Pak. J. Bot., 43(6): 3057-3060, 2011.

TAXONOMIC STUDY OF SOME EUGLENOID ALGAE ALONG G.T. ROAD BETWEEN SHAHDARA AND GUJRANWALA

A. ZARINA [1], SYED TARIQ-ALI [1], MASUD-UL-HASAN[3] AND MUSTAFA SHAMEEL[4]

[1]*Department of Botany, Federal Urdu University of Arts, Science & Technology, Gulshan-e-Iqbal Campus, Karachi-75300*
[2]*Department of Botany, Government College University, Katcheri Road, Lahore-54000*
[3]*Department of Botany, University of Karachi, Karachi-75270, Pakistan*

Abstract

Six taxa of algae (phylum Euglenophycota Shameel) were collected from various freshwater habitats in the Punjab Province of Pakistan during April and June 1989. They have been taxonomically investigated and were found to include two unreported taxa from Pakistan *i.e., Euglena oxyuris* var. *charkoviensis* Bourrelly and *e.* o. f. *minima* Bourrelly.

Introduction

During a large survey for the collection of euglenoid algae from certain areas of the Punjab (Pakistan), a few species of the genera *Euglena* and *Phacus* were collected and described (Tariq-Ali *et al.,* 2005, 2006). This initiated the investigation on the taxonomy of the phylum Euglenophycota from this region (Husna *et al.,* 2006; Shahida *et al.,* 2006; *Gul et al.,* 2008). In this connection the material collected during 1989 was obtained from Lahore and studied at Karachi for the search of these genera. Present paper is the outcome of this study.

Materials and Methods

The algal specimens were collected from a variety of freshwater habitats along G. T. Road between the cities of Shahdara and Gujranwala in the Punjab Province of Pakistan during April and June 1989. They were preserved in 4 % formaline in small vials and later on sent to Karachi. The methods used for their collection, preservation, microscopic examination and preparation of drawings have already been explained earlier (Tariq-Ali *et al.,* 2005). The specimens were identified up to species level with the help of authentic literature (Conrad & van Meel, 1952; Tiffany & Britton, 1952; Gojdics, 1953; Huber-Pestalozzi, 1955; Pringsheim, 1956; Prescott, 1962; Fjardingstad, 1965; Meyer & Brook 1969; Ioria, 1988; Kim *et al.,* 1998; Dillard, 2000, Wolowski, 2003; Wang & Chen, 2004; Rai & Rai 2007). The voucher specimens are deposited in the Phycology & Phycochemistry Lab. (Room No. 18), MAH Qadri Biological Research Centre, University of Karachi, where this research work was carried out.

Result and Discussion

From cytological examination and taxonomic investigation of the collected material, six taxa were obtained belonging to the family Euglenaceae (Order Euglenales, class Euglenophyceae, phylum Euglenophycota; *fide* Shameel, 2008). Following are the taxonomic enumerations of the relevant taxa.

Family Euglenaceae: Unicellular, mostly green, some members colourless and parasitic; free-floating or attached; shape variable or fixed; reserved food material paramylum or chrysolaminarin; cells flagellated having 1, 2 or 3 flagella; nucleus in posterior region of cell; large paramylum bodies quite prominent; plastids variable *i.e*., lens shaped, reticulate or stellate; pyrenoids present only in some cases; no wall but a paliable or rigid pellicle; an anterior invagination or gullet present; reproduction by longitudinal cell division; sexual reproduction absent. The present material included the following two genera which may be distinguished as follows:

1. Cells elongated, fusiform or nearly cylindrical …… *Euglena*
   Cells more or less flattened …… *Phacus*

***Euglena* Ehrenberg, 1830: 507:** Unicellular, mostly green, some members are colourless and parasitic; elongated, fusiform or nearly cylindrical; they may be free-floating or attached, shape either variable or fixed; like other algae they have chlorophyll a and b and a series of carotenoids; reserve food material is paramylum or chrysolaminarian; cells are flagellated having 1, 2 or 3 flagella, nucleus lies in posterior region of the cell; large paramylum bodies are quite prominent; plastids variable in shape, that is lens shaped, band shaped, reticulate or stellate; pyrenoids present only in some cases; cells have no wall but a paliable rigid pellicle, an anterior invagnation or gullet is present in the cell; reproduction by longitudinal cell division, sexual reproduction is doubtful. In the present collection following three species were collected which may be distinguished as follows:

1. Cells up to 80 µm long …… 2
   Cells more than 80 µm long …… *E. oxyuris (2)*
2. Chromatophores ribbon like …… *E. viridis (3)*
   Chromatophores otherwise …… *E. hemichromata (4)*

1. *E. hemichromata* Skuja, 1948

References: Gojdics, 1953: 130; Dillard, 2000: 27; Tariq-Ali *et al.,* 2006: 25; Khondker *et al.,* 2008: 41.
General characters: Cell size 75-78 µm long and 30-35 µm broad; spindle shaped with anterior end somewhat truncate and the posterior end tapering to a blunt end; chromatophores numerous at times short hands, at other time discoid, withy irregular margins, pyrenoids absent; flagellum one-third to three-fourth body length; eye spot bright large (Fig. 1).
Locality: Monnooabad (9-6-1989).
Geographical distribution: Worldwide, Erken Lake, southeast of Uppsala (Sweden).
Remarks: Collected from freshwater pond mixed with *E. viridis.*

2. *E. oxyuris* Schmarda, 1846: 17

References: Conrad & van Meel, 1952: 142; Tiffany & Britton, 1952: 318; Gojdics, 1953: 120; Huber-Pastalozzi, 1955: 65; Prescott, 1962: 393; Fjerdingstad, 1965: 526; Haughey,1968: 729; El-Naggar, 1994: 206; Tariq-Ali *et al.,* 2006: 26; Rai & Rai, 2007: 61.
General characters: Cell size 125-128 µm long and 34-36 µm broad; shape roughly like a cylinder, rounded on the anterior end and tapering gently at the posterior end; chromatophores very numerous, spherical with diameter 2-3 µm; flagellum short and active, up to one third body length (Fig. 2).
Locality: Monnooabad (9-6-1989).
Geographical distribution: USA, Poland, Hungary, Germany, China, Java and Australia.
Remarks: Collected from freshwater pond mixed with other euglenophycotes and the species of the genus *Arthrospira* in rice fields. Following two sub-taxa of this species were also collected which are distinguishable as given below:

1. Cells up to 28 µm broad ……..……..…… *E. oxyuris* f. *minima (4)*
   Cells more than 28 µm broad ……..…… *E. oxyuris* var. *charkoviensis (3)*

3. *E. oxyuris* var. *charkoviensis* Bourrelly

General characters: Cell size 110-115 µm long and 30-34 µm broad; elongate, somewhat flattened, with a keel like fold that produces a shallow groove ending in colourless tip, nearly cylindrical or extended straight; chromatophores numerous and occur as small discs, pyrenoids absent; flagellum one third of the body length (Fig. 3).
Locality: Monnooabad (9-6-1989).
Geographical distribution: China and Russia.
Remarks: Collected from freshwater pond mixed with other euglenophycotes forming algal bloom in the rice fields.

4. *E. oxyuris* f. *minima* P. Bourrelly

General characters: Cell size 112-114 µm long and 27-28 µm broad; shape is cylindrical tapering posteriorly to from a short tail piece; chromatophores numerous and disc like (Fig. 4).
Locality: Monnooabad (9-6-1989).
Geographical distribution: Worldwide.
Remarks: Collected from pond at rice field mixed with other euglenophycotes.

5. *E. viridis* (O.F. Müller) Ehrenberg, 1832

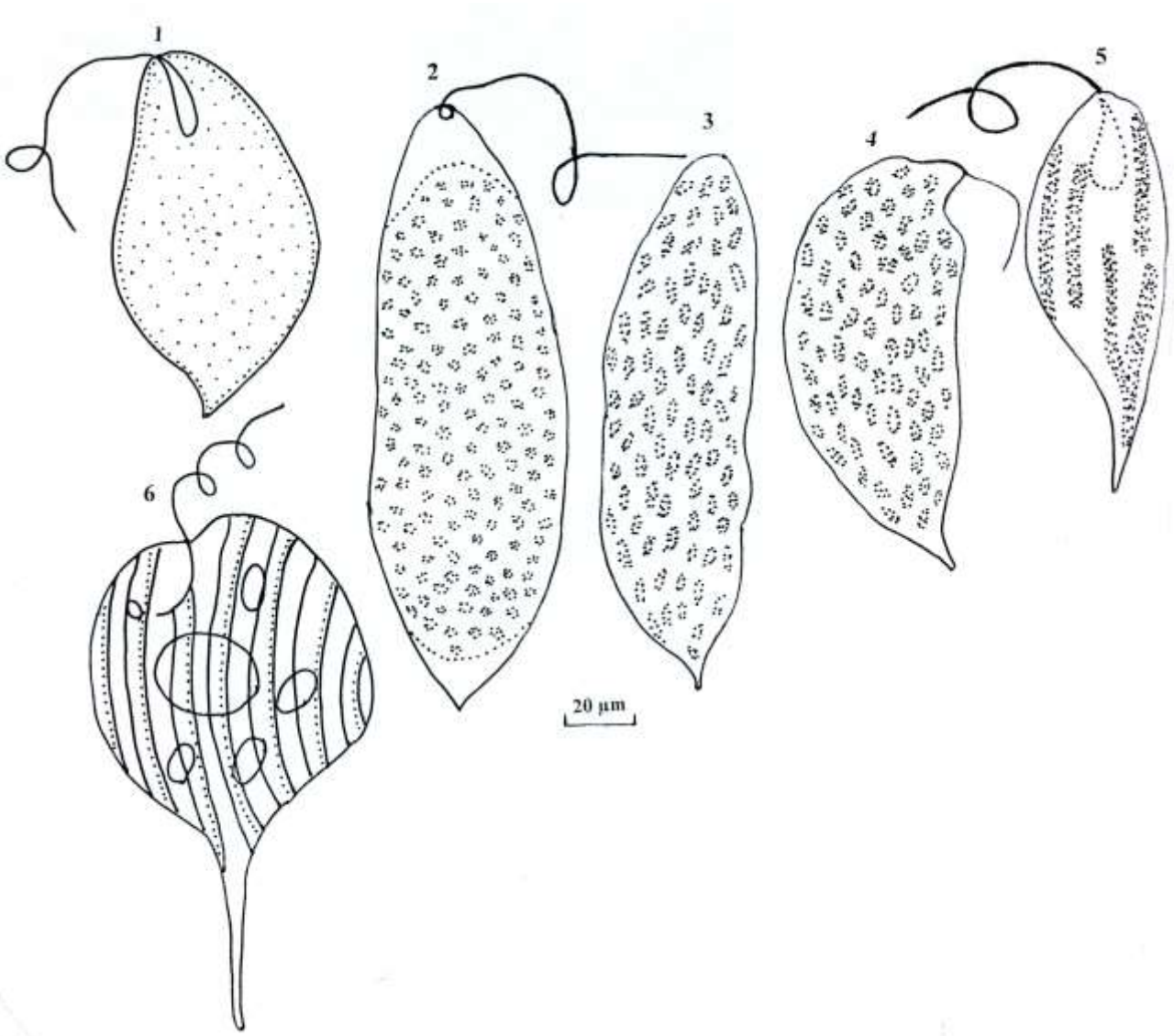
Basionym: *Cercaria viridis* O.F. Müller 1786.
Synonym: *Euglena viridis* f. *salina* Popowa 1947.
References: Conrad & van Meel, 1952: 132; Tiffany & Britton, 1951: 321; Gojdics, 1953: 70; Huber-Pastalozzi, 1955: 45; Pringsheim, 1956: 102; Fjerdingstad, 1965: 530; Meyer & Brook, 1969: 374; Kim *et al.,* 1998: 175; Wang & Chen, 2004: 11; Tariq-Ali *et al.,* 2006: 30; Khondker *et al.,* 2008: 44; Senthilkumar & Sivakumar, 2008: 751; Wolowski, 2003: 336.
General characters: Cell size 78-80 µm long and 22-23 µm broad; spindle shaped to cylindrical with anterior end rounded and the posterior end tapering gently to a point; chromatophores appear like long ribbons, pyrenoids possibly present; flagellum longer than the body, very active and easily discarded (Fig. 5).
Locality: Kohin (27-4-1989).
Geographical distribution: Worldwide.
Remarks: Collected from pond mixed with members of the order Desmidiales.

***Phacus* Dujardin 1841:** Cells are more or less flattened, rigid and somewhat compressed. Frequently they are rigid, cup-shaped or twisted, periplast striations are always present and generally quite distinct. Unlike other flagellates, they are preserved with beautiful deltoid in died condition. They have a posterior spine or tail which is curved and pointed, or may be straight and long. The plastids are in the form of small discs, without pyrenoids. In the present collection only following species was collected.

6. *P. longicauda* (Ehrenberg) Dujardin, 1841: 337

Heterotypic synonymy: *Euglena longicauda* Ehrenberg.
References: Fritsch, 1948: 726; Tiffany & Britton, 1952: 323; Palmer, 1959: 73; Prescott & Vinyard, 1965: 469; Meyer & Brook, 1969: 379; Fott, 1971: 428; Ioriya, 1988: 35; Tariq-Ali *et al.,* 2005: 174; Shahida *et al.,* 2006: 11; Rai & Rai, 2007: 62; Gul *et al.,* 2008: 58; Senthilkumar & Sivakumar, 2008: 751; Begum, 2009: 11.
General characters: Cell size 90-95 µm long and 54-56 µm broad; shape oval, with straight posterior tail piece about as long as the body proper; periplast longitudinally striate; one large discoid paramylum body; flagellum length less than the body. Straight long tail piece is the best character for distinguishing the species (Fig. 6).

Geographical distribution: USA: Michigan, Wisconsin, Cincinnati, Ohio, Minnesota, Pakistan.
Remarks: Collected from stagnant water pond mixed with numerous desmids.
Locality: Kohni (27-4-1989).



Figs. 1-6. Euglenoid algae from Punjab: **1.** *Euglena hemichromata*, **2.** *E. oxyuris*, **3.** *E. oxyuris* var. *charkoviensis*, **4.** *E. oxyuris* f. *minima*, **5.** *E. viridis*, **6.** *Phacus longicauda*.

References

Begum, Z.N.T. 2009. A taxonomic account on the phytoplankton of a pond receiving textile industrial effluents: II. Euglenophyceae and Bacillariophyceae. *Bangl. J. Plant Taxon.*, 16: 9-19.

Conrad, W. and L. van Meel. 1952. Matériaux pour une Monographie de *Trachelomonas* Ehrbg., *Strombomonas* Deflandre *et Euglena* Ehrbg., generes d' Euglenacées. *Mem. Inst. Sci. Nat. Belg.*, 124: 1-176.

Dillard, G.E. 2000. Freshwater algae of the Southeastern United States: Part VII. Pigmented Euglenophyceae. *J. Cramer, Berlin*, p. 1-135 + pls. 1-20.

El-Naggar, M.E.E. 1994. Studies on the freshwater algae of Makkah area, Saudi Arabia. *Pak. J. Bot.*, 26: 203-213.

Fjerdingstad, E. 1965. Taxonomy and saprobic valency of benthic phytomicro-organisms. *Int. Rev. ges. Hydrobiol.*, 50: 475-604.

Fott, B. 1971. *Algenkunde*. Gustav Fischer, Stuttgart, 581 pp.

Fritsch, F.E. 1948. *The Structure and Reproduction of the Algae.* Vol. 1 Camb. Univ. Press, 791pp.

Gojdics, M. 1953. *The Genus Euglena*. Univ. Wisconsin Press, Madison, 268 pp.

Gul, R., A. Zarina, Masud-ul-Hasan and M. Shameel. 2008. Taxonomic study of some microalgae from Sialkot, Pakistan. *Int. J. Phycol. Phycochem.*, 4: 57-64.

Haughey, A. 1968. The planktonic algae of Auckland sewage treatment ponds. *N. Z. J. Mar. Freshw. Res.*, 2: 721-766.

Huber-Pastalozzi, G. 1955. Das Phytoplankton des Süβwassers: IV. Euglenophyceae. In: (Ed.): Thienemann. *Die Binnengewässer*. 16: 1-606.

Husna, R., A. Zarina, Masud-ul-Hasan and M. Shameel. 2006. Taxonomic Study of some microalgae from Lahore, Pakistan. *Int. J. Phycol. Phycochem.*, 2: 157-164.

Ioriya, T. 1988. Some euglenoid flagellates from Kathmandu. In: *Cryptogams of the Himalayas.* (Eds.): M. Watanabe & S.B. Malla. Vol. 1 *Nat. Sci. Mus.*, Tsukuba, Japan 31-37 pp.

Khondker, M., R.A. Bhuiyan, J. Yeasmin, M. Alam, R.B. Sack, A. Huq and R.R. Colwell. 2008. New records of phytoplankton for Bangladesh: 5. *Euglena, Euglenocapsa*. *Bangl. J. Plant Taxon.*, 15: 39-46.

Kim, J.T., S.M. Boo and B. Zakrys. 1998. Floristic and taxonomic account of the genus *Euglena* (Euglenophyceae) from Korean freshwaters. *Algae*, 13: 173-197.

Meyer, R.L. and A.J. Brook. 1969. Freshwater algae from the Ilasca State Park, Minnesota. *Nov. Hedw.*, 18: 367-382.

Palmer, C.M. 1959. *Algae in Water Supplies*. Public Health Ser Publ No 657, Cincinnati, Ohio, 88 pp.

Prescott, G.W. 1962. *Algae of the Western Great Lakes Area.* 2nd ed. Wm. C. Brown Co, Dubuque, Iowa 977 pp.

Prescott, G.W. and W.C. Vinyard. 1965. Ecology of Alaskan freshwater algae: V. Limnology and flora of Malikpuk Lake. *Trans. Amer. Microscop. Soc.,* 84: 427-478.

Pringsheim, E.G. 1956. Contribution towards a monograph of the genus *Euglena*. *Nova Act. Leopold.,* New. Ser. 125, 18: 1-168.

Rai, S.K. and R.K. Rai. 2007. Some euglenophycean algae from Biratnagar, Nepal. *Our Nat.,* 5: 60-66.

Senthilkumar, R. and K. Sivakumar. 2008. Studies on phytoplankton diversity in response to abiotic factors in Veeranam Lake in the Cuddalore district of Tamil Nadu. *J. Environ. Biol.,* 29: 747-752.

Shahida, B., A. Zarina, Masud-ul-Hasan and M. Shameel. 2006. Taxonomic study of some green and red microalgae from Rabwah and Sargodha, Pakistan. *Int. J. Phycol. Phycochem.,* 2: 7-14.

Shameel, M. 2008. Change of divisional nomenclature in Shameelian Classification of algae. *Int. J. Phycol. Phycochem.,* 4: 224-232.

Tariq-Ali, S., A. Zarina, Masud-ul-Hasan and M. Shameel. 2006. Diversity of the genus *Euglena* Ehrenberg from certain areas of the Punjab, Pakistan. *Int. J. Phycol. Phycochem.,* 2: 17-32.

Tariq-Ali, S., Masud-ul-Hasan and M. Shameel. 2005. Taxonomic study of the genus *Phacus* Dujardin (Euglenophyta) from Lahore and Sialkot districts of Pakistan. *Int. J. Phycol. Phycochem.,* 1: 173-176.

Tiffany, L.H. and M.E. Britton. 1952. *The Algae of Illinois.* Univ. Chicago Press, Chicago, 407 pp.

Wang. C.L. and P.C. Chen. 2004. Taxonomic studies of the genus *Euglena* (Euglenophyceae, Euglenophyta) in Taiwan (Formosa) freshwaters I: Subgenus *Euglena* Zakrys´ (1986). *Algol. Stud.,* 114: 11-21.

Wolowski, K. 2003. Euglenophytes reported from karst sink-holes in the Malopolska Upland (Poland, central Europe). *Ann. Limnol. – Int. J. Lim.,* 39: 333-346.

(Received for publication 5 January 2011)