

NEW RECORDS OF PHYTOPLANKTON FOR BANGLADESH.

5. *EUGLENA*, *EUGLENOCAPSA*

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Abstract

This study presents 20 taxa of the genus *Euglena* and one species of the rare euglenoid genus *Euglenocapsa*. All these taxa are reported for the first time from some pond ecosystems of Mathbaria in Pirojpur and Bakerganj of Barisal districts of Bangladesh.

Introduction

The genus *Euglena* has been represented worldwide by approximately 73-155 taxa (Gojdic 1953, Huber-Pestalozzi 1955). Recently, Dillard (2000) reported 67 taxa of pigmented *Euglena* from the Southeastern United States. In Bangladesh, relatively limited work has been conducted on the genus *Euglena* compared with other groups of algae. Studies so far carried out reveal the occurrence of 30 taxa from *Euglena* in Bangladesh (Islam and Khatun 1966, Islam and Aziz 1977, Islam and Paul 1978, Islam *et al.* 1991).

In the present study, altogether 20 taxa of *Euglena* and one taxa of *Euglenocapsa* are further added to the list of euglenoid algae of Bangladesh. *Euglenocapsa* is also a new generic record for Bangladesh. These taxa were found in the plankton samples collected from different pond ecosystems of Mathbaria of Pirojpur and Bakerganj of Barisal districts between 2004 and 2006. New reports of phytoplankton for Bangladesh belonging to Cyanophyceae, Cryptophyceae, Xanthophyceae, Synurophyceae and the members of the order Volvocales and Chlorococcales from the same study areas have been published elsewhere (Khondker *et al.* 2006, 2007a, b, c, d).

Materials and Methods

Samples for the present study were obtained after filtering a definite volume of pond water through plankton net and sedimenting approximately 100 ml water by Lugol's solution. The sampling was carried out at 1-8 and 1-6 permanent stations of Bakerganj and Mathbaria, respectively, between 2004 and 2006. Details of the sampling procedure and descriptions of the sites have been presented in Khondker *et al.* (2006).

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Taxonomic enumeration

Illustrated accounts of 21 taxa of the family Euglenaceae have been elaborated in the present paper. The species are alphabetized under the genera.

Division: Euglenophyta; Class: Euglenophyceae; Order: Euglenales
Family: Euglenaceae; Genus: Euglena Ehr. 1838

1. ***Euglena acus* var. *longissima*** Defl. [Syn.: *Euglena acutissima* var. *longa* Johnson] (Huber-Pestalozzi 1955, 97; Pringsheim 1956, 49, 2F) **(Figs 1-2)**

Cells solitary, spindle-shaped, elongated. Posterior end straight, gradually narrowed to a sharp end. Periplast weakly striated. Cells 212-269 μm long, 16 μm broad. Flagellum short, 8 μm long. Paramylum 2-6 in number. Cells length to breadth ratio varies from 14-17.

Note: The size range and length to breadth ratio is highly variable in the cells of *Euglena acus*. Gojdics (1953) considered a higher range in sizes (150-311 μm long, 12-15 μm broad) for *E. acus* and included var. *longissima* as a synonym. Huber-Pestalozzi (1955), however, quoted a size range for *E. acus* – 91-180 μm long, 7-14 μm broad. Pringsheim (1956) has clearly mentioned that "it is more practical to include in *E. acus* only those of 80-150 μm long and 7-12 μm broad. Differences between forms are to a great part hereditary as clone cultures show. The length to width ratio changes considerably from strain to strain, some being slender, others being stouter. The flagellum is shorter, less than one third of its length." The present authors have followed the opinions of latter two authors and placed the taxon under var. *longissima*.

Mathbaria, Station No. 2, 22.11.2004; Station No. 6, 30.08.2004.

2. ***Euglena agilis* var. *praeexcisa*** Schiller **(Figs 3a-b)**
(Schiller 1956, 556, 4: 11a,b)

Cells almost cylindrical, one side straight another side slightly convex. Both the posterior and anterior ends rounded, ends similar or posterior end slightly swollen. Cells 16-18 μm long, 6 μm broad. Flagellum short, apical or slightly laterally inserted, 3-7 μm long.

Bakerganj, Station No. 4, 12.07.2004.

3. ***Euglena allorgei*** Defl. **(Fig. 4)**
(Huber-Pestalozzi 1955, 80, 12: 56A; Dillard 2000, 17, 4: 6)

Cells elongate, margin parallel, anterior end slightly tapered with a longitudinal groove. Posterior end gradually narrowed to a sharp end. Pellicle with longitudinally arranged striations. Chloroplasts discoid, small. Pyrenoid absent. Cells 120 μm long, 13 μm broad. Paramylum bodies long rods, 3-4 in number, 38 μm long, 8 μm broad.

Bakerganj, Station No. 5, 11.07.2005.

4. **Euglena archaeoplastidiata** Chadeffaud (Fig. 5)

(Gojdics 1953, 78, 6: 1b)

Cells pyriform, anterior end rounded. Posterior slightly tapered to a blunt end. Cells 18 µm long, 8 µm broad. Flagellum apical, 10 µm long. Closer to *E. pisciformis* Klebs.

Mathbaria, Station No. 3, 12.02.2005.

5. **Euglena fusca** (Klebs) Lemm. [Syn.: *Euglena spirogyra* var. *fusca* Klebs] (Fig. 6)

(Huber-Pestalozzi 1955, 64, 7: 41c; Pringsheim 1956, 56; Dillard 2000, 24, 4: 5)

Cells brown, elongate, cylindrical, one margin parallel, other margin at the middle slightly depressed, not spirally coiled. Anterior gradually narrowed to a flat end (approx. 12 µm broad) with a central notch, posterior also deeply and gradually narrowed to a smaller flat end (approx. 8 µm broad) from which a sharp spine (approx. 20 µm long) originated. Pellicle ornamented with prominent deep striations. Cells 191 µm long and 26 µm broad. Paramylum two in number, centrally located, 23 µm long, 10 µm broad.

Note: The species has got similarity with *E. spirogyra* Ehr. Pringsheim (1956) separated *E. fusca* and *E. spirogyra* by size, colour, flagellum and habitat characters. The present material fits well in respect of size, colour and habitat as those mentioned for *E. fusca*.

Mathbaria, Station No. 2, 30.08.2004.

6. **Euglena caudata** Hübner (Figs 7a-c)

(Huber-Pestalozzi 1955, 88, 14: 67; Pringsheim 1956, 15; Dillard 2000, 18, 5: 11)

Cells broadly spindle, posterior end sharply pointed, metabolic, can be seen in different forms. Periplast spirally striated, flagellum body length. Chloroplasts many, roundish, hour-glass-shaped. Cells 71-91 µm long, 18-20 µm broad.

Mathbaria, Station Nos 4 & 5, 30.08.2004.

7. **Euglena hemichromata** Skuja (Figs 13a-b)

(Dillard 2000, 27, 5: 6)

Cells cylindric to spindle-shaped. Anterior end narrowly curved with a groove, posterior end gradually narrowed to a tapering blunt point. Cells 76-99 µm long, 15-25 µm broad. Chloroplast discoid, numerous. Flagellum almost body length.

Mathbaria, Station No. 2, 16.03.2004; Station No. 3, 13.09.2004.

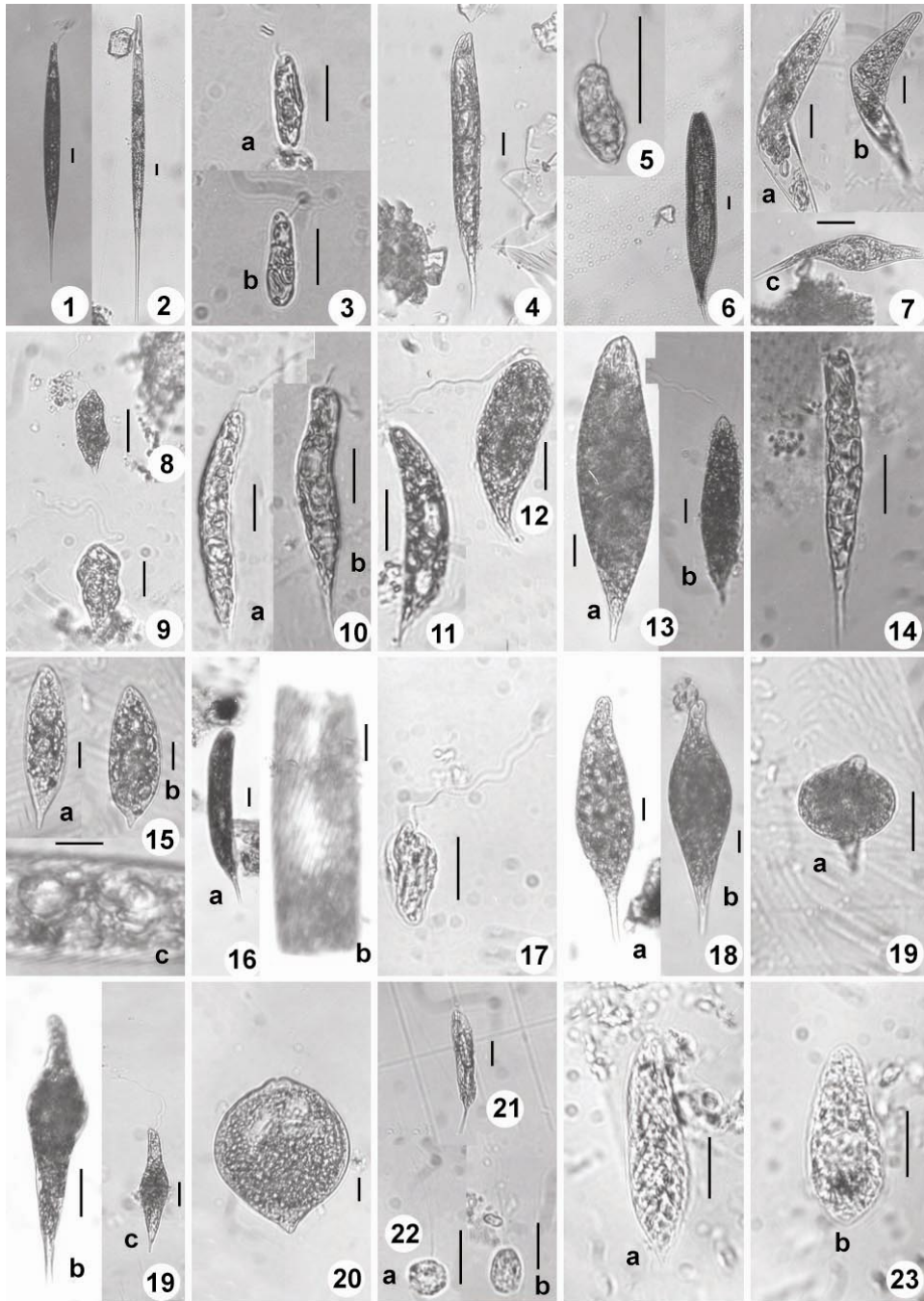
8. **Euglena gojdicsae** Prescott (Figs 8, 9)

(Gojdics 1953, 97, 10: 7a)

Cells fusiform to subcylindric, anterior end truncated, posterior end attenuated to a short, blunt point. Pellicle smooth, weakly metabolic. Chloroplasts irregular discs, numerous, tightly packed. Cells 22-38 µm long, 10-13 µm broad. Flagellum 56 µm long.

Bakerganj, Station Nos 4 & 7, 12.07.2004.

9. ***Euglena limnophila*** Lemm. (Figs 10a-b)
(Huber-Pestalozzi 1955, 82, 13: 59; Pringsheim 1956, 50, 3)
Cells cylindrical to elliptical, elongated, spindle-shaped with straight or slightly bent end spine. Anterior end slightly flat to rounded. Periplast thin, may be gently striated. Cells 46-49 μm long, 8 μm broad. Flagellum one, half to two third of body length.
Bakerganj, Station Nos 1 & 4, 27.01.2005.
10. ***Euglena limnophila*** var. **minor** Drez. (Fig. 11)
(Huber-Pestalozzi 1955, 83, 13: 59B)
Cells spindle-shaped, curved. Anterior narrowed to a rounded end, posterior suddenly narrowed to a sharp point. Cells 38 μm long, 8 μm broad. Paramylum two in number, short rods, 6 μm long, 4 μm broad.
Bakerganj, Station No. 1, 04.10.2004.
11. ***Euglena mainxii*** Defl. [Syn.: *E. reticulata* Mainx nec *E. reticulata* Sjöstedt] (Fig. 12)
(Huber-Pestalozzi 1955, 40, 1: 13)
Cells lanceolate with rounded anterior and a gradually narrowed and pointed posterior. Periplast thin, smooth. Cells 40 μm long, 15 μm broad. Flagellum 38 μm long.
Bakerganj, Station No. 1, 04.10.2004.
12. ***Euglena mutabilis*** var. **lefevrei** Chadeff. (Fig. 14)
(Huber-Pestalozzi 1955, 78, 11: 53A)
Cells elongated cylinder, anterior tapered to a little, posterior end gradually narrowed to a long and sharp point. Cells 51 μm long, 6 μm broad. Chloroplast many, parietal plates, adjacent to the cell wall.
Mathbaria, Station No. 1, 19.07.2004.
13. ***Euglena oblonga*** Schmitz (Figs 15a-c)
(Huber-Pestalozzi 1955, 44, 2: 18)
Cells ovoid, elongated oval or elliptical spindle, anterior weakly narrowed to a rounded end, posterior suddenly narrowed to a blunt end. Cells 64-71 μm long, 20-25 μm broad. Periplast relatively thick, striated spirally.
Bakerganj, Station No. 4, 12.07.2004.
14. ***Euglena oxyuris*** var. **minor** Defl. (Figs 16a-b)
(Gojdics 1953, 182, 36: 9; Huber-Pestalozzi 1955, 65)
Cells elongated cylinder, anterior end rounded or truncate, posterior end gradually tapering to a short caudus. Cells 155 μm long, 25 μm broad. Pellicular striations spirally arranged, distinct. Chloroplast many, ovoid. Paramylum 1-2 in number, short rods.
Bakerganj, Station No. 2, 12.07.2004.



Figs. 1-23. 1-2. *Euglena acus* var. *longissima*, 3a-b. *E. agilis* var. *praeexcisa*, 4. *E. allorgei*, 5. *E. archaeoplastidiata*, 6. *E. fusca*, 7a-c. *E. caudata*, 8-9. *E. gojdicsae*, 10a-b. *E. limnophila*, 11. *E. limnophila* var. *minor*, 12. *E. mainxii*, 13a-b. *E. hemichromata*, 14. *E. mutabilis* var. *lefevrei*, 15a-c. *E. oblonga* (c, striation), 16a-b. *E. oxyuris* var. *minor* (b, striation), 17. *E. retronata*, 18a-b. *E. rostrifera*, 19a-c. *E. spathirhyncha*, 20. *E. splendens*, 21. *E. tripteris*, 22a-b. *Euglenocapsa ochracea*, 23a-b. *Euglena viridis*. (Bars =10 μ m)

15. ***Euglena retronata*** L.P. Johnson (Fig. 17)
(Huber-Pestalozzi 1955, 95, 15: 74A)
Cells more or less ovoid, metabolic, can be seen in different forms. Anterior truncated, posterior gradually narrowed to a rounded end. Cells 17 μm long, 9 μm broad. Chloroplasts parietal plates. Flagellum about 30 μm long.
Mathbaria, Station No. 6, 22.06.2004.
16. ***Euglena rostrifera*** L.P. Johnson (Figs 18a-b)
(Dillard 2000, 32, 5: 10)
Cells elongated spindle- or top-shaped, anterior narrowed to a blunt end, posterior gradually tapered to a sharp long point, mid-region bulged out. Cells 102-109 μm long, 25-28 μm broad. Paramylum discoid. Cells tightly packed with chloroplasts.
Mathbaria, Station No. 2, 31.07.2004; Station No. 5, 28.02.2005.
17. ***Euglena spathiryncha*** Skuja [Syn.: *E. phacoides* Nygaard] (Figs 19a-c)
(Huber-Pestalozzi 1955, 100, 17: 79)
Cells elongated spindle, strongly metabolic, anterior long neck-like, posterior gradually narrowed to a sharply pointed end, mid-region bulged out. In a metabolic stage mid-region is nicely top-shaped. Cells (51) 53-119 μm long, 13-28 (46) μm broad. Flagellum about 38 μm long.
Bakerganj, Station Nos 2 & 4, 12.07.2004.
18. ***Euglena splendens*** Dangeard (Fig. 20)
(Pringsheim 1956, 95, 23D)
Cells ovoid with conical posterior end, rarer extended state look cylindro-fusiform, when irritated becomes almost spherical, but the posterior tip does not disappear completely. Cells 69 μm long, 64 μm broad. Paramylum granular.
Mathbaria, Station No. 6, 13.09.2004.
19. ***Euglena tripteris*** (Duj.) Klebs [Syn.: *Phacus tripteris* Duj.] (Fig. 21)
(Huber-Pestalozzi 1955, 62, 7: 39; Pringsheim 1956, 58, 6C)
Cells elongated, twisted, with or without three wings or 2-3 spiral ridges. Posterior end contains a slightly angled, colourless, long (10 μm), cylindrical tail, weakly metabolic. Cells 56 μm long, 10 μm broad. Paramylum 2 in number, thick, rod like, 15 μm long, 4 μm broad.
Mathbaria, Station No. 6, 30.08.2004.
20. ***Euglena viridis*** Ehrb. (Figs 23a-b)
(Huber-Pestalozzi 1955, 45, 2: 19; Pringsheim 1956, 102, 26)

Cells elongated oval to spindle-shaped. Anterior end lightly bent, posterior gradually narrowed to a short and sharp point. Cells 30-40 μm long, 10-14 μm broad. Periplast soft, covered with deep spiral striations. Chloroplasts many, band-shaped, arranged in stars.

Bakerganj, Station No. 1, 15.06.2004.

Genus: *Euglenocapsa* Steinecke 1931

Unflagellated cells spherical, 8-10 μm in diameter, embedded singly or in double in visible mucilaginous sheath. Flagellated cells slightly ovoid, 10 μm long, 6 μm broad. Chromatophores discoid, many, without a stigma and a pyrenoid. Flagellum single, approximately body length. Paramylum body rounded, few. Reproduction by longitudinal splitting via gullet.

21. *Euglenocapsa ochracea* Steinecke

(Figs 22a-b)

(Huber-Pestalozzi 1955, 400, 72: 868)

Cells spherical to slightly oval, faintly coloured, 7-8 μm long, 7-6 μm broad. Chloroplasts many, disc-shaped, remain adjacent to the cell wall. Vacuole system present as in *Euglena*. Flagellum 22 μm long. Pyrenoid absent. The genus is also a new record for Bangladesh.

Mathbaria, Station No. 4, 16.08.2004.

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References

- Dillard, G.E. 2000. Freshwater algae of the Southeastern United States. Part 7. Pigmented Euglenophyceae. J. Cramer, Berlin, pp. 1-135. + pls. 1-20.
- Gojdics, M. 1953. The genus *Euglena*. The University of Wisconsin Press, Madison, pp. 1-267.
- Huber-Pestalozzi, G. 1955. Das Phytoplankton des Süßwassers. Systematik und Biologie. 4. Teil: Euglenophyceen. E. Schweizerbart'sche Verlagsbuchhandlung (Nägele u. Obermiller), Stuttgart, Germany, pp. 1-606 + pls. 1-114.
- Islam, A.K.M. Nurul and Khatun, M. 1966. Preliminary studies on the phytoplanktons of polluted waters. Sci. Res. 3(2): 94-109.
- Islam, A.K.M. Nurul and Aziz, A. 1977. Studies on the phytoplankton of the Karnaphuli river estuary. J. Bangladesh Acad. Sci. 1(2): 141-154.

- Islam, A.K.M. Nurul and Paul, N. 1978. Hydrobiological study of the *haor* Hakaluki in Sylhet. J. Asiatic Soc. Bangladesh (Sci.) **4**(1): 83-91.
- Islam, A.K.M. Nurul, Khondker, M. and Haque, S. 1991. Euglenoid algae of four polluted ponds in and around Dhaka city. Bangladesh J. Bot. **20**(1): 7-15.
- Khondker, M., Bhuiyan, R.A., Yeasmin, J., Alam, M., Sack, R.B., Huq, A. and Colwell, R.R. 2006. New records of phytoplankton for Bangladesh. 1. Cyanophyceae. Bangladesh J. Bot. **35**(2): 173-179.
- Khondker, M., Bhuiyan, R.A., Yeasmin, J., Alam, M., Sack, R.B., Huq, A. and Colwell, R.R. 2007a. New records of phytoplankton for Bangladesh. 2. Cryptophyceae, Xanthophyceae and Synurophyceae. Bangladesh J. Bot. **36**(1): 53-59.
- Khondker, M., Bhuiyan, R.A., Yeasmin, J., Alam, M., Sack, R.B., Huq, A. and Colwell, R.R. 2007b. New records of phytoplankton for Bangladesh. 3. Order: Volvocales. Bangladesh J. Plant Taxon. **14**(1): 1-12.
- Khondker, M., Bhuiyan, R.A., Yeasmin, J., Alam, M., Sack, R.B., Huq, A. and Colwell, R.R. 2007c. New records of phytoplankton for Bangladesh. 4. Order: Chlorococcales. Bangladesh J. Plant Taxon. **14**(2): 83-91.
- Khondker, M., Bhuiyan, R.A. and Yeasmin, J. 2007d. *Colacium vesiculosum* Ehr.: A new record for Bangladesh. Bangladesh J. Bot. **36**(2): 195-197.
- Pringsheim, E.G. 1956. Contribution towards a monograph of the genus *Euglena*. Johann Ambrosius Barth Verlag, Leipzig, pp. 1-168.
- Schiller, J. 1956. Untersuchungen an den planktischen Protophyten des Neusiedler Sees 1950-1954. III. Teil: Euglenen. Österr. Akad. Wiss. Mathem.-naturw. Kl., Abt. I. **165**(6-8): 547-583.

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