On Some Freshwater Soft Algae from Bhulla Taal Lake Lansdowne, District Pauri Garhwal, Uttarakhand

Rakesh Kumar Dwivedi*
1Department of Botany, B.D. Govt. P.G. College, Jaiharikhal

Corresponding author Email id: dwivedirakeshji@gmail.com

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Abstract: Bhulla taal is a freshwater artificial lake, famous for tourist attraction in Lansdowne city of Pauri Garhwal district of Uttarakhand state, India. The lake is situated on Shivalik range of the Garhwal Himalaya. Morpho-taxonomic identification reveals total 26 freshwater soft algal taxa from the lake belonging to class Cyanophyceae and Chlorophyceae. Taxon Coenocystis subcylindrica Korshikov has been reported for the first time from the western Himalayan range.

Keywords: Freshwater algae, Pauri Garhwal, Uttarakhand

Introduction

Mapping of algal diversity in Himalayan region is a mammoth task. Morpho-taxonomic identification of freshwater soft algae is the part of biodiversity inventories. Sporadic reports have been made so far especially regarding freshwater soft algal taxa of Himalayan region. The Lansdowne city is situated at 1780 meter above msl, in Garhwal Himalaya; a part of Shivalik range of Western Himalaya. Bhulla taal, a famous tourist destination of the area, is an artificial small lake maintained by the army cantonment board of the Garhwal Rifles Regiment Centre. The lake has length 140.75 meter, width 62.81 meter and the area ca. 4004.98 m². The lake is surrounded by the oak trees. It has inlet of water from northern end and the water goes out of the lake from its southern end and maintains the flow of water though out the year.

Sporadic reports on freshwater soft algae have been done from the Western Himalayan range. From Shivalik range of the Western Himalaya, fresh water soft algae have been reported by Dwivedi et al. (2006, 2008, 2008, 2009, 2014) mainly desmids, chlorococcalean and cyanophycean flora from Himachal Pradesh, from Kumaon region of the Uttarakhand, freshwater soft algae have been reported by Misra et al (2007, 2007) while that of from Garhwal Himalaya has been carried out by Habib (1998, 2001), Shukla et al. (2007, 2008), Misra et al. (2008) and Shukla et al. (2010).

Material and method

Freshwater algal samples were collected by random sampling method during summer seasons in May 2015 from the four different margins of the lake and in the middle of the lake through the boat. Epiphytic forms were collected by careful observations on the submerged plants. The samples were preserved with 4% formalin. Photomicrographs of the studied taxa were clicked by Nikon Labophot- II microscope in Phycology Laboratory of Lucknow University.

Results and discussion

1. *M. flos-aquae* (Wittr.) Kirchner
(Pl. 1, fig. 3)
Desikachary, T.V. (1959) (Pl. 17, fig. 11, pg. 94)
Cells 3-4 μm in diameter. Colonies roughly spherical, ellipsoidal, or somewhat elongate or often squarish in optical section, not clathrate, with indistinct colonial mucilage; cells spherical, with gas-vacuoles.
Collection no. & date Lans/BT/01, 10/05/2015

2. *Chococcus limneticus* Lemmermann
(Pl. 1, fig. 1)
Desikachary, T.V. (1959) (Pl. 26, fig. 4-5, pg. 107)
Cells without sheath 10 μm in dia., with sheath 14 μm in dia., cells sub-spherical, sheath distinct, unlamellated, colourless, cell contents olive-green.
Collection no. & date Lans/BT/03, 10/05/2015

3. *Merismopedia glauca* (Ehr.) Naegeli
(Pl. 1, fig. 2)
Desikachary, T.V. (1959) (Pl. 29, fig. 5, pg. 155)
Diameter of Cell, 3-4 μm, dia. of colony 10 μm, colony light blue green, almost rectangular with slightly sinuate-crenate margins cells; ovate or hemispherical, present in multiples of four, regularly arranged to form quadrangular colonies. Cell contents blue green homogenous, without granules but each cell have distinct centrally situated gas vacuole, cell wall smooth thick.
Collection no. & date Lans/BT/01, 10/05/2015

4. *O. princeps* Vaucher ex Gomont var. crassa Rao
(Pl. 1, fig. 4)
Desikachary, T.V. (1959) (Pl. 39, fig. 11, pg. 206)
Trichome 45 μm broad, 5 μm long, blue-green, more or less brownish, violet or reddish, mostly forming a thallus, mostly straight, not constricted at the cross-walls, blue-green to dirty green, slightly or briefly attenuated at the apices and bent, end cells flatly rounded, slightly capitate without or with slightly thickened membrane.
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5. *Oscillatoria peronata f. attenuata* Skuja
(Pl. 1, fig. 5)
Desikachary, T.V. (1959) (Pl. 41, fig. 14, pg. 205) Trichome 10 μm broad, 3-4 μm long. Trichomes erect and flexuous, apices briefly attenuated and bent or curved, well constricted at the cross walls, 13-15 μm broad, single or aggregated in flocose masses; cells finely granular, septa more or less granulated, end cell humilis depressed hemispherical, calyptra absent.
Collection no. & date Lans/BT/02, 10/05/2015
Fig Plate 1


Fig Plate 2


6. *O. sancta* (Kuetz.) Gomont

(Pl. 1, fig. 6)

Desikachary, T.V. (1959) (Pl. 42, fig. 10, Pg. 203)

Trichome 2.5 µm long, 11 µm broad, thallus dark green, trichome slightly bent, distinctly

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7. *Anabaena macrospora* Klebahn

(Pl. 1, fig. 7)

Prescott, G. W. (1961) (Fig. 4-6, pl. 117, pg. 517)

Cells 7 µm in width, heterocyst 7 µm in width. Trichomes planktonic, straight or flexuous, solitary; cells globose or somewhat ellipsoid, 5-6.5 µm in dia., with abundant pseudo-vacuoles; heterocyst spherical about 6 µm in diameter, spores not adjoining the heterocyst.

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8. *A. iyengarii* Bharadwaja

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9. **A. spiroides** Klebahn

(Pl. 1, fig. 8)

Desikachary, T.V. (1959) (Pl. 76, fig. 1, pg. 406)

Cells 5-6 µm in width, heterocyst 7 µm in width, spores 8 µm in width and 10-11 µm in length, trichome single, cell barrel shaped, slightly longer than the broad, end cells with rounded apex, heterocyst spherical, spores ellipsoidal on either side of the heterocyst. Epispor e thick and smooth.

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10. **Coenocystis subcylindrica** Korshikov

(Pl. 1, fig. 10)

Komárek and Fott (1983) (Tafel 124, fig 1, pg. 411)

Colonies are spherical, oval, slightly irregular or several sub-colonies, arranged parallel in 1 or 2 planes, slightly irregularly, with a distance from each other. Cells are widely ovoid or sometimes slightly asymmetrical shape. Chloroplast is parietal, massive, without pyrenoid. Cells are 5–7 µm in length and 3-5 µm in width.

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11. **Oedogonium brevicingulatum var. brevicingulatum** Jao

(Pl. 1 fig. 11)

Gonzolves (1982) (Fig. 9.22A, pg.159)

Macrandrous, homothallic, vegetative cells cylindric 32 µm broad, basal cell short, oogonium single, obovoid, 51 µm in diameter, poriferous, pore superior, oospore globose not filling the oogonium, spore wall smooth

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12. **Scenedesmus tropicus** Crow

(Pl. 1 fig. 12)

Philipose (1967) (Fig. 185, pg. 279)

Colony 4-celled, subquadrate, cells more or less biconvex in middle attenuated towards apex with inflated poles. Poles of terminal cells provided with long recurred spine. Chloroplast parietal with a large single pyrenoid. Cells 15 µm long, 4-6 µm broad, spines 12 µm long.

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13. **S. acuminatus** (Lagerheim) Chodat

(Pl. 2 fig. 1)

Philipose, M.T. (1967) (Fig 161a, pg. 251)

Cell 20 µm long, 4 µm broad. Colonies curved and of 4-8 fusiform cells with sharp pointed ends. All the cells in a colony lunate or the interior cells forming a flat plate.

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14. **S. longus** Meyen

(Pl. 2 fig. 2)

Philipose, M.T. (1967) (Fig 180a, pg. 273)

Colony flat, eight cells arranged in a single linear series, cells oblong cylindrical with rounded poles. Poles with 2 spines at each end. Cell 8-10 µm long, 4-5 µm broad, spines 8-12 µm long.

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15. **S. arcuatus var. capitatus** G.M. Smith

(Pl. 2 fig. 1)

Philipose, M.T. (1967) (Fig 161a, pg. 251)

Cell 20 µm long, 4 µm broad. Colonies curved and of 4-8 fusiform cells with sharp pointed ends. All the cells in a colony lunate or the interior cells forming a flat plate.

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Philipose, M.T. (1967) (Fig 166k, pg. 257)
Colony curved, 4 celled, in sublinear series.
Cells slightly curved with one side convex and
other slightly concave. End of cells stumpy
with nodular thickenings. Cells 5 μm broad,
12-15 μm long.
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16. *Closterium moniliferum* (Bory) Ehrenberg
(Pl. 2. Fig. 4)
Tiffany L.H. & Britton, M.E. (1992) (Pl. 52,
fig. 549, pg. 172)
Cell 305 μm long, 46 μm broad, and apex 6
μm. Cell stout, moderately curved, inner
margin inflated in the middle, cell uniformly
narrowed with rounded apex. Cell wall
smooth, chloroplast with 6 ridges with
pyrenoids and vacuoles.
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17. *Staurastrum neglectum* G.S. West
(Pl. 2. Fig. 5)
Coesel, P.F.M. & Meesters, K.J. 2013. (Pl. 95:
1-3, pg. 124)
Body of semi-cell in apical view is triradiate,
cell 20 μm in length twisted at isthmus,
processes ornamented, end of the processes
tipped with minute spines.
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18. *Euastrum sinuosum* var. *reductum* West & West
(Pl. 2, fig. 6)
Prasad & Misra 1992. (Pl 19, fig. 2, pg. 135)
Cells small, 1.7 times longer than broad,
deeply constricted, sinus narrowly linear with
dilated extremity, lateral lobes bilobulate and
less prominent, polar lobe quadrate oblong
with deep median incision, punctation on cell
wall not seen. Cell 40 μm, in length, width 21
μm, isthmus 5 μm.
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19. *E subornatum* West & West var. *braziliense* Borge
(Pl.2 fig 7)
2j)
Cell slightly longer than wide, 40 x 30 μm
isthmus 8 μm with median constriction,
central linear sine, fully open, opening to the
isthmus; trapezoidal semicell, lateral lobes
rounded; slightly truncated polar lobe;
semicell with tumescence in the midline of the
lateral lobes formed by a single ring of
granules; cell wall ornate with granules.
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20. *Cosmarium obsoletum* (Hantzsch) Reinsch
(Pl. 2. Fig 8)
Prasad & Misra 1992. (Pl. 22. Fig. 16 pg. 170)
Cell 58 μm long, 65 μm broad, and isthmus 20
μm, transversely elliptic, slightly broader than
the long, deeply constricted, sinus narrow with
dilated apex and slightly open outwards, cell
wall punctate, chloroplast axile with two
pyrenoids in each semicells.
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21. *Closterium braunii* Reinsch
(Pl. 2 fig. 9)
Tiffany & Britton (1952) (Pl. 51, fig. 541, pg.
176)
Cell 720 μm long, 40 μm broad, apex 8 μm.
wall yellowish and very finely striate,
becoming brown at poles which are punctate.
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22. Cosmarium awadhense Prasad & Mehrotra
(Pl. 2, fig. 10)
Prasad & Misra (1992) (Pl. 21, fig. 27, pg. 153)
Cell 26 μm long, 18 μm broad, isthmus 14 μm.
cell small, slightly longer than broad,
sinus narrowly linear toward apex and slightly
open, semicells sub-semicircular, apex
truncate with more or less straight margin,
each semicell with one large chloroplast and
one pyrenoid.
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23. C. medioretusum Coesel
(Pl. 2. Fig. 11)
Stastny (2010) (fig. 166)
Cell small, 18 μm long, 12 μm broad, isthmus 6 μm,
apex of semicells flattened, margin
crenated, chloroplast with one pyrenoid.
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24. C. ornatum Eichler & Gutwinski
(Pl. 2. Fig. 12)
Prescott et.al. (1981) (Pl. 256, Fig. 6, pg. 239)
Cell medium sized, slightly longer than the bord,
length 34 μm, width 28 μm, isthmus 15 μm,
semicell with narrow sinus opening,
chloroplast with two pyrenoids in each
semicell.
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25 & 26. Staurastrum lunatum Ralf
(Pl. 2 fig. 13, 14)
Prescott (1940) (Pl II, Fig. 20-21, pg. 9)
Length 26 μm, width with processes 29 μm,
ithmus 10 μm
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27. Stigeoclonium tenue (Agardh) Kuetzing
(Pl. 2 fig. 15)
Tiffany & Britton (1952) (Pl 10, fig. 70, pg. 34)
Cell 7-10 μm long, and 5-8 μm broad,
branches more often opposite, some always
solitary, tuft bright green.
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Out of total 26 taxa reported from the Bhulla
lake, the taxon Coenocystis subcylindrica
Korshikov has been reported for the first time
from the western Himalayan range.

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