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Research Paper

DIVERSITY OF SCYTONEMATACEAE, MICROCHAETACEAE, NOSTOCHOPSIDACEAE AND STIGONEMATACEAE (CYANOPHYCEAE) OF GOSSAIGAON SUBDIVISION, KOKRAJHAR DISTRICT, ASSAM

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Abstract

The present research works has been attempting to explore the cyanobacteria from Gossaigaon subdivision from different aquatic environments during January 2017-June 2018(one and half year). The cyanophyceae or cyanobacteria or blue green algae are ubiquitous and present everywhere. A total of 23 species were identified from four families and belongs to 6 genera. The study was contended with only aquatic environment. All of them were filamentous heterocystous forms. The Scytonemataceae carried 11 species (47%), 6 species of Stigonemataceae (26.09%), 4 species of Microchaetaceae(17.39%) and 2 species of Nostochopsidaceae(8.70%). The maximum number of species were found during monsoon season (8) followed by winter (6), re-treating monsoon (5), and pre-monsoon (4).

Key words: *Diversity, cyanophyceae, aquatic, filamentous, heterocystous.*

INTRODUCTION

Cyanophyceae or blue green algae are oxygen producing prokaryotic micro-organisms. The Blue Green Algae (BGA) exhibit remarkable diversity of forms and sizes. The thallus of BGA varies from unicellular to multicellular, coccoid to branched filamentous types. Sometimes the unicellular forms the colony. They are found both free living and as endosymbiont. Though prokaryotes, they are economically very important organisms. They can fix atmospheric nitrogen by heterocystous like *Anabaena*, *Nostoc*, etc. [1] and non heterocystous eg. *Plectonema* [2], marine Trichoderma species [3]. Canobacteria can easily survive in the extreme environments such as hot springs, hyper-saline waters, freezing environments and arid desert [4]. Cyanobacteria are more able to survive at lower PH value than 4-5[5,6] and optimum range of 7.5-10[7]. In Assam, there are some works has done with these algae in many districts [8,9,10,11,12,13]. But Kokrajhar is one the district where it is still neglected of studying in this field.

MATERIALS AND METHODS

The present study was carried out in Gossaigaon sub division under Kokrajhar district. Phytogeographically Gossaigaon subdivision is situated at the latitude of 26. 4371 °N and longitude 89. 9767 ° E. The maximum average temperature of the area is 30.18°C and minimum is 18.94°C. The average rainfall is 297.93 mm. The PH ranges from 5.78-7.15. The algal samples were collected from different habitat water in different season during January 2017 to July 2018 into level vials. The collected samples were washed with water and then preserved in 4% formalin. The identifications were done with the microphotographs and following the monograph of [14,15] taking consideration of morphological characters.

RESULTS AND DISCUSSION

The present investigation reveals only with four families of cyanophyceae and identified a total 23 species within Gossaigaon subdivision of Kokrajhar district (Table 1). The identified species belongs to 7 genera which are *Scytonema* constitute 7 species, others are *Tolypothrix* 4, *Microchaete* 4, *Stigonema* 3, *Hapalosiphon* 2, *Nostochopsis* 2, and *Westiellopsis* 1. The samples were collected from aquatic environments and most of the identified species attached with aquatic plants roots, rocks and other substratum.

Table 1. List of species with their occurrence, habit and habitats and morphological characters

Sl. No.	Name of sp.	Occurrence Of season	Habit and habitats.	Morphological characters
1	<i>Scytonema bohneri</i> Schmidle	Monsoon	Free floating with other algae in beel	Trichomes 5.2-8.0 μm broad; cells rectangular; end cell rounded; heterocysts intercalary, ellipsoidal to cylindrical.
2	<i>Scytonema hofminni</i> Ag.ex Born. et Flah.	Winter	On temporary rain paddels(rice field)	Trichome 5-9.8 μm broad, blue green, cells unequal in length; heterocysts oblong.
3	<i>Scytonema hofminni</i> var. <i>crassa</i> Bharadwaja	Winter	On rice fields	Trichomes 3.4- 4.6μm broad, gradually broadening towards the

				growing apices.
4	<i>Scytonema malaviyaensis</i> Bharadwaja	Pre.monsoon	On moist cemented floor	Trichomes with false geminate, branched,6.0-8.2 μm broad in young trichomes; heterocysts absent in young filaments, present in old ones,10.5-13.9 μm long.
5	<i>Scytonema pseudoguyanense</i> Bharadwaja	Retreating monsoon	Moist rocks in steam	Trichomes 8.2- 9 μm broad; cells quadratic; heterocysts cylindrical.
6	<i>Scytonema simplex</i> Bharadwaja	Monsoon	Free floating with other algae in rice fields	Trichomes 7.8-10.5 μm broad cells elongate; heterocysts single, elongate with convex end.
7	<i>Scytonema tolypothrichoides</i> Kützing ex Born.et Flah.	Winter	On moist wall	Trichome 7.4- 12 μm broad, olivaceous yellow; cells subquadrate; heterocysts varied,
8	<i>Tolypothrix byssoidea</i> (Berk) Kirchner	Retreating monsoon	Free floating in rice fields	Trichome 8.2- 10.5 μm broad, torulose; cells barrel shaped; heterocysts basal, rarely intercalary, single or in twos.
9	<i>Tolypothrix distorta</i> Kützing ex Born. et Flah.	Monsoon	Pond and pool	Trichomes 8.8-12.4 μm broad, cells as long as broad or shorter than

				broad; heterocysts single, spherical to cylindrical
10	<i>Tolypothrix nodosa</i> Bharadw.	Monsoon	Stagnant water (pool)	Trichome constricted at the joints; cells cylindrical up to 5 times as long as broad; heterocysts basal, single.
11	<i>Tolypothrix tenuis</i> (Kütz.) Johs. Schmidt em.	Premonsoon	Drain, on submerged rock surface in stream	; filaments 6.2- 16.4 μ m broad; repeatedly branched; sheath thin, hyaline, close to the trichome, not constricted at the cross walls; heterocysts cylindrical
12	<i>Microchaete elongata</i> (Fremy) comb. nov.	Monsoon	Attached with aquatic plants in ditches	Trichomes 8.2- 10.9 μ m broad, not constricted at the cross walls; cells cylindrical, in the apical parts longer than broad; heterocyst basal, terminal, intercalary
13	<i>Microchaete tenera</i> Thuret ex Born. et Flah.	Retreating monsoon	On rice field	trichome blue green, 4.8 μ m broad; cells 1 ½- 2 times as long as broad, heterocysts basal and intercalary.
14	<i>Microchaete tenera</i> var. <i>tenuis</i> Bharadwaja	winter	Floating with other algae in	Filaments long, 4.2 μ m broad; trichomes 3- 3.5

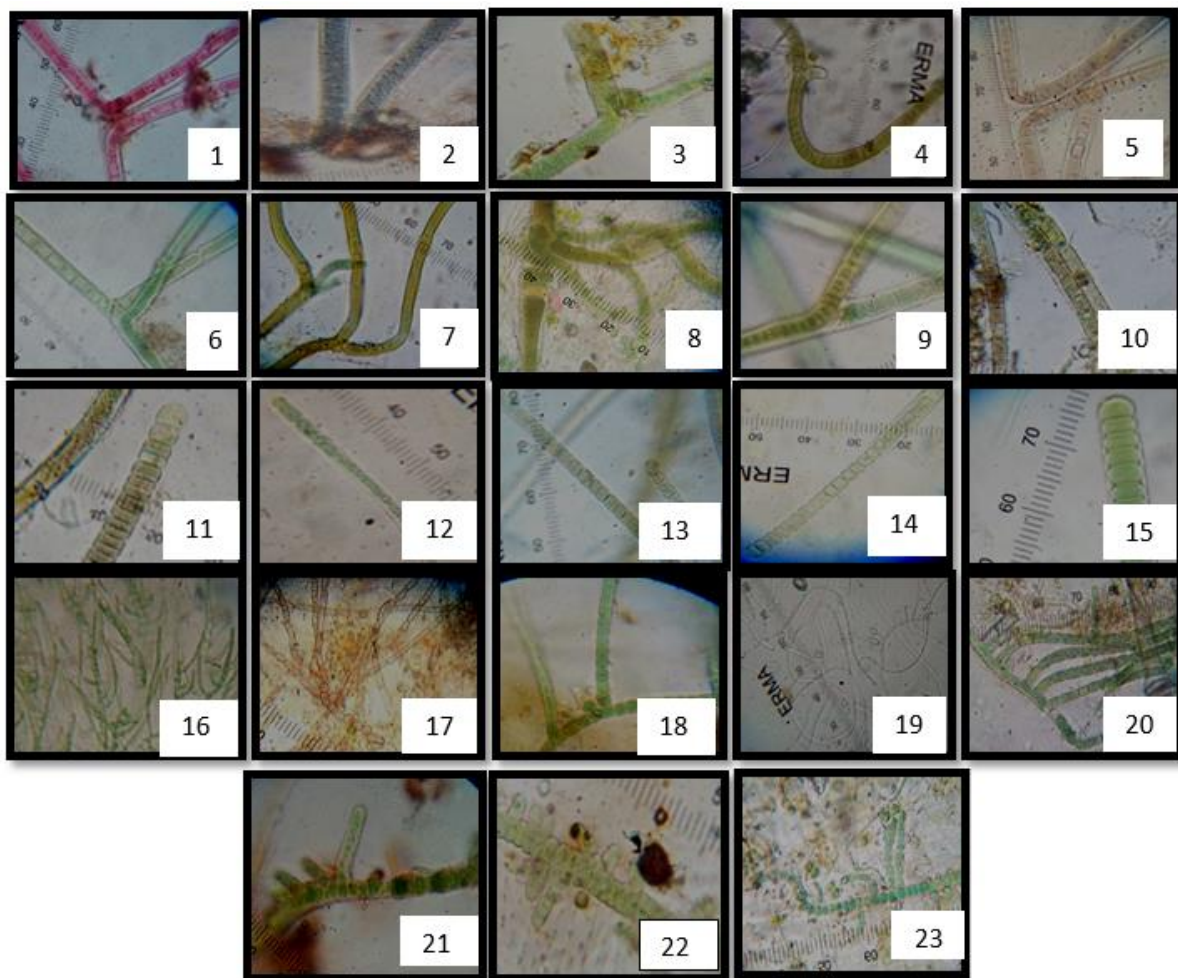
			pond	μm broad; heterocysts not cylindrical, 3.5- 4.2 μm diam.
15	<i>Microchaete uberrima f. minor</i> Carter, N.	Pre.monsoon	Floating on paddy field forming large scums	; trichomes 7-8.2 μm broad; not attenuated; cells subquadrate; heterocysts basal, spherical and adpressed; spores in long series, olivaceous, quadrate.
16	<i>Hapalosiphon hibernicus</i> W.ET g.s.,West	Monsoon	In beel as epiphyte on other submerged plant	Filaments single mixed with other algae, 7.4-9.5 μm broad, richly branched, sheath close to the filaments, thin colorless; cells quadrate; lateral branches erect, thinner than the main filaments, 4.6-5.8 μm broad, single or 2-3 side by side; false branches may also present; hetrocysts cylindrical.
17	<i>Hapalosiphon welwitschii</i> W. ET g.s. West	Pre.mon.	Temporary rain water pool	filaments closely entangled sheath thin, firm; cells spherical, quadrate or longer than broad, 3.0-6.8 μm

				broad, 4.2-12.8µm long; branches short and narrower than the main axis; heterocysts rare, long cylindrical; spores more or less spherical
18	<i>Westiellopsis prolifica</i> Janet	Winter	In Beel attached with submerged plant	Main filaments torulose, with barrel shaped cells; branched filaments thinner and elongate; heterocysts oblong-cylindrical, 5.0-5.6µm broad, and 10.0-15.4µm long
19	<i>Stigonema informe</i> Kütz . ex B orn .et Flah.	Monsoon	Attached with submerged plants in ditches	filaments 40-70 µ m broad; prostrate below and erect above, irregularly branched; branches straight or flexuous, up to 45µ m broad, secondary branches arising from the upper surface; trichome with 4-6 rows of cells; cells 15-18 µ m broad; heterocyst many, lateral
20	<i>Stigonema mamillosum</i> (Lyngb) Ag.ex Born et Flah.	Monsoon	Present on rice fields	; filaments interwoven, more or less entangled, up to 65 µ m broad,

				richly branched at the base; with long, broadly developed lateral branches or with short; heterocysts lateral mamilliform hormogoniferous branches
21	<i>Stigonema dendroideum</i> Fremy	Retreating monsoon	Attached with roots of floating grass and moist rock	Thallus blue-green, richly branched, erect; trichome with one or two rows of cells, 12-15.8µm broad; heterocysts sparse, intercalary or lateral.
22	<i>Nostochopsis lobatus</i> Wood em. Geitler	Winter	Attached with stone in sluice canal	Trichomes radially arranged, in the inner most parts bent irregularly or in a zig-zag manner, lower part of the upper region richly branched; trichomes tapering or slightly pointed at the end; cells barrel shaped; heterocysts lateral, sessile or pedicellate.
23	<i>Nostochopsis radians</i> Bharadwaja	Re. mon.	Attached with other aquatic plant in ditches	Thallus profusely branched filaments running radially; cells constricted in the basal

				region, more or less rounded; heterocysts lateral, sessile or pedicel laterate.
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The samples were collected from aquatic environments and most of the identified species attached with aquatic plants roots, rocks and other substratum. After investigation, it is concluded that the area is rich in organic matter of forest and agricultural litters which drained off to these habitats due to heavy rainfall during the monsoon season. The identified species proved that the area is rich in nutrients and cyanophycean flora grow abundantly. The range of PH value is in between 5.78- 7.15 which perhaps, favors the growth of cyanophycean flora in this region.



Figures.1. *Scytonema bohneri* Schmidle, 2. *Scytonema hofminni* Ag.ex Born. et Flah. 3. *Scytonema hofminni* var. *crassa* Bharadwaja, 4. *Scytonema malaviyaensis* Bharadwaja, 5. *Scytonema pseudoguyanense* Bharadwaja, 6. *Scytonema simplex* Bharadwaja, 7. *Scytonema tolypothrichoides* Kützing ex Born. et Flah., 8.

Tolypothrix byssoidea (Berk) Kirchner,9. *Tolypothrix distorta* Kützing ex Born. et Flah.,10. *Tolypothrix nodosa* Bharadw.,11. *Tolypothrix tenuis* (Kütz.) Johs. Schmidt em.,12. *Microchaete elongata* (Fremy) comb. nov.,13. *Microchaete tenera* Thuret ex Born. et Flah.,14. *Microchaete tenera var. tenuis* Bharadwaja,15. *Microchaete uberrima f. minor* Carter, N.,16. *Nostochopsis lobatus* Wood em. Geitler. ,17 *Nostochopsis radians* Bharadwaja. ,18. *Hapalosiphon hibernicus* W.ET g.s.,West.19.) *Hapalosiphon welwitschii* W. ET g.s. West.,20.*Westiellopsis prolifica* Janet., 21. *Stigonema informe* Kütz. ex Born. et Flah.,22. *Stigonema mamillosum* (Lyngb) Ag.ex Born. et Flah.,23. *Stigonema dendroideum* Fremy.

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