

## Additional desmids (Chlorophyceae) to eastern flora of Nepal

Shiva Kumar Rai

Department of Botany

Post Graduate Campus, Tribhuvan University, Biratnagar, Nepal

E-mail: shivarai24244@yahoo.com

### Abstracts

Desmid of eastern Nepal has been studied. A total 15 desmids are described from different freshwater lotic and lentic habitats in the present communication. They belong to genera *Closterium* (8), *Pleurotaenium* (2), *Cylindrocystis* (1), *Micrasterias* (1), *Arthrodesmus* (1), *Staurastrum* (1) and *Spondylosium* (1). These are the addition of desmids from different locality to the algal flora of eastern Nepal.

**Key words:** Algae, *Closterium*, *Staurastrum*, *Staurodesmus* terai, Morang.

### Introduction

Desmid flora of Nepal has been contributed by Hirano (1955, 1963, 1969, 1984) who reported 79 species of desmids from different localities in Central and Eastern Nepal. Watanabe (1971, 1982) of National Science Museum, Tsukuba has reported 24 species of *Closterium* from Gosain Kund, Dudh Pokhari, and Dudh Koshi river in eastern Nepal and Trisuli river, Begnas lake, and Hetauda in Central Nepal and added 5 species (*Closterium ehrenbergii*, *Cl. jenneri*, *Cl. pseudopsillum*, *Cl. rostratum*, and *Cl. venus*) and 5 varieties (*Closterium closteroides* var. *intermedium*, *Cl. diana* var. *brevius*, *Cl. diana* var. *minus*, *Cl. littorale* var. *crassum*, and *Cl. parvulum* var. *maius*) new to the Nepalese desmid flora. Similarly, Bando *et al.* (1989) have studied the desmid flora of Kathmandu and reported 49 species, 5 varieties, and 3 forms belonging to 10 genera. The frequently observed species were *Closterium acerosum*, *Cl. leibleinii* var. *recurvatum*, *Cosmarium javanicum*, *C. obtusatum*, and *C. subcostatum*. Foerster (1965) has also reported 79 desmids from Lobuche, Pheriche, Karyolung, and Thodung areas in the Himalaya regions. Among them 72 taxa were first time reported from Nepal and 18 species were new to the world. Kusel-Fatzmann (1969) has studied both desmid and Cyanophycean algae from Kathmandu and Solukhumbu. Habib and Chaturvedi (1995, 1997) have reported a total 103 taxa from Mahendranagar and Mahakali river among which 63 were new for the country. Rai and Misra (2008) have reported 26 desmids (*Closterium* 4, *Euastrum* 4, *Micrasterias* 3, *Cosmarium* 7, *Staurastrum* 3, *Onychonema* 2, *Hyalotheca* 1, and *Desmidium* 2) from Koshi Tappu Wildlife Reserve, Sunsari district including 11 desmids new to Nepal and genus *Onychonema* first time described from the country. Similarly, Rai *et al.* (2008) have studied the desmids of Beez-Hazaar lake, Chitwan reporting 30 taxa belonging to 7 genera among which 11 were new to Nepal. The present paper describes the addition of some desmids reported from one or more places in eastern Nepal.

Eastern Nepal (Eastern Development Region) is situated at 26°20'-28°08'N and 86°08'-88°15'E in the eastern part of Nepal consists of 3 zones (Mechi, Koshi, Sagarmatha) and 16 districts occupying an area of about 28,456 sq. km. Due to altitudinal variation, it is divisible into 5 geographical regions from south to north *viz.*, Terai plain, Churia (Siwalik) hills, Middle mountain (Mahabharat), High mountain and Himalaya. The terai in the south has hot and humid

sub-tropical climate, Mountains in the middle has warm and cold temperate climate and Himalaya in the north has Alpine and Tundra types of climate. The average winter temperature ranges from -30 to 18°C and average summer temperature from 27 to 30°C. About 80% of the total annual rainfall occurs during monsoon in the month of June, July and August. The eastern part receives up to 3000 mm rainfall whereas the hill and Terai receives average 1000-2000 mm annually. It has extreme variation in elevation from 56 msl (Kechana Kawal) to 8848 msl (Mt. Everest, the highest peak in the world).

Eastern Nepal is rich in water resources. The major river systems in this region are Saptakoshi, Sunkoshi, Arun, Tamor, and Dudhkoshi river systems. It has many glaciers, lakes, ponds, and waterfalls especially in the mountain and Himalaya regions. Some of the important lake and ponds are Sinjema Tal, Sabha Pokhari, Gupha Pokhari, Gokyu lake, Panch Pokhari, Mai Pokhari, Rautaha Pokhari, Betana pond, Koshi Tappu wetland etc.

### Materials and Methods

Algal samples were collected randomly from different lotic and lentic habitats of various geographical regions of Eastern Nepal. Epiphytic forms were collected by squeezing submerged macrophytes where as planktonic forms were collected with the help of plankton mesh (net size 10 µm) and preserved in 4% formalin in the plastic tubes (250 ml). Samples were brought to the laboratory of Dept of Botany, PG Campus and temporary prepared slides were observed and microphotography under Olympus light microscope. Desmids were identified with the help of literature and monographs following Scott and Prescott (1961), Kouwets (1987), Croasdale and Flint (1986, 1988), Gerrath and John (1988), Croasdale *et al.* (1994), Watanabe (1995), Flint and Williamson (1998) etc.

### Results

A total 15 desmids have been described under 7 genera viz., *Closterium* (8), *Pleurotaenium* (2), *Cylindrocystis* (1), *Micrasterias* (1), *Arthrodesmus* (1), *Staurastrum* (1) and *Spondylosium* (1). These are the reports of desmids from different locality than the previous one if any reported and addition to the desmid flora of eastern Nepal. Description of the desmids is given as follows.

1. *Cylindrocystis brébissonii* (Ralfs) De Bary (Fig. 11) [Basionym: *Penium brebissonii* Ralfs]  
References: Scott, A.M. and G.W. Prescott 1961, p. 8, pl. 1, fig. 3; Foerster, K. 1965, p. 29, abb. 1, figs. 1-4 (as *C. Brébissonii* var. *jenneri*); Kouwets, F.A.C. 1987, p. 196, pl. 1, figs. 1-2; Gerrath, J.F. and D.M. John 1988, p. 193, pl. 2, fig. 1; Watanabe, M. 1995, p. 12, fig. 39.  
Dimension: Cells 50 µm long, 16.5 µm broad.  
Locality: Sabha Pokhari lake, 4,100 m, Sankhuwasabha district (Himalaya).  
Distribution in Nepal: Khumbu, 2,000 m, Eastern Nepal (Kusel-Fetzmann, 1969); Mewa valley, Wolang Chung Gola, Eastern Nepal (Hirano, 1984); a small pond south of lake Rara, 3,030 m, Mugu (Watanabe, 1995).
2. *Closterium diana* Ehr. ex Ralfs *brevius* (Petk.) Krieg. (Fig. 1) [Basionym: *Closterium diana* f. *brevior* Petkoff]  
References: Yacubson, S. 1980, p. 297, pl. 9, fig. 102 (as *Cl. diana*); Watanabe, M. 1982, p. 50, fig. 1j; Kouwets, F.A.C. 1987, p. 201, pl. 2, figs. 19-20; Bando, T. *et al.* 1989, p. 3, fig. 1d.  
Dimension: Cells 180 µm long, 22.5 µm broad; apices 2.8-4 µm broad, 145 µm distant.

Locality: Sarouchia pond, 72 m, Biratnagar, Morang district (Terai).

Distribution in Nepal: Paddy fields at Hetauda, 500 m, Makawanpur (Watanabe, 1982; Bando, *et al.* 1989); a pond near Police Station, Mahendranagar, Kanchanpur (Habib & Chaturvedi, 1997).

**3. *Closterium incurvum*** Bréb. (Fig. 2) [Synonym: *Closterium venus* var. *incurvum* (Bréb.) Krieger]

References: Croasdale, H. and E.A. Flint 1986, p. 61, pl. 6, figs. 1-2; Kouwets, F.A.C. 1987, p. 203, pl. 2, figs. 12-13; Bando, T. *et al.* 1989, p. 4, figs. 2 f-g; Prasad, B.N. and P.K. Misra 1992, p. 107, pl. 16, fig. 8; Flint, E.A. and D.B. Williamson 1998, p. 77, pl. 2, fig. 6.;

Dimension: Cells 92 µm long, 12 µm broad; apices 2-3 µm broad, 68 µm distant.

Locality: MMAM Campus pond, 72 m, Biratnagar, Morang district (Terai).

Distribution in Nepal: Dudh Pokhari lake, 4,750 m, Gokyu, Solukhumbu, Eastern Nepal (Watanabe, 1982; Bando *et al.*, 1989).

**4. *Closterium lanceolatum*** Kütz. ex Ralfs (Fig. 6) [Synonym: *Closterium acerosum* var. *lanceolatum* (Kützing ex Ralfs) Playfair]

References: Croasdale, H. and E.A. Flint 1986, p. 63, pl. 9, figs. 1-2.

Dimension: Cells 301 µm long, 47 µm broad; apices 4-5 µm broad.

Locality: Sarouchia pond, 72 m, Biratnagar, Morang district (Terai).

Distribution in Nepal: A pool at Boudhanath, Kathmandu, 13,00 m. (Bando *et al.*, 1989).

**5. *Closterium littorale*** Gay (Fig. 3)

References: Tiffany, L.H. and M.E. Britton 1952, p. 173, pl. 51, fig. 544; Gerrath, J.F. and D.M. John 1988, p. 200, pl. 2, fig. 15; Prasad, B.N. and P.K. Misra 1992, p. 111, pl. 17, fig. 9.

Dimension: Cells 170-174 µm long, 19-20 µm broad; apices 4-5 µm broad.

Locality: Fish pond at Everest Science Centre, 72 m, Santi Ban, Sunsari district (Terai).

Distribution in Nepal: *Cl. littorale* var. *crassum* reported from Trisuli river, 500 m, Nuwakot (Watanabe, 1982).

**6. *Closterium moniliferum*** (Bory) Ehr. ex Ralfs var. *gracile* Foerster (Fig. 4)

References: Gerrath, J.F. and D.M. John 1988, p. 201, pl. 5, figs. 1-2 (as var. *conconvum*); Bando, T. *et al.* 1989, p. 7, fig. 2k.

Dimension: Cells 225-300 µm long, 36-39 µm broad; apices 7.5-9 µm broad, 247-276 µm distant.

Locality: Sarouchia pond, 72 m, Biratnagar, Morang district (Terai).

Distribution in Nepal: A small pool near Swayambhu, 1,350 m, Kathmandu (Bando *et al.*, 1989).

**7. *Closterium praelongum*** Bréb. var. *brevius* (Nordst.) Krieg. (Fig. 5) [Basionym: *Closterium praelongum* f. *brevius* Nordstedt; Synonym: *Closterium praelongum* subsp. *brevius* (Nordstedt) Sarim et Faridi; *Closterium praelongum* f. *brevius* Nordstedt]

References: Croasdale, H. and E.A. Flint 1986, p. 67, pl. 9, figs 4-7; Bando, T. *et al.* 1989, p. 7, fig. 1h.

Dimension: Cells 341-370 µm long, 18-19 µm broad; apices 4-6 µm broad.

Localities: Malaya Roadside ditches, 72 m, Biratnagar, Morang district (Terai); Birat Pokhari (Pond), 135 m, Anarmani, Jhapa district (Terai).

Distribution in Nepal: Ring Road ditches at Chabahil, 1,300 m, Kathmandu (Bando *et al.*, 1989).

**8. *Closterium ralfsii* Bréb. ex Bréb. var. *hybridum* Rabenh. (Fig. 7)**

References: Scott, A.M. and G.W. Prescott 1961, p. 13, pl. 1, fig. 25; Yacubson, S. 1980, p. 298, pl. 9, fig. 108; Kouwets, F.A.C. 1987, p. 207, pl. 4, fig. 2.

Dimension: Cells 570 µm long, 38-39 µm broad; apices 9-11 µm broad.

Locality: Birat Pokhari (Pond), 135 m, Anarmani, Jhapa district (Terai).

Distribution in Nepal: A pond near Mahendranagar road, Kanchanpur (Habib & Chaturvedi, 1997).

**9. *Closterium tumidum* Johns. (Fig. 8) [Basionym: *Closterium cornu* Ehr. ex Ralfs]**

References: Scott, A.M. and G.W. Prescott 1961, p. 41, pl. 1, fig. 16; Yacubson, S. 1980, p. 298, pl. 9, fig. 107; Watanabe, M. 1982, p. 58, fig. 6g; Gerrath, J.F. and D.M. John 1988, p. 205, pl. 5, figs. 6-7; Bando, T. *et al.* 1989, p. 8, fig. 1e (as *Cl. tumidum* var. *tumidum*); Prasad, B.N. and P.K. Misra 1992, p. 119, pl. 17, fig. 11.

Dimension: Cells 107.5 µm long, 17.5 µm broad; apices 5-7.5 µm broad.

Locality: Fish pond at Everest Science Centre, 72 m, Santi Ban, Sunsari district (Terai).

Distribution in Nepal: A shallow pool above Gosainkunda, 4,500 m, Rasua and rice fields at Hetauda, 500 m, Makawanpur (Watanabe, 1982); Mahendranagar, Kanchanpur (Habib & Chaturvedi, 1997).

**10. *Pleurotaenium baculoides* (Roy et Biss.) Playf. (Fig. 9) [Basionym: *Docidium baculoides* Roy et Bisset; Synonym: *Docidium trabecula* var. *baculoides* (Roy et Bissett) Playfair]**

References: Scott, A.M. and G.W. Prescott 1961, p. 14, pl. 3, fig. 5; Nurul Islam, A.K.M. 1970, p. 912, pl. 4, figs. 8-9; Kouwets, F.A.C. 1987, p. 207, pl. 6, fig. 8; Bando, T. *et al.* 1989, p. 11, fig. 3g.

Dimension: Cells 387 µm long, 30 µm broad; isthmus 20 µm wide; apices 20-21 µm broad.

Remarks: Present specimen has shorter but slightly broader dimension with wider isthmus.

Locality: Sarouchia pond, 72 m, Biratnagar, Morang district (Terai).

Distribution in Nepal: Taudaha, 1,350 m, Kathmandu (Bando *et al.*, 1989); Bees hazar lake, 286 m, Tikauli, Chitwan (Rai *et al.*, 2008).

**11. *Pleurotaenium trabecula* (Ehr.) ex Naeg. (Fig. 10)**

References: Scott, A.M. and G.W. Prescott 1961, p. 18, pl. 3, fig. 4; Nurul Islam, A.K.M. and A.K. Yusuf Haroon 1980, p. 564, pl. 4, fig. 56; Kouwets, F.A.C. 1987, p. 208, pl. 6, fig. 7.

Dimension: Cells 568 µm long, 39-40 µm broad; isthmus 32-35 µm wide; apices 20-22 µm broad.

Locality: Malaya Roadside ditches, 72 m, Biratnagar, Morang district (Terai).

Distribution in Nepal: Pond at Ankhu Khola, 640 m, Luitel Bhanjyang, 770 m, Gorkha and Pisang, 3,100 m, Manang (Hirano, 1955).

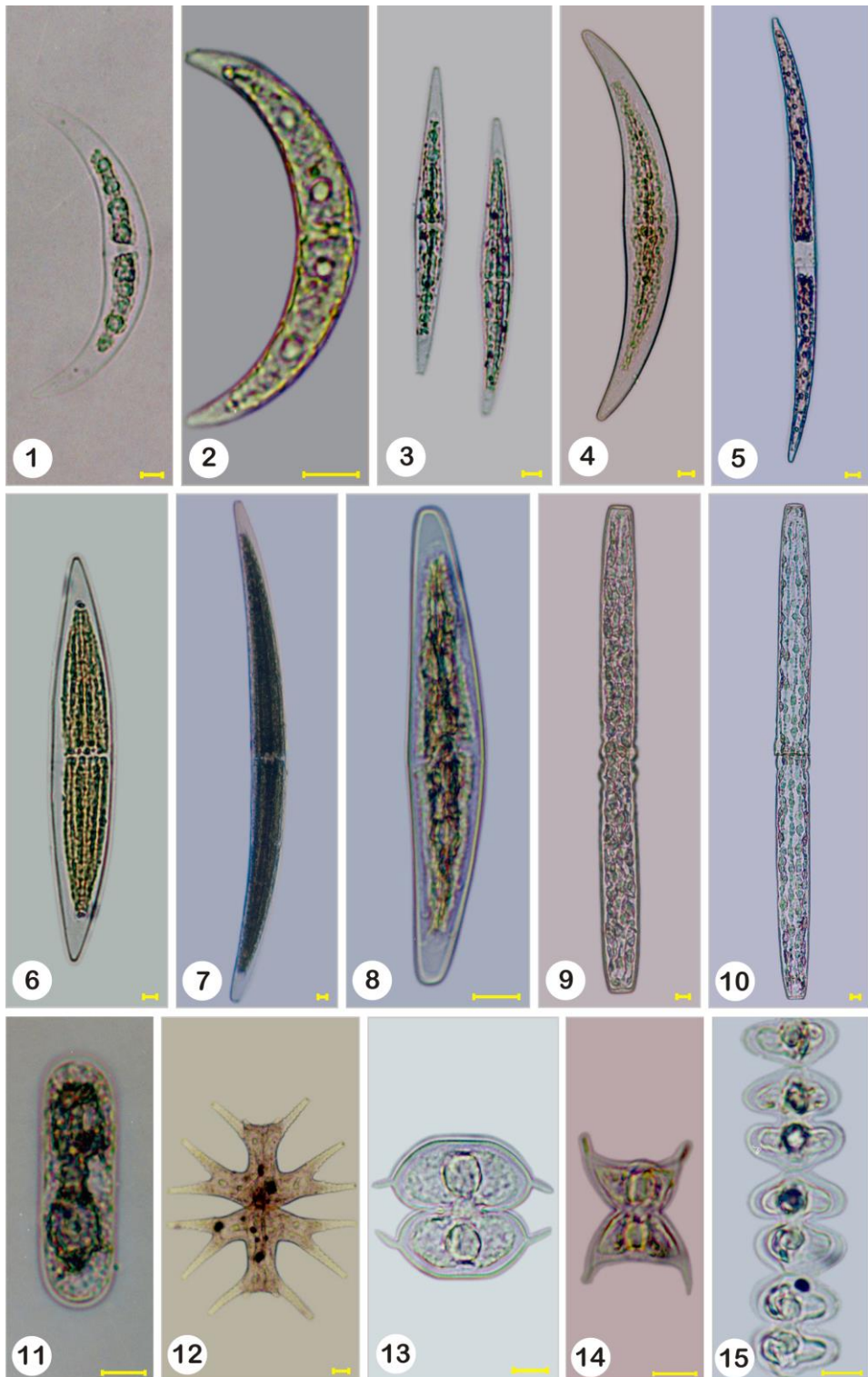
**12. *Micrasterias mahabuleshwarensis* Hobs. var. *surculifera* Legerh. (Fig. 12)**

References: Scott, A.M. and G.W. Prescott 1961, p. 50, pl. 16, figs. 1-2; Nurul Islam, A.K.M. 1970, p. 920, pl. 7, figs. 7-8; pl. 11, fig. 5; pl. 9, fig. 3 (as *M. mahabuleshwarensis* morpha); Nurul Islam, A.K.M. and A.K. Yusooof Haroon 1980, p. 572, pl. 3, fig. 51; Bando, T. *et al.* 1989, p. 15, fig. 6a (as *M. mahabuleshwarensis*).

Dimension: Cells 110 µm (without processes)-145 µm (with processes) long, 125 µm broad; isthmus 22.5 µm wide; polar lobes 24 µm (without processes)-68 µm (with processes) broad.

Locality: Routaha Pokhari (Lake), 1,770 m, Udayapur district (Mountain).

Distribution in Nepal: Bees hazar lake, 286 m, Tikauli, Chitwan (Rai *et al.*, 2008).



Figures 1. *Closterium diana* brevius 2. *Closterium incurvum* 3. *Closterium littorale* 4. *Closterium moniliferum* var. *gracile* 5. *Closterium praelongum* var. *brevius* 6. *Closterium lanceolatum* 7. *Closterium ralfsii* var. *hybridum* 8. *Closterium tumidum* 9. *Pleurotaenium baculoides* 10. *Pleurotaenium trabecula* 11. *Cylindrocystis brébissonii* 12. *Micrasterias mahabuleshwarensis* var. *surculifera* 13. *Staurodesmus convergens* var. *ralfsii* 14. *Staurodesmus dejectus* var. *dejectus* 15. *Spondylosium nitens* var. *triangulare* f. *javanicum* (scales measure 10 µm)

**13. *Staurodesmus convergens*** (Ehr.) Teil. var. *ralfsii* Teil. (Fig. 13) [Basionym: *Arthrodesmus convergens* Ehr. ex Ralfs]

References: Croasdale et al. 1994, p. 42, pl. 75, figs 13-14.

Dimension: Cells 42 µm long, 39.5-42 µm broad; isthmus 12.5 µm wide; spines 6.2-7 µm long.

Locality: Fish pond at Everest Science Centre, 72 m, Santi Ban, Sunsari district (Terai).

Distribution in Nepal: Bees hazar lake, 286 m, Tikauli, Chitwan (Rai et al., 2008 as *Arthrodesmus convergens* var. *curtus*).

**14. *Staurodesmus dejectus*** (Bréb. ex Ralfs) Teil. var. *dejectus* (Fig. 14)

References: Croasdale et al. 1994, p. 45, pl. 66, figs. 3-9.

Dimension: Cells 22.5-23.7 µm (without spines) to 34-35 µm (with spines) long, 22.5 µm (without spines) to 25 µm (with spines) broad; isthmus 10 µm wide; spines 3.8-4.7 µm long.

Locality: Fish pond at Everest Science Centre, 72 m, Santi Ban, Sunsari district (Terai).

Distribution in Nepal: As *Staurodesmus dejectus* Bréb. ex Ralfs - Khumbu, 5,000 m, Eastern Nepal (Kusel-Fetzmann, 1969); a small pond south of Rara lake, 3,030 m, Mugu (Watanabe, 1995).

**15. *Spondylosium nitens*** (Wall.) Arch. var. *triangulare* Turn. f. *javanicum* Gutw. (Fig. 15)

References: Scott, A.M. and G.W. Prescott 1961, p. 121, pl. 60, fig. 10; Nurul Islam, A.K.M. 1970, p. 932, pl. 3, figs. 7, 11; Prasad, B.N. and P.K. Misra 1992, p. 202, pl. 26, fig. 13.

Dimension: Cells 27.5 µm long, 25 µm broad; isthmus 6.3 µm wide.

Locality: Fish pond at Everest Science Centre, 72 m, Santi Ban, Sunsari district (Terai).

Distribution in Nepal: The lakes Phewa, Rupa, Begnas, and Khaste, 960 m, Kaski (Hickel, 1973); a small pond near Mahendranagar Sabzi Market, Kanchanpur (Habib & Chaturvedi, 1995).

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