, apical angles slightly rounded, chloroplast axial and ribbonlike with series of 8–12 pyrenoids, cells 110–132 µm long, 5–7 µm broad and apex 6–8 µm broad.

Site of collection: Charan Beel, Morigaon; Ulabari Pond, Nalbari.

New to northeastern India (Image 92).

Gonatozygon brebissonii var. *minutum* (West) West & G.S. West 1900: 39, pl. I: figs 15, 16

Basionym: *Gonatozygon minutum* West

Cells elongate, very narrow, spindle-shaped, about 15.6–16.2 times longer than broad, margins tapering towards slightly swollen capitate apices, cell wall densely granulate, apex dilated, truncate, apical angles slightly rounded, chloroplast axial and ribbon-like with series pyrenoids, cells 65–78 µm long, 4–5 µm broad and apex 2–3 µm broad.

Site of collection: Haribhanga Beel, Nagaon.

New to northeastern India (Image 93).

Gonatozygon monotaenium De Bary 1856: 106

Cell elongated, cylindrical, about 16.3–18.7 times longer than broad, lateral sides parallel to slightly concave, apices slightly dilated with truncate ends, ribbonlike chloroplast with series of evenly arranged 6–16 pyrenoids, cell wall granulate, granules closely arranged, cells 98–150 µm long, 6–8 µm broad and apex 7–8 µm broad.

Site of collection: Narpara Pond, Nalbari.

Previous records and distribution in northeastern India: Dachi Lake, Hajong & Ramanujam (2018).

Order: Zygnematales

Family: Mesotaeniaceae

Genus: *Netrium*

Netrium digitus (Brébisson ex Ralfs) Itzigsohn & Rothe 1856: no. 508

Basionym: *Penium digitus* Brébisson ex Ralfs

Cells are large, solitary, broadly fusiform, about 2.7–3 times longer than broad, lateral walls convex, gradually tapering from the middle to broadly rounded-truncated poles, cell wall smooth, single chloroplast in each semicell with many pyrenoids, cells 96–130 µm long, 35–41 µm broad and apex 15–16 µm broad.

Site of collection: Chandubi Beel, Kamrup; Urapad Beel, Goalpara; Dheer Beel, Dhubri; Dighali Beel, Nagaon; Bheriki Beel, Jorhat; Daphlong Beel, Golaghat.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011); North Eastern India, Yasmin et al. (2011); Urapad Beel, Deka et al. (2011); Dachi Lake, Hajong & Ramanujam (2018); Kokrajhar, Das (2020).

Netrium oblongum var. *acuminatum* Irénée-Marie 1954: 111

Cells medium-sized, solitary, elongated, fusiform, about 4.6–5 times longer than broad, lateral margins convex, gradually tapering from the middle towards the rounded poles, slightly retuse near the apex, single chloroplast in each semicell with numerous pyrenoids, cell wall smooth, cells 172–205 µm long, 37–41 µm broad and apex 16–18 µm broad.

Site of collection: Chandubi Beel, Kamrup; Jogorahabi Beel, Sivasagar; Rajapukhuri, Nahira Kamrup.

Previous records and distribution in northeastern India: Chandubi Beel, Nath & Baruah (2020).

Genus: *Spirotaenia*

Spirotaenia condensata Brébisson 1848: 179, pl. XXXIV [34]: fig. 1

Cells cylindrical, solitary, elongated with broadly rounded poles, about 8.7–9.2 times longer than broad, lateral sides slightly convex but almost parallel, cell wall smooth, chloroplast parietal, ribbon-like having 7 close turns, cells 123–158 µm long, 14–17 µm broad and apex 8–9 µm broad.

Site of collection: Raja Beel, Baksa; Digholi Beel, Kamrup.

Previous records and distribution in northeastern India: Kokrajhar, Das (2020).

Family: Zygnemataceae

Genus: *Cylindrocystis*

Cylindrocystis brebissonii (Ralfs) De Bary 1858: 35, 74

Basionym: *Penium brebissonii* Ralfs

Cells small sized, cylindrical, straight, cells about 2.2 times longer than broad, lateral margins parallel with rounded apex, devoid of median constriction, cell wall smooth or sometimes granulated, chloroplasts ridged, cells 27–32 µm long and 12–14 µm broad.

Site of collection: Dhamar Beel, Goalpara.

Previous records and distribution in northeastern India: Loktak Lake, Jena & Adhikary (2011).

Genus: *Mesotaenium*

Mesotaenium chlamydosporum De Bary 1858: 75, pl. VII D: figs 1–29

Cells small sized, oblong, about 1.5–1.6 times longer than broad, poles broadly rounded, with small apical nodules, chloroplast parietal and plate-like, cell wall smooth, cells 20–24 µm long and 13–15 µm broad.

Site of collection: Kusumfula Beel, Goalpara.

New to northeastern India (Image 94).

DISCUSSION

The outcome of the present endeavour is the comprehensive account of desmid flora from the Brahmaputra valley of the northeastern region of India. Altogether 231 desmids under two orders, five families, and 25 genera were recorded during the study period which is slightly higher than the number of desmids reported by Islam & Haroon (1980); Islam & Akter (2005); Islam & Irfanullah (2006); Ekhtor et al. (2013); Ramos et al. (2021); Coesel & Geest (2008); Stamenkovic & Cvijan (2008) in different parts of the world excluding Das & Keshri (2016); Verma et al. (2021).

Results also revealed that the Desmidiaceae was the dominant family with the highest representation of 19 genera and 195 species followed by Closteriaceae (1 genus and 27 species), Gonatozygaceae (1 genus and 4 species), Mesotaeniaceae (2 genera and 3 species), and Zygnemataceae (2 genera and 2 species). Amongst the genera, *Cosmarium* was the dominant one with 69 spe-

cies followed by *Euastrum* (33 species), *Stauroastrum* (31 species), and *Closterium* (27 species) respectively. An inclusive account of desmid flora from various parts of the Indian subcontinent reported dominance of *Cosmarium* in other river basins of the Indian subcontinent (Table 2). It was noted that the *Cosmarium* showed overall dominance in the majority of waterbodies in Bangladesh also (Islam & Haroon 1980; Islam & Irfanullah 2006).

The results further showed that the number of desmids (231) recorded during the present exploration suppresses the earlier records of desmids from northeastern India (Bordoloi 1983; Deka et al. 2011; Yasmin et al. 2011; Phukan & Bora 2012; Baruah & Baruah 2013; Das 2020) and it was found that out of the 231 reported species, a total of 94 species were reported for the first time from the northeastern region of India.

As the Brahmaputra River basin harbours a higher number of desmids (231), the region could be considered a suitable habitat for the desmids diversity and could be explored for bio-prospection in a phased manner. Another interesting fact that emerged in the present study is that *Cosmarium forceps*, *Micrasterias foliacea*, and *Micrasterias pinnatifida* were universally present in a majority of the water bodies located in the entire stretch of Brahmaputra River which invites an in-depth ecological study.

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