



Twenty New Records for Turkish Freshwater Algal Flora from Çaygören and İkizcetepeler Reservoirs (Balıkesir, Turkey)

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Abstract

Twenty new records for freshwater algal flora of Turkey were determined in a study conducted from February 2007 to January 2009 in İkizcetepeler and Çaygören Reservoirs, Balıkesir, Turkey. Among these new records, 4 were Bacillariophyta, 7 were Chlorophyta, 3 were Streptophyta, 1 was Cryptophyta, 3 were Dinophyta, 1 was Euglenophyta and 1 was Heterokontophyta.

Keywords: İkizcetepeler Reservoir, Çaygören Reservoir, new record, algae, Turkey.

Çaygören ve İkizcetepeler Barajlarından (Balıkesir, Türkiye) Türkiye Tatlısu Alg Florası İçin Yirmi Yeni Kayıt

Özet

Şubat 2007 ile Ocak 2009 tarihleri arasında İkizcetepeler ve Çaygören Barajlarında yapılan bu çalışmada Türkiye Alg Florası için yirmi yeni kayıt belirlenmiştir. Teşhis edilen alglerden 4 tanesi Bacillariophyta, 7 tanesi Chlorophyta, 3 tanesi Streptophyta, 1 tanesi Cryptophyta, 3 tanesi Dinophyta, 1 tanesi Euglenophyta ve 1 tanesi Heterokontophyta bölümüne aittir.

Anahtar Kelimeler: İkizcetepeler Barajı, Çaygören Barajı, yeni kayıt, algler, Türkiye.

Introduction

Turkey has a great potential of algal diversity in inland waters, but the total list of the algal flora of Turkey has not yet been completed. A few check-lists were published including the results of the studies of freshwater algal flora of Turkey at different times (Gönüloğlu *et al.*, 1996; Aysel, 2005; Şahin, 2005). Moreover new records are given for the freshwater algal flora of Turkey in various dates (Aysel *et al.*, 1993; Öztürk *et al.*, 1995a, 1995b; Şahin, 2000, 2002, 2007, 2009; Apaydın-Yağcı and Turna, 2002; Atıcı, 2002; Baykal *et al.*, 2009; Ogun-Sevindik *et al.*, 2010). These studies contribute largely to the determination of the freshwater algal flora of Turkey. At the same time in these publications, reliable descriptive information was given about the new records.

For that reason, in a study on Çaygören and İkizcetepeler Reservoirs, 24 new records of algal species had been published (Ogun-Sevindik *et al.*, 2010). In this study, it is intended to introduce another

20 new records of algal species for Turkish algal flora from the same reservoirs.

Materials and Methods

Study Area

İkizcetepeler Reservoir (İR) is located between the longitudes of 27°94'16" E and latitudes of 39°47'48" N in province of Balıkesir, Turkey (Figure 1). It is 175 m above the sea level. It is mainly fed by Kille Stream and is also fed by Akçaköy Stream, Taşköy Stream, Kocaçay Stream, Bağrsak Stream and Kozludere Stream. It was constructed in 1992 for the purposes of irrigation, flood prevention and domestic utilization. The total length of the İR is approximately 6.34 km. Reservoir has a surface area of 9.60 km² with a maximum depth of 47 m, an annual mean water capacity 112.20 hm³ and a total volume 164.56 hm³ (DSİ, 1987).

Çaygören Reservoir (ÇR) is located between the longitudes of 28°19'16" E and latitudes of 39°17'24"

N in province of Balıkesir, Turkey (Figure 2). It is 273.5 m above the sea level. It is mainly fed by Simav Stream and is also fed by Demyan Stream. It was constructed in 1971 for the purposes of irrigation, energy production and flood prevention. The total length of the ÇR is approximately 4.6 km. Reservoir has a surface area of 8.15 km² with a maximum depth of 53.5 m, an annual mean water capacity 392 hm³ and a total volume 142.57 hm³ (DSİ, 1987).

Sampling and Identification

Three stations were chosen in different areas of each reservoir. The samples were taken from these stations each month between February 2007 and January 2009 vertically with 10 m intervals using plankton net with a pore diameter of 55 µm. In the field, phytoplankton samples were placed in dark

bottles and fixed with the mixture of lugol and formaldehyde solution. In the laboratory, 0.05 ml of water was poured into objective slides for microscopic analysis. Identification of samples was performed on a compound microscope, equipped with water immersion lenses and a phase contrast attachment. Identification of algae were made according to John *et al.* (2003), Jensen, (1985), Kramer and Lange-Bertalot (1991, 1999), Philipose (1967), Huber-Pestalozzi (1941, 1955, 1961, 1976, 1982, 1983), Coesel and Meesters (2007). Taxa were photographed with a camera attached to an Olympus BX 51 microscope.

Identified taxa were checked with the checklist of Gönülol *et al.* (1996), Aysel (2005) and Şahin (2002, 2005) determined as new taxa for Turkish algal flora. Taxonomy of algae was controlled with Guiry and Guiry (2009) and <http://bioces.tubitak.gov.tr>

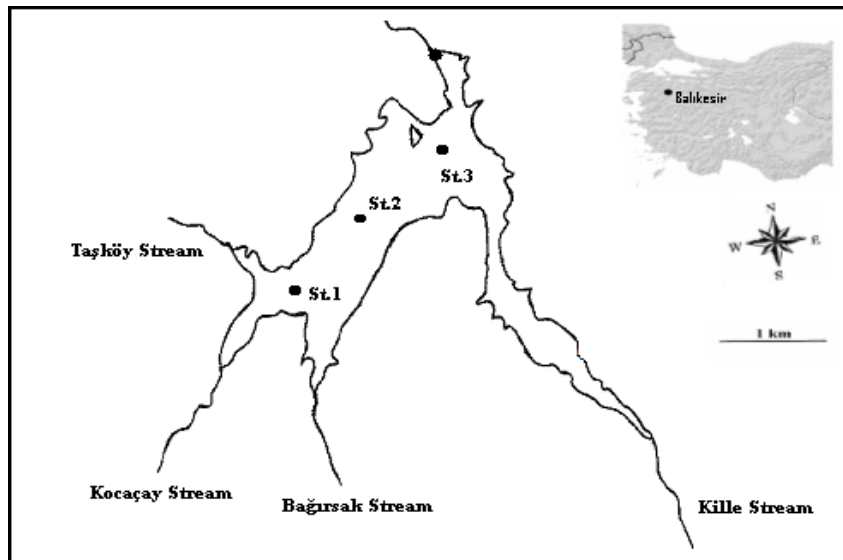


Figure 1. Map of the İkizcetepeler Reservoir showing the position of sampling stations.

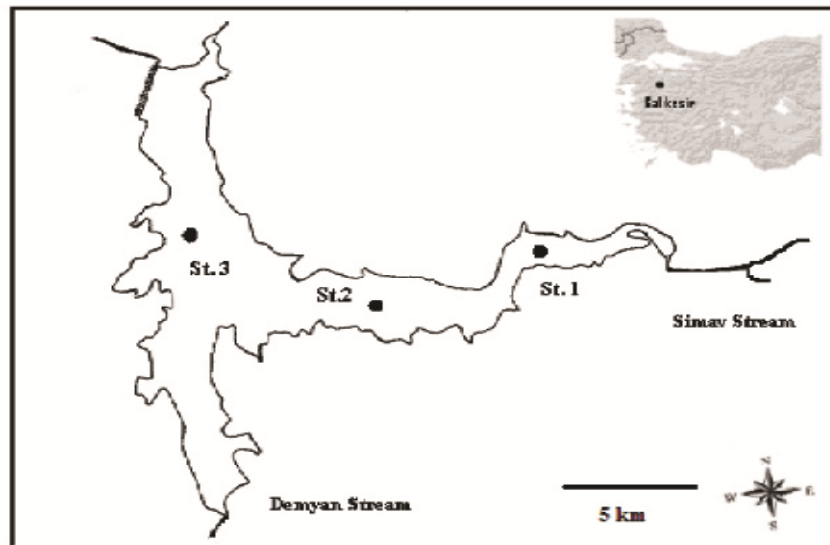


Figure 2. Map of the Çaygören Reservoir showing the position of sampling stations.

websites.

Conductivity, total dissolved solid, pH and water temperature were measured monthly using a YSI 6600 multi probe. Water transparency was determined monthly using a Secchi disk during the sampling. Other chemical analyzes were done according to standard methods at Balıkesir University Basic Sciences Research Center (APHA, 1995).

Results

Physicochemical variables of IR and ÇR waters are given in Table 1.

A total number of new records for freshwater algal flora of Turkey are 20: Bacillariophyta 4, Chlorophyta 7, Streptophyta 3, Cryptophyta 1, Dinophyta 3, Euglenophyta 1 and Heterokontophyta 1 taxa are listed below.

Divisio: Bacillariophyta

Classis: Mediophyceae

Ordo: Thalassiosirales

Familia: Stephanodiscaceae

Genus: *Stephanodiscus* Ehrenberg 1846

S. neoastraea Håkansson and Hickel 1986, (Krammer and Lange-Bertalot, 1991)

Cells circular, 30 µm in diameter with convex centre. Radial areolate striae in biseriate fascicles at the margin becoming uniseriate after a short distance. Only some of the uniseriate areolate striae reach the valve face center; central areolae pattern mostly disorganized. One to several labiate processes is present on the valve mantle. Found at St1, St2, St3 of ÇR and St1, St2, St3 of IR.

Classis : Bacillariophyceae

Ordo : Naviculales

Familia : Pleurosigmataceae

Genus : *Gyrosigma* Hassall, 1845

G. wansbeckii (Donkin) Cleve 1894, (Figure 3b)

Basionym: *Pleurosigma wansbeckii* Donkin

Synonyms: *Pleurosigma wansbeckii* Donkin 1858; *Pleurosigma balticum* var. *wansbeckii* (Donkin)

Van Heurck 1896, (Jensen, 1985).

Valve linear, of constant width in the middle part, gradually narrowed near the diagonally and bluntly rounded apices, 70 µm long, 15 µm wide. Raphe bent into an S-shape. Transverse striae perpendicular to the middle line. Found at St2 and St3 of IR.

Familia : Naviculaceae

Genus : *Navicula* Bory de Saint-Vincent, 1822

N. constans Hustedt var. *symmetrica*

Hustedt 1957, (Figure 3c), (Krammer and Lange-Bertalot, 1999).

Cells, curvilinear and beak-shaped apices, 44 µm long, 14 µm wide. Raphe is thread-like with bending off polar terminal fissure. Axial area linear; central area massive; transapikal axis broaden. Striae irregularly confined. Found only at St2 of IR.

Ordo : Cymbellales

Famiy : Gomphonemataceae

Genus : *Gomphonema* Ehrenberg, 1832

G. exiguum Kützing var. *minutissimum* Grunow in Van Heurck 1880, (Figure 3d)

Synonyms: *Gomphonema obscurum* Krasske 1939; *G. pseudoexiguum* Simonsen 1959; *G. valenticum* Nikolajev 1970; *G. domnicia* Guslyakov 1980, (Kramer and Lange-Bertalot, 1999)

Frustule in girdle view narrow, wedge shaped, 20 µm long, 5 µm wide. Raphe thread-like, axial area highly narrow-linear. Striae subparallel in the middle, slightly radial with little punctas at poles. Found at St1 and St2 of ÇR.

Divisio : Chlorophyta

Classis : Chlorophyceae

Ordo : Sphaeropleales

Familia : Scenedesmaceae

Genus : *Scenedesmus* Meyen, 1829

S. plancticus (Korshikov) Fott 1973, (Figure 3e)

Synonym: *Didymocystis planctonica* Korshikov, (John et al., 2003)

Coenobia of 2 cells connected by a straight wall,

Table 1. Physicochemical variables of IR and ÇR waters

| Analyses | Ikizcetepeler Reservoir | | Çaygören reservoir | |
|--|-------------------------|-------|--------------------|-------|
| | Min. | Max. | Min. | Max. |
| pH | 4.10 | 11.80 | 7.38 | 11.67 |
| Total Dissolved Substance (g L ⁻¹) | 0.231 | 0.291 | 0.250 | 0.446 |
| Temperature (°C) | 4.4 | 26.8 | 4.5 | 27.7 |
| Conductivity (mS/cm) | 0.244 | 0.405 | 0.282 | 0.684 |
| Secchi Disc (cm) | 70.0 | 140.0 | 20.0 | 200.0 |
| Total suspended solid (mg L ⁻¹) | 4.8 | 14.8 | 4.0 | 31.8 |
| Orthophosphate (mg L ⁻¹) | 0.060 | 0.644 | 0.050 | 0.892 |
| Sulphate (mg L ⁻¹) | 18.28 | 38.39 | 50.45 | 70.22 |
| NH ₄ -N (mg L ⁻¹) | 0.018 | 0.339 | 0.024 | 0.663 |
| NO ₃ -N (mg L ⁻¹) | 0.735 | 2.600 | 0.505 | 2.900 |
| NO ₂ -N (mg L ⁻¹) | 0.013 | 0.111 | 0.007 | 0.061 |
| Total nitrogen (mg L ⁻¹) | 2.27 | 13.40 | 3.32 | 9.06 |

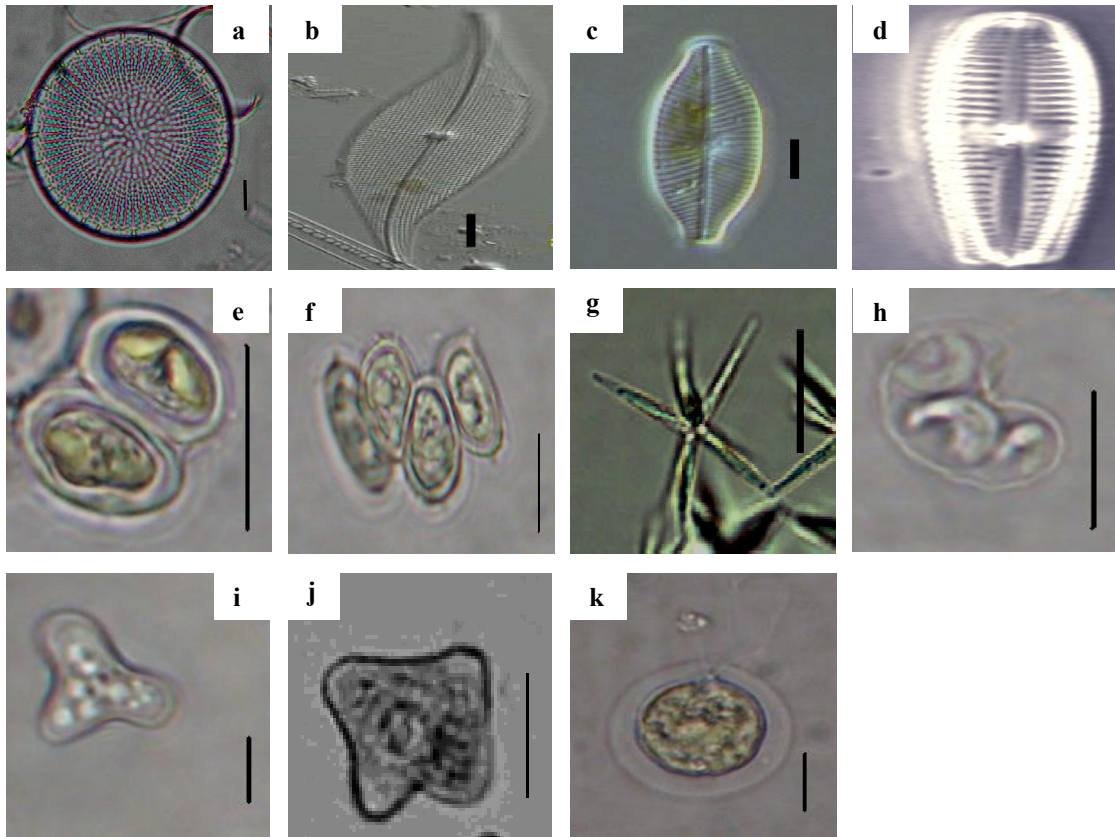


Figure 3. a. *Stephanodiscus neoastraea*, b. *Gyrosigma wansbeckii*, c. *Navicula constans* var. *symmetrica*, d. *Gomphonema exiguum* var. *minutissimum*, e. *Scenedesmus planctonicus*, f. *Scenedesmus smithii*, g. *Actinastrum hantzschii* var. *Subtile*, h. *Kirchneriella contorta* var. *elegans*, i. *Tetraedron trilobatum*, j. *Tetraedron tumidulum*, k. *Sphaerellopsis gloeosphaera* (Scale 10 μ m).

cells 5 μ m wide, 10 μ m long, broadly ovoid, with inner wall straight and outer wall convex, apices broadly rounded. Found at St2 and St3 of IR.

S. smithii Teiling, (Figure 3f), (Huber-Pestalozzi, 1983)

Colony 4-celled with the cells arranged in a subalternating series. Cells more or less naviculoid with the sides of cells, where they are in contact with one another, flat. Poles of cells with 2 sharp spines which are often obliquely placed. Cells 6 μ m wide, 15 μ m long. Found only at St3 of IR.

Genus : *Actinastrum* Lagerheim, 1882

A. hantzschii Lagerheim var. *subtile* J. Woloszynska, (Figure 3g), (John et al., 2003)

Coenobia 8 celled, cells 2.4 μ m wide, 20 μ m long, spindle-shaped, dull acute-rounded. Chloroplast with a single pyrenoid. Found at St1, St2, St3 of ÇR and St1, St2, St3 of IR.

Familia : Ankistrodesmaceae

Genus : *Kirchneriella* Schmidle, 1893

K. contorta (Schmidle) Bohlin var. *elegans* (Playfair) Komárek, (Figure 3h), (John et al., 2003)

Coenobia 3 celled, enclosed within a

homogeneous and often indistinct mucilaginous envelope. Cells 2 μ m wide, 6 μ m long, cylindrically curved with broadly rounded apices. Found at St1, St2, St3 of ÇR and St1, St2, St3 of IR.

Familia : Neochloridaceae

Genus : *Tetraedron* Kützing, 1845

T. trilobatum (Reinsch) Hansgirg 1889, (Figure 3i).

Basionym: *Polyedrium trilobulatum* Reinsch

Synonym: *Polyedrium trilobulatum* Reinsch 1888, (Philipose, 1967)

Cells triangular, sides equal in length, deeply concave. Angles of cells broadly rounded. Cell membrane thick and smooth. Cells 5 μ m wide and 10 μ m long. Found only at St2 of IR.

T. tumidulum (Reinsch) Hansgirg, (Figure 3j)

Basionym: *Polyedrium tumidulum* Reinsch

Synonym: *Tetraedriella tumidula* (Reinsch) Krienitz and Heynig, (Philipose, 1967)

Cells tetragonal with margins more or less concave and angles rounded. Cells 16 μ m in diameter. Found only at St1 of IR.

Ordo : Volvocales

Familia : Chlamydomonadaceae
 Genus : *Sphaerellopsis* Korshikov, 1925
S. gloeosphaera (Pascher and Jahoda) H. Ettl and O. Ettl 1959, (Figure 3k)
 Basionym: *Chlamydomonas gloeosphaera* A. Pascher and R. Jahoda
 Synonym: *Chlamydomonas gloeosphaera* A. Pascher and R. Jahoda 1928, (Huber-Pestalozzi, 1961)
 Cells spheroid, 30 µm in diameter. Conical papilla present. Cell wall always apart from cell body, thick. Outline of cell wall spherical. Space between the cell wall and protoplasm filled with gelatinous matrix. Flagella nearly body-length. Chloroplast big, cup-shaped. Nucleus almost centrally located. Found at St1, St 2 and St3 of ÇR.

Divisio : Streptophyta
 Classis : Zygnematophyceae
 Ordo : Zygnematales
 Familia : Desmidiaceae
 Genus : *Cosmarium* Ralfs, 1848
C. sphalerostichum Nordstedt 1876, (Figure 4a), (John et al., 2003)

Cells are very small, 13 µm wide, 15 µm long and isthmus is 7µm wide. Sinus moderately deep, narrow, linear; semicells subkidney shaped with flat base; lateral margins convex. Walls with variable surface granulation. Found at St1, St2 and St3 of IR.

C. berryense Kouwets 1998, (Figure 4b), (Coesel and Meesters 2007)

Cells slightly longer than broad to as long as broad with a linear sinus closed for the greater part. Isthmus is 11µm wide. Semicells are consisting of a hexagonal basal part and a narrower, low trapeziform apical part, the latter is taking at most one third of the total length of the semicell. Lateral sides of the basal part of the semicell distinctly incurved, semicell apex slightly crenate. Semicell surface with a faint tubercular inflation in the centre, furnished with two big granules. In addition to that, series of acute granules do occur. Cell length 20 µm, breadth 21 µm. Found at St1 and St3 of IR.

C. tenue W. Archer 1868, (Figure 4c), (Huber-Pestalozzi, 1982)

Cells very small, slightly longer than width, 12 µm long, 10 µm wide. Sinus deep and narrow; isthmus very narrow, 4µm wide. Semicells broad, transversely ellipsoidal with long, transversely ellipsoidal apex. Walls are smooth and colorless. Found at St2 and St3 of IR.

Divisio : Cryptophyta
 Classis : Cryptophyceae
 Ordo : Cryptomonadales
 Familia : Cryptomonadaceae
 Genus : *Cryptomonas* C.G.Ehrenberg, 1832
C. caudata J. Massart, (Figure 4d), (Huber-

Pestalozzi, 1976)

Cells 17 µm long, 8µm wide; thick, often with a moderate degree of lateral compression, anterior end with a slight, acute, dorsal protuberance and 2 refringent bodies, posterior end rounded; flagella equal, as long as the cell, chloroplasts 2 per cell, olive green, in color. Found at St1, St 2 and St3 of IR.

Divisio : Dinophyta
 Classis : Dinophyceae
 Ordo : Peridinales
 Familia : Peridiniaceae
 Genus : *Peridiniopsis* Lemmermann, 1904
P. oculatum (F. Stein) Bourrelly 1968, (Figure 4e)

Basionym: *Glenodinium oculatum* F. Stein
 Synonyms: *Glenodinium oculatum* F. Stein 1883; *Peridiniopsis acuelatum* (F. Stein) Bourrelly 1968, (John et al., 2003)

Cells spherical, slightly dorsiventrally flattened, 12µm wide, 23 µm long. Epitheca and hypotheca equal in length, both rounded and separated by a well-defined cingulum offset by one cingulum width. Sulcus wide and not reaching antapex of hypotheca. Found at St1, St2 and St3 of IR.

P. polonicum (Woloszynska) Bourrelly 1968, (Figure 4f),

Basionym: *Peridinium polonicum* Woloszynska
 Synonyms: *Peridinium polonicum* Woloszynska 1916; *Glenodinium gymnodium* Pénard 1891; *Peridinium trilineatum* Lindemann 1919; *Glenodinium gymnodium* var. *biscutelliforme* Thompson 1950, (Huber-Pestalozzi, 1976)

Epitheca conical, hypotheca rounded, dorsoventral compression, apical pore with surrounding ridges, broad sulcus with parallel sides to the antapex, and thick spine at the terminus of the sulcus on the left side. Length 42 µm, width 36 µm. Found at St1 and St2 of IR.

Ordo : Gymnodinales
 Familia : Gymnodiniaceae
 Genus : *Gymnodinium* Stein, 1878
G. varians Maskell 1887, (Figure 4g)
 Synonym: *Gymnodinium minimum* Klebs 1912, (Huber-Pestalozzi, 1976)

Cells very small, ovate shaped, 17 µm long, 12 µm wide. Epitheca smaller than hypotheca. Hypotheca is thinner than epitheca. Cingulum almost centrally placed, round. Found only at St1 of IR.

Divisio : Euglenophyta
 Classis : Euglenophyceae
 Ordo : Euglenales
 Familia : Euglenaceae
 Genus : *Trachelomonas* Ehrenberg, 1835
T. scabrata (Playfair) Deflandre 1927, (Figure 4h)

Basionym: *Trachelomonas volvocina* var.

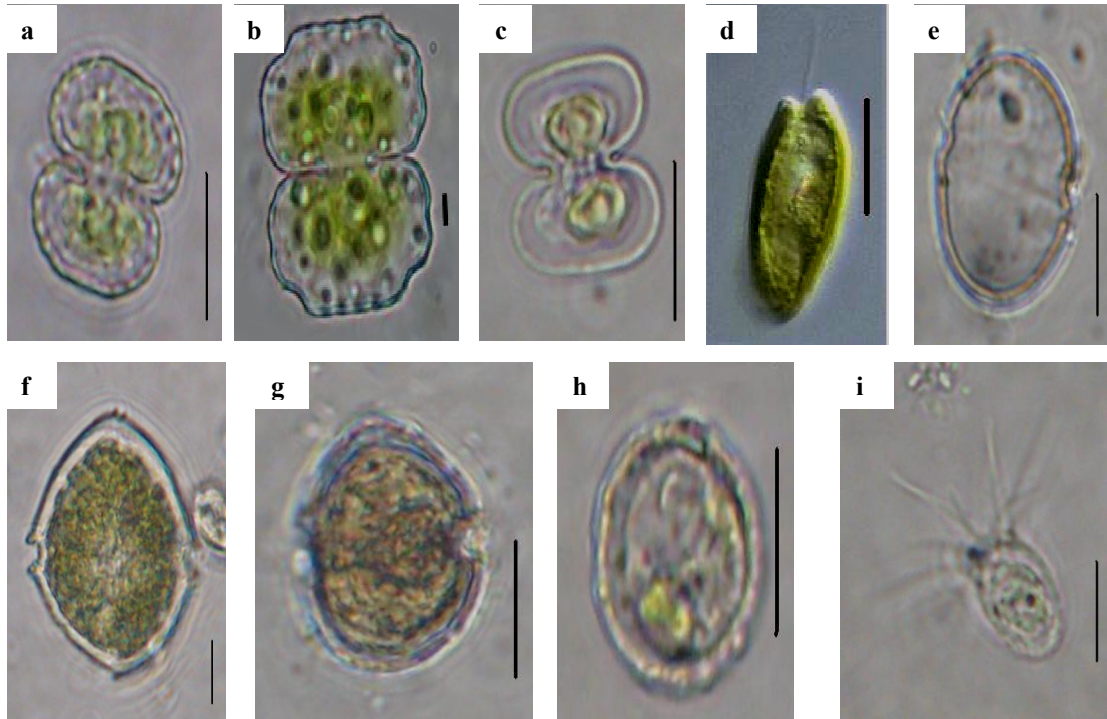


Figure 4. a. *Cosmarium sphaerostichum*, b. *Cosmarium berryense*, c. *Cosmarium tenue*, d. *Cryptomonas caudata*, e. *Peridiniopsis oculatum*, f. *Peridiniopsis polonicum*, g. *Gymnodinium varians*, h. *Trachelomonas scabrata*, i. *Mallomonas alpina* (Scale 10 μ m).

scabra Playfair, (Huber-Pestalozzi, 1955)

Lorica 12 μ m in diameter. Apical pore with short collar. Wall covered by gnarled process. Found only at St1 of IR.

Divisio : Heterokontophyta

Classis : Synurophyceae

Ordo : Synurales

Familia : Mallomonadaceae

Genus : *Mallomonas* Perty, 1852

M. alpina Pascher and Ruttner, (Figure 4i)

Synonym: *Mallomonas tonsurata* var. *alpina* (Pascher and Ruttner) Krieger, (Huber-Pestalozzi, 1941, John *et al.*, 2003)

Cells lanceolat, 35 μ m long, 15 μ m wide. Flagella as long as body length. Nucleus located at posterior half of the cell body, pear-like shaped. Found at St1, St2 and St3 of IR.

Discussion

The taxa listed in the results from Çaygören and İkizcetepeler Reservoirs phytoplankton have not been recorded so far in Turkey (Gönülol *et al.*, 1996; Aysel, 2005; Şahin, 2005).

The division Chlorophyta contains the highest (7) records. It is reported that these 7 taxa are cosmopolite and widespread in the plankton of little ponds (John *et al.*, 2003; Huber-Pestalozzi, 1983). It is stated that *Kirchneriella contorta* var. *elegans* was found in the plankton of Thames River (John *et al.*, 2003). *Kirchneriella* and *Sphaerellopsis* are reported

only from Lake Gököy (Çelekli *et al.*, 2007a). Species belong to these genera are found common in lakes located in the same region; Lake Manyas (Balıkesir) (Şipal *et al.*, 1994; Çelik and Ongun, 2008), Lake Hafik (Kılınç, 1998), Lake Uluabat (Bursa) (Karacaoğlu *et al.*, 2004), Lake Simenit (Samsun) (Ersanlı and Gönülol, 2006); Lake Abant (Bolu) (Çelekli *et al.*, 2007b), Lake Gıcı and Lake Liman (Samsun) (Soylu and Gönülol, 2006, 2010).

Stephanodiscus neoastrea and *Gomphonema exiguum* var. *minutissimum* from Bacillariophyta are both cosmopolite and *S. neoastrea* are only found in eutrophic water (Krammer and Lange-Bertalot, 1991, 1999). It is reported that *Gyrosigma wansbeckii* is brackish water algae but rarely found in salt inland waters (Jensen, 1985). Conductivity levels of ÇR where this species was found are between 0.282 and 0.684 mS/cm. These levels show that the characterization of water is slightly brackish. It is stated that *Navicula costans* var. *symetrica* was very abundant in Netherlands but rare in oligotrophic waters of Northwest Germany (Krammer and Lange-Bertalot, 1999). Species belongs to genus *Stephanodiscus*, *Navicula* and *Gomphonema* are abundant in lakes and reservoirs plankton of Turkey (Gönülol *et al.*, 1996; Aysel, 2005).

It is stated that 3 *Cosmarium* species from Streptophyta (*C. sphaerostichum*, *C. berryense* and *C. tenue*) were found in ponds, lakes and muddy waters. *C. tenue* dispersed in Europe, North America, Asia, Japan, Indonesia and Philippines and prefers

acidic (pH: 4.8-7.5) waters (Huber-Pestalozzi, 1982). Total suspended solid and pH of IR where this species was found were 4.8-14.8 mg L⁻¹ and 7.38-11.67, respectively. Although these levels were not constituted an acidic environment, total suspended solid levels were found high.

Cryptomonas caudata from Cryptophyta were found in Vienna and Danube River in Austria and distinguished from *Cryptomonas erosa* with little beaked appendix on base part (Huber-Pestalozzi, 1976). *C. globosa* and *C. erosa* in the genus of *Cryptomonas* were abundant in Çubuk-I Reservoir, Kurtboğazi Reservoir and Lake Mogan (Ankara) (Aykulu et al., 1983) but rarely found in Lake Ladik and Lake Akgöl (Samsun) (Maraşlıoğlu et al., 2005; Ersanlı et al., 2006); Derbent Reservoir (Samsun) (Taş and Gönüloğlu, 2007); Riva Stream (İstanbul) (Temel, 1994).

Trachelomonas scabrata from Euglenophyta was found in Australia and England (Huber-Pestalozzi, 1955). *Mallomonas alpina* from Heterokontophyta is probably cosmopolite and distributed in the island of England (John et al., 2003). The genus *Mallomonas* is reported only from two locality, Gediz River Basin (Marmara Lake, Demirköprü Reservoir) (Aysel, 2005) and Yeniçağa (Bolu) (Kılınç, 2003) in Turkey.

Such reports increase the need for taxonomic studies that demonstrate how phytoplankton plays an important role in the species richness of an environment.

References

- Apaydın-Yağcı, M. and Turna, İ.İ. 2002. A new record for the algal flora of Turkey: *Chaetomorpha crassa* (C. ag.) kütz. (Cladophoraceae, Chlorophyceae). Turkish Journal of Botany, 26: 171-174. doi:bot-26-3-7-0104-5
- APHA (American Public Health Association), 1995. Standard methods for the examination of water and wastewater. 19th Edition, Washington, D.C.
- Atıcı, T. 2002. Nineteen new records from Sarıyar Dam Reservoir phytoplankton for Turkish Freshwater algae. Turkish Journal of Botany, 26: 485-490. doi:bot-26-6-0109-2.
- Aykulu, G., Obalı, O. and Gönüloğlu, A. 1983. Ankara çevresindeki bazı göllerde fitoplanktonun yayılışı. Doğa Bilim Dergisi, 7: 277-288.
- Aysel, V., Dural, B. and Gezerler-Şipal, U. 1993. Two new records of Cyanophyceae for the Algal Flora of Turkey. Turkish Journal of Botany, 17: 263-266.
- Aysel, V. 2005. Check-List of the Freshwater Algae of Turkey. Journal of the Black Sea/Mediterranean Environment, 11(1):1-124.
- Baykal, T., Akbulut, A., Açıkgöz, İ., Udoh, A.U., Yıldız, K. and Şen, B. 2009. New records for the freshwater algae of Turkey, Turkish Journal of Botany, 33: 141-152. doi:10.3906/bot-0705-10.
- Coesel, P.F.M. and Meesters, K.J. 2007. Desmids of the Lowlands, Mesotaeniaceae and Desmidiaceae of the European Lowlands. KNNV Publishing, The Netherlands, 352 pp.
- Çelekli, A., Albay, M. and Dügel, M. 2007a. Phytoplankton (except Bacillariophyceae) Flora of Lake Gökçöy (Bolu). Turkish Journal of Botany, 31: 49-65. doi:bot-31-1-7-0604-12
- Çelekli, A., Obalı, O. and Külköylüoğlu, O. 2007b. The phytoplankton community (except Bacillariophyceae) of lake Abant (Bolu, Turkey). Turkish Journal of Botany, 32:109-124. doi: bot-31-2-3-0604-11
- Çelik, K. and Ongun, T. 2008. Spatial and temporal dynamics of the steady-state phytoplankton assemblages in a temperate shallow hypertrophic lake (Lake Manyas, Turkey). Limnology, 9(2): 115-123. doi:10.1007/s10201-007-0233-1.
- DSİ, 1987. İkiztepeliler ve Çaygören II. Aşama Projesi Planlama Revizyon Raporu. DSİ, Ankara, 502: 85-95.
- Ersanlı, E. and Gönüloğlu, A. 2006. A study on the phutoplankton of lake Siment, Turkey. Cryptogamie, Algol., 27(3): 289-305.
- Ersanlı, E., Gönüloğlu, A., Şehirli, H. and Baytut, Ö. 2006. The phytoplankton of lake Akgöl, Turkey. Journal of Freshwater Ecology, 21(3): 523-526. doi:10.1080/02705060.2006.9665030.
- Gönüloğlu, A., Öztürk, M. and Öztürk, M. 1996. A check-list of the freshwater algae of Turkey. Ondokuz Mayıs Üniv. Fen Edb. Fak., Fen dergisi, 7(1): 8-46.
- Guiry, M.D. and Guiry, G.M. 2009. AlgaeBase. - Worldwide electronic publication. National University of Ireland, Galway. <http://www.algaebase.org> (28 May 2009).
- Huber-Pestalozzi, G. 1941. Das Phytoplankton des Süßwassers, (Die Binnengewässer, Band XVI). Teil 2. (i) Chrysophyceen, Farblose Flagellaten Heterokonten. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, 365 pp.
- Huber-Pestalozzi, G. 1955. Das Phytoplankton des Süßwassers. Systematik und Biologie. 4. Teil.Euglenophyceen. In: A. Thienemann, (Ed.), Die Binnengewässer, E. Schweizerbart'sche Verlagsbuchhdlg. (Nägele and Obermiller), Stuttgart, 606 pp.
- Huber-Pestalozzi, G. 1961. Das Phytoplankton des Süßwassers. Systematik und Biologie. 5. Teil.Chlorophyceae (Grünalgen). Ordnung: Volvocales. Unveränd. Nachdruck 1974. In: A. Thienemann, (Ed.), Die Binnengewässer-E. Schweizerbart'sche Verlagsbuchhdlg. (Nägele and Obermiller), Stuttgart, 744 pp.
- Huber-Pestalozzi, G. 1976. Das Phytoplankton des Süßwassers, 3 Teil, 2. Auflage Cryptophyceen, Chloromonadien, Peridineen. Mit einem Beitrag von In: B. Fott. E. Schweizerbart'sche Verlagsbuchhhandlung. (Nagele u. Obermiller). Stuttgart, 310 pp.
- Huber-Pestalozzi, G. 1982. Das Phytoplankton des Süßwassers Systematik und Biologie, 8. Teil, 1.Hälfte Conjugatophyceae Zygnematales und Desmidiaceae (excl.Zygnemataceae), Von Kurt Föster, Pfronten/Allgäu, E. Schweizerbarth'sche Verlagsbuchhandlung (Nagele u. Obermiller). Mit 785 Abbildungrn in zahlreichen Einzeldarstellungen auf 65 Tafeln und 11 Abbildungn in Text. Stuttgart,
- Huber-Pestalozzi, G. 1983. Das Phytoplankton des Süßwassers Systematik und Biology, 7. Teil, 1. Hälfte, Chlorophyceae (Grünalgen) Ordnung: Chlorococcales. In: J. Komarek, B. Fott, E.

- Schweizerbart'sche Verlagsbuchhandlung (Nagele u. Obermiller). Mit 253 Tafeln, 14 Abbildungen und 43 Tabellen in Text, Stuttgart, 1043 pp.
- Jensen, N.G. 1985. The Pennate Diatoms, a translation of Husted's "Die Kieselsalgen, 2. Teil". Koeltz Scientific Books, Koenigstein, 918 pp.
- John, D.M., Whitton, B.A. and Brook, A.J. 2003. The Freshwater Algal Flora of the British Isles, An Identification Guide to Freshwater and Terrestrial Algae. Cambridge University Pres., Cambridge, 702 pp.
- Karacaoglu, D., Dere, Ş. and Dalkıran, N. 2004. A Taxonomic Study on the Phytoplankton of Lake Ulubat (Bursa). Turkish Journal of Botany, 28: 473-485. doi:10.1127/0029-5035/2003/0076-0429.
- Kılınç, S. 1998. A Study in the seasonal variation of phytoplankton in Hafik Lake (Sivas, Turkey). Turkish Journal of Botany, 22: 35-41. doi:22-1-6-960-16.
- Kılınç, S. 2003. The phytoplankton community of Yeniçağa Lake (Bolu, Turkey). Nova Hedwigia, 76(3-4):429-442. doi:10.1127/0029-5035/2003/0076-0429.
- Kramer, K. and Lange-Bertalot, H. 1991. Bacillariophyceae. 3. Teil: Centrales, Fragilariaceae, Eunotiaceae. Unter Mitarbeit von H. Hakanson und M. Nörpel, Gustav Fischer Verlag, Stuttgart, 577 pp.
- Kramer, K. and Lange-Bertalot, H. 1999. Bacillariophyceae. 1. Teil: Naviculaceae. Durchgesehener Nachdruck der 1. Auflage. Spektrum Akademischer Verlag-Heidelberg, Berlin, 876 pp.
- Maraşlıoğlu, F., Soylu, E.N. and Gönüloğlu, A. 2005. Seasonal variation of the phytoplankton of Lake Ladik, Samsun, Turkey, Journal of Freshwater Ecology, 20(3):549-554.
- Ongun-Sevindik, T., Çelik, K. and Gönüloğlu, A. 2010. Twentfour New Records From Çaygören Reservoir Phytoplankton for Turkish Freshwater Algae. Turkish Journal of Botany, 31(4): 249-259. doi:10.3906/bot-0906-56.
- Öztürk, M., Gönüloğlu, A. and Öztürk, M. 1995a. Türkiye alg florası için yeni bir kayıt: *Pleurotaenium trabecula* (Ehr.) ex Nägeli (Desmidiaceae), O.M.Ü. Fen Dergisi, 6(1): 212-218.
- Öztürk, M., Gezerler-Şipal, U., Güner, H., Gönüloğlu, A. and Aysel, V. 1995b. *Closterium kuetzingii* Bréb. var. *kuetzingii* (Conjugatophyceae, Desmidiales), A new record for the algal flora of Turkey. E.Ü. Su ürünleri Dergisi, 12(1-2): 145-149.
- Philipose, M.T. 1967. Chlorococcales, I.C.A.R., Monographs, New Delhi, 365 pp.
- Soylu, E.N. and Gönüloğlu, A. 2006. Seasonal variation in the diversity, species richness and composition of the phytoplankton assemblages in shallow lake. Cryptogamie, Algol., 27(1): 85-101.
- Soylu, E.N. and Gönüloğlu, A. 2010. Functional classification and composition of phytoplankton in Liman Lake. Turkish J. Fisheries Aquatic Sciences, 10(1):53-59.
- Şahin, B. 2000. Some new desmids records for freshwater algal flora of Turkey. Flora Mediterranea, 10: 223-226.
- Şahin, B. 2002. Contribution to the desmid flora of Turkey. Algological Studies, 107: 39-48
- Şahin, B. 2005. A preliminary checklist of desmids of Turkey. Cryptogamie, Algol., 26(4): 399-415.
- Şahin, B. 2007. Two new records for the freshwater algae of Turkey. Turk. J. Bot., 31: 153-156. doi: 31-2-8-0605-14.
- Şahin, B. 2009. Contribution to the desmid flora of Turkey. Turk. J. Bot., 33: 457-460. doi:10.3906/bot-0809-15
- Şipal-Gezerler, U., Aysel, V. and Güner, H. 1994. Bandırma Kuş Gölü'ne Dökülen Sığircı Deresi'nin Alg Florası ve Çevresinin Kirlenmesindeki Etkileri. Ege Üniv., Fen Fak. Derg., 16(1): 351-356.
- Taş, B. and Gönüloğlu, A. 2007. Derbent Baraj Gölü (Samsun, Türkiye)'nün planktonik algleri. Journal of FisheriesSciences.com, 1(3): 111-123. doi: 10.3153/jfsc.com.2007014.
- Temel, M. 1994. Riva Deresi fitoplanktonu üzerinde bir ön araştırma. İ.Ü. Su ürünleri Dergisi, 1-2: 1-14.