

**HYDROBIOLOGICAL STUDIES WITHIN THE TEA GARDENS AT  
SRIMANGAL, BANGLADESH. II. ALGAL FLORA  
(EXCLUDING CHLOROPHYCEAE)**

A. K. M. NURUL ISLAM\* AND HASEEB MD. IRFANULLAH<sup>1</sup>

*Department of Botany, University of Dhaka, Dhaka-1000, Bangladesh*

*Key words:* Acidic habitats, diversity, phytoplankton, periphyton, new records

**Abstract**

A total of 108 algal taxa belonging to 57 genera and nine classes (excluding Chlorophyceae), namely, Cyanophyceae 28, Euglenophyceae 37, Chloromonadophyceae 1, Charophyceae 3, Xanthophyceae 11, Chrysophyceae 4, Bacillariophyceae 20, Dinophyceae 2 and Rhodophyceae 2 have been recorded from some acidic habitats within the tea gardens at Srimangal, Maulvi Bazar. Of these 13 are new records for Bangladesh.

**Introduction**

Recently, Islam and Irfanullah (2000a) have described the vascular hydrophytes of Baraora Lake and the Burburia River located within the tea gardens at Srimangal *Upazilla* (latitude 24°18'N and longitude 91°44'E), Maulvi Bazar District. The present paper is the second one in a series in continuation of the above work under the same title. Some preliminary studies suggest that these acidic habitats are rich in algae with diverse taxonomy and ecology (Islam and Irfanullah 1998a, 1998b, 1999a, 1999b, 2000b and 2001). This paper is the first attempt to document a complete list of the algal flora of the area (excluding Chlorophyceae).

**Materials and Methods**

For the description of the study area and meteorological information see Islam and Irfanullah (2000a). The pH of Baraora Lake ranged from 5.5 to 6.8, nearby ditches 5.8–6.6, and the Burburia River 6.0–7.2. In total 120 algal samples were collected in winter of 1996 (9 January) and different seasons of 1997 (winter, 6 January; spring, 18 March; rainy season, 20 July and autumn, 20 October). Phytoplankton samples were collected by using plankton net or by agitating and squeezing the aquatic macrophytes. Epiphytes and epizoons were collected by preserving the submerged plant parts and host molluscs, respectively. Algae were also collected from moist soil, rock and wet sand from the bank of the water-bodies. All algal materials were preserved in Transeau's solution. While examining the samples, camera lucida drawings were made and relative abundance was eye estimated for each taxon.

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\*Corresponding author. <sup>1</sup>Present address: IUCN-The World Conservation Union, Bangladesh Country Office, House No. 11, Road No. 138, Gulshan-1, Dhaka-1212, Bangladesh. e-mail: hmirfanullah@yahoo.co.uk

## Results and Discussion

In total, 108 algal taxa under 57 genera and nine classes are listed from the study area. The classes are, Cyanophyceae (28 taxa), Euglenophyceae (37 taxa), Chloromonadophyceae (1 taxon), Charophyceae (3 taxa), Xanthophyceae (11 taxa), Chrysophyceae (4 taxa), Bacillariophyceae (20 taxa), Dinophyceae (2 taxa) and Rhodophyceae (2 taxa). Out of these, 13 are recorded for the first time in Bangladesh (marked by asterisks). However, a few algal taxa from this area have already been reported by the authors as new records for Bangladesh (Islam and Irfanullah 2000b, 2001), which are not marked in this account.

In terms of algal species richness this study area seems to be unique. Most of the species encountered are expected in the acidic habitats. But, high number of blue-green taxa was unusual. The population size of the algal taxa recorded is very low in number and appeared once a year. The species diversity indices for algae have not been calculated, but given the community structure presented here the value would be high. The algal distribution appeared to be highly patchy in the lake as well as in the river. Existence of various ecological niches is also evident from this study. More systematic sampling and quantitative estimation of species abundance (density or biovolume) over a longer period may give a more detailed picture of the algal flora of these interesting habitats.

A complete list of all the studied taxa is given below.

### Class: Cyanophyceae; Order: Chroococcales; Family: Chroococcaceae

1. **Chococcus minutus** (Kütz.) Näg. (Pl. 1, Fig. 1)  
(Skuja 1949, Pl. 1, Fig. 9; Prescott 1951, 449, Pl. 100, Fig. 9)  
Colony L. 37 µm, d. 30.4 µm; cell L. 5.4–7.4 µm, d. 3.4–4.7 µm. Lake; winter 96, 97; few.
2. \***Gloeocapsa aeruginosa** (Carm.) Kütz. (Pl. 3, Fig. 26)  
(Geitler 1925, 89, Fig. 87)  
One to four small, spherical cells are surrounded by thin mucilage sheath forming free-floating colonies; colony d. 5.4–8.8 µm, cell d. 2 µm. However, it did not form firm or leathery mucilage sheath (Prescott, 1951, 451, 101:6). Lake; autumn 97; few.
3. **Merismopedia glauca** (Ehr.) Näg. (Pl. 1, Figs. 2 & 3)  
(Prescott 1951, 459, Pl. 101, Figs. 2–4)  
Cell L. 4.0–9.4 µm, d. 2.7–5.4 µm. Lake; winter 97; common; and river; spring 97; few.
4. \***Synechocystis septentrionalis** Skuja (Pl. 3, Fig. 25)  
(Skuja 1956, 48, Pl. 5, Figs. 1–5)  
Free-floating, solitary, spherical cell, surrounded by thick mucilage, cell d. (with mucilage layer) 21 µm and (without mucilage layer) 14.8 µm. Lake; winter 97; few.

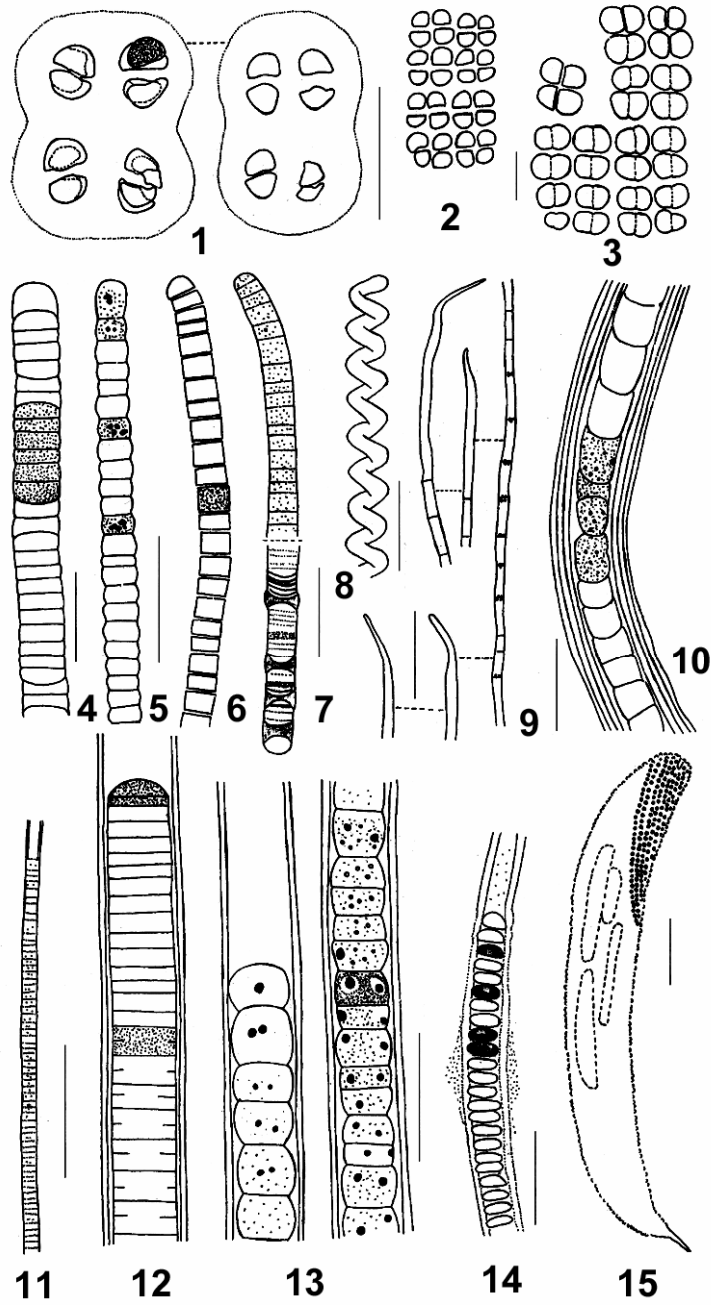


Plate 1 (Figs. 1-15)

1. *Chroococcus minutus*, 2 & 3. *Merismopedia glauca*, 4. *Oscillatoria ornata*, 5. *O. chalybea*, 6. *O. tenuis*, 7. *O. subbrevis*, 8. *Spirulina princeps*, 9. *Oscillatoria acutissima*, 10. *Porphyrosiphon notarisii*, mid-part, 11. *Lyngbya limnetica* fa., 12. *L. hieronymusii*, 13. *L. ceylanica* var. *constricta*, 14. ? *Johannesbaptistia pellucida*, 15. *Euglena oxyuris*. (Scales = 20  $\mu$ m).

**Family: Entophysalidaceae**

5. ? **Johannesbaptistia pellucida** (Dickie) Taylor & Drouet (Pl. 1, Fig. 14)  
(Desikachary 1959, 165, Pl. 32, Figs. 14-19)  
Filament d. 8 µm; cell L. 2–2.7 µm, d. 4–4.7 µm. River; autumn 97; rare.

**Order: Pelonematales; Family: Pelonemataceae**

6. **Pelonema aphanes** Skuja  
(Islam and Irfanullah 2000b, 115, Pl. 1, Figs. 1 & 2)  
Lake (rare) and river (episammic; few); rainy 97.

**Order: Oscillatoriales; Family: Oscillatoriaceae**

7. **Lyngbya ceylanica** Wille var. **constricta** Frémy (Pl. 1, Fig. 13)  
(Desikachary 1959, 299, Pl. 54, Fig. 5)  
Filament d. 11 µm; cell L. 7.8–9.8 µm, d. 7.3–8.5 µm. Lake; rainy 97; few.
8. **Lyngbya hieronymusii** Lemm. (Pl. 1, Fig. 12)  
(Desikachary 1959, 297, Pl. 48, Fig. 4)  
Filament d. 14 µm; cell L. 2.0–5.4 µm, d. 10–10.8 µm. Lake; winter 96; rare.
9. **Lyngbya limnetica** Lemm. fa. (Pl. 1, Fig. 11)  
Filament d. 2.7–3.3 µm; trichome d. 2.0–2.7 µm. Lake; rainy 97; rare.
10. **Oscillatoria acutissima** Kufferath (Pl. 1, Fig. 9)  
(Prescott 1951, 484, Pl. 109, Fig. 1)  
Cell L. 5–10 µm, d. 2.7 µm. Lake; spring 97; common.
11. **Oscillatoria amphibia** Ag. ex Gomont (Pl. 3, Fig. 28)  
(Desikachary 1959, 229, Pl. 37, Fig. 6)  
Intercalary cell L. 5.4–11.3 (–16.2) µm, d. 4.7–5.4 µm; tip cell round, size similar to other cells; cross-walls without constriction, in most intercalary portion cross-walls are not evident for quite a length. River; spring 97; few.
12. **Oscillatoria chalybea** (Mertens) Gomont (Pl. 1, Fig. 5)  
(Desikachary, 1959, 218, Pl. 38, Fig. 3)  
Cell L. 2.0–4.0 (–6.7) µm, d. 5.4–6.0 µm. Lake; autumn 97; rare.
13. **Oscillatoria ornata** Kütz. ex Gomont (Pl. 1, Fig. 4)  
(Desikachary 1959, 206, Pl. 37, Fig. 12)  
Cell L. 2.7–5.4, d. 10.8 µm. Lake; rainy 97; rare.

14. **Oscillatoria subbrevis** Schmidle (Pl. 1, Fig. 7)  
(Desikachary 1959, 207, Pl. 37, Fig. 2)  
Cell L. 2.7–5.4  $\mu\text{m}$ , d. 5.4–6.7  $\mu\text{m}$ . River; rainy & autumn 97; rare.
15. **Oscillatoria tenuis** Ag. ex Gomont (Pl. 1, Fig. 6)  
(Prescott 1951, 491, Pl. 110, Fig. 9)  
Cell L. 2–4  $\mu\text{m}$ , d. 4.7–5.4  $\mu\text{m}$ . River; autumn 97; rare.
16. \***Oscillatoria vizagapatensis** Rao (Pl. 3, Fig. 29)  
(Desikachary 1959, 205, Pl. 39, Figs. 16 & 18)  
Trichome is deep blue in colour, straight, about 0.7 mm long; intercalary cell L. 2–4  $\mu\text{m}$  and d. 8–9.4  $\mu\text{m}$ ; cross-walls not constricted; tip cell is round and dome shaped, L. 3.3–4  $\mu\text{m}$  and d. 5.4–6.7  $\mu\text{m}$ ; ultimate and penultimate cells have constrictions on the cross-wall. Lake; rainy 97; rare.
17. **Oscillatoria willei** Gardner em. Drouet (Pl. 3, Fig. 30)  
(Desikachary 1959, 217, Pl. 38, Figs. 4 & 5)  
Thallus deep green in colour, forms mat-like colony of 8–9 cm diameter on mud; long, flexible light blue-green trichomes entangling each other; cell L. 4.7–10.0  $\mu\text{m}$  and d. 5.4  $\mu\text{m}$ ; no constriction on cross-walls, tip cell round, in some intercalary regions cross-walls are not evident for quite a length. River; winter 97; common.
18. **Porphyrosiphon notarisii** (Menegh.) Kütz. ex Gomont (Pl. 1, Fig. 10)  
(Desikachary 1959, 248, Pl. 47, Fig. 9)  
Filament d. 18  $\mu\text{m}$ ; cell L. 3–12  $\mu\text{m}$ , d. 10.8  $\mu\text{m}$ . River; autumn 97; rare.
19. \***Spirulina laxa** G.M. Smith (Pl. 3, Fig. 27)  
(Prescott 1951, 479, Pl. 108, Fig. 10)  
Trichome d. 1.3–2  $\mu\text{m}$ , spiral width 4  $\mu\text{m}$ ; distance between the adjacent spirals 16.2–17.5  $\mu\text{m}$ ; loosely twisted, deep blue-green in colour. Lake; rainy 97; rare.
20. **Spirulina princeps** W. & W. (Pl. 1, Fig. 8)  
(Prescott 1951, 480, Pl. 108, Fig. 13; Desikachary 1959, 197, Pl. 36, Fig. 7)  
Trichome d. 4  $\mu\text{m}$ , spiral width 9.4  $\mu\text{m}$ , distance between adjacent spirals 8.5  $\mu\text{m}$ . Lake; winter & rainy 97; few.

**Order: Nostocales; Family: Nostocaceae**

21. **Anabaena oscillatoroides** Bory fa. (Pl. 2, Fig. 20)  
Trichome solitary; cell L. 3.0–4.7  $\mu\text{m}$ , d. 3.6–4.7  $\mu\text{m}$ ; 2–4 heterocysts per trichome, heterocyst L. 10.8  $\mu\text{m}$ , d. 4.7  $\mu\text{m}$ ; smaller than typical (young stage). River; spring 97; few. Other forms of this genus were also seen in the lake; year round 97; few to common.

**Order: Scytonematales; Family: Scytonemataceae**

22. ? *Scytonema* sp. (Pl. 2, Fig. 21)  
 Filament d. 10.8–12.0 µm; cell L. 2–6 µm, d. 6–8 µm; heterocyst L. 16.8 µm, d. 10 µm. Lake; winter 96; rare.

**Order: Stigonematales; Family: Stigonemataceae**

23. \**Hapalosiphon aureus* W. & W. (Pl. 2, Fig. 24)  
 (Prescott 1951, 544, Pl. 128, Figs. 1–3)  
 Filament d. 8.3–13.3 µm; cell L. 6.7–18.7 µm, d. 3.3–5.8 µm; heterocyst L. 11.7 µm, d. 6.7 µm. Lake; epiphytic; winter 96, 97; few to common.
24. \**Hapalosiphon flexuosus* Borzi (Pl. 2, Fig. 23)  
 (Prescott 1951, 545, Pl. 128, Figs. 5 & 6)  
 Filament d. 7.4–9.4 µm; cell L. 4–12 µm, d. 5.4–7.4 µm. Lake; epiphytic; rainy 97; few.

**Order: Rivulariales; Family: Rivulariaceae**

25. *Calothrix clavatoides* Ghose (Pl. 2, Fig. 17)  
 (Desikachary 1959, 531, Pl. 113, Fig. 9)  
 Cell L. 3.4–9.4 µm, max. d. 7.4 µm; heterocyst d. 8.0–9.4 µm; an young stage. Lake; autumn 97; few.
26. *Gloeotrichia natans* (Hedwig) Rab. (Pl. 2, Fig. 16)  
 (Prescott 1951, 559, Pl. 134, Figs. 6 & 7)  
 Cell L. 6.7–7.4 (–12.8) µm, max. d. 10.8 µm; heterocyst L. 12.8–16.2 µm, d. 10.8 µm; akinete L. 143–194 µm, d. 12.8–13.5 µm. Lake; free-floating macroscopic colony; winter 96; common.
27. *Rivularia aquatica* De Wildeman (Pl. 2, Figs. 18 & 19)  
 (Desikachary 1959, 552)  
 Cell L. 11–25 µm, d. 3.0–5.4 µm; heterocyst L. 8.0–13.5 µm, d. 6.4–10.8 µm. Lake; epiphytic; spring & rainy 97; common.
28. ? *Pelonema* sp. (Pl. 2, Fig. 22)  
 Cell L. 3.4–6.7 µm, d. 0.7 µm. Lake; within *Schizochlamys gelatinosa* mucilage; winter 97; common.

**Class: Euglenophyceae; Order: Euglenales; Family: Euglenaceae**

29. *Euglena acus* var. *acus* Ehr. (Pl. 4, Fig. 46)  
 (H.-P. 1955, 96, Pl. 16, Fig. 75)  
 L. 74 µm, d. 6 µm. Lake; rainy 97; rare.

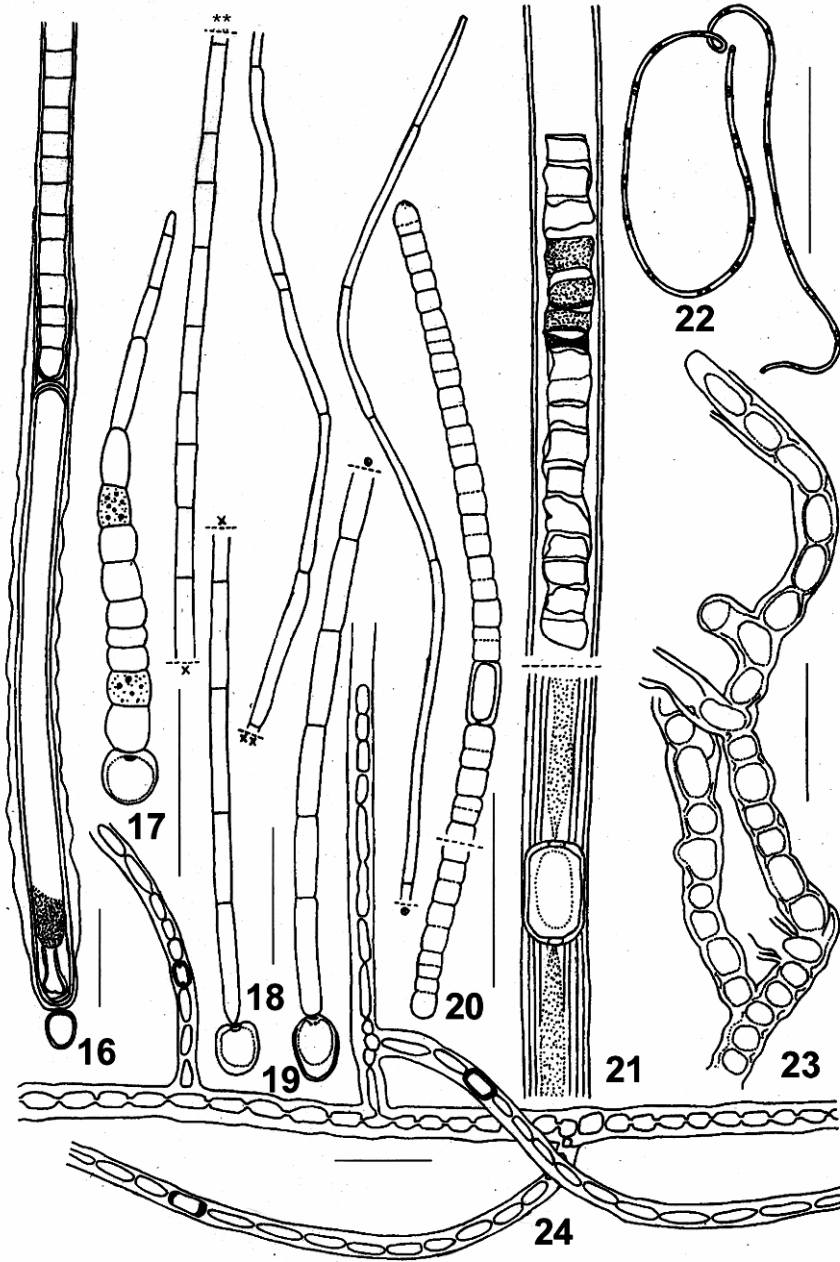


Plate 2 (Figs. 16-24)

16. *Gloeotrichia natans*, 17. *Calothrix clavatooides*, 18 & 19. *Rivularia aquatica*, 20. *Anabaena oscillarioides* fa., 21. ? *Scytonema* sp., 22. ? *Pelonema* sp., 23. *Hapalosiphon flexuosus*, 24. *H. aureus*. (Scales = 30  $\mu$ m).

30. **Euglena charkowiensis** Swir. (Pl. 4, Fig. 47)  
(H.-P. 1955, 61, Pl. 6, Fig. 37)  
L. 157  $\mu\text{m}$ , d. 27  $\mu\text{m}$ , two paramylon bodies. Paddy field; autumn 97; few.
31. **Euglena oxyuris** Schmarida (Pl. 1, Fig. 15)  
(H.-P. 1955, 65, Pl. 7, Fig. 42)  
L. 150  $\mu\text{m}$ , d. 23  $\mu\text{m}$ , four paramylons. Lake; spring 97; common.
32. **Euglena pisciformis** Klebs (Pl. 3, Fig. 36)  
(H.-P. 1955, 41, Pl. 1, Fig. 15)  
L. 82  $\mu\text{m}$ , d. 8  $\mu\text{m}$ ; striation present; two large and one small cylindrical paramylon bodies. Lake; winter 97; few.
33. **Euglena ? tripteris** (Duj.) Klebs (Pl. 4, Fig. 48)  
(Prescott 1951, Pl. 86, Figs. 4-6; H.-P. 1955, 62, Pl. 7, Fig. 39)  
L. 65–68  $\mu\text{m}$ , d. 10.8  $\mu\text{m}$ , spiral striation. Lake; rainy 97; common.
34. \***Lepocinclis cymbiformis** Playf. fa. (Pl. 3, Fig. 31)  
Fusiform cell with stout anterior end, L. 33.7  $\mu\text{m}$ , d. 12.2  $\mu\text{m}$ , anterior end d. 4  $\mu\text{m}$ ; longitudinal striation present; one pair of spindle-shaped paramylon bodies; tail short and oblique. Lake; winter 97; rare.
35. **Lepocinclis ovum** (Ehr.) Lemm. variety (Pl. 3, Fig. 33)  
Elliptical, golden coloured cell, L. 44.5  $\mu\text{m}$ , d. 23.7  $\mu\text{m}$ ; spiral striation, 8-10 striations per 10  $\mu\text{m}$ ; straight, stout tail. Paddy field; autumn 97; few.
36. **Lepocinclis ovum** (Ehr.) Lemm. fa. (Pl. 3, Fig. 32)  
L. 30.5  $\mu\text{m}$ , d. 17.5–19  $\mu\text{m}$ , 12 striations/10  $\mu\text{m}$ . Lake; rainy 97; few.
37. \***Lepocinclis playfairiana** Defl. (Pl. 4, Fig. 49)  
(Prescott 1951, 407, Pl. 89, Fig. 16)  
L. 32.4–40.5  $\mu\text{m}$ , d. 27.0–29.7  $\mu\text{m}$ . Lake; rainy 97; rare.
38. **Lepocinclis** sp. - 1 (Pl. 3, Fig. 34)  
Ovate cell with long pointed posterior tail; many disc-shaped chloroplasts; L. 32.4  $\mu\text{m}$ , d. 12  $\mu\text{m}$ . Lake; winter 97; rare.
39. **Lepocinclis** sp. - 2 (Pl. 5, Fig. 85)  
L. 15.5  $\mu\text{m}$ , d. 13.5  $\mu\text{m}$ . Lake; winter 97; rare.
40. **Phacus caudatus** Hübner (Pl. 4, Fig. 54)  
(H.-P. 1955, 196, Pl. 39, Fig. 236)  
L. 29.7  $\mu\text{m}$ , d. 18.2  $\mu\text{m}$ . Lake; rainy 97; rare.



41. **Phacus curvicauda** Swir. (Pl. 4, Fig. 55)  
(H.-P. 1955, 200, Pl. 41, Fig. 251)  
L. 30.4–33  $\mu\text{m}$ , d. 24.3–25.6  $\mu\text{m}$ , 6-8 striations/10  $\mu\text{m}$ . Lake; autumn 97; rare.
42. **Phacus helicoides** Pochm. (Pl. 4, Figs. 50 & 51)  
(H.-P. 1955, 226, Pl. 51, Fig. 312)  
L. 64.8  $\mu\text{m}$ , d. 32.4  $\mu\text{m}$ . Lake; rainy 97; rare.
43. **Phacus platalea** Drez. (Pl. 4, Fig. 52)  
(H.-P. 1955, 210, Pl. 45, Fig. 274)  
L. 47.2  $\mu\text{m}$ , d. 32.4  $\mu\text{m}$ , one large paramylon body, longitudinal striation. Lake; spring & rainy 97; rare.
44. **Phacus pleuronectes** (O.P.M.) Duj. (Pl. 4, Fig. 53)  
(H.-P. 1955, 211, Pl. 45, Fig. 276)  
L. 55.3  $\mu\text{m}$ , d. 46  $\mu\text{m}$ , distance between adjacent striations 2.7  $\mu\text{m}$ . Lake; spring & rainy 97; rare.
45. **Phacus** sp. – 1 (Pl. 3, Fig. 35)  
L. 47.2  $\mu\text{m}$ , d. 36.4  $\mu\text{m}$ . Ditch; autumn 97; rare.
46. **Phacus** sp. – 2 (Pl. 4, Fig. 56)  
L. 44  $\mu\text{m}$ , d. 13.5  $\mu\text{m}$ . Lake; winter 97; rare.
47. \***Strombomonas fluviatilis** (Lemm.) Defl. variety (Pl. 3, Fig. 44)  
Light brown, thick walled lorica with smooth but undulated surface; raised ostiole; straight posterior tail; L. (with tail) 37.8  $\mu\text{m}$ , d. 22.3  $\mu\text{m}$ , ostiole d. 5.4  $\mu\text{m}$ . Lake; winter 96; rare.
48. **Trachelomonas abrupta** Swir. em. Defl. (Pl. 5, Fig. 70)  
(Prescott 1951, 410, Pl. 83, Fig. 18; H.-P. 1955, 320, Pl. 69, Fig. 628)  
L. 22.3  $\mu\text{m}$ , d. 14  $\mu\text{m}$ , ostiole d. 2  $\mu\text{m}$ . Lake; winter 97; few.
49. **Trachelomonas armata** (Ehr.) Stein variety (Pl. 5, Fig. 67)  
L. 27  $\mu\text{m}$ , d. 21.6  $\mu\text{m}$ , ostiole d. 3.4  $\mu\text{m}$ . Lake; winter 96; few.
50. **Trachelomonas australica** (Playf.) comb. Defl.? var. **granulata** (Playf.) comb. Defl. (Pl. 5, Fig. 68)  
(H.-P. 1955, 303, Pl. 65, Fig. 560)  
L. 20.2  $\mu\text{m}$ , d. 17  $\mu\text{m}$ , ostiole d. 3  $\mu\text{m}$ . Lake; winter 97; few.
51. **Trachelomonas cylindrica** Ehr. sec. Playf. variety (Pl. 3, Fig. 43)  
Elliptic lorica with smooth wall, 7–8 vertical extensions /spines form the collar; L. 15.5  $\mu\text{m}$ , d. 7.4  $\mu\text{m}$ . Lake; winter 97; rare.

52. **Trachelomonas dubia** Swir. em. Defl. (Pl. 5, Fig. 66)  
(Prescott 1951, 412, Pl. 85, Figs. 1 & 2; H.-P. 1955, 334, Pl. 72, Fig. 696)  
L. 24.3  $\mu\text{m}$ , d. 12  $\mu\text{m}$ , ostiole d. 2  $\mu\text{m}$ , smooth wall. Lake; winter 97; few.
53. **Trachelomonas dybowskii** Drez. (Pl. 4, Fig. 60)  
(H.-P. 1955, 280, Pl. 61, Figs. 465 & 466)  
L. 19  $\mu\text{m}$ , d. 17  $\mu\text{m}$ , ostiole d. 2.7  $\mu\text{m}$ . Lake; winter 97; rare.
54. \***Trachelomonas eurystoma** Stein sec. Playf. var. **minuta** van Oye (Pl. 3, Fig. 40)  
(H.-P. 1955, 316, Pl. 68, Fig. 614)  
Irregularly ovate, smooth wall lorica with simple ostiole, L. 14  $\mu\text{m}$ , d. 9  $\mu\text{m}$ , ostiole d. 2.3  $\mu\text{m}$ . Lake; winter 97; rare.
55. **Trachelomonas hispida** (Perty) Stein em. Defl. (Pl. 3, Fig. 37, Pl. 5, Fig. 71)  
(H.-P. 1955, 293, Pl. 63, Fig. 520)  
L. 20.2–24.3  $\mu\text{m}$ , d. 16.2–17.5, ostiole d. 2.7  $\mu\text{m}$ . Lake; winter 97; rare.
56. **Trachelomonas hispida** var. **punctata** Lemm. (Pl. 5, Figs. 63–65)  
(H.-P. 1955, 295, Pl. 63, Fig. 521)  
L. 15.5–28.3  $\mu\text{m}$ , d. 13.5–22.3  $\mu\text{m}$ , ostiole d. 2.3–2.7  $\mu\text{m}$ . Lake; winter 96; few.
57. **Trachelomonas hispida** (Perty) Stein em. Defl. variety (Pl. 3, Fig. 39)  
L. 20.2  $\mu\text{m}$ , d. 15.5  $\mu\text{m}$ , ostiole d. 3.4  $\mu\text{m}$ . Lake; winter 97; rare.
58. **Trachelomonas hispida** (Perty) Stein em. Defl. fa. (Pl. 4, Fig. 62)  
L. 16.2  $\mu\text{m}$ , d. 13.5  $\mu\text{m}$ , ostiole d. 2  $\mu\text{m}$ . Lake; winter 96; common.
59. **Trachelomonas lacustris** Drez. (Pl. 5, Fig. 69)  
(Prescott 1951, 415, Pl. 83, Fig. 14; H.-P. 1955, 290, Pl. 62, Fig. 504)  
L. 27  $\mu\text{m}$ , d. 15.5  $\mu\text{m}$ , ostiole d. 4  $\mu\text{m}$ . Lake; winter 97; few.
60. **Trachelomonas oblonga** Lemm. (Pl. 4, Fig. 61)  
(H.-P. 1955, 278, Pl. 61, Fig. 459)  
L. 13.5  $\mu\text{m}$ , d. 10.8  $\mu\text{m}$ . Lake; winter 96; rare.
61. **Trachelomonas superba** Swir. em. Defl. var. **duplex** Defl. (Pl. 4, Fig. 57)  
(Prescott 1951, 417, Pl. 84, Fig. 11; H.-P. 1955, 306, Pl. 66, Fig. 573)  
L. 43.2  $\mu\text{m}$ , d. 35  $\mu\text{m}$ . Lake; winter 97; rare.
62. **Trachelomonas sydneyensis** Playf. (Pl. 5, Fig. 72)  
(Prescott 1951, 418, Pl. 84, Fig. 2; H.-P. 1955, 300, Pl. 65, Fig. 545)  
L. 40.5  $\mu\text{m}$ , d. 23  $\mu\text{m}$ . Lake; winter 97; rare.

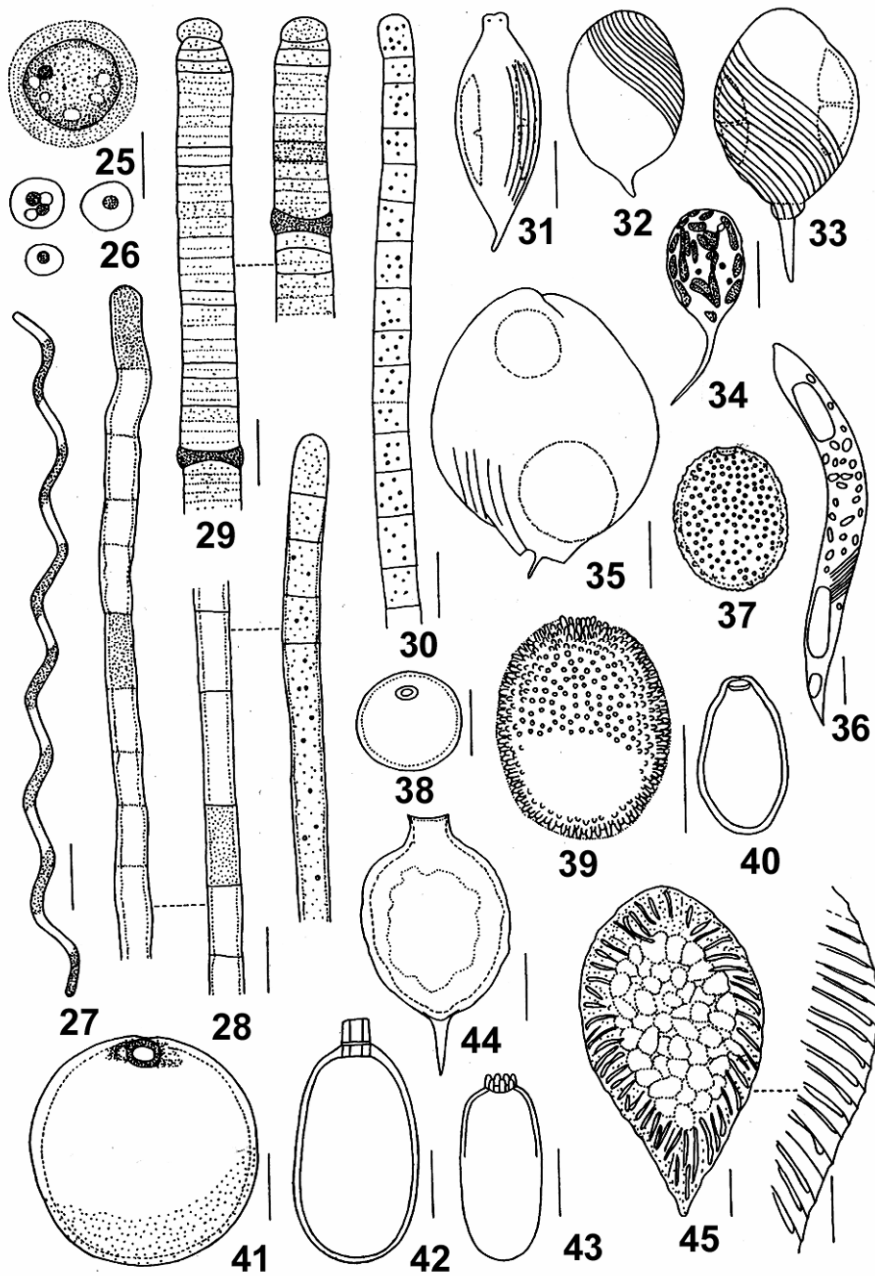


Plate 3 (Figs. 25-45)

25. *Synechocystis septentrionalis*, 26. *Gloeocapsa aeruginosa*, 27. *Spirulina laxa*, 28. *Oscillatoria amphibia*, 29. *O. vizagapatensis*, 30. *O. willei*, 31. *Lepocinclis cymbiformis* fa., 32. *L. ovum* fa., 33. *L. ovum* variety, 34. *Lepocinclis* sp. - 1, 35. *Phacus* sp. - 1, 36. *Euglena pisciformis*, 37. *Trachelomonas hispida*, 38. *T. volvocina*, 39. *T. hispida* variety, 40. *T. eurystoma* var. *minuta*, 41. *T. volvocinopsis*, 42. *T. volzii* var. *cylindracea*, 43. *T. cylindrica* variety, 44. *Strombomonas fluviatilis* variety, 45. *Gonyostomum semen* (Scales = 10  $\mu$ m).

63. **Trachelomonas volvocina** Ehr. (Pl. 3, Fig. 38, Pl. 4, Figs. 58 & 59)  
(H.-P. 1955, 251, Pl. 66, Fig. 349)  
Lorica d. 12–16.8  $\mu\text{m}$  (dimension once, 14.8  $\times$  18.2  $\mu\text{m}$ ), ostiole d. 1.5–2  $\mu\text{m}$ . Lake;  
winter 97; few.
64. **Trachelomonas volvocinopsis** Swir. (Pl. 3, Fig. 41)  
(H.-P. 1955, 253, Pl. 66, Fig. 358)  
Spherical lorica with finely pitted wall, d. 36.4  $\mu\text{m}$ , ostiole d. 3.4  $\mu\text{m}$ . Lake; winter  
96; rare.
65. \***Trachelomonas volzii** Lemm. var. **cylindracea** Playf. (Pl. 3, Fig. 42)  
(H.-P. 1955, 334, Pl. 72, Fig. 695)  
Red-brown, ovo-elliptic, smooth walled lorica with cylindrical collar at ostiole; L.  
40.5  $\mu\text{m}$ , d. 20.2  $\mu\text{m}$ . Lake; winter 97; few.

**Class: Chloromonadophyceae; Order: Chloromonadales;  
Family: Chloromonadaceae**

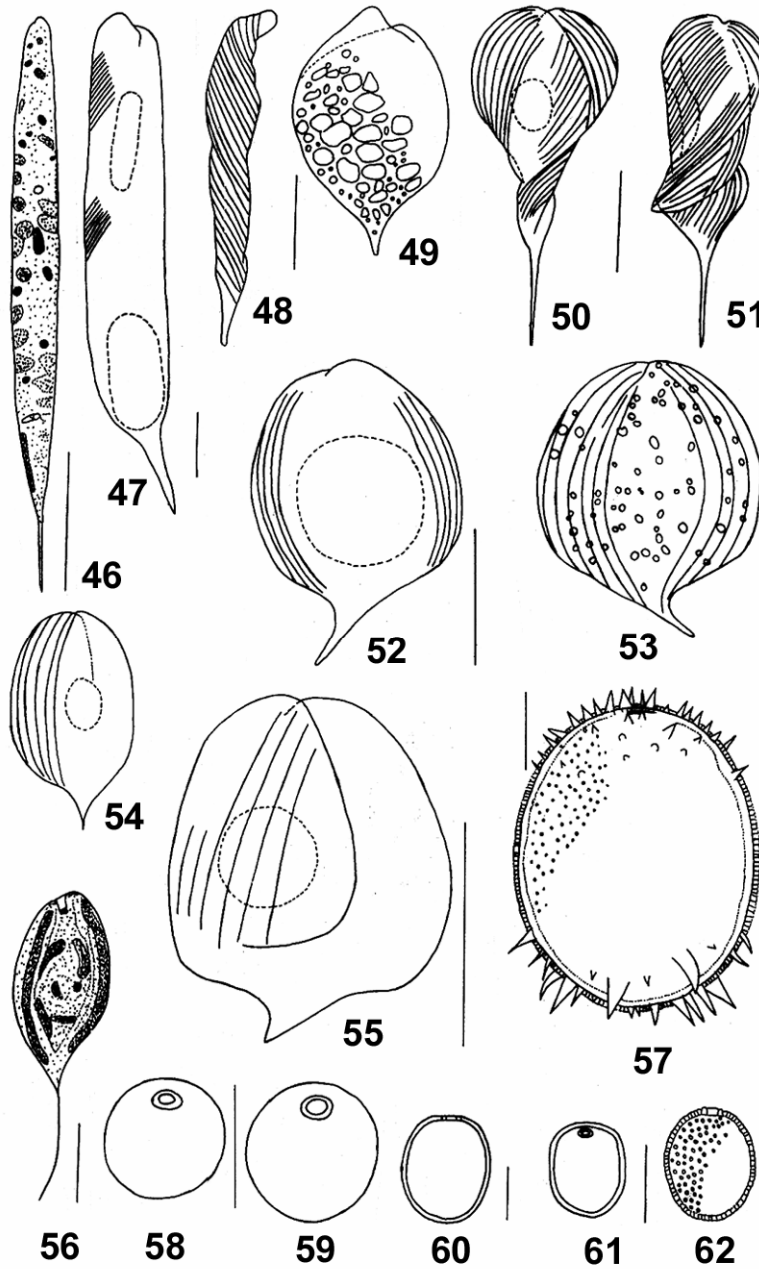
66. **Gonyostomum semen** (Ehr.) Diesing (Pl. 3, Fig. 45)  
(Prescott 1951, 422, Pl. 99, Figs. 11 & 12)  
Brownish, fusiform cell with spiral striation, central mass of (?) food material was  
evident, top view circular; L. 66  $\mu\text{m}$ , d. 37  $\mu\text{m}$ . Lake; winter 97; rare.

**Class: Charophyceae; Order: Charales; Family: Characeae**

67. **Chara fibrosa** Agardh ex Bruzelius em. Wood var. **hookeri** (Braun) Wood fa.  
**burmanica** (Pal) Wood (Islam and Sarma 1968, 370, Pl. 6, Figs. 46–52)  
Lake; year round 97; common to abundant.
68. **Nitella furcata** (Roxb. ex Bruz.) Ag. subsp. **furcata** R.D.W. var. **furcata** Wood fa.  
**furcata** R.D.W. (Islam and Sarma 1976, 48, Figs. 24–32)  
Lake; year round 97; few to common.
69. **Nitella pseudoflabellata** Braun subsp. **pseudoflabellata** var. **leptodactyla** (J. Gr.)  
R.D.W. (Islam and Sarma 1976, 58, Figs. 73–79)  
River; winter (common) & summer (few) 97.

**Class: Xanthophyceae; Order: Heterococcales; Family: Pleurochloridaceae**

70. **Botrydiopsis arhiza** Borzi  
(Islam and Irfanullah 2000b, 116, Pl. 2, Fig. 15)  
Lake; autumn 97; rare.



**Plate 4** (Figs. 46–62)

46. *Euglena acus* var. *acus*, 47. *E. charkowiensis*, 48. *E. ? tripteris*, 49. *Lepocinclis playfairiana*, 50 & 51. *Phacus helicoides*, 52. *P. platalea*, 53. *P. pleuronectes*, 54. *P. caudatus*, 55. *P. curvicauda*, 56. *Phacus* sp. – 2, 57. *Trachelomonas superba* var. *duplex*, 58 & 59. *T. volvocina*, 60. *T. dybowskii*, 61. *T. oblonga*, 62. *T. hispida* fa. (Scales: Figs. 46-55 = 20  $\mu$ m, Figs. 56-62 = 10  $\mu$ m).

71. **Gloeobotrys limnetica** (G.M. Smith) Pascher  
(Islam and Irfanullah 2000b, 118, Pl. 1, Fig. 8)  
Lake; winter 96; few.

**Family: Characiopsidaceae**

72. **Characiopsis longipes** (Rab.) Borzi (Pl. 5, Fig. 83)  
(Prescott 1951, 358, Pl. 93, Figs. 32 & 34)  
L. (with stipe) 46  $\mu\text{m}$ , (without stipe) 24.3  $\mu\text{m}$ , d. 5.4  $\mu\text{m}$ . Lake; rainy 97; few.
73. **Characiopsis** sp. (Pl. 5, Figs. 81 & 82)  
L. (with stipe) 32.4–37.8  $\mu\text{m}$ , (without stipe) 13.5–19  $\mu\text{m}$ , d. 5.4–6.7  $\mu\text{m}$ . Lake; rainy 97; few.
74. **Peroniella planctonica** G.M. Smith  
(Islam and Irfanullah 2000b, 118, Pl. 1, Fig. 3)  
Lake; epiphytic on *Oedogonium* sp.; rainy 97; common.

**Family: Sciadaceae**

75. **Bumilleriopsis brevis** Printz  
(Islam and Irfanullah 2000b, 118, Pl. 2, Figs. 12–14)  
River; rainy 97; common.

**Family: Centritractaceae**

76. **Centritractus belanophorus** Lemm. (Pl. 5, Fig. 77)  
(Prescott 1951, 361, Pl. 95, Figs. 37 & 38)  
L. (with spine) 78.3  $\mu\text{m}$  and (without spine) 28.3  $\mu\text{m}$ , d. 5.5  $\mu\text{m}$ . Lake; winter 96; rare.

**Family: Chlorotheciaceae**

77. **Ophiocytium arbusculum** (A.Br.) Rab. (Pl. 5, Figs. 74-76)  
(Prescott 1951, 363, Pl. 94, Fig. 12)  
L. (without spine) 21.6–54  $\mu\text{m}$ , d. 2.7–4  $\mu\text{m}$ . Lake; winter 96 (rare) and rainy 97 (common).
78. \***Ophiocytium capitatum** Wolle (Pl. 5, Figs. 78 & 79)  
(Prescott 1951, 363, Pl. 94, Figs. 21 & 22)  
L. (without spine) 94–108  $\mu\text{m}$ , d. 5.4–7.4  $\mu\text{m}$ ; spines at both ends, L. 5.4–21.6 (–27)  $\mu\text{m}$ . Lake; rainy 97; common.

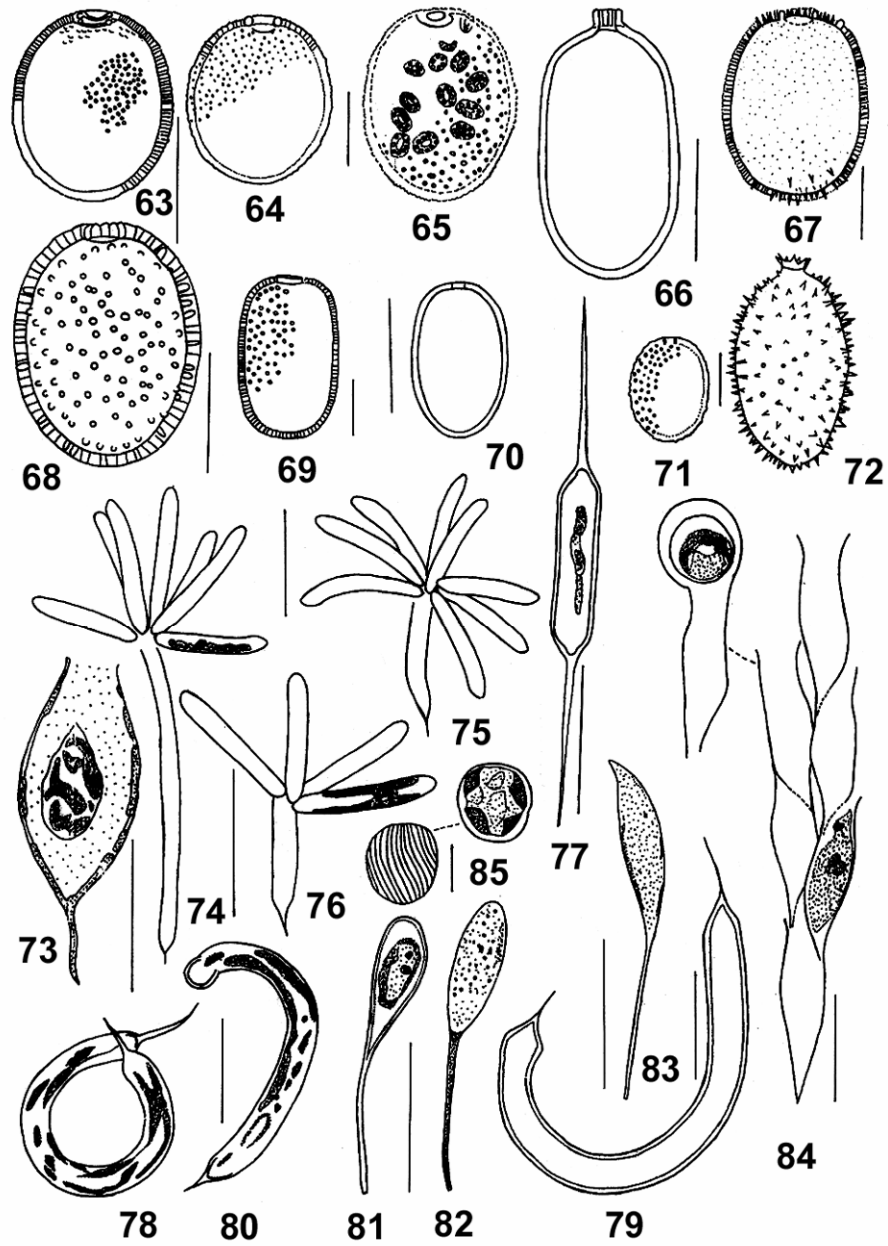


Plate 5 (Figs. 63-85)

63-65. *Trachelomonas hispida* var. *punctata*, 66. *T. dubia*, 67. *T. armata* variety, 68. *T. australica* ? var. *granulata*, 69. *T. lacustris*, 70. *T. abrupta*, 71. *T. hispida*, 72. *T. sydneyensis*, 73. ? *Stipitococcus* sp., 74-76. *Ophiocytium arbusculum*, 77. *Cetriractus belanophorus*, 78 & 79. *Ophiocytium capitatum*, 80. *O. cochleare*, 81 & 82. *Characiopsis* sp., 83. *C. longipes*, 84. *Dinobryon sertularia*, 85. *Lepocinclis* sp. - 2. (Scales: Figs. 63-72 & 85 = 10  $\mu$ m, Figs. 73-84 = 20  $\mu$ m).

79. \***Ophiocytium cochleare** (Eichw.) A.Br. (Pl. 5, Fig. 80)  
 (Prescott 1951, 363, Pl. 94, Figs. 10 & 11)  
 L. (without spine) 94  $\mu\text{m}$ , d. 5.4  $\mu\text{m}$ ; spine at one end, L. 5.4  $\mu\text{m}$ . Lake; rainy 97; common.

**Order: Mischoococcales; Family: Pleurochloridaceae**

80. **Pseudostaurastrum abbreviatum** Islam & Irfanullah  
 (Islam and Irfanullah 2001, 6, Figs. 8–11)  
 Lake; winter 97; rare.

**Class: Chrysophyceae; Order: Chrysomonadales;  
 Family: Ochromonadaceae**

81. **Dinobryon sertularia** Ehr. (Pl. 5, Fig. 84)  
 (Prescott 1951, 378, Pl. 98, Fig. 10)  
 Lorica L. 32.4–36.4  $\mu\text{m}$ , d. 9.4  $\mu\text{m}$ , opening d. 10.8  $\mu\text{m}$ ; zygospore d. 14.8  $\mu\text{m}$ . Lake;  
 winter 97; common.

**Order: Rhizochrysidales; Family: Stylococcaceae**

82. **Lagynion subovatum** Prescott  
 (Islam and Irfanullah 2000b, 118, Pl. 2, Figs. 18 & 19)  
 Paddy field; epiphytic on *Hyalotheca dissiliens* var. *tatrica*; autumn 97; common.
83. **Stylococcus aureus** Chodat  
 (Islam and Irfanullah 2000b, 118, Pl. 1, Fig. 7)  
 Paddy field; epiphytic on *Hyalotheca mucosa*; autumn 97; common.

**Family: Stipitococcaceae**

84. ? **Stipitococcus** sp. (Pl. 5, Fig. 73)  
 L. (without stalk) 29.7  $\mu\text{m}$  and (with stalk) 40.5  $\mu\text{m}$ , d. 14.8  $\mu\text{m}$ , ostiole d. 5.4  $\mu\text{m}$ .  
 Lake; rainy 97; rare.

**Class: Bacillariophyceae; Order: Centrales; Family: Coscinodiscaceae**

85. **Melosira granulata** (Ehr.) Ralfs : Lake; winter & spring 97; rare to few.

**Order: Pennales; Family: Diatomaceae**

86. **Diatoma** sp. : River; winter (few), rainy (rare) and autumn (common) 97.



**Family: Fragilariaceae**

87. **Synedra ulna** (Nitzsch) Ehr.: Lake; winter 96; rare to few.

**Family: Eunotiaceae**

88. **Eunotia flexuosa** Kütz : Also a few other forms; lake and river; year round 97; rare to few.

**Family: Achnanthaceae**

89. **Achnanthes** sp. : Lake; winter 96; few.  
90. **Cocconeis** sp. : Lake; winter 96; rare to few.

**Family: Naviculaceae**

91. **Frustulia rhomboides** (Ehr.) De Toni : Also a few other forms; lake and river; winter 96, spring and autumn 97; few.  
92. **Navicula pupula** Kütz : Also a few other forms; lake and river; year round 97; few to common.  
93. **Pinnularia gibba** Ehr. : Also a few other forms; lake and river; year round 97; few.  
94. **Stauroneis** sp. : Lake; year round 97; rare to few.  
95. **Gomphonema angustatum** (Kütz) Rabh. : Also a few other forms; lake and river; year round 97; few to common.  
96. **Cymbella affinis** Kütz.: Lake; year round 97; few to common.  
97. **C. tumida** (Breb.) Van Heurck: Lake; year round 97; few to many.  
98. **C. turgidula** Grun.: Lake; year round 97; few to common.  
99. **Amphora** sp. : Lake; winter 97; few.  
100. **Rhopalodia gibba** (Ehr.) O. Müll.: Lake; winter 97; rare.

**Family: Nitzschiaceae**

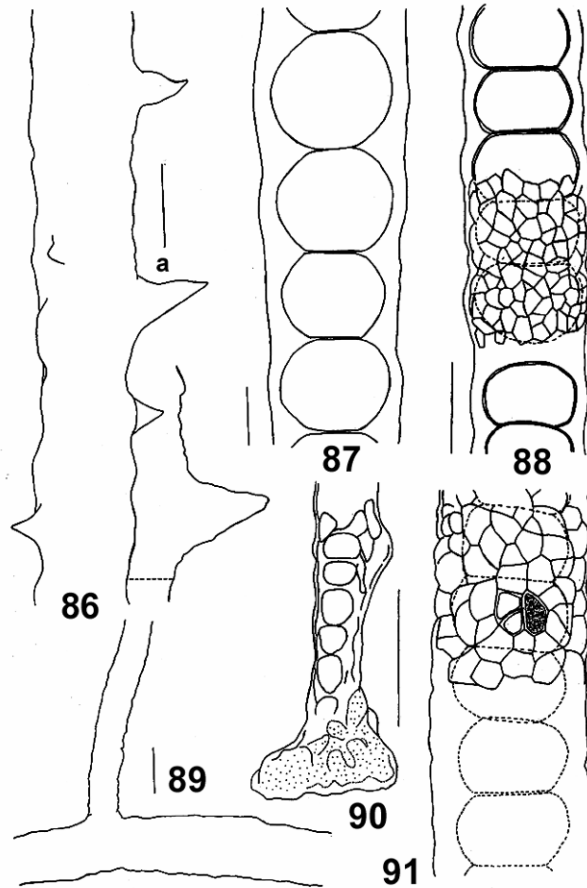
101. **Hantzschia** sp. : Lake and river; year round 97; rare to few.  
102. **Nitzschia sigmoidea** (Ehr.) W. Smith : River; spring & autumn 97; few.  
103. **Nitzschia** sp. : Lake and river; winter & rainy 97; rare to common.

**Family: Surirellaceae**

104. **Surirella robusta** Ehr.: River; year round 97; rare to few.

**Class: Dinophyceae; Order: Peridinales; Family: Peridiniaceae**

105. **Peridinium** spp. : Lake and river; winter & spring 97; rare.



**Plate 6** (Figs. 86–91)

86–88. *Compsopogon aeruginosa* (showing main axis, spine like branches and the central cells of branches),  
 89–91. *C. coeruleus* (showing main axis with a branch, a basal part and the central cells of a branch)  
 (Scales: a = 500  $\mu$ m, rest = 100  $\mu$ m)

**Order: Dinococcales; Family: Glenodiniopsidaceae**

106. **Cystodinium** sp.  
 (Islam and Irfanullah 2000b, 120, Pl. 2, Figs. 16 & 17)  
 Lake; rainy 97; rare.

**Class: Rhodophyceae; Order: Bangiales; Family: Erythrotrichiaceae**

107. **Compsopogon aeruginosa** (J. Ag.) Kütz. (Pl. 6, Figs. 86–88)  
(Islam 1992, 34, Pl. 3, Fig. 20, Pl. 4, Fig. 25, Pl. 5, Figs. 26–29)  
River; year round 97; common.
108. **Compsopogon coeruleus** (Balbis) Mont. (Pl. 6, Figs. 89–91)  
(Islam 1992, 34, Pl. 3, Figs. 17–19)  
River; autumn 97; few.

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