

Some interesting freshwater algae from Chimdi lake including a new record for Nepal

Shiva Kumar Rai^{1*} and Ram Kumar Rai²

¹Department of Botany, Post Graduate Campus, T.U., Biratnagar, Nepal

²Department of Botany, MMAM Campus, T.U., Biratnagar, Nepal

*E-mail: sk.khaling@gmail.com

Abstract

A preliminary study on algae of Chimdi lake was carried out. A total six freshwater algae viz., *Oscillatoria splendida* Grev. ex Gom., *Cylindrospermum stagnale* (Kuetz.) Born. et Flah. f. *variabilis* Prasad, *Gloeotrichia raciborskii* Woloszynska var. *kashiense* Rao, *Melosira varians* Ag., *Crucigenia crucifera* (Wolle) Collins and *Euastrum spinulosum* Delp. var. *bellum* Scott et Prescott were recorded from Chimdi lake. *Euastrum spinulosum* var. *bellum* was recorded for the first time from Nepal.

Key words: Freshwater algae, taxonomy and diversity, Chimdi lake, *Oscillatoria*, Nepal

Introduction

Algae grow in water and act as primary producer, supplying energy for all aquatic organisms through food chain. Recent activities and researches on algal biofuel, algal super food, space food, genetic engineering, pollution control, bio-indicator, algal nano-technology etc. are blooming fields in the Science, all based on the taxonomy of algae.

Topography of Nepal is as such that generally all types of world's climates are found within the small area and the country has rich lentic water resources like lakes, ponds, ditches etc. The lakes and ponds of Nepal harbor luxuriant growth of diverse species of algae. But, literature reveal that the algae of lentic environment of Nepal has not been studied extensively except sporadic works. Hickel (1973), Nakanishi *et al.* (1984) and Ishida (1986) have studied algae of Phewa lake; Watanabe (1995) has studied algae of Rara lake; Rai *et al.* (2008) has studied algae of Bees hazaar Tal; and Rai (2005, 2009, 2011) has studied algae of Maipokhari and Betana pond. In the present study, an attempt has been made to study the algae of Chimdi lake, Nepal.

Chimdi lake (Lat. 26°29'23.5"N, Long. 87°10'51.3"E, Alt. 70 msl) is situated in Sitaganj VDC, Sunsari district, about 12 km west from Biratnagar (Fig. 1). It has a total area of approximately 101.6 ha. The lake has permanent, clean and unpolluted water. The physico-chemical parameters of Chimdi lake is as follows: water temperature ranges from 18.8°C (January) to 30.5°C (September), pH from 6.05 (April) to 8 (May), transparency from 2.13 cm (July) to 27.83 cm (September), dissolved oxygen from 4.82 mg/l (June) to 19.92 mg/l (September), total alkalinity from 32 mg/l (July) to 86 mg/l (March) and total hardness from 38 mg/l (June) to 140 mg/l (March) (Surana *et al.*, 2010). It is inhabited by many macrophytes, viz., *Echinochloa* sp., *Ipomoea carnea*, *Hydrilla verticillata*, etc and is also famous for migratory birds.

Materials and Methods

Algal samples were collected from the peripheral edge of Chimdi lake. Planktonic forms were collected with the help of plankton net and epiphytic forms were collected by squeezing submerged macrophytes. Samples were preserved in 4% formaldehyde solution, tagged appropriately and brought to the Algae Research Lab, Department of Botany, P.G. Campus, Biratnagar for further investigation. Identification of algae was done with the help of Olympus CH20i Microscope following relevant literature. Classification and distribution of algae followed online website 'algaebase' (Guiry & Guiry, 2012). Diatoms were identified after clearing the frustules following modified method of Patrick and Reimer (1966). Scale bar drawn in each algae picture is equal to 10 μm .

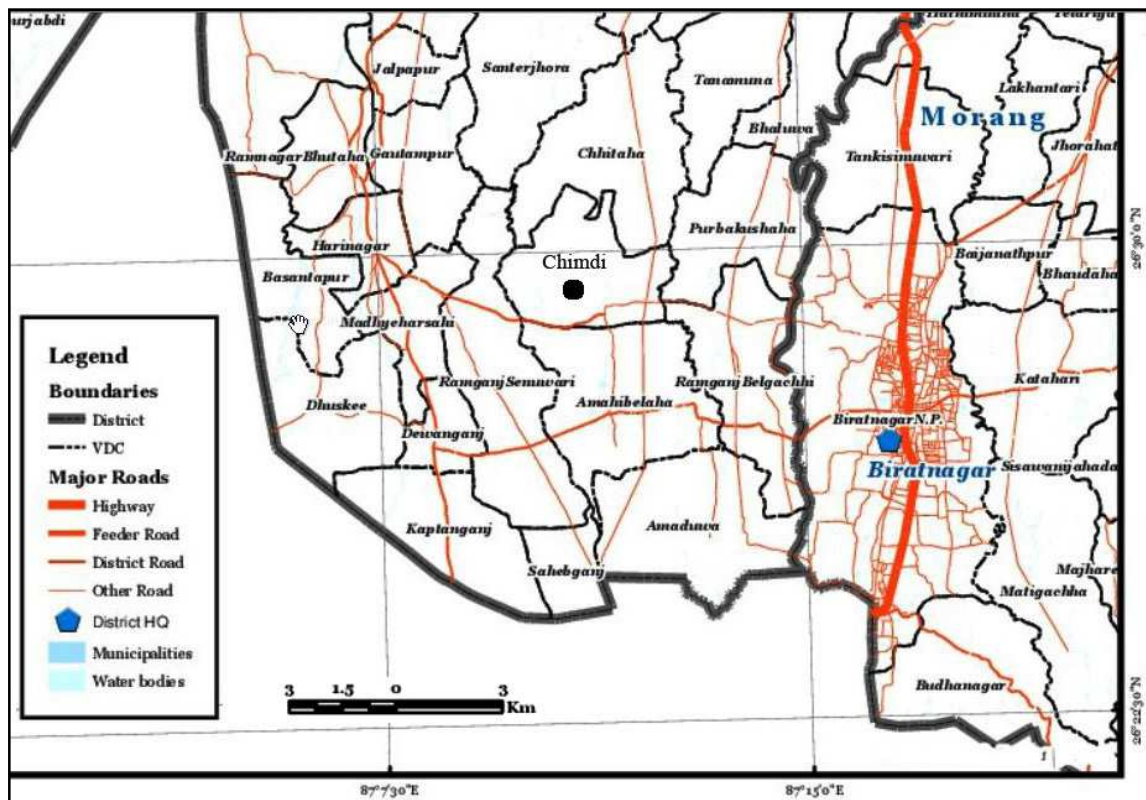


Figure 1. Map of the study area (Chimdi lake area).

Taxonomic Description

Phylum: Cyanobacteria
 Class: Cyanophyceae
 Subclass: Oscillatoriophycideae
 Order: Oscillatoriales
 Family: Oscillatoriaceae
 Genus: *Oscillatoria* Vaucher 1803

1. *Oscillatoria splendida* Grev. ex Gom. (Pl. 1)

Current accepted name: *Geitlerinema splendidum* (Greville ex Gomont) Anagnostidis

Lectotype: *Oscillatoria princeps* Vaucher ex Gomont.

Taxonomic characters: Dark blue-green thin masses or scattered; trichome straight or bent, 2.5 μm broad, without constrictions but with somewhat granulated cross-walls, gradually tapering at apex, apex often twisted or bent; cells 4-5 μm long; end cell 12 μm long, capitates, nearly rounded.

Collection number and date: Ch 32 (10-02-2011).

Distribution in Nepal: Lirum glacier, 3,900 m, Rasuwa (Hirano, 1969); Chimdi lake, 73 m, Sunsari (Rai & Misra, 2010).

World distribution: Britain (Whitton *et al.*, 1998), Israel (Vinogradova *et al.*, 2000), Queensland (Day *et al.*, 1995), Romania (Caraus, 2012), Spain (Aboal, 1989), Sweden (Skuja, 1948).

Phylum: Cyanobacteria

Class: Cyanophyceae

Subclass: Nostocophycideae

Order: Nostocales

Family: Nostocaceae

Genus: *Cylindrospermum* Kützing 1843

2. *Cylindrospermum stagnale* (Kuetz.) Born. et Flah. f. *variabilis* Prasad (Pl. 2)

Holotype: *Cylindrospermum majus* Kützing.

Taxonomic characters: Light blue-green mat; trichomes single, cylindrical, slightly constricted at the cross-wall, 4-5 μm broad; cells 4-6 μm long; heterocyst single, cylindrical, sub elliptical or ellipsoidal, 12 μm long, 6.5-7 μm broad; akinet single, sub-cylindrical, elongate, 10 μm long, 6.5 μm broad.

Remarks: Present specimen has small spores.

Collection number and date: Ch 22 (10-02-2011).

Distribution in Nepal: Chimdi lake, 73 m, Sunsari (Rai & Misra, 2010).

Phylum: Cyanobacteria

Phylum: Cyanobacteria

Class: Cyanophyceae

Subclass: Nostocophycideae

Order: Nostocales

Family: Rivulariaceae

Genus: *Gloeotrichia* Agardh 1842

3. *Gloeotrichia raciborskii* Woloszynska var. *kashiense* Rao (Pl. 4)

Holotype: *Gloeotrichia pisum* (C. Agardh) Thuret ex Bornet & Flhault.

Taxonomic characters: Trichome slightly constricted at cross-wall, 7-10 μm broad at base, 6-6.5 μm broad higher up; cell 7.5-9 μm long at base, upto 10 μm long higher up; heterocyst single, spherical or ellipsoidal, 12.5 μm long, 10-11.3 μm broad; akinet ellipsoidal, outer wall smooth hyaline, 30 μm long, 14.6 μm broad (30-45 μm broad with sheath).

Collection number and date: Ch 34 (10-02-2011).

Distribution in Nepal: Chimdi lake, 73 m, Sunsari (Rai & Misra, 2010).

Phylum: Ochrophyta
 Class: Bacillariophyceae
 Subclass: Coscinodiscophycidae
 Superorder: Coscinodiscanae
 Order: Melosirales
 Family: Melosiraceae
 Genus: *Melosira* C.A. Agardh 1824

4. *Melosira varians* Ag. (Pl. 3)

Holotype: *Melosira nummuloides* C. Agardh

Homotypic synonymous: *Lysigonium varians* (C. Agardh) De Toni 1892

Taxonomic characters: Frustule cylindrical, semicell 12 µm long, 15 µm in diameter; generally united into a straight or rarely curved chains, valves more or less convex with fine punctae interspersed with coarse dots; girdle finely punctate, slightly smooth.

Collection number and date: Ch 30 (10-02-2011).

Distribution in Nepal: A pond at Ankhu Khola, 640 m and Luitel Bhanjyang, 770 m, Gorkha (Hirano, 1955); a small pond near Pitchhara Nahar, 73 m, Biratnagar (Rai & Rai, 2005); Lamphengwa river, Gajurmukhi VDC, Ilam (Rai *et al.*, 2008); Muga river at Pakhribas Agriculture Research Centre, 1850 m, Dhankuta and Hongchur river, 900 m, Khotang (Misra *et al.*, 2009); Betana wetland, 123 m, Belbari VDC, Morang (Rai, 2011).

World distribution: Argentina (Rodriguez *et al.*, 2006), Brazil (Eskinazi-Leça *et al.*, 2010), Britain (Whitton *et al.*, 1998), China (Hu & Wei, 2006), Germany (Bahulikar & Kroth, 2007), Hawaiian Islands (Sherwood, 2004), Iran (Jamaloo *et al.*, 2006), Israel (Tsarenko *et al.*, 2000), New South Wales (Day *et al.*, 1995), Queensland (Bostock & Holland, 2010), Romania (Caraus, 2012), South Australia (Day *et al.*, 1995), Spain (Pérez *et al.*, 2010), Turkey (Ersanli & Gönülol, 2006), Victoria (Roberts *et al.*, 2004).

Phylum: Chlorophyta
 Subphylum: Tetraphytina
 Class: Trebouxiophyceae
 Order: Trebouxiophyceae ordo incertae sedis
 Family: Trebouxiophyceae incertae sedis
 Genus: *Crucigenia* Morren 1830

5. *Crucigenia crucifera* (Wolle) Collins (Pl. 5)

Holotype: *Crucigenia quadrata* Morren.

Synonym: *Crucigeniella crucifera* (Wolle) Komárek

Taxonomic characters: Planktonic; coenobia 4-celled, rhomboidal, with rounded ends, slightly concave sides, central rectangular space, 24-27.5 µm in diameter, sometimes 4 colonies jointed to form multiple colonies; cell elongate, outer face concave, inner attached margin concave or slightly convex, 7.5 µm long, 4-5 µm broad; chloroplast single, parietal, laminate, without a pyrenoid.

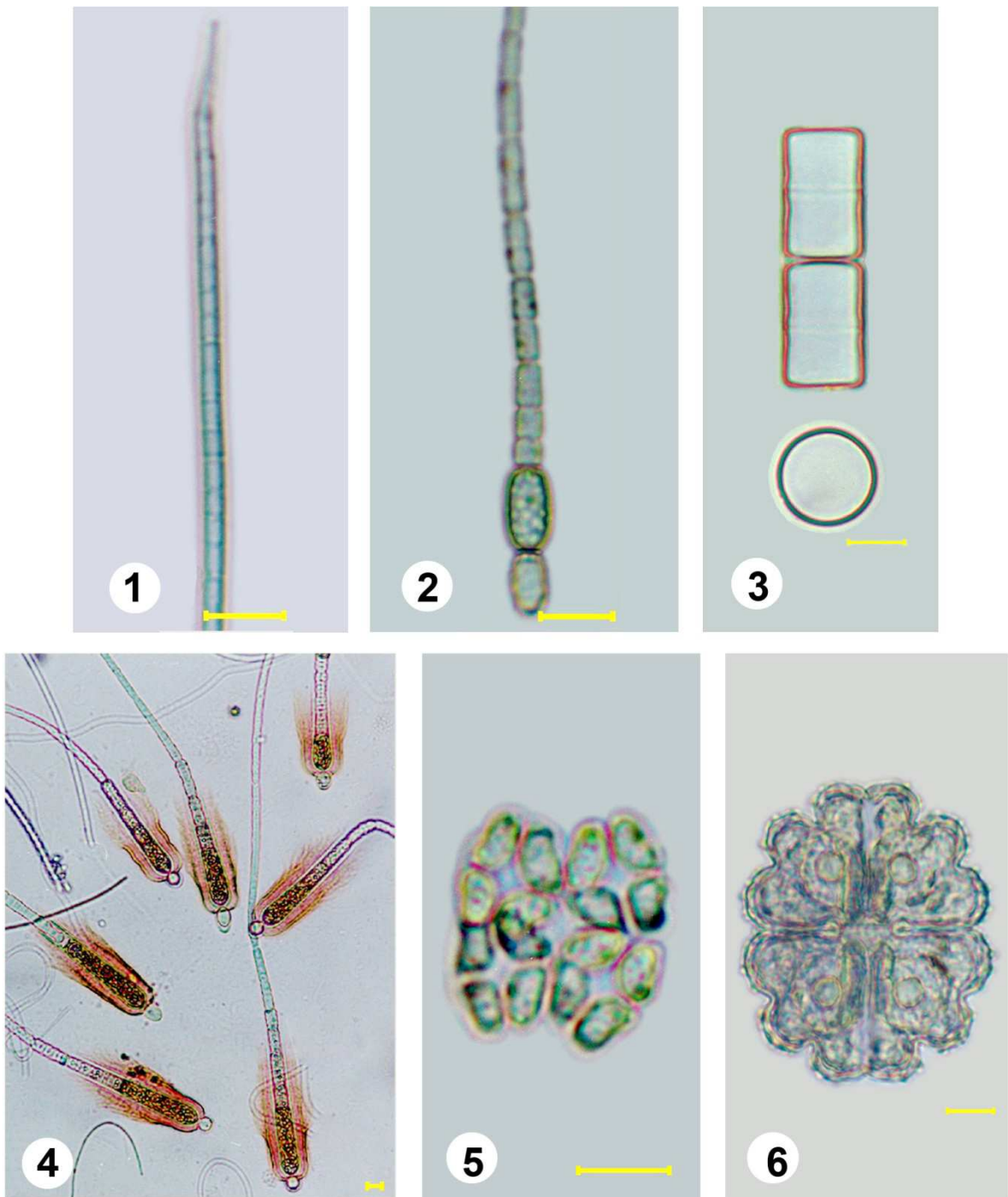


Plate 1. *Oscillatoria splendida* Grev. ex Gom., Plate 2. *Cylindrospermum stagnale* (Kuetz.) Born. et Flah. f. *variabilis* Prasad, Plate 3. *Melosira varians* Ag., Plate 4. *Gloeotrichia raciborskii* Woloszynska var. *kashiense* Rao, Plate 5. *Crucigenia crucifera* (Wolle) Collins, Plate 6. *Euastrum spinulosum* Delp. var. *bellum* Scott et Prescott. (Scale bar in each plate = 10 μ m)

Ecology: Usually found in the meso to eutrophic rivers, ponds, lakes and reservoirs.

Collection number and date: Ch 35 (10-02-2011).

Distribution in Nepal: Rupa lake, 900 m, Kaski (Ishida, 1986); Fish pond as Hetauda, Makawanpur (Sahay *et al.*, 1992).

World distribution: Asia: Taiwan (Anonymous, 2012).

Phylum: Charophyta

Class: Zygnematophyceae

Order: Desmidiiales

Family: Desmidiaceae

Genus: *Euastrum* Ehrenberg 1832

6. *Euastrum spinulosum* Delp. var. *bellum* Scott et Prescott (Pl. 6)

Taxonomic characters: Cell large, 62-63 μm long, 52.5 μm broad, longer than broad, deeply constricted; sinus narrow and linear; semi cell 5 lobed, lobes widely rounded with acute indentations between them, lateral lobes furnished with 5-6 spines, polar lobes broadly truncate with a median notch, polar lobes 23 μm broad; verrucae of the central rosettes unusually large; isthmus 13-15 μm wide.

Collection number and date: Ch 28 (10-02-2011).

Distribution in Nepal: New record for Nepal.

World distribution: Asia: Taiwan (Anonymous, 2012).

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