

# SOME BACILLARIOPHYCEAN ALGAE FROM BIRATNAGAR, NEPAL

Shiva K. Rai and Ram K. Rai

Department of Botany

Post Graduate Campus, Tribhuvan University, Biratnagar, Nepal

## ABSTRACT

The present paper deals with 12 taxa belonging to 10 genera of Bacillariophycean algae from Biratnagar, Nepal, out of which five taxa viz. *Synedra ulna* var. *amphirhynchus*, *Navicula perrotetti*, *Gomphonema gracile* var. *lanceolata*, *F. turris*, *G. parvulum* var. *exilissima* and *Nitzschia intermedia* are being reported for the first time from Nepal. Algae have been collected from different freshwater habitats viz. ponds, ditches, canals, rivers, etc. during September to November, 2004.

**Key words:** Algae, bacillariophyceae, diatom.

## INTRODUCTION

Biratnagar is situated between latitude 26° 20' N and longitude 87° 16' E in the eastern Terai region at an elevation of 72 m above mean sea level. It has tropical monsoonic climate with three distinct seasons in a year viz. a warm and wet rainy (June to October), a cool and dry winter (November to February) and a hot and dry summer (March to May) seasons. The temperature rises up to 41° C (May to June) and falls up to 4° C (January to February) and average annual rainfall is 1730.2 mm out of which 87.2 % falls in rainy season. Highest relative humidity (>90 %) was recorded in winter and lowest (70.6 %) in summer season. The soil is made up of recently transported and deposited materials by the tributaries of the Ganges.

A perusal of literature shows that the earlier works on Bacillariophycean flora of Nepal is very scanty and most of the work was concentrated on high altitude regions. Since there has been no report on Bacillariophycean forms from Biratnagar, an attempt was made to enumerate the algae.

## MATERIAL AND METHODS

Algal samples were collected by random sampling techniques, from different localities viz. ponds, ditches, canals, rivers, etc. during September to November, 2004. Epiphytic forms were collected by squeezing submerged plants where as planktonic forms were collected with the help of planktonic mesh net (size 0.5 mm) and preserved in 3-4% formalin (aqueous solution of formaldehyde) in the plastic tubes (250 ml) for detail laboratory studies. Slides were prepared following Patrick and Reimer (1966) method and for detailed study and photomicrography Nikon microscope with photomicrographic attachment were used.

All these collections have been deposited in the Algal Repository of the Botany Department, P.G. Campus, Biratnagar, Nepal. Accession numbers of these collections are same as those of the collection numbers.

## TAXONOMIC DESCRIPTION

The present communication includes systematic enumeration of 12 taxa under 10 genera

out of which 5 taxa are being reported for the first time from Nepal.

1. *Melosira granulata* (Ehr.) Ralfs (Fig. 11)

Hustedt, F. 1930, P. 248, Figs. 104 a-b; Foged, N. 1980, P. 647, Pl. I, Figs. 2-4, 11-12; Carter, J. R. and Bailey-Watts, A. E. 1981, P. 572, Pl. 10, Fig. 19; Hadi, R. A. M. *et al.* 1984, P. 518, Pl. 8, Fig. 132.

Frustules cylindrical, 11.5  $\mu\text{m}$  long, 3  $\mu\text{m}$  broad, united into a slightly curved chain; mantle cylindrical, punctate; punctae coarse, punctae rows 5 in 2  $\mu\text{m}$ , punctae in a row 5-6 in 2  $\mu\text{m}$ , arranged more or less parallelly and spirally; end cells with or without marginal spines; sulcus shallow or acute, pseudosulcus absent.

Locality, Collection number and Date: Fresh and stagnant water ditches at the side of Pitchhra Nahar; B-123; 31-03-2004.

Distribution: Phewa, Begnas and Rupa Lakes, 967 m, Kaski (Ishida, Y. 1986).

2. *Melosira varians* Ag. (Fig. 5)

Hustedt, F. 1930, P. 240, Fig. 100; Foged, N. 1980, P. 648, Pl. I, Fig. 5; 1982, P. 608, Pl. I, Figs. 1-2; 1983, P. 445, Pl. I, Fig. 4; Hadi, R. A. M. *et al.* 1984, P. 518, Pl. 1, Fig. 21; Pl. 8, Fig. 131.

Frustules cylindrical, 25-29  $\mu\text{m}$  long, 17.5-18  $\mu\text{m}$  broad, united into a short or long, straight or slightly curved chain; valves somewhat convex, finely punctate and interspersed with coarser dots; girdles very finely punctate, nearly smooth; sulcus absent.

Locality, Collection number and Date: A small pond near Pitchhra Nahar; B-126; 06-04-2004.

Distribution: A pond at Ankhu Khola, 640 m and Luitel Bhanjyang, 770 m, Gorkha (Hirano, M. 1955).

3. *Cyclotella meneghiniana* Kuetz. (Fig. 7)

Hustedt, F. 1930, P. 341-344, Fig. 174 a-b; Foged, N. 1980, P. 638, Pl. I, Figs. 13-15

Frustule small; girdle view somewhat rectangular; valve discoid, 18.5  $\mu\text{m}$  in diameter, radially symmetrical; marginal striae coarse, 8 in 10  $\mu\text{m}$ , wedge-shaped; central area smooth, rarely punctate.

Locality, Collection number and Date: Birendra Sabha Griha Pond; B-104, 28-02-2004.

Distribution: A pond at Dillibazar, 1300 m, Kathmandu (Hirano, M. 1963).

4. *Synedra ulna* (Nitz.) Ehr. var. *amphirhynchus* (Ehr.) Grun. (Fig. 1)

Gonzalves, E. A. and Gandhi, H. P. 1952, P. 128, Fig. 19; Hustedt, F. 1959, P. 195, Fig. 691 e; Gandhi, H. P. 1967, P. 269, Fig. 64.

Valves solitary, linear-lanceolate, 230  $\mu\text{m}$  long, 5.5  $\mu\text{m}$  broad, with abruptly constricted, large capitate ends; pseudoraphe narrow, linear, gradually widening towards centre; central area rectangular or slightly longer than broad, reaching the sides; striae strong, 9-10 in 10  $\mu\text{m}$ , lineate, parallel.

Locality, Collection number and Date: Malaya roadside ditches in front of National Training; B-124; 04-04-2004.

Distribution: New to Nepal.

5. *Eunotia tschirchiana* Muell. (Fig. 6)

Hustedt, F. 1938, P. 173-174, Tab. 12, Fig. 29; Gandhi, H. P. 1967, P. 257, Figs. 19-21; Gandhi, H. P. 1999, P. 26, Pl. I, Fig. 37; P. 92, Pl. I, Fig. 23; P. 153, Pl. II, Fig. 61

Valves linear, arcuate, 59  $\mu\text{m}$  long, 7  $\mu\text{m}$  broad, dorsal margin convex, constricted towards ends, ventral margin more or less straight, sharply bent towards the extremity; obliquely

truncate or sub-truncate apices; polar nodules and raphe small, toward the poles on ventral side; striae coarse, 12 in 10  $\mu\text{m}$ , lineate, distantly and irregularly arranged in the middle, dense and radiate toward apices.

Locality, Collection number and Date: Birendra Sabha Griha Pond, B-77, 18-01-2004.

Distribution: A stream at Mewa Valley (Hirano, M. 1984).

6. *Navicula perrotetti* Grun. (Fig. 9)

Hustedt, F. 1961-1966, P. 56, Fig. 1205 a; Foged, N. 1980, P. 652, Pl. VIII, Figs. 1-2

Valves broadly lanceolate or somewhat rhombo-lanceolate, 84  $\mu\text{m}$  long, 21.5  $\mu\text{m}$  broad, with constricted, produced, flatly rostrate capitate ends; raphe straight, median with slightly unilaterally bent central nodules and swollen terminal fissures; axial area narrow, linear; central area moderately wide and longitudinally elongated; transverse striae fine, 12-13 in 10  $\mu\text{m}$ , lineate, parallel; longitudinal striae parallel to axial area.

Locality, Collection number and Date: Roadside ditches in front of Sent Joseph's School; B-116; 11-03-2004.

Distribution: New to Nepal.

7. *Pinnularia braunii* (Grun.) Cl. var. *amphicephala* (Mayer) Hust. (Fig. 2)

Hustedt, F. 1938, P. 290, Tab. XX, Fig. 40; Foged, N. 1980, P. 660, Pl. VIII, Fig. 8

Valves sublinear-lanceolate, 41.5  $\mu\text{m}$  long, 10  $\mu\text{m}$  broad, slightly convex sides with deeply constricted, slightly produced rounded capitate ends; raphe thin, straight, median with closely set unilaterally bent central nodules and curved terminal fissures; axial area broad, somewhat lanceolate; central area broad, stauros shaped, reaching the sides; striae coarse, 13 in 10  $\mu\text{m}$ ,

lineate, slightly radiate and short in the middle and curved and convergent towards apices.

Locality, Collection Number and Date: Sarouchia pond; B-105; 29-02-2004.

Distribution: A stream at Mewa Valley (Hirano, M. 1984).

8. *Gomphonema gracile* Ehr. var. *lanceolata* (Kuetz.) Cl. f. *turris* (Ehr.) Hust. (Fig. 3)

Hustedt, F. 1938, P. 438-439, Tab. XXVIII, Figs. 14-16.

Valves linear, 46  $\mu\text{m}$  long, 9  $\mu\text{m}$  broad, lanceolate to clavate, with abruptly constricted, bluntly rounded, pointed apex and gradually attenuated rounded base; raphe thin, straight with central nodules; axial area narrow, linear; central area medium, unilateral, isolated punctae undistinct; striae coarse, 13-16 in 10  $\mu\text{m}$ , lineate, radiate, distantly placed in the middle, close towards apices.

Locality, Collection number and Date: Slowly running water at Pitichra Nahar; B-124; 31-03-2004.

Distribution: New to Nepal.

9. *Gomphonema parvulum* (Kuetz.) Grun. var. *exillissima* Grun. (Fig. 4)

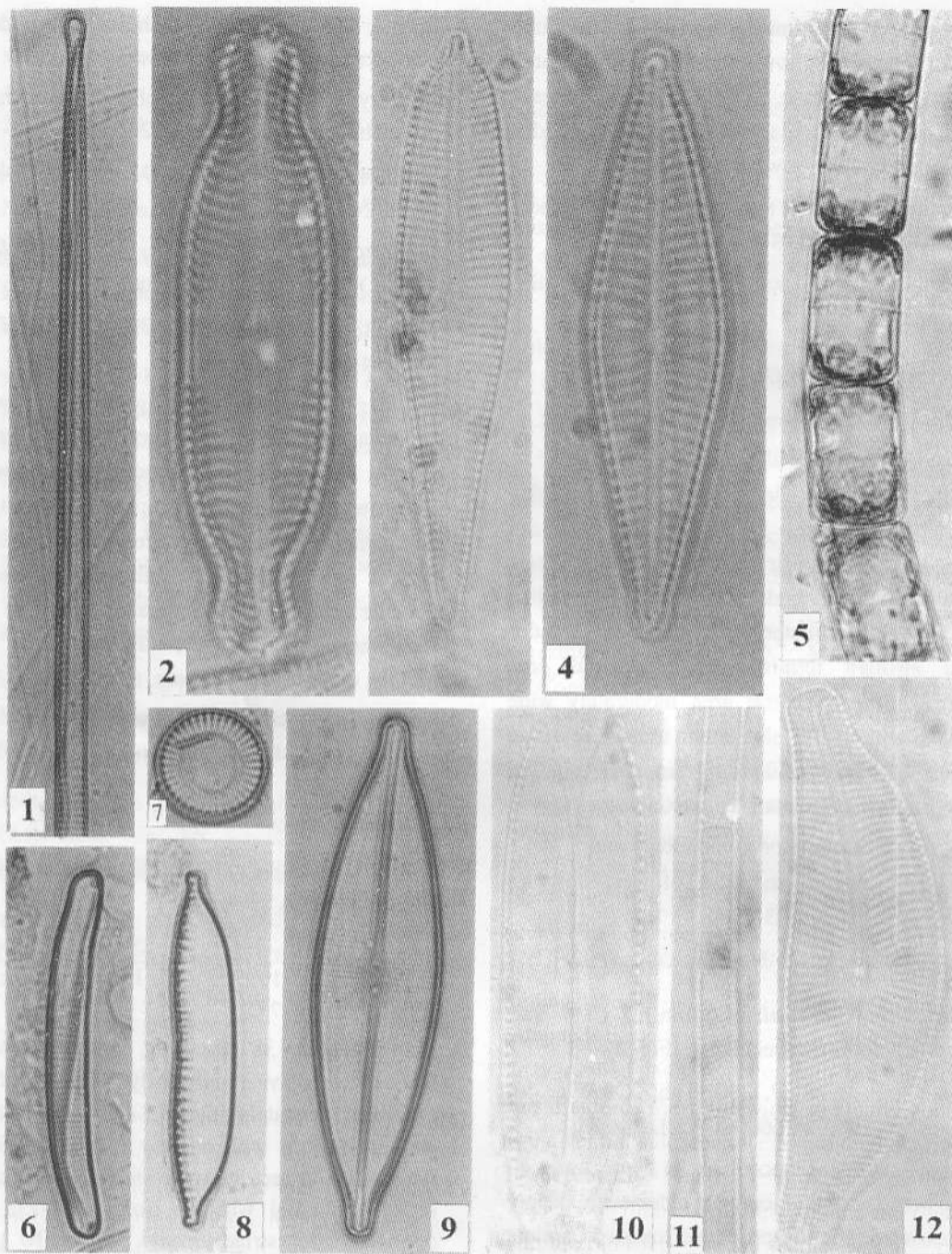
Gandhi, H. P. 1967, P. 258, Figs. 25-26; Gandhi, H. P. 1999, P. 96, Pl. I, Fig. 27; P. 156, Pl. II, Fig. 77.

Valves linear, 38  $\mu\text{m}$  long, 8.9  $\mu\text{m}$  broad, lanceolate, clavate narrowly with slightly produced, cuneately rounded apex; raphe thin, straight median with slightly curved terminal fissures; axial area narrow, linear; central area broad, unilateral with an isolated puncta on opposite side; striae lineate, 13 in 10  $\mu\text{m}$ , slightly radiate, short and distantly placed in the middle but close toward apices.

Locality, Collection number and Date: A small pond near Kesalya river; B-104; 29-02-2004.

Distribution: New to Nepal.





Figs 1. *Synedra ulna* (Nitz.) Ehr. var. *amphirhynchus* (Ehr.) Grun. (x920), (2) *Pinnularia braunii* (Grun.) Cl. var. *amphicephala* (Mayer) Hust. (x2250), (3) *Gomphonema gracile* Ehr. var. *lanceolata* (Kuetz.) Cl. f. *turris* (Ehr.) Hust. (x1870), (4) *Gomphonema parvulum* (Kuetz.) Grun. var. *exilissima* Grun. (x2250), (5) *Melosira varians* Ag. (x1870), (6) *Eunotia tschirchiana* Muell. (x920), (7) *Cyclotella meneghiniana* Kuetz. (x920), (8) *Hantzschia amphioxys* (Ehr.) Grun. (x1870), (9) *Navicula perrotetti* Grun. (x920), (10) *Nitzschia intermedia* Hantz. (x1870), (11) *Melosira granulata* (Ehr.) Ralfs (x1870), (12) *Cymbella tumida* (Breb.) Van. Heurck. (x920).

10. *Cymbella tumida* (Breb.) Van. Heurck. (Fig. 12)

Suxena, M. R. and Venkateswarlu, V. 1970, P. 645, Pl. V, Fig. 33; Foged, N. 1980, P. 640, Pl. IX, Figs. 9-10; Hadi, R. A. M. *et al.* 1984, P. 534, Pl. 4, Fig. 70; Pl. 11, Fig. 194.

Valves broadly naviculoid, 90  $\mu\text{m}$  long, 26.5  $\mu\text{m}$  broad, curved, asymmetric, dorsal margin convex, ventral margin straight or slightly convex having a median expansion, with bluntly rostrate, truncate poles; raphe thick, excentric, with distinct central nodules; axial area narrow; central area large, rounded, with an isolated puncta towards the ventral side; striae coarse, 8 in 10  $\mu\text{m}$ , punctate, slightly curved, radial.

Locality, Collection number and Date: A small pond near Pitchhra Nahar; B-126; 06-04-2004.

Distribution: A pond at Arughat Bazar, 710 m, Gorkha (Hirano, M. 1955; 1984); Roadside ditches at Mahendranagar, Kanchanpur (Habib, I. 1997).

11. *Nitzschia intermedia* Hantz. (Fig. 10)

Hustedt, F. 1938, P. 477, Tab. XLI, Figs. 4-7; Gandhi, H. P. 1967, P. 262, Fig. 46; Foged, N. 1980, P. 656, Pl. XIII, Figs. 5-6.

Valves long, 40.5  $\mu\text{m}$  long, 5.5  $\mu\text{m}$  broad, narrowly linear with almost parallel margins and oblique, cuneata constricted, subcapitate poles; keel punctae coarse, 12-15 in 10  $\mu\text{m}$ , marginal, elongated and placed at unequal distance; striae fine, lineate, delicate, parallel.

Locality, Collection number and Date: Malaya roadside ditches in front of Post Graduate Campus, B-125, 05-04-2004.

Distribution: New to Nepal.

12. *Hantzschia amphioxys* (Ehr.) Grun. (Fig. 8)

Hustedt, F. 1930, P. 394, Fig. 747; Carter, J. R. and Bailey-Watts, A. E. 1981, P. 570, Pl. 10,

Fig. 9; Foged, N. 1982, P. 607, Pl. V, Fig. 4; Pl. VI, figs. 9-10, 12.

Valves arcuate, 57.5  $\mu\text{m}$  long, 10  $\mu\text{m}$  broad, dorsal margin convex, ventral margin slightly concave, distinct depression in the middle with broadly, bluntly, produced rounded poles; keel punctae coarse, 7 in 10  $\mu\text{m}$ , distinct, slightly elongated, median too somewhat distantly placed; striae fine.

Locality, Collection number and Date: A pond south of Biratnagar Bust Stand; B-154; 23-05-2004.

Distribution: A glacier lake at Rarkya Pass, 4850 m, Manang (Hirano, M. 1955; 1984); Thimi, 1300 m, Bhaktapur (Shrestha, B. and J. D. Manandhar 1983).

#### ACKNOWLEDGEMENT

We like to thank Head, Botany Department, Post Graduate and MMAM Campus, Biratnagar for laboratory and photomicrography facilities.

#### REFERENCES

- Carter, J.R. and A.E. Bailey-Watts. 1981. A taxonomic study of diatoms from standing freshwaters in Shetland. *Nova Hedwigia* 33(1-4):513-628.
- Foged, N. 1980. Diatoms in Egypt. *Nova Hedwigia* 33(1-4):629-707.
- Foged, N. 1982. Diatoms in Asklepieion, Pergamon, Turkey. *Nova Hedwigia* 36(2-4):587-620.
- Gandhi, H.P. 1967. Notes on the diatomaceae from Ahmedabad and its environs-VI. On some diatoms from fountain reservoir of Seth Sarabhai's garden. *Hydrobiol* 30(2):248-272.
- Gandhi, H.P. 1999. Fresh water diatom of Central Gujrat. B. Singh and M.P. Singh, Dehradun, India, 324 pp.

- Gonzalves, E.A. and H.P. Gandhi. 1952. A systematic account of the diatoms of Bombay and Salsette (Part I). *J. Ind. bot. Soc.* **31(3)**:117-151.
- Habib, I. 1997. Algal flora from Mahendranagar, Nepal. *J. Econ. Taxn. Bot.* **21(1)**:19-26.
- Hadi, R.A.M., A.A. Al-Saboonchi and A.K.Y. Haroon. 1984. Diatoms of the Shattal-Arab river, Iraq. *Nova Hedwigia* **39**:513-557.
- Hirano, M. 1955. Fresh water algae. In: *Fauna and Flora of Nepal Himalaya*. (ed.) H. Kihara. Fauna and Flora Research Society, Kyoto University, Japan. pp. 5-42.
- Hirano, M. 1963. Fresh water algae from the Nepal Himalaya, collected by a member of the Japanese climbing expedition. *Contr. Biol. Lab.* Kyoto University, Japan **16**:1-23.
- Hirano, M. 1984. Fresh water algae from East Nepal. Study report of Baika Junior College. **32**:197-215.
- Hustedt, F. 1930. Die Kieselalgen Deutschlands, Osterreichs Und der Schweiz, vol. 1. Koeltz Scientific Books, USA. pp. 920.
- Hustedt, F. 1938. Systematische und okologische Untersuchungen iiber die Diatomeen flora von Java, Ball und Sumatra. *Archiv Fur Hydrobiol. Suppl.* Vol. **15**.
- Hustedt, F. 1959. Die Kieselalgen Deutschlands, Osterreichs Und der Schweiz, vol. 2. Koeltz Scientific Books, USA. pp. 845.
- Hustedt, F. 1961-1966. Die Kieselalgen Deutschlands, Osterreichs Und der Schweiz, vol. 3. Koeltz Scientific Books, USA. pp. 816.
- Ishida, Y. (ed.) 1986. Studies on distribution, adaptation and evolution of microorganisms in Nepal Himalayas (Second report). Kyoto, Japan. pp. 3-13.
- Patrick, R. and C.W. Reimer. 1966. The diatoms of the United States exclusive of Alaska and Hawaii, I. Monograph of the Acad. Nat. Sci. Philad. 13.
- Shrestha, B. and J.D. Manandhar. 1983. Contribution to the algal flora of Kathmandu valley. *J. Inst. Sc. Tech.* **6**:1-6.
- Suxena, M.R. and V. Venkateswarlu. 1968. Algae of the Cho Oyu (East Himalaya) expedition-1, Bacillariophyceae. *Hydrobiol.* **32(1-2)**:1-26.
- Suxena, M.R. and V. Venkateswarlu. 1970. Diatoms of the hot springs of Badrinath, Himalayas. *Nova Hedwigia* **31**:633-665.