

ALGAL DIVERSITY OF KAZIRANGA NATIONAL PARK AND MAJULI RIVER ISLAND HOT SPOTS IN ASSAM

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ABSTRACT

Seventy algal taxa belonging to 32 genera were recorded from Kaziranga National Park and Majuli river island of Assam. Of these 22 taxa belonging to 15 genera were recorded from different water bodies within Kaziranga National Park of these, 3 species belonged to 2 genera of Cyanophyceae (Cyanoprokaryota/Cyanobacteria), 2 species to 2 genera of Euglenophyceae, 8 species to 5 genera of Chlorophyceae and 9 species to 6 genera of Bacillariophyceae. The algal diversity in Majuli island was higher compared to Kaziranga national park. In Majuli a total of 50 algal taxa belonging to 26 genera were recorded. Of these 3 species belonged to 3 genera of Cyanophyceae, 3 species to 2 genera of Euglenophyceae, 34 species to 14 genera of Chlorophyceae and 10 species to 7 genera of Bacillariophyceae. Only 2 species, *Phormidium chalybeum* (Mertens ex. Gomont) Anagnostidis et Komárek and *Ankistrodesmus falcatus* (Corda) Ralfs were common to these localities showing location specific occurrence of most algal taxa in these two important “hot spots”.

Keywords: Algae, freshwater, hot spot, Kaziranga national park, Majuli river island.

INTRODUCTION

Kaziranga National Park located between latitudes 26°30'N and 26°45'N and longitudes 93°08'E and 93°36'E is approximately 46 km in length from east to west, and 13 km in breadth from north to south covering an area of 378 km². The area is circumscribed by the Brahmaputra river which forms the northern and eastern boundary and the Mora Diphlu the southern periphery. It is composed of flat expanses of fertile land and the landscape consists of exposed sandbars and riverine flood formed lakes known as beels (which make up 5% of the surface area). It is one of the largest tracts of perfected land in the sub-Himalayan belt in the Indo-Malaya ecozone of Brahmaputra valley, and due to its high species diversity has been described as a “diversity hot spot”. The rainy season lasts from June to September rising of water levels of Brahmaputra during the period resulting in flooding of almost three-fourth of the western region of the park.

Majuli is the largest freshwater river island in the world (latitude 26° 30'-27° 10' N and longitude 94° 07'-94° 20' E) occupying an area about 577 km² within Brahmaputra river in the state of Assam. This is also a “hot spot” for flora and fauna. However, the algal diversity in the water bodies of these two important specialized habitats in the north-eastern region of India have not yet been documented. In this paper we reported 70 species of algae for the first time from these “two hot spots” in Assam.

MATERIALS AND METHODS

Sampling was carried out at six sites within the Kaziranga National Park and total 20 samples were collected from water bodies. These were Mahi beel, Kaulilmardi beel, Korasigh beel, Kohara, Diphlu river and Dhansiri river. In the island Majuli sampling was carried out from water bodies at five sites e.g. Namati, Alimore, Majuli town, Sri Aunikati Sastra and Kamadubadi and also from the adjacent river Bhrahmaputra. The location of all the sites were determined with a Garmin 12 GPS receiver (Table-1). Samples were collected in clean sterilized Tarson specimen tubes by forcep and needle, and the plankton samples were collected using plankton net (25µm pore size). Photomicrograph of each specimen was taken using a Meiji trinocular research microscope fitted with Nikon coolpix 4500 digital camera. The specimens were identified following monographs of Kützing

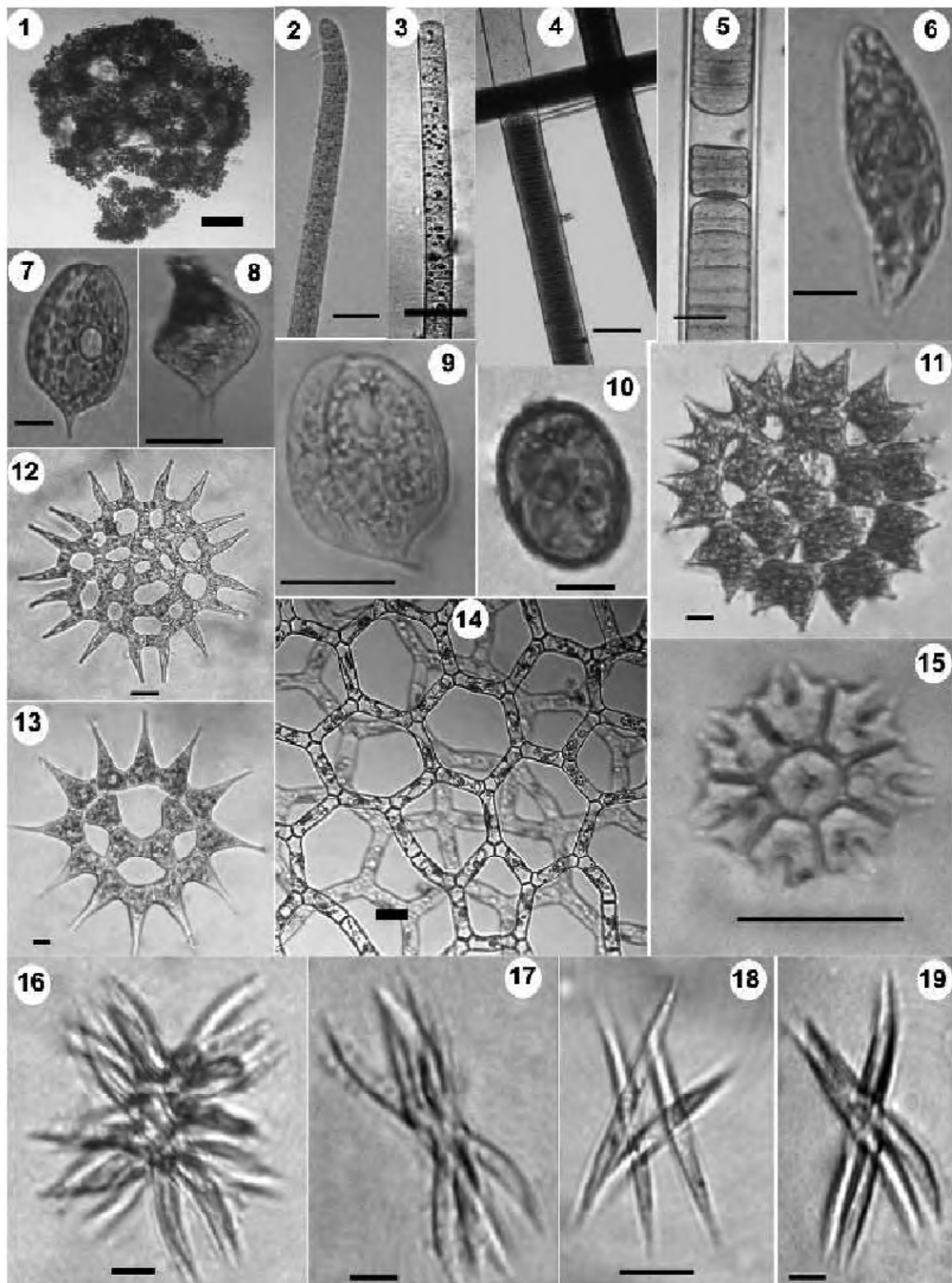


Plate 1. 1. *Microcystis viridis* (A. Braun) Lemmermann, 2. *Phormidium chalybeum* (Mertens ex. Gomont) Anagnostidis et Komárek, 3. *Phormidium retzii* (C. Agardh) Kützing ex Gomont, 4. *Lyngbya magnifica* N.L. Gardner, 5. *Lyngbya majuscula* (Dillwyn) Harvey, 6. *Euglena agilis* Carter, 7. *Phacus caudatus* Hubner, 8. *Phacus longicauda* (Ehrenberg) Dujardin, 9. *Phacus peteloti* Lefevre, 10. *Trachelomonas intermedia* Dangeard, 11. *Pediatrump duplex* Meyen var. *asperum* (A. Braun) Hansgirg, 12. *Pediatrump simplex* Meyen var. *biwaense* Fukushima, 13. *Pediatrump simplex* Meyen var. *simplex* Komárek, 14. *Hydrodictyon reticulatum* (Linnaeus) Lagerheim, 15. *Pediatrump tetras* (Ehrenberg) Ralfs, 16 & 17. *Ankistrodesmus densus* Koršikov, 18 & 19. *Ankistrodesmus falcatus* (Corda) Ralfs. (Scale bar: Figs: 1-3, 5, 9 = 20 µm; 4, 6-8, 10-19 = 10 µm).

Table-1. Collection sites in Kaziranga National Park and Majuli island of Brahmaputra river showing latitude, longitude, voucher number and habitat.

Collection site	Latitude and longitude	Voucher no.	Habitat
Mahi-beel	26° 36' 41? N	1146, 1148	Lake
Maulilmadi beel	93° 22' 40? E	1149, 1150	Lake
Diphlu, Kohara		1152, 1153	Rivers
Korasigh beel		1154 – 1156	Lake
Majuli town,	26° 52' 30? N	1169	Puddle
Brhmaputra river, Majuli,	94° 12' 55? E	1171, 1172	River
Alimore, Majuli		1173 – 1175	Pond
Sri Aunikati Sastra, Majuli	26° 55' 03? N	1176 – 1178	Pond
Kamadubadi, Majuli	94° 29' 49? E	1179, 1180	Pond
Brahmaputra river, Namati,	26° 51' 34? N	1166 – 1168	River
Near Majuli	94° 14' 48? E		

(1865), West and West (1904), Huber-Pestalozzi (1942, 1955), Desikachary (1959, 1987, 1989), Randhawa (1959), Philipose, (1967), Gonzalves (1981), Komárek and Fott (1983), Hindák (1984, 1988), Kadlubowka (1984), Mrozińska (1985), Anand (1998), Kant & Gupta (1998), Krishnamurthy (1998), Komárek and Jankovska (2001), Komárek and Anagnostidis (2005) and Rath and Adhikary (2005). Each sample was assigned with a voucher number along with the date of collection, fixed in 4% formaldehyde and deposited in the collection at the laboratory for record.

SYSTEMATIC ENUMERATION

CYANOPHYCEAE (CYANOBACTERIA/CYANOPROKARYOTA)

Order : CHROCOCCALES

1. *Microcystis viridis* (A. Braun) Lemmermann (Pl. 1.1)

Desikachary 1959, p. 87, pl. 18, figs. 1-6

Komárek and Anagnostidis, 1999, p. 230, fig. 303.

[Synonym: *Polycystis viridis* A. Braun]

Thallus bluish green; colonies packet like, three-dimensional arrangement clearly visible, agglomerated in large, irregular clusters but without distinct holes; cells spherical, 3.7-7.5 µm diameter, mucilage colorless, slightly distinct from cell clusters and delimited by slight refractive outline.

Bloom in pond; Voucher number, date and site: 1178, 29th March 2007, Sri Aunikati sastra, Majuli.

Order: NOSTOCALES

2. *Phormidium chalybeum* (Mertens ex. Gomont) Anagnostidis et Komárek (Pl. 1.2)

[Synonym: *Oscillatoria chalybea* var. *insularis* N. L. Gardner]

Desikachary 1959, p. 219, pl. 38, fig. 18; Komárek and Anagnostidis, 2005, p. 424, fig. 605.

Thallus blackish-green; trichome end bent and sickle-shaped, attenuated at the apex; cells 9-13.2 µm broad and, 4.5-7.2 µm long, granulated, without calyptra; motile, usually slowly oscillating or rotating.

Wet soil surface, epiphytic in river: Voucher number, date and site: 1146, 28th March 2007, Mahilake, Golaghat, Kajranga National Park, Assam. 1166, 29th March 2007, Brahmaputra river, Namati.

3. *Phormidium retzii* (C. Agardh) Kützing ex Gomont (Pl. 1.3)

[Synonym: *Oscillatoria retzii* C. Agardh]

Desikachary 1959, p. 268, pl. 44, fig. 15, Komárek and Anagnostidis, 2005, p. 454, fig. 666.

Thallus bluish-green; trichome straight, cross-wall slightly constricted; apical cell optuse-rounded;

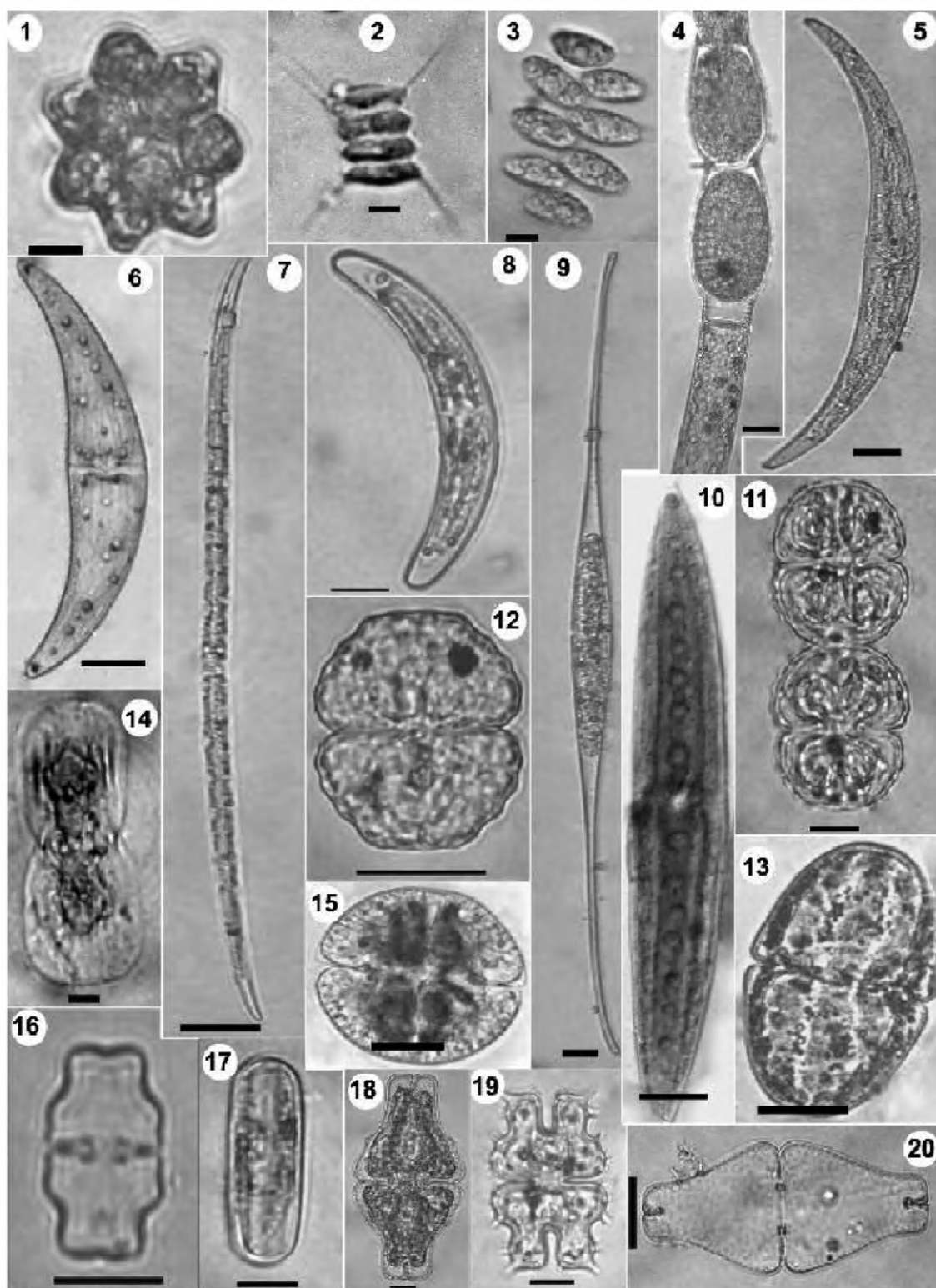


Plate 2. 1. *Coelastrum proboscideum* Bohlin, 2. *Desmodesmus communis* (E.H.Hegewald) E.H.Hegewald, 3. *Scenedesmus obtusus* Meyen f. *obtusius* Meyen, 4. *Oedogonium angustum* (Hirn) Tiffany, 5. *Closterium dinnae* Ehren. ex Ralfs, 6. *Closterium ehrenbergii* Menegh., 7. *Closterium gracile* Brébi., 8. *Closterium jenneri* Ralfs var. *robustum* G.S. West, 9. *Closterium kützingii* Brébisson, 10. *Closterium lunula* (Müller) Nitzsch, 11. *Cosmarium boeckii* Wille, 12. *Cosmarium cymatopleurum* Nordstedt, 13. *Cosmarium javanicum* Nordste., 14. *Cosmarium moniliforme* (Turpin) Ralfs var. *subpyriforme* W. West and G.S. West, 15. *Cosmarium obsoletum* (Hantzsch) Reinsch, 16. *Cosmarium venustum* Brébisson var. *majus* Wittrock, 17. *Cylindrocystis brebissonii* (Menegh. ex Ralfs) de Bary, 18. *Euastrum ansatum* Ralfs var. *pyxidatum* Delponte ex Delponte, 19. *Euastrum clavatum* Turner, 20. *Euastrum cuneatum* Jenner. (Scale bar, Figs: 1-3, 5, 8, 9, 11-12, 14, 16-20= 10 µm; 4, 6-7, 10, 13, 15= 20 µm).

sheath thin; cells as long as or shorter than broad, 7.8-11.2 µm broad and 5-11 µm long, without calyptra.

Epilithic attached to small stone in river; Voucher number, date and site: 1153, Diffolo river, 28th March 2007, Kaziranga National Park.

4. **Lyngbya magnifica** N. L. Gardner (Pl. 1.4)

Desikachary 1959, p. 320; Komárek and Anagnostidis, 2005, p. 628, fig. 959.

Thallus blackish-green; trichome rigid, long, straight; 30-40 µm broad; apical cell rounded; sheath 2.5-5.5 µm thick; cells 27-38 µm broad and 3.8-5.5 µm long, not constricted at cross-walls.

Epilithic attached to small stones in river or free floating; Voucher number, date and site: 1153, Diffolo river, 28th March 2007, Kaziranga National Park, Assam.

5. **Lyngbya majuscula** (Dillwyn) Harvey (Pl. 1.5)

Desikachary 1959, p. 313, pl. 48, fig. 7, pl. 49, fig. 12 & pl. 52, fig. 10; Komárek and Anagnostidis, 2005, p. 625, fig. 950.

Thallus brownish-green to deep green; trichome very long, straight or bent, 30-83 µm broad; sheath yellowish brown, 4-14 µm thick, lamellated; end cell rounded without calyptra; cells 5-15 µm long

Epiphytic or free floating in river; Voucher number, date and site: 1167, 29th March 2007, Brahmaputra river, Namati.

EUGLENOPHYCEAE

Order: EUGLENALES

6. **Euglena agilis** Carter (Pl. 1.6)

Wolowski 1998, p. 26, figs. 73-74.

Cells green, fusiform, metabolic; anterior end rounded or truncate, posterior end tapered; central region widest; two small parietal chloroplast with double pyrenoids; paramylum numerous, rounded; nucleus central; stigma prominent; cell 42.3-43 µm long and 14-15 µm broad.

Planktic in puddle; Voucher number, date and site: 1169, 29th March 2007, Majuli, near Ferry ghat, Assam.

7. **Phacus caudatus** Hubner (Pl. 1.7)

Wolowski 1998, p. 79, figs. 275-276.

Cells green, solitary, flattened, ovoid; a straight tail (cauda) present at the posterior end, sharply pointed; pellicle longitudinally striated; chloroplast numerous; paramylum bodies two, unequal, arranged along the long axis, smaller one at the hind end; cell 40-43.2 µm long and 26.4-27.2 µm broad.

Planktic in puddle; Voucher number, date and site: 1169, 29th March 2007, Majuli, near Ferry ghat.

8. **Phacus longicauda** (Ehrenberg) Dujardin (Pl. 1.8)

Wolowski 1998, p. 84, figs. 291-294.

[Synonym: *Euglena longicauda* Ehrenberg, *Phacus longicaudus* (Ehrenberg) Butschi]

Cells green, solitary, ovoid to pyriform; anterior broadly rounded; posterior end tapered to form a long, slightly twisted and pointed tail (cauda) about equal to the body length; pellicle longitudinally striated; paramylum single, ring shaped; chloroplast numerous, small, discoid; cell 80-120 µm long and 25-43.5 µm broad.

Planktic in lake; Voucher number, date and site: 1148, 28th March 2007, Mahilake, Kaziranga National Park, Golaghat.

9. **Phacus peteloti** Lefevre (Pl. 1.9)

Huber-Pestalozzi 1955, Pl. XLI, fig. 257.

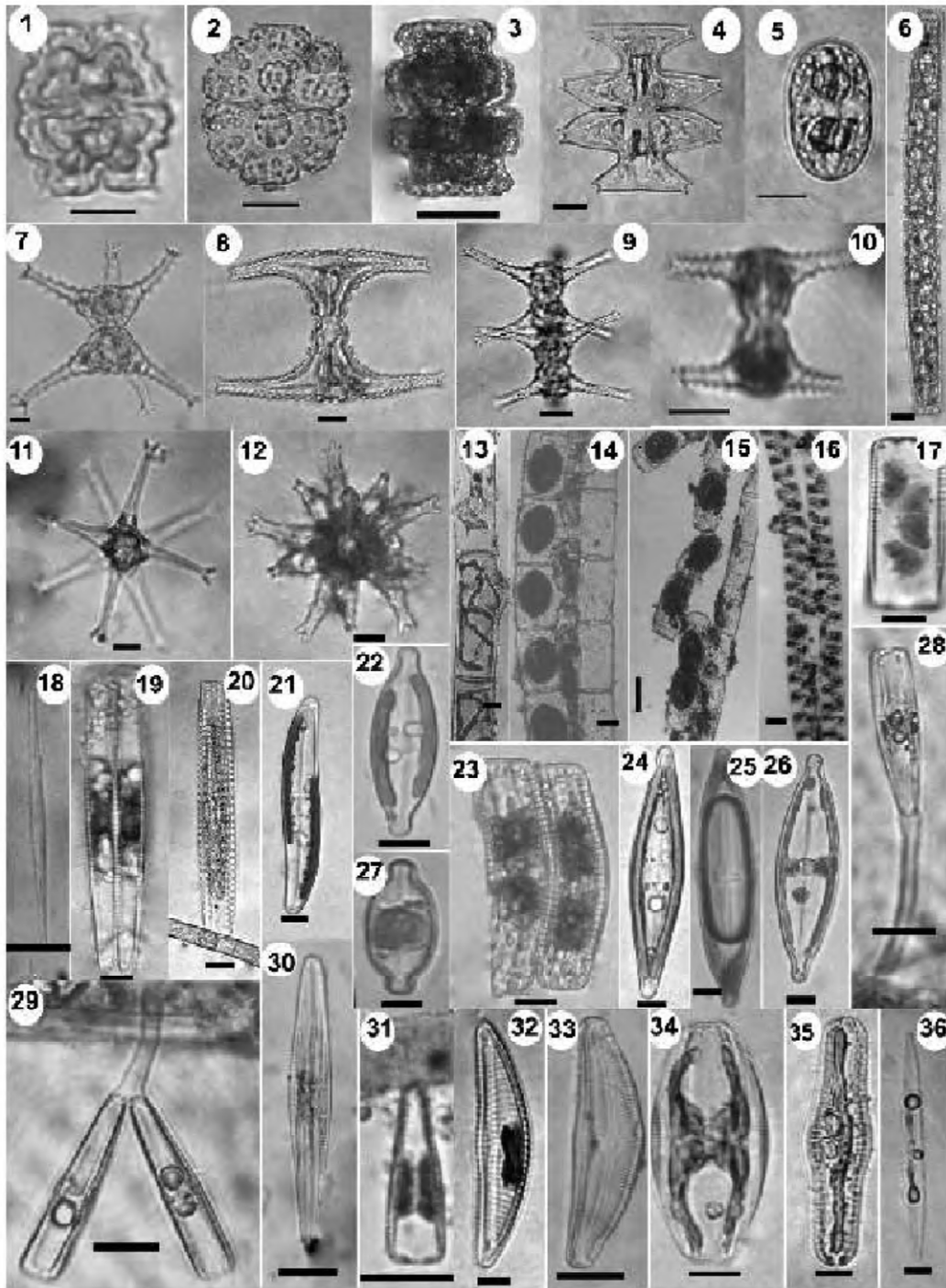


Plate 3. 1. *Euastrum denticulatum* Gay, 2. *Euastrum spinulosum* Delponte var. *spinulosum* Delponte, 3. *Euastrum turgidum* Wallich var. *grunovii* Turner, 4. *Micrasterias pinnatifida* (Kütz.) Ralfs, 5. *Penium spinospermum* Joshua, 6. *Pleurotaenium rectum* Delponte var. *rectum* Delponte, 7. *Staurastrum anatinum* Cooke and A. Wills in Cooke, 8. *Staurastrum leptocladum* Nordst., 9. *Staurastrum paradoxum* Meyen var. *evolutum* West, 10. *Staurastrum pseudosebaldi* Wille, 11. *Staurastrum stellium* Turner, 12. *Staurastrum sexangulare* (Brühl) Lundell var. *crassum* Turner, 13 & 14. *Spirogyra fluvialis* Hilse, 15 & 16. *Spirogyra gracilis* (Hassall) Kütz., 17. *Grammatophora undulata* Ehrenb., 18. *Synedra gracilis* Kütz., 19. *Synedra tabulata* Kütz., 20. *Synedra ulna* (Nitzsch) Ehrenb. var. *oxyrhynchus* (Kütz.) V. H., 21. *Pleurosigma aestuarii* Bréb. ex. Kütz., W. Son, 22. *Navicula amphirhynchus* Ehrenb., 23. *Achnanthes subessilis* Kütz., 24. *Navicula gracilis* Ehrenb., 25. *Navicula major* Kütz., 26. *Navicula microspora* Kant and Gupta, 27. *Navicula pupula* Kütz., 28 & 29. *Gomphonema dichotomum* Kütz., 30. *Gomphonema hebridense* Gregory, 31. *Gomphonema parvulum* (Kütz.) Grunow var. *micropus* (Kütz.) Clève, 32. *Cymbella affinis* Kütz., 33. *Cymbella cistula* (Hempr.) Grunow, 34. *Amphora ovalis* Kütz., 35. *Rhopalodia gibba* (Ehrenb.) O. Müller, 36. *Nitzschia palea* (Kütz.) C.W. Sm. (Scale bar, Figs: 1, 4, 5, 7- 12, 17, 19-21, 24-32, 34-36 = 10 µm; 2, 18, 22, 33 = 20 µm; 3 = 50 µm, 6 = 30 µm; 13-16 = 40 µm).

Cells green, ovoid to orbicular; posterior end broader, abruptly ending into a shortsharp inclined tail; pellicle longitudinally striated; paramylum 1-2 ring shaped; cell 30-32µm long and 25-27µm broad.

Planktic in pond; Voucher number, date and site: 1178, 29th March 2007, near Sri Aunikati Sastra, Majuli.

10. **Trachelomonas intermedia** Dangeard (Pl. 1. 10)

Cells brown, sub-spherical to ellipsoid, punctate pore at anterior with a ring like thickening; chloroplast numerous; lorica thick; cell 18-19µm diameter.

Planktic in lake; Voucher number, date and site: 1148, 28th March 2007, Mahilake, Golaghat, Kaziranga National Park.

CHLOROPHYCEAE

Order: CHLOROCOCCALES

11. **Pediastrum duplex** Meyen var. **asperum** (A. Braun) Hansg. (Pl. 1. 11)

[Synonym: *Pediastrum pertusum* var. *asperum* A. Braun 1855]

Philipose 1967, p. 121, fig. 43; Komárek and Fott 1983, p. 301-302, fig. 90.3; Komárek and Jankovska 2001, p. 58, fig. 34.

Coenobia 16-32-64 celled, 90 µm in diameter, small lens shaped perforation between cells, inner cells quadrate to angular and in contact at the central portion of the side wall, inner side of marginal cells concave, outer sides produced into two short truncate processes; chloroplast single and parietal with a pyrenoid; cells 8-18 µm in diameter.

Planktic in puddle (polluted); Voucher number, date and site: 1169, 29th March 2007, Majuli.

12. **Pediastrum simplex** Meyen var. **biwaense** Fukushima (Pl. 1. 12)

Komárek and Fott 1983, p. 290, fig. 85.2.

Coenobia 16-32 or more celled, circular; large intercellular spaces or a single central space with the cells arranged in a ring at the periphery; inner face of marginal cells concave, outer face prolonged into a single tapering processes; side of marginal cells concave on nearly straight; inner cells similar to marginal cells but short in processes; cell wall smooth or slightly punctuate; cells 7-20µm broad and 10-35µm long; coenobia up to 130µm in diameter.

Epiphytic or free floating in river; Voucher number, date and site: 1167, 29th March 2007, Brahmaputra river, Namati.

13. **Pediastrum simplex** Meyen var. **simplex** Komárek (Pl. 1. 13)

[Synonym: *Pediastrum ovatum* (Ehrenberg) A. Braun 1855]

Komárek and Jankovska 2001, p. 32-33, fig. 12.A.

Coenobia circular, 8-16 celled coenobia up to 80-85µm in diameter; large intercellular spaces or a central space with the cells arranged in a ring at the periphery, inner side of marginal cells concave, outer surface prolonged into a single delicately tapering process, sides of marginal cells concave or straight, internal cells similar to marginal cells with shorter process, cell wall smooth; chloroplast single and parietal; cells 12-15µm broad and 20-25µm long.

Planktic in river; Voucher number, date and site: 1152, 28th March 2007, Diffolo river, Kaziranga National Park, Golaghat.

14. **Pediastrum tetras** (Ehrenb.) Ralfs (Pl. 1. 15)

[Basionym: *Micrasterias tetras* Ehrenb. 1838]

[Synonym: *Pediastrum rotula* Kütz. 1845, *Pediastrum ehrenbergii* (Corda) A. Braun 1855, *Pediastrum incavatum* Turner 1892]

Philipose 1967, p. 128, fig. 45(b); Komárek and Jankovska 2001, p. 68, fig. 43.

Coenobia circular, 8 celled, 20-33µm in diameter, coenobia a flat plate; cells without intercellular spaces; marginal cells divided into two lobes with a deep single linear incision, inner cells 4-6 sided with a single linear incision, cells 6-8µm in diameter.

Epiphytic or free floating in river; Voucher number, date and site: 1167, 29th March 2007, Brahmaputra river, Namati.

15. Hydrodictyon reticulatum (L.) Lagerheim (Pl. 1. 14)

[Basionym: *Conferva reticulatum* Linnaeus 1753]

[Synonym: *Hydrodictyon pentagonum* Voucher 1800]

Philipose 1967, p. 134, fig. 48 (a); Komárek and Fott 1983, p.317, fig. 95.2.

Coenobia reticulate net-like, meshes pentagonal or hexagonal, up to 15-20cm long; cells elongate-cylindrical, coenocytes with large central vacuole, cell wall two layered; chloroplast single, parietal and with a single pyrenoid; cells up to 250µm broad and up to 1.5-2cm long.

Free floating (thick mat) in lake; Voucher number, date and site: 1149, 28th March 2007; Kaulilmardi beel, Golaghat, Kaziranga National Park.

16. Ankistrodesmus densus Koršikov (Pl. 1. 16 & 1.17)

[Synonym: *Ankistrodesmus spiralis* var. *fasciculatus* G.M. Smith 1922]

Hindák 1988, p. 237, pl. 87.

Coenobia multicelled, denser with interlaced cells; relatively free, slightly detached from each other, colonies assume to spherical shape; cells are equal in length and width, normal from centre towards the ends, ends pointed, 2.5-4µm broad and 50-80µm long; coenobia 70-80µm in diameter.

Planktic in pond; Voucher number, date and site: 1178, 29th March 2007, Sri Aunikati Sastra, Majuli.

17. Ankistrodesmus falcatus (Corda) Ralfs (Pl. 1. 18 & 1.19)

[Basionym: *Micrasterias falcata* Corda 1835]

[Synonym: *Ankistrodesmus biplex* (Reinsch) G.S. West 1904, *Ankistrodesmus lundbergii* Koršikov 1953]

Philipose 1967, p. 211, figs. 121 (a & e); Komárek and Fott 1983, p. 686, fig. 192.3.

Coenobia 2-4-8 celled, cells fasciculate bundles; cells acicular to narrowly fusiform with the ends tapering to acute apices; chloroplast single, parietal and without pyrenoid; cells 2-3µm broad and 20-165µm long.

Planktic in river, pond; Voucher number, date and site: 1152, 28th March 2007, Diffolo river, Kaziranga National Park, Golaghat, Assam; 1178, 29th March 2007, near Sri Aunikati Sastra, Majuli.

18. Coelastrum proboscideum Bohlin (Pl. 2. 1)

[Synonym: *Coelastrum microporum* f. *typica* Wolle 1887, *Coelastrum irregulare* Schröder 1897, *Coelastrum pseudocubium* Schröder 1897]

Philipose 1967, p. 229, fig. 137 (a); Komárek and Fott 1983, p. 726, fig. 203.1.

Coenobia more or less pyramidal, 8-16 celled, 40-110µm in diameter, intercellular spaces usually large and polygonal, cells truncate and six-sided with the lateral sides slightly concave, poles of thickened, 6-12µm in diameter.

Planktic in pond; Voucher number, date and site: 1176, 29th March 2007, near Sri Aunikati Sastra, Majuli.

19. Desmodesmus communis (E.H.Hegewald) E.H.Hegewald (Pl. 2. 2)

[Basionym: *Scenedesmus communis* E.H.Hegewald 1977]

[Synonym: *Scenedesmus quadricauda* (Turpin) Brébisson sensu *logispina* (Chodat) G.M. Smith 1913,

Scenedesmus longus Meyen 1829, *Scenedesmus caudatus* Corda 1835, *Scenedesmus westii* (G.M. Smith) Chodat 1926]

Komárek and Fott 1983, p.828, fig. 249.2; Hegewald and Silva 1988, p.429, fig. 687, Hegewald 2000, p.8.

Coenobia 2-4 celled; cells oblong cylindrical with rounded ends, long curved spine; cell wall smooth, cells broader than long; chloroplast single and parietal without pyrenoid; cells 9.6-10.6µm broad and 24.5-27.3µm long.

Epiphytic or planktic in river; Voucher number, date and site: 1167, 29th March 2007, Brahmaputra river, Namati'

20. **Scenedesmus obtusus** Meyen f. **obtusius** Meyen (Pl. 2. 3)

[Synonym: *Scenedesmus bijugatus* var. *arcuatus* Lemmerm. 1898, *Scenedesmus arcuatus* (Lemmerm.) Lemmerm. 1899, *Scenedesmus alternans* var. *arcuatus* (Lemmerm.) Fott and Komárek 1960, *Scenedesmus alternans* var. *platydiscus* (G.M. Smith) Fott and Komárek 1960]

Komárek and Fott 1983, p.828, fig. 225.8; Hegewald and Silva 1988, p.341, fig. 557.

Coenobia 4-8 celled, cells oblong-ellipsoid, obtuse poles, arranged in an alternating series, adjacent cells in contact only along a short portion of their length; chloroplast single and parietal with a pyrenoid at the centre; cells 10-14µm long and 4-5µm broad.

Epilithic attached to small stones in river or free floating; Voucher number, date and site: 1153, Diffolo river, 28th March 2007, Kaziranga National Park, Assam.

Order: OEDOGONIALES

21. **Oedogonium angustum** (Hirn) Tiffany (Pl. 2. 4)

Gonzalves 1981, p. 251, fig. 9.133; Mrozińska 1985, p. 128, fig.145.

[Synonym: *Oedogonium grande* var. *angustum* Hirn]

Macrandrous, heterothallic; vegetative cells cylindric, female filaments 19-30µm in diameter, 70-300µm long; male filaments 19-25µm diameter, 70-220µm in long; oogonia single or sometimes up to 4 seriate, sub-ovoid, elongate, 30-52µm in diameter, 50-110µm long, oospore identical in shape to the oogonium and nearly filling it, 30-40µm in diameter, 50-70µm long; spore wall smooth; antheridia up to 36-seriate, 18-22µm in diameter, 7-015µm in long.

Epiphytic in river; Voucher number, date and site: 1166, 29th March 2007, Brahmaputra river, Namati.

Order: DESMIDIALES

22. **Closterium dinnae** Ehrenberg ex Ralfs (Pl. 2. 5)

W. West and G.S. West 1904, p. 130, pl. 15, fig. 3.

Cells solitary, strongly curved, with less pronounced curvature at the central part; attenuated towards apex; central part of the ventral side is slightly convex; dorsal side is distinctly inflated; apex obtuse; cell wall smooth; chloroplast single axial; cells 8-10 times longer than broad; 100-170µm long and 10-20µm broad.

Planktic in river; Voucher number, date and site: 1171, 29th March 2007, Brahmaputra river, Majuli.

23. **Closterium ehrenbergii** Meneg. (Pl. 2. 6)

W. and G. S. West 1904, p. 143, pl. 17, figs. 1-4; Prasad and Misra 1982, p. 116, fig. 5.

Cells solitary, green, moderately curved, inner margin concave, slightly bulged in the middle, attenuated at the apex, apex rounded; chloroplast longitudinally 6-8 bands, pyrenoids many, at each apex one reddish polar nodule present; cells 150-245µm long and 25-35µm broad.

Planktic in river; Voucher number, date and site: 1172, 29th March 2007, Brahmaputra river, Majuli.

24. *Closterium gracile* Bréb. (Pl. 2. 7)

W. West and G.S. West 1904, p. 166, pl. 21, fig. 8-12.

Cells solitary long green; straight or slightly bend at the middle parallel, attenuated at the ends; ends semi-lunate, ends-obtuse or semi-obtuse; cells 15-30 times longer than broad, 100-130µm long and 4-8µm broad; chloroplast single axial, at the end absent at the granular.

Planktic in river; Voucher number, date and site: 1172, 29th March 2007, Brahmaputra river, Majuli.

25. *Closterium jenneri* Ralfs var. *robustum* G.S. West (Pl. 2. 8)

W. West and G.S. West 1904, p. 136, pl. 15, fig. 26-27.

Cells solitary, small, lunate the central part ventral side, without curvature slightly curved, dorsal side convex; slightly attenuated towards apex, apex obtuse rounded; chloroplast axial with 2-3 ridges, granulated at the apex; cells longer than broad, 50-90µm long and 10-15µm broad.

Epiphytic in puddle; Voucher number, date and site: 1173, 29th March 2007, near Alimore, Majuli.

26. *Closterium kützingii* Brébisson (Pl. 2. 9)

W. West and G.S. West 1904, p. 186, pl. 25, fig. 6-11

Williamson 2006, p. 62, pl. 1, fig. 7.

Cells solitary, green, central part, semi-spindle, long, straight attenuated towards end to long setae, ends semi-obtuse; chloroplast axial; present at the central part pyrenoids not found; cells 420-480µm long and 12- 20 µm broad at the apices 5-3µm

Epiphytic in river; Voucher number, date and site: 1157, 28th March 2007, Kohara river, Kaziranga National Park.

27. *Closterium lunula* (Müller) Nitzsch (Pl. 2. 10)

Kant and Gupta 1998, p. 252, pl. 58, fig. 5.

Cells solitary, elongated, attenuated towards the end; chloroplast with longitudinal linear ridge, separated at the middle, pyrenoids many; at each end one reddish nodule is present; cells 450-666µm long and 40 -112µm broad.

Epiphytic in river and in lake; Voucher number, date and site: 1154, 28th March 2007, Korasing beel, Kaziranga National Park, Assam; 1157, 28th March 2007, Kohara river, Kaziranga National Park.

28. *Cosmarium boeckii* Wille (Pl. 2.11)

W. West and G.S. West 1908, p. 234, pl. 86, fig. 26-32

Cells very small, slightly longer than broad; deeply constricted; sinus narrowly linear, biliped and closed; semicell semi-circular, basal angle rounded; apical margin rounded with faintly crenate; cell wall slightly punctate; chloroplast single axial with two big pyrenoids in each cells; cells 10-12µm long and 10-12-13µm broad; isthmus 3-5µm broad.

Epiphytic in pond; Voucher number, date and site: 1175, 29th March 2007, near Alimore, Majuli.

29. *Cosmarium cymatopleurum* Nordstedt (Pl. 2. 12)

W. West and G. S. West 1908, p. 7, pl. 65, fig. 8

Cells small, slightly longer than broad; side converging upwards, from broad base; deeply constricted; sinus narrowly linear open outwards, semicells semi-circular, crenate; basal angle broadly, apical angle rounded, a apex smooth; cell wall smooth; chloroplast single axial; cells 20-25 µm long and 18-20µm broad; isthmus 8-10µm broad.

Epiphytic in pond; Voucher number, date and site: 1174, 1175, 29th March 2007, near Alimore, Majuli.

30. **Cosmarium javanicum** Nordstedt (Pl. 2. 13)

Bordoloi 1983, p. 120, figs. 1-3; Vidyavati & al. 1983, p. 149, fig. 1.

Cells solitary, longer than broad; deeply constricted sinus, narrow, linear, closed; semicells ellipsoid; cell wall smooth, punctate; cells 108µm long and 82µm broad; isthmus 35µm broad.

Epiphytic in river; Voucher number, date and site: 1151, 28th March 2007, Kaulilmardi beel, Kaziranga National Park, Assam; 1157, 28th March 2007, Kohara river, Kaziranga National Park.

31. **Cosmarium moniliforme** (Turpin) Ralfs var. **subpyriforme** W. West and G.S West (Pl. 2. 14)

W. West and G.S. West 1908, p. 23, pl. 67, fig. 5

Cells 1-2 times longer than broad; moderately constricted; sinus open-outwards; apex-truncately rounded; apical angle rounded; cell wall smooth; chloroplasts axial; cells 45-50µm long, 20-25µm broad; isthmus 15-20µm broad.

Epiphytic in puddle; Voucher number, date and site: 1173, 29th March 2007, near Alimore, Majuli.

32. **Cosmarium obsoletum** (Hantzsch) Reinsch (Pl. 2. 15)

W. West and G. S. West 1905, p. 133, pl. 56, figs. 1-3.

Cells solitary, green, transversely elliptic, almost as long as broad, deeply constricted sinus narrow, open outwards; semicells depressed semicircular; chloroplast axial; cell wall smooth; Cells 60-64µm long and 60-63µm broad; isthmus 30µm.

Epiphytic in puddle; Voucher number, date and site: 1173, 29th March 2007, near Alimore, Majuli,

33. **Cosmarium venustum** Brébisson var. **majus** Wittrock (Pl. 2. 16)

W. West and G. S. West 1908, p. 11, pl. 92, fig. 2

Cells solitary, small; longer than broad; front view rectangular; deeply constricted; sinus with dilated extremities nearly linear; semicells sub-rectangular; with pseudo-elevated and ridges; near to upper side of basal angle; apex truncate with a depression at middle; apical angle rounded; cell wall smooth; chloroplast axial; cells 15-20µm long and 12-15µm broad; isthmus 3-4µm broad.

Epiphytic in river; Voucher number, date and site: 1151, 28th March 2007, Kaulilmardi lake, Kaziranga National Park.

34. **Cylindrocystis brebissonii** (Meneghini ex Ralfs) de Bary (Pl. 2. 17)

W. West and G. S. West 1904, p. 58, pl. 23-25

Cells solitary, cylindrical, straight rounded apex; without median constriction; cell wall smooth or bearing granules chloroplasts ridges without complex lobing; cells longer than broad; 30-45 long and 15-20µm broad.

Planktic in river; Voucher number, date and site: 1168, 29th March 2007, Brahmaputra river, Namati.

35. **Euastrum ansatum** Ralfs var. **pyxidatum** Delponte ex Delponte (Pl. 2. 18)

W. West and G.S. West 1905, p. 29, pl. 36, fig. 29, Brühl and Biswas 1926, p. 277, pl. VIII, fig. a-b.

Cells solitary, larger than broad, deeply constricted at the middle, sinus narrowly linear; apical margin of semicells elevated, polar lobe elevated with an angled deep incision; rotundas; apex truncate lateral side undulated near to upper-side of semicell base; cells 65-90 µm long and 30-45µm broad at base, apex 15 µm broad; isthmus 10-15µm broad.

Planktic or epiphytic in pond; Voucher number, date and site: 1176, 29th March 2007, Sri Aunikati sastra, Majuli.

36. **Euastrum clavatum** Turner (Pl. 2. 19)

Turner 1892, p. 85, pl. II, fig. 18

Cells about 1.5 times longer than broad, deeply constricted at isthmus with sinus linear and open outwards; semicells tapaziform basal angles broadly rounded, with 3-5 stout spines; apical angles with a stout spine, the apical margin of polar lobe with a U- shaped deep invagination in the middle; slightly lower to the lateral side of apical angles with small spines; apex of polar lobe truncate; cell wall smooth; cell 45-50µm long and 30-36µm broad and isthmus 5-7µm broad.

Planktic in river; Voucher number, date and site: 1168, 29th March 2007, Brahmaputra river, Namati.

37. ***Euastrum cuneatum* Jenner** (Pl. 2. 20)

W. West and G. S. West 1905, p. 25, pl. 36, fig. 9

Cells solitary, longer than broad; deeply constricted at the middle, sinus narrowly linear, slightly open at outwards, semicells oblong-pyramidal, apical margin of semicells having deeply incision; apex angular-truncate; semicell at the base slightly elevated concave; cell wall granulated; cell 50-70µm long and 15-20µm broad; isthmus 8-10µm.

Planktic in river; Voucher number, date and site: 1168, 29th March 2007, Brahmaputra river, Namati.

38. ***Euastrum denticulatum* Gay** (Pl. 3. 1)

Williamson 2006, p. 64, pl. 2, fig. 5

Cells solitary, longer than broad; deeply constricted at isthmus, sinus closed; semi-cells tapaziform the basal angles rounded, the apical margin of angles with stout spine, the apical margin of polar lobe with U-shaped invagination in the middle; face of semicells with a central large protuberance and with intramarginal small granules; polar lobe rosti form; lateral side of semicells with small protuberance on the middle of each; cells 25-33µm long and 20-26µm broad ; isthmus 5-7µm.

Planktic or epiphytic in pond; Voucher number, date and site: 1176, 29th March 2007, Sri Aunikati sastra, Majuli.

39. ***Euastrum spinulosum* Delponte var. *spinulosum* Delponte** (Pl. 3. 2)

Williamson 2006, p. 64, pl. 2, fig. 8

Cells solitary, slightly longer than broad, flattened lateral lobes and somewhat trapezoids polar lobe, deeply constricted at the middle, sinus narrowly linear, closed; semicells with short apical lobe; apical lobe without smalls depression at the middle, lobes margins with small granular protuberance and at the middle of semicell granules arranged in a circular fashion; cells 55-60µm long and 50-53µm broad; isthmus 13-14µm broad.

Epiphytic in pond; Voucher number, date and site: 1177, 29th March 2007, Sri Aunikati sastra, Majuli.

40. ***Euastrum turgidum* Wallich var. *grunovii* Turner** (Pl. 3. 3)

Turner 1892, p. 74, pl. 10, fig. 29.

Cells solitary, medium size, longer than broad, deeply constricted at the middle; sinus linear with slightly angular outward open; semicells semi-pyramidal the basal angles rounded, lateral margin semi-concave with small swelling at the base of sinus; having pseudo-nodule; polar-lobe apex truncate without median notch; cells 100-120µm long, 70-80µm broad; isthmus 20-30µm broad.

Planktic or epiphytic in pond; Voucher number, date and site: 1176, 29th March 2007, Sri Aunikati sastra, Majuli..

41. ***Micrasterias pinnatifida* (Kützing) Ralfs** (Pl. 3. 4)

W. West and G.S. West 1905, p. 80, pl. 41, fig. 7-11; Brühl and Biswas 1926, p. 279, pl. VI, fig. 51; Turner 1892, p. 88, pl. 5, fig. 3.

Cells small, deeply constricted, linear sinus, slightly open outwards; semicells 3-lobed, interlobular incisions deep and broadly constricted, lateral lobes horizontal, sub-fusiform with minutely bifid apex exhibiting

acuminate ends, polar lobe with basal portion sub-rectangular and apical portion with extremities like lateral lobes, relatively shorter in length; cell wall minutely punctuate; cells slightly longer than broad, 40-60µm long and 40-50µm broad; isthmus 10-15µm broad.

Planktic or epiphytic in pond; Voucher number, date and site: 1176, 29th March 2007, Sri Aunikati sastra, Majuli..

42. **Penium spinospermum** Joshua (Pl. 3.5)

W. West and G. S. West 1904, p. 78, pl. 8, fig. 6-7.

Cells solitary, small very slightly attenuated towards apex; apex rounded; unconstricted at the middle; chloroplast one axial with three ridges and one pyrenoids; cells 2.5 times longer than broad, 25-30µm long and 10-15µm broad.

Epiphytic in pond; Voucher number, date and site: 1174, 29th March 2007, near Alimore, Majuli.

43. **Pleurotaenium rectum** Delponte var. **rectum** Delponte (Pl. 3.6)

[Synonym: *Pleurotaenium trabecula* (Ehrenberg ex Nägeli var. *rectum* (Delponte) West et G.S. West.)]

W. West and G.S. West 1904, p. 212, pl. 30, fig. 10

Cells solitary, long and robust, basal wall marked with one or two undulations; broader at the middle of the semicells gradually tapering towards apex from the base; pole is cylindrical, apex is truncate and bears very small minutes tubercles; cell wall is punctuate; cell many times longer than broad; 300-400 µm long and 15-25µm middle; 10-18µm broad at apex.

Epiphytic in pond; Voucher number, date and site: 1174, 29th March 2007, near Alimore, Majuli.

44. **Staurostrum anatinum** Cooke and A.W. Wills in Cooke (Pl. 3.7)

West & al 1923, p. 142, Pl. 147, Fig. 1

Cells solitary, broader than long, constricted at the middle; isinus widely opened outwards; semicells with three distinct long denticulate or crenate processes tipped with three minute spines, in vertical view triangular; cells granulated; cells 20-25µm long and 30-40µm, with horns 40-60µm broad; isthmus 10-12µm.

Planktic in river; Voucher number, date and site: 1172, 29th March 2007, Brahmaputra river, Majuli.

45. **Staurostrum leptocladum** Nordstedt (Pl. 3.8)

Brühl and Biswas 1926, p. 306, pl. XIII, fig. 140.

Cells solitary, broader than long; at the middle constricted with acute incised sinus; isthmus long; semicells having elongated base and extended into prolong horns at both side; horns crenate and apex with bifid apex; pyrenoids single in each semicells; cells 35-45µm long and 80-100µm broad with horns; isthmus 8-10µm.

Epiphytic in pond; Voucher number, date and site: 1174, 29th March 2007, near Alimore, Majuli.

46. **Staurostrum paradoxum** Meyen var. **evolutum** West (Pl. 3.9)

West & al 1923, p. 107, pl. 145, fig. 7-8.

Cells solitary, slightly compressed; deeply constricted at the middle sinus widely open outwards with acute angled; semicells crenate extended into 3 medium sized attenuated processes with 2 small spines; cells 15-25µm long and with processes 55-65µm broad; isthmus 8-10µm.

Epiphytic in pond; Voucher number, date and site: 1174, 29th March 2007, near Alimore, Majuli.

47. **Staurostrum pseudosebaldi** Wille (Pl. 3.10)

Brühl and Biswas 1926, p. 308, pl. XII, fig. 126 a-b.

Cells solitary, compressed, radially symmetrical, deeply constricted with acute angled sinus; semicells projected into processes somewhat straight, elliptical; semicell apex slightly convex; in vertical view triangular

and at the middle internally concave, processes apex bifid with 2 small spine; cells 15-25µm long and with processes 30-40µm broad; isthmus 10-15µm broad.

Epiphytic in pond; Voucher number, date and site: 1174, 29th March 2007, near Alimore, Majuli.

48. **Staurostrum stellium** Turner (Pl. 3. 11)

Turner 1892, p. 119, pl. XV, fig. 6 a-b.

Cells solitary, cell longer than broad, semicells with long 4-6 processes slightly convex; divergens, attenuated-sinuses towards apex with dilated minute teeth; sinus very incised; cells highly ornamented, 50-60 µm long with processes 80-90µm long and 25-35µm broad; isthmus 7-10µm broad.

Epiphytic in puddle; Voucher number, date and site: 1173, 29th March 2007, near Alimore, Majuli.

49. **Staurostrum sexagulare** (Brühl) Lundell var. **crassum** Turner (Pl. 3. 12)

Turner 1892, p. 117, pl. XV, fig. 1;

Lenzenweger 2000, p. 35, pl. 3, fig. 3

Cells solitary, deep median constriction in top view, cell with 5 radiate processes, processes denticulate, glabrous and serrate; apex with trifid and smooth small teeth; cells 40-50µm long, with processes 60-70µm long; isthmus 12-15µm broad.

Epiphytic in puddle; Voucher number, date and site: 1173, 29th March 2007, near Alimore, Majuli.

Order: ZYGNEMATALES

50. **Spirogyra fluviatilis** Hilse (Pl. 3. 13 & 3.14)

Randhawa 1959, p. 332, fig. 322; Kadlubowska 1984, p. 406, fig. 634.

Vegetative cell cylindric, 20-60µm broad and 40-192µm long, cross wall plain; chloroplasts 2-3 making 2 to 2.5 turn, pyrenoids distinct; conjugation scalariform, conjugation tubes formed by both gametangia, zygospores oval, ellipsoidal, 20-30µm broad and 40-60µm long, spore wall smooth and dark.

Free floating in river; Voucher number, date and site: 1167, 29th March 2007, Brahmaputra river, Namati.

51. **Spirogyra gracilis** (Hassall) Kütz. (Pl. 3. 15 & 3.16)

Prasad and Misra 1983, p.65, figs. 15-16; Randhawa 1959, p. 296, fig. 253 (a,b,c); Kadlubowska 1984, p. 285, fig. 438.

Vegetative cell 25-30µm broad and 50-100µm long, end wall plain; chloroplast 1 making 1 to 2 turns; conjugation scalariform, tubes formed by both gametangia; zygospores ellipsoid with rounded ends, 25-35µm broad and 50-65µm in long; spore wall smooth.

Free floating in river; Voucher number, date and site: 1167, 29th March 2007, Brahmaputra river, Namati.

BACILLARIOPHYCEAE

Order: FRAGILARIALES

52. **Grammatophora undulata** Ehrenb. (Pl. 3. 17)

Rath and Adhikary 2005, p. 80, pl. 11, fig. 68.

Frustules quadrangular with rounded angles, septa slightly undulate, valves linear-oblong, slightly widened in the middle, ends capitulate, 20-120µm long and 10-20µm broad; striation visible at the margin of central area, but not visible at the ends, transverse, striae 6-8 in 10µm.

Planktic in lake and epiphytic in lake; Voucher number, date and site: 1148, 28th March 2007, Mahilake, Golaghat, Kaziranga National Park, Assam; 1150, 28th March 2007, Kaulilmardi beel, Kaziranga National Park.

53. **Synedra gracilis** Kütz. (Pl. 3. 18)

Kützing 1865, p. 64, pl. 3, figs. XIV.

Frustules linear, acicular, attenuated toward apices, slightly lanceolate at the middle, end acuminate-acute; 30-50µm long and 5-7µm broad, striation not seen.

Planktic in river; Voucher number, date and site: 1168, 29th March, 2007, Brahmaputra river, Namati.

54. ***Synedra tabulata* Kütz.** (Pl. 3. 19)

[Synonym: *Diatoma tabulatum* Kütz.]

Kütz. 1865, p.68, pl. 15, fig. X (1-3).

Frustules slender, linear, slightly attenuated toward apices, apices rotundatum-obtuse; one to two frustules conjugated, stipe short or not distinct, valve 50-102µm long and 13-22µm broad, striation clear at the middle, toward end not visible.

Epiphytic in river; Voucher number, date and site: 1167, 29th March 2007, Brahmaputra river, Namati.

55. ***Synedra ulna* (Nitzsch) Ehrenb. var. *oxyrhynchus* (Kütz.) Van Heurck** (Pl. 3. 20)

[Synonym: *Synedra amphirhynchus* Ehrenb.]

Huber-Pestalozi 1942, p. 462, pl. CXXXVI, fig. 545.

Frustules slender, linear, straight, at the end narrow and slightly constricted to form a rounded end, many times longer than broad, 100-250µm in long and 10-12µm broad; striation distinct, parallel, absent at the middle, striae 9-12 in 10µm.

Epiphytic in river; Voucher number, date and site: 1167, 29th March 2007, Brahmaputra river, Namati.

Order: ACHNANTHALES

56. ***Achnanthes subsessilis* Kütz.** (Pl. 3. 23)

[Synonym: *Achnanthes turgens* Ehrenb.]

Kütz. 1865, p.76, pl. 20, fig. IV.

Frustules rectangular, slightly bent at the middle, 1-2 valves articulate, turgid form, laterally oblong, 30-50µm long and 5-14µm broad; striation intermediate or distinct, striae 6-9 in 10µm

Planktic in river; Voucher number, date and site: 1152, 28th March 2007, Diffolo river, Kaziranga National Park, Golaghat.

Order: NAVICULALES

57. ***Pleurosigma aestuarii* Brébisson ex. Kütz. C.W. Son.** (Pl. 3. 21)

Desikachary 1989, p. 5, pl. 680, fig. 8 & 9.

Frustules broadly lanceolate, slightly sigmoid at the apices with round obtuse end, 50-80µm long and 10-20µm broad; raphae straight or slightly oblique at the end; striation not seen clearly in fresh material.

Planktic in river; Voucher number, date and site: 1171, 29th March, 2007, Brahmaputra river, Majuli.

58. ***Navicula amphirhynchus* Ehrenb.** (Pl. 3. 22)

Kütz. 1865, p. 95, pl. 4, fig-XIII; pl. 28, fig. 47.

Frustules broadly elliptic-lanceolate with quite narrowly rostrate apices, apices constructed to form truncate, longer than broad, 50-100µm long, 10-20µm broad; raphae thin and central area slightly widened; striation barely visible in fresh material.

Epiphytic or planktic in lake; Voucher number, date and site: 1155, 28th March 2007, Korasing beel, Kaziranga National Park.

59. ***Navicula gracilis* Ehrenb.** (Pl. 3. 24)

[Synonym: *Cymbella hyalina* Agardh; *Frustulia avenacea* De Bréb.]

Kütz. 1865, p. 91, pl. 3, figs. XLVIII & pl. 30, fig. 57.

Frustules linear-lanceolate, elongate; end obtuse, axial area narrow, central area fairly wide, 60-90µm long and 15-20µm broad; raphae thin, straight; striation barely visible in fresh materials.

Epiphytic in lake; Voucher number, date and site: 1151, 28th March 2007, Kaulilmardi beel, Kaziranga National Park.

60. **Navicula major** Kütz. (Pl. 3. 25)

[Synonym: *Bacillaria fulva* Nitzsch; *Frustulia major* Kütz.]

Kütz. 1865, P. 97, pl. 4, fig. XIX.

Frustules elongate-elliptic; towards apices rotundas, in valve view rectangular, middle or axial portion granular, 50-75µm long and 10-15µm broad; striation transverse, less visible, striae 10-12 in 10µm.

Planktic in river; Voucher number, date and site: 1170, 29th March, 2007, Brahmaputra river, Majuli.

61. **Navicula microspora** Kant and Gupta (Pl. 3. 26)

Kant and Gupta 1998, p. 27, pl. 127, fig. 12.

Frustules, elliptical- lanceolate, rostrate apices, capitate, axial area broad, 30-50µm long and 6-12µm broad; pseudoraphe at the centre; striation not visible in fresh material.

Epiphytic in lake; Voucher number, date and site: 1150, 1151, 28th March 2007, Kaulilmardi beel, Kaziranga National Park.

62. **Navicula pupula** Kütz. (Pl. 3. 27)

Kütz. 1865, p. 93, pl. 30, figs. 40.

Frustules linear, sub-lanceolate, end rounded, raphae absent at the centre, toward apices slightly constricted, striation not clearly seen in fresh material; 20-40µm long and 5-12µm broad.

Epiphytic in lake; Voucher number, date and site: 1149, 28th March 2007, Kaulilmardi beel, Kaziranga National Park; 1155, 28th March 2007, Korasing lake, Kaziranga National Park.

63. **Gomphonema dichotomum** Kütz. (Pl. 3. 28 & 3.29)

[Synonym: *Gomphonema gracile* Ehrenb.]

Kütz. 1865, p. 85, pl. 8, fig. XIV.

Frustules linear-cuneate, apices obtuse, laterally lanceolate, obtuse apex, 20-35µm long and 4-8µm broad, striation medium, seen only at the middle; stipe elongate and dichotomous; stipe or stalk of 20-40 µm long and 4 µm broad.

Epiphytic in lake; Voucher number, date and site: 1150, 28th March 2007, Kaulilmardi beel, Kaziranga National Park.

64. **Gomphonema hebridense** Gregory (Pl. 3. 30)

Pal and Santra 1990, p. 74, pl. 1, fig. 7.

Frustules linear lanceolate, elongated, central area slightly wide and attenuated towards both the end, end sub-acute, 50-90µm long and 6-12µm broad; raphae median; striation course, striae 8-12 in 10µm.

Planktic in river; Voucher number, date and site: 1171, 29th March, 2007, Brahmaputra river, Majuli.

65. **Gomphonema parvulum** (Kütz.) Grunow var. **micropus** (Kütz.) Cléve (Pl. 3. 31)

Pal and Santra 1990, p. 75, pl. 1, fig. 16; Sinha and Naik 1997, p. 50, pl. 19, fig. 8 a-k.

Frustules clavata-lanceolate, gradually tapering from the middle towards the ends, apices rostrate, axial area narrow; 20-25µm long and 5-7µm broad; striation not clearly seen in fresh material.

Epiphytic in river; Voucher number, date and site: 1167, 29th March 2007, Brahmaputra river, Namati.

66. **Cymbella affinis** Kütz.

(Pl. 3.32)

Kütz. 1865, P.80, pl. 6, fig. XV; Pal and Santra 1990, p. 73, pl.1, fig. 3.

Frustules biraphid, asymmetrical, elliptic long, end obtuse, dorsal side convex, ventral margin slightly gibbous, longer than broad, 30-60µm long and 10-16 µm broad; raphae arcuate or toward the ventral margin; striation distinct transverse, parallel, striae 9-10 in µm.

Epiphytic in lake; Voucher number, date and site: 1150, 28th March 2007, Kaulilmardi beel, Kaziranga National Park.

67. **Cymbella cistula** (Hempr.) Grunow

(Pl. 3.33)

Prasad and Jaitly 1985, p. 137, fig. 3

Frustules biraphid, asymmetrical at the apical axis, bend; valves lunate with convex dorsal side, gibbous on ventral margin and obtuse end, axial area somewhat broad, central nodule present, longer than broad, 85-100 µm long and 10-25µm broad; raphae located at the middle; striation radial in the middle and slightly convergent at the end; striae 8-10 in 10µm.

Epiphytic in river; Voucher number, date and site: 1167, 29th March 2007, Brahmaputra river, Namati.

68. **Amphora ovalis** Kütz.

(Pl. 3.34)

[Synonym: *Navicula amphora* Ehrenb.; *Frustulia ovalis* Kütz.]

Kütz. 1865, P.107, pl-5, fig-XXXV and XXXIX.

Frustules in girdle view oval, strongly biconvex dorsal valves, ventral valve margin weakly concave, apices rotundatum, truncate, longer than broad, 50-105 µm long and 10-20 µm broad; striation transverse at the dorsal valve margin, striae 10-13 in 10µm at the centre.

Epiphytic in lake; Voucher number, date and site 1156, 28th March 2007, Korasing beel, Kaziranga National Park.

Order: RHOPALODIALES

69. **Rhopalodia gibba** (Ehrenb.) O. Müller

(Pl. 3.35)

Desikachary 1987, p. 3, pl. 231, fig. 10.

Frustules sub linear with truncate ends, fully inflated; valves straight on the ventral side and with slight depression at the ends, dorsal side slightly convex, end rounded; 80-120 µm long and 14-18µm broad; costae transverse, parallel, striae 7-8 in 10µm.

Planktic in puddle; Voucher number, date and site: 1173, 29th March 2007, near Alimore, Majuli.

Order: BACILLARIALES

70. **Nitzschia palea** (Kütz.) C.W. Sm.

(Pl. 3.36)

Desikachary 1987, p. 8, pl. 305, fig. 15.

Frustules linear, sub-lanceolate, attenuated to sub-acute apices, 25-70µm long and 3-8µm broad; keel punctate, small, striae 10-12 in 10µm.

Planktic in river; Voucher number, date and site: 1172, 29th March 2007, Brahmaputra river, Majuli.

RESULTS AND DISCUSSION

Comparative occurrence of the algal taxa in two “hot spots” in the North eastern region of India, the Kaziranga National Park and the river island Majuli is given in table 2. Out of the total of 70 taxa documented first time from these specialized habitats, 22 taxa belonging to 15 genera were recorded from different water bodies of Kaziranga National Park. Of these 3 species belonged to 2 genera of Cyanophyceae, 2 species to 2 genera of Euglenophyceae, 8 species to 5 genera of Chlorophyceae and 9 species to 6 genera of Bacillariophyceae. The Pinales group of diatoms and Chlorophyceae members were dominant due to availability

Table -2: Comparison of occurrence of algal taxa recorded in the water bodies within Kaziranaga National Park and Majuli river island.

Sl No.	Algal Taxa	Kaziranga National Park	Majuli Island
	Cyanophyceae (Cyanobacteria/Cyanoprokaryota)		
	Order: Chroococcales		
1	<i>Microcystis viridis</i> (A.Braun) Lemmermann	-	+
	Order: Nostocales		
2	<i>Phormidium chalybeum</i> (Martens ex. Gomont) Anagn. & Komárek	+	+
3	<i>Phormidium retzii</i> (C.Agardh) Kütz. ex Gomont	+	-
4	<i>Lyngbya magnifica</i> N.L.Gardner	+	-
5	<i>Lyngbya majuscula</i> (Dillwyn) Harvey	-	+
	Euglenophyceae		
	Order: Euglenales		
6	<i>Euglena agilis</i> Carter		+
7	<i>Phacus caudatus</i> Hubner	-	+
8	<i>Phacus longicauda</i> (Ehrenb.) Dujardin	+	-
9	<i>Phacus peteloti</i> Lefevre	-	+
10	<i>Trachelomonas intermedia</i> Dangeard	+	-
	Chlorophyceae		
	Order: Chlorococcales		
11	<i>Pediastrum duplex</i> Meyen var. <i>asperum</i> (A.Braun) Hansg.	-	+
12	<i>Pediastrum simplex</i> Meyen var. <i>biwaense</i> Fukushima	-	+
13	<i>Pediastrum simplex</i> Meyen var. <i>simplex</i> Komárek	+	-
14	<i>Pediastrum tetras</i> (Ehrenb.) Ralfs	-	+
15	<i>Hydrodictyon reticulatum</i> (L.) Lagerheim	+	-
16	<i>Ankistrodesmus densus</i> Koršikov	-	+
17	<i>Ankistrodesmus falcatus</i> (Corda) Ralfs	+	+
18	<i>Coelastrum proboscideum</i> Bohlin	-	+
19	<i>Desmodesmus communis</i> (E.H.Hegewald) E.H.Hegewald	-	+
20	<i>Scenedesmus obtusus</i> Meyen f. <i>obtusum</i> Meyen	+	-
	Order: Oedogoniales		
21	<i>Oedogonium angustum</i> (Hirn) Tiffany	-	+
	Order: Desmidiaceae		
22	<i>Closterium dinnae</i> Ehrenb. ex Ralfs	-	+
23	<i>Closterium ehrenbergii</i> Menegh.	-	+
24	<i>Closterium gracile</i> Brébisson	-	+
25	<i>Closterium jenneri</i> Ralfs var. <i>robustum</i> G.S.West	-	+
26	<i>Closterium kützingii</i> Brébisson	+	-
27	<i>Closterium lunula</i> (Müller) Nitzsch	+	-
28	<i>Cosmarium boeckii</i> Wille	-	+
29	<i>Cosmarium cymatopleurum</i> Nordstedt	-	+
30	<i>Cosmarium javanicum</i> Nordstedt	+	-
31	<i>Cosmarium moniliforme</i> (Turpin) Ralfs var. <i>subpyriforme</i> W. and G.S West	-	+
32	<i>Cosmarium obsoletum</i> (Hantz.) Reinsch	-	+
33	<i>Cosmarium venustum</i> Bréb. var. <i>majus</i> Wittrock	+	-
34	<i>Cylindrocystis brebissonii</i> (Menegh. ex Ralfs) de Bary	-	+

Sl No.	Algal Taxa	Kaziranga National Park	Majuli Island
35	<i>Euastrum ansatum</i> Ralfs var. <i>pyxidatum</i> Delponte ex Delponte	-	+
36	<i>Euastrum clavatum</i> Turner	-	+
37	<i>Euastrum cuneatum</i> Jenner	-	+
38	<i>Euastrum denticulatum</i> Gay	-	+
39	<i>Euastrum spinulosum</i> Delponte var. <i>spinulosum</i> Delponte	-	+
40	<i>Euastrum turgidum</i> Wallich var. <i>grunovii</i> Turner	-	+
	<i>Micrasterias pinnatifida</i> (Kütz.) Ralfs	-	+
41	<i>Penium spinospermum</i> Joshua	-	+
42	<i>Pleurotaenium rectum</i> Delponte var. <i>rectum</i> Delponte	-	+
43	<i>Staurastrum anatinum</i> Cooke and A. W. Wills in Cooke	-	+
44	<i>Staurastrum leptocladum</i> Nordst.	-	+
45	<i>Staurastrum paradoxum</i> Meyen var. <i>evolutum</i> West	-	+
46	<i>Staurastrum pseudosebaldi</i> Wille	-	+
47	<i>Staurastrum stellium</i> Turner	-	+
48	<i>Staurastrum sexagulare</i> (Brühl) Lundell var. <i>crassum</i> Turner	-	+
	Order: Zegnematales		
49	<i>Spirogyra fluviatilis</i> Hilse	-	+
50	<i>Spirogyra gracilis</i> (Hassall) Kütz.	-	+
	Bacillariophyceae		
	Order: Fragilariales		
51	<i>Grammatophora undulata</i> Ehrenb.	+	-
52	<i>Synedra gracilis</i> Kütz.	-	+
54	<i>Synedra tabulata</i> Kütz.	-	+
55	<i>Synedra ulna</i> (Nitzsch) Ehrenb. var. <i>oxyrhynchus</i> (Kütz.) V. H.	-	+
	Order: Achnanthes		
56	<i>Achnanthes subsessilis</i> Kütz.	+	-
	Order: Naviculales		
57	<i>Pleurosigma aestuarii</i> Bréb. ex. Kütz. C.W. Sm.	-	+
58	<i>Navicula amphirynchus</i> Ehrenb.	+	-
59	<i>Navicula gracilis</i> Ehrenb.	+	-
60	<i>Navicula major</i> Kütz.	-	+
61	<i>Navicula microspora</i> Kant and Gupta	+	-
62	<i>Navicula pupula</i> Kütz.	+	-
63	<i>Gomphonema dichotomum</i> Kütz.	+	-
64	<i>Gomphonema hebridense</i> Gregory	-	+
65	<i>Gomphonema parvulum</i> var. <i>micropus</i> (Kütz.) Cléve	-	+
66	<i>Cymbella affinis</i> Kütz.	+	-
67	<i>Cymbella cistula</i> (Hempr.) Grunow	-	+
68	<i>Amphora ovalis</i> Kütz.	+	-
	Order: Rhopalodiales		
69	<i>Rhopalodia gibba</i> (Ehrenb.) O. Müller	-	+
	Order: Bacillariales		
70	<i>Nitzschia palea</i> (Kütz.) C.W. Sm.	-	+
	Total taxa	22	50

of perennial water flow from adjacent Brahmaputra river in the entire area forming beels and making it a marshy area. The algal diversity in the water bodies in Majuli island located within Brahmaputra river was higher as compared to Kaziranga national park. Totally 50 algal taxa belonging to 26 genera were recorded from different water bodies of Majuli island. Out of these 3 species belong to 3 genera of Cyanophyceae, 3 species to 2 genera Euglenophyceae, 34 species to 14 genera of Chlorophyceae and 10 species to 7 genera of Bacillariophyceae. The members of green algae were about 70 % of the total algal taxa recorded from this habitat. These taxa were under the Order Chlorococcales and Zygnematales including Desmids. The members of the Order Chlorococcales were found abundantly in the stagnant water pools except the members of genus *Pediastrum*; the latter was recorded from river Brahmaputra. Desmids were more diversified as these comprised of 24 taxa belonging to 9 genera occurring in ponds, tributaries of the water of Brahmaputra in the island. The members of Bacillariophyceae were about 20 % of the total taxa of this habitat and all of those belong to Pinnate group. Such dominance of the Desmids and pinnate Diatoms reflect pollution free water bodies of Majuli island. Though Kaziranga National Park and river island Majuli are located in close vicinity, due to the nature of the water bodies within these two habitats, in the former without any human habitation and almost no anthropogenic input, only 2 species of algae were common to both. These are *Phormidium chalybeum* (Mertens ex. Gomont) Anagnostidis & Komárek and *Ankistrodesmus falcatus* (Corda) Ralfs.

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v l e e a d k t h j a k j k'V; m l k u , o a e k t g h u n h } h i g k W L i k W e a' k 6 k y h; f o f o / r k
 , l - i h - v f / d k h , o a , e - t a k
 l k j k a k

v l e d s d k t h j a k j k'V; m l k u , o a e k t g h u n h } h i l s v f H k y § k c ¼ f d , x , 32 o a k a d s 70 ' k 6 k y h; V D l k e a
 l s d k t h j a k j k'V; m l k u e a f o f H k u t y k k k a l s 15 o a k a d s 22 V D l k v f H k y § k c ¼ f d ; s x ; A b u e a l s l k u k Q o l h
 (l k u k k s j v k k a k u k s V f j ; k) d s 2 o a k a d h 3 t k r ; k a ; W y h u k Q o l h d s 2 o a k a d h 2 t k r ; k a D y k k Q o l h d s
 5 o a k a d h 8 t k r ; k a F k c s l y s j v k Q o l h d s 6 o a k a d h 9 t k r ; k a g a d k t h j a k j k'V; m l k u l s e k t g h } h i d h
 ' k 6 k y h; f o f o / r k v f / d F k A e k t g h l s 26 o a k a d s 50 ' k 6 k y h; V D l k v f H k y § k c ¼ f d ; s x ; A b u e a l k u k Q o l h d s
 3 o a k a d h 3 t k r ; k a ; W y h u k Q o l h d s 2 o a k a d h 3 t k r ; k a D y k k Q o l h d s 14 o a k a d h 34 t k r ; k a F k c
 s l y s j v k Q o l h d s 7 o a k a d h 10 t k r ; k a g a e k k 2 t k r ; k a i Q a e Z M ; e p s y f c ; e , o a , u f d L V R M e l i Q d V l n k a k a
 v p y k a e a F k A b u n k e g R o i w k Z m U k r L F k y k a (g k W L i k W) e a v f / d k a k ' k 6 k y h; V D l k d h v p y f o f ' k'V Q; k l r i z h r
 g k h g a