

A Taxonomic Study on the Phytoplankton of Lake Uluabat (Bursa)

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Abstract: The phytoplanktonic algal flora of Lake Uluabat was studied during July 1998- June 1999 by analysing samples taken each month from 5 sampling stations. Identified taxa (331) of the phytoplanktonic community are as follows: 152 *Bacillariophyta*, 89 *Chlorophyta*, 42 *Cyanophyta*, 31 *Euglenophyta*, 11 *Dinophyta*, 4 *Cryptophyta* and 2 *Chrysophyta*. Algal species which live in eutrophic water are dominant in the phytoplankton. Most of the species are characterised by their widespread presence, although it is also noted that some taxa are rarely found in Turkey.

Key Words: Lake Uluabat, Phytoplankton, Taxonomy

Uluabat Gölü (Bursa) Fitoplanktonu Üzerine Taksonomik Bir Çalışma

Özet: Uluabat Gölü'nün fitoplanktonik alg florası Temmuz 1998 ve Haziran 1999 tarihleri arasında göl üzerinde belirlenen 5 istasyondan alınan örneklerde incelenmiştir. Uluabat Gölü fitoplanktonunda 152'si *Bacillariophyta*, 89'u *Chlorophyta*, 42'si *Cyanophyta*, 31'i *Euglenophyta*, 11'i *Dinophyta*, 4'ü *Cryptophyta* ve 2'si *Chrysophyta* divizyonlarına ait 331 takson tespit edilmiştir. Gölde ötrofik suları tercih eden fitoplankton türleri dominant olmuştur. Tespit edilen taksonların büyük çoğunluğu geniş coğrafik yayılış göstermeleri ile karakterize edilmiş, ancak bazı taksonların Türkiye'de nadir tespit edilen taksonlar olduğu belirlenmiştir.

Anahtar Sözcükler: Uluabat Gölü, Fitoplankton, Taksonomi

Introduction

Lake Uluabat is located between 44°40' and 44°60' N latitude and 62°00' and 65°00' E longitude in Bursa, Turkey, lying east to west, south of the Marmara Sea. The lake has a volume of 2060 hm³ together with the Mustafakemalpaşa Creek and its 2 branches, the Emet and Orhaneli Creeks. The length of the lake from east to west is approximately 24 km and that from south to north is approximately 12 km. The depth of Lake Uluabat is 3 m in winter, but this decreases to 1 m in summer.

Lake Uluabat is one of the eutrophic lakes of Turkey from the point of view of biological productivity. Because of its rich biodiversity, lying on a migratory bird route and almost all its shores being covered with submerged plants, Lake Uluabat is one of the most important wetlands of Turkey. The lake is protected by the Ramsar Convention (1998).

Studies on the algal flora of Lake Uluabat are limited. The preliminary planktonic investigations in Lake Uluabat

performed by Demirhindi (1972) during 1962-1964 concerned only genera. Artüz and Korkmaz reported that some investigations of the phytoplankton composition of the lake had been performed, again limited to genera, by Akşiray in 1977 (Dalkıran et al., 2003). However, in recent studies of the planktonic algal flora of the lake and its benthic algal flora, their seasonal variations and relations with environmental factors have been investigated in detail (Dalkıran et al., 2003). In another study by the same researchers, the effects of physical, chemical, biological factors on shallow lake systems have been shown using Lake Uluabat as a model (Dalkıran et al., 2003). Following their study between July 1998 and June 1999 on the physical, chemical and biological properties of the lake water, Lake Uluabat appears to have a typical eutrophic character: 408 benthic algae (epipellic, epiphytic, epilithic), 37 aquatic plants and 21 fish taxa have been identified in Lake Uluabat and many bird species live in the area. Lake Uluabat is among the most biologically diverse lakes of Turkey. However,

human activities are beginning to cause problems where industrial wastes are discharged into the lake (Dalkiran et al., 2003).

The aim of this study was to determine the phytoplanktonic algal flora of Lake Ulubat (Apolyont), which is an important wetland and recreational area for the people of Bursa and Turkey. This study will contribute to a national algal database of Turkey.

Materials and Methods

Plankton samples were taken from 5 sampling stations each month during July 1998-June 1999 (Figure 1). Phytoplankton samples were collected from the surface with a 55 µm mesh plankton net. To obtain phytoplankton species samples smaller than 55 µm, water samples were filtered through Whatman GF/A filter paper. Samples were preserved in 4% formaldehyde solution. Algae were examined live in temporary preparations, except for diatoms, which were studied in permanent preparations, the samples having been digested with acid (APHA, 1985). Taxonomic identifications were made according to Hustedt (1930), Bourrelly (1966,1968,1970), Prescott (1973), Compere

(1974), Patrick & Reimer (1966,1975), Findlay & Kling (1979) and Krammer & Lange-Bertalot (1991a, 1991b,1997). Some taxa were photographed with a Zeiss Axioplan research microscope (Figures 2-7).

Results

A total of 331 phytoplanktonic taxa were identified. *Bacillariophyta* comprised 46% (152 taxa) of the total taxa and were dominant in the phytoplankton. The remaining divisions were as follows: *Chlorophyta* 27% (89 taxa), *Cyanophyta* 13% (42 taxa), *Euglenophyta* 9% (31 taxa), *Dinophyta* 3% (11 taxa), *Cryptophyta* 1% (4 taxa) and *Chrysophyta* 1% (2 taxa). A floristic list is given in Table 1.

Discussion

A rich phytoplankton was found in Lake Ulubat. Among the dominant diatoms, Centrales had 14 taxa, while Pennales had 138 taxa. *Aulacoseira subarctica* (O.Müll.) E.Y.Haw was the most common centric diatom in the phytoplankton, being present every month, together with *Cyclotella* spp. and *Stephanodiscus dubius*

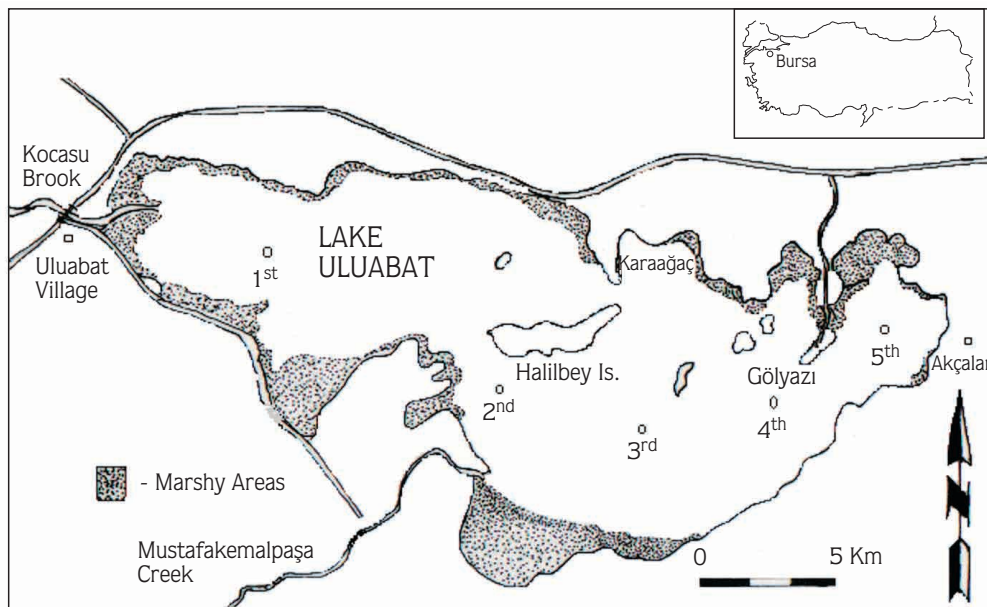


Figure 1. Sampling stations on Lake Ulubat.
 (1st station: 40° 12' 14" latitude; 28° 28' 50" longitude, 2nd station: 40° 08' 09" latitude; 28° 35' 43" longitude, 3rd station: 40° 10' 32" latitude; 28° 37' 07" longitude, 4th station: 40° 08' 53" latitude; 28° 39' 14" longitude, 5th station: 40° 10' 36" latitude; 28° 42' 14" longitude)

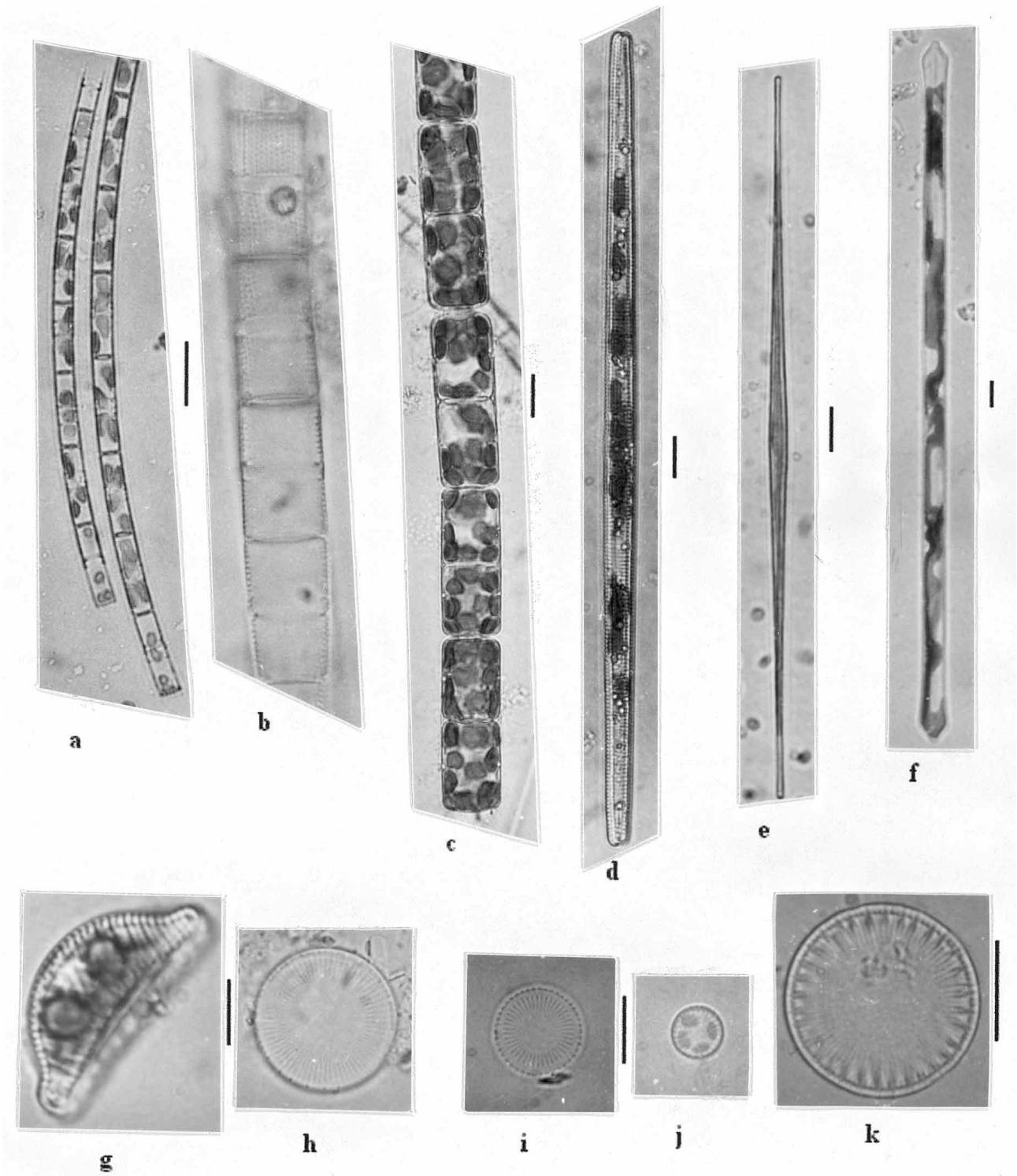


Figure 2. a. *Aulacoseira subarctica*, b. *A. granulata*, c. *Melosira varians*, d. *Synedra ulna*, e. *S. delicatissima* var. *angustissima*, f. *S. capitata*, g. *Epithemia sorex*, h. *Stephanodiscus niagarae*, i. *S. dubius*, j. *Cyclotella glomerata*, k. *C. comta* (Scale 10 μ).

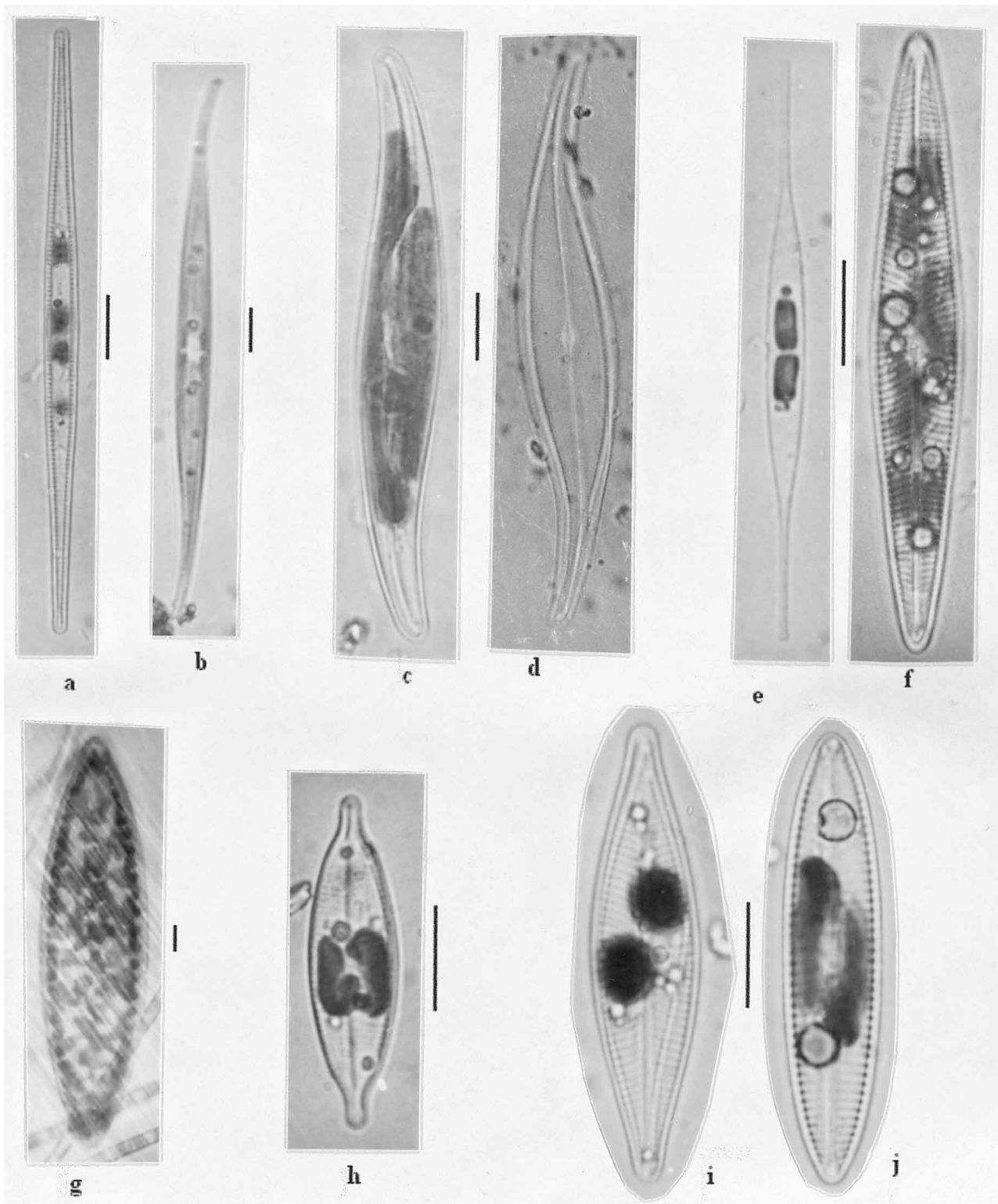


Figure 3. a. *Synedra acus*, b. *Nitzschia lorenziana* var. *subtilis*, c. *Gyrosigma acuminatum*, d. *G. wormleyi*, e. *Nitzschia acicularis*, f. *Navicula radiosa*, g. *Surirella biseriata*, h. *Navicula cryptocephala*, i. *N. rhynchocephala*, j. *N. tripunctata* (Scale 10 μ).

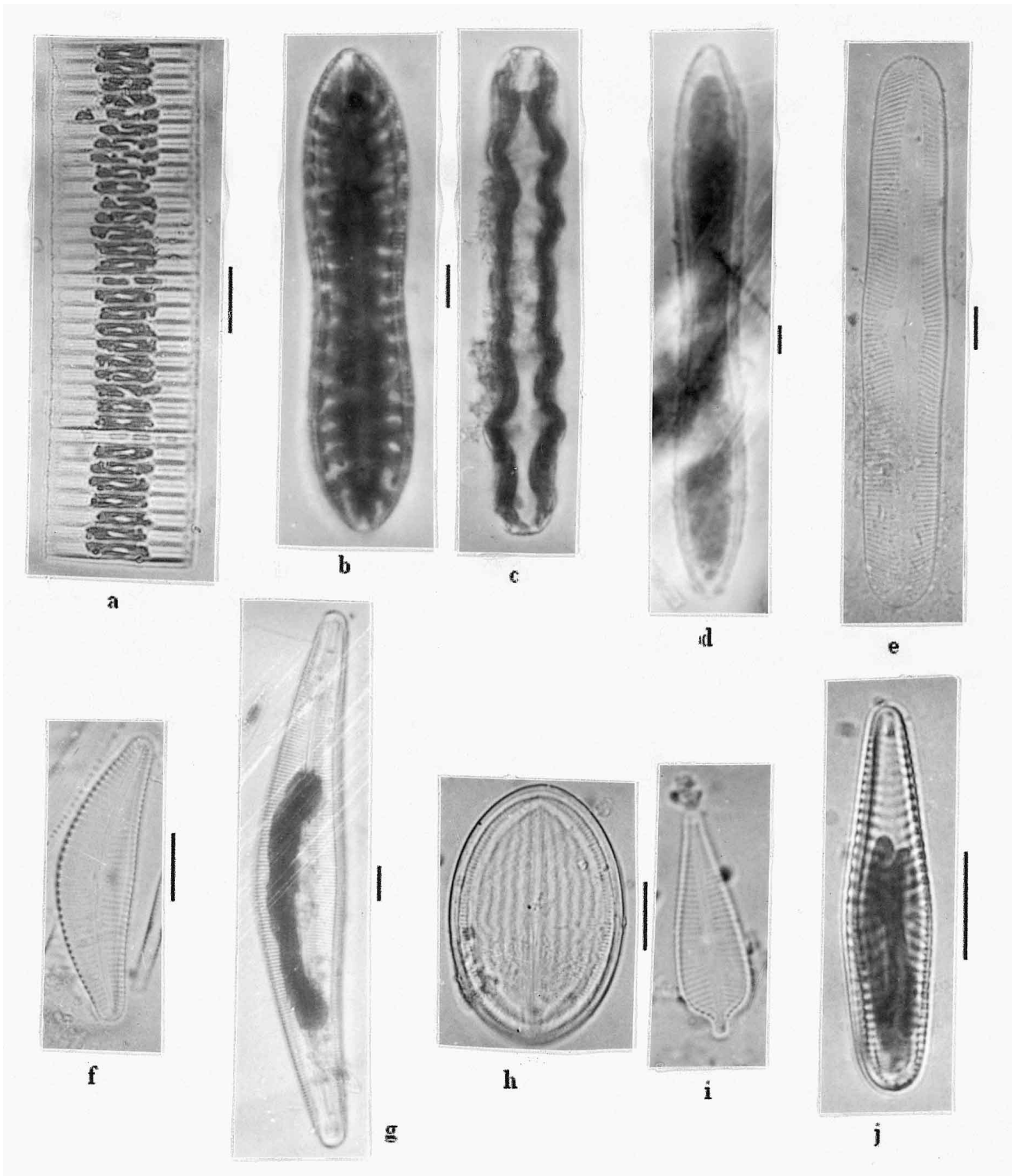


Figure 4. a. *Fragilaria vaucheriae*, b. *Cymatopleura solea* (valve view), c. *C. solea* (girdle view), d. *C. solea* var. *gracilis*, e. *Pinnularia maior*, f. *Cymbella cistula*, g. *C. lanceolata*, h. *Cocconeis placentula* var. *lineata*, i. *Gomphonema augur*, j. *G. truncatum* var. *capitatum* (Scale 10 μ).

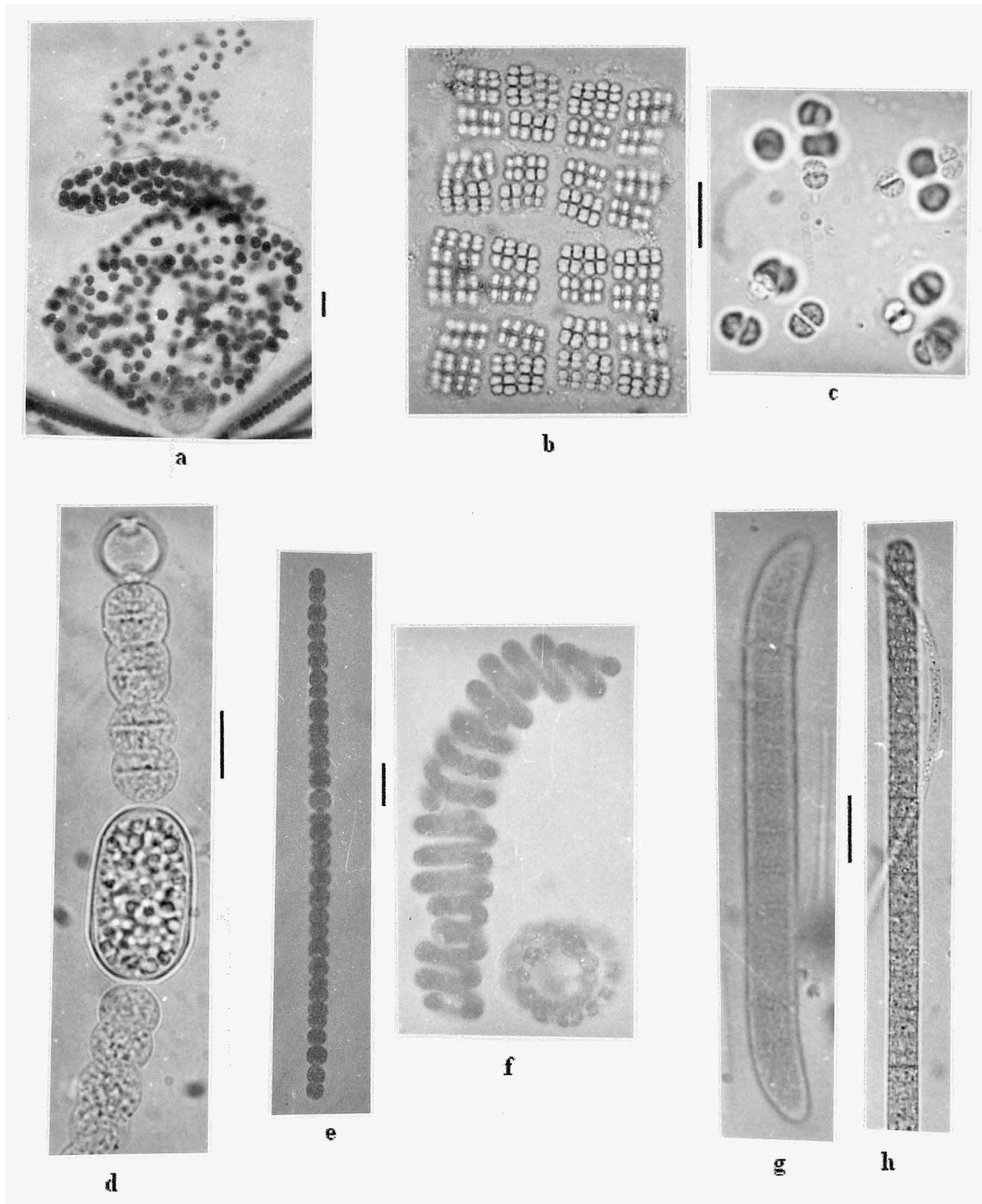


Figure 5. a. *Microcystis aeruginosa*, b. *Merismopedia punctata*, c. *Chroococcus limneticus* var. *subsalsus*, d. *Anabaena circinalis*, e. *A. affinis*, f. *A. spiroides*, g. *Oscillatoria formosa*, h. *O. granulata* (Scale 10 μ).

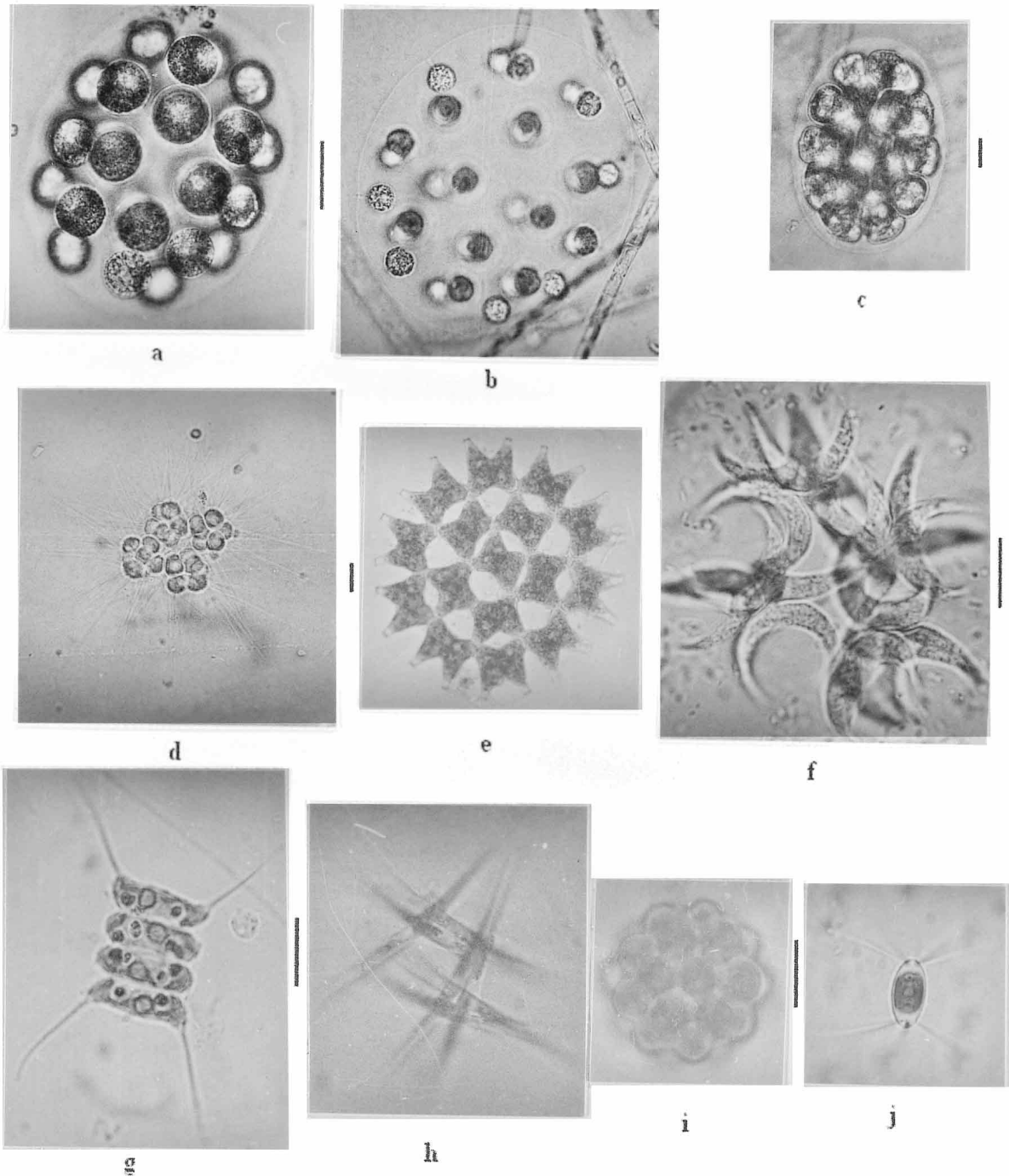


Figure 6. a. *Eudorina elegans*, b. *E. unicocea*, c. *Pandorina morum*, d. *Micractinium pusillum*, e. *Pediatrum duplex* var. *clathratum*, f. *Selenastrum gracile*, g. *Scenedesmus quadricauda*, h. *Monoraphidium contortum*, i. *Coelastrum microporum*, j. *Lagerhemia subsalsa* (Scale 10 μ).

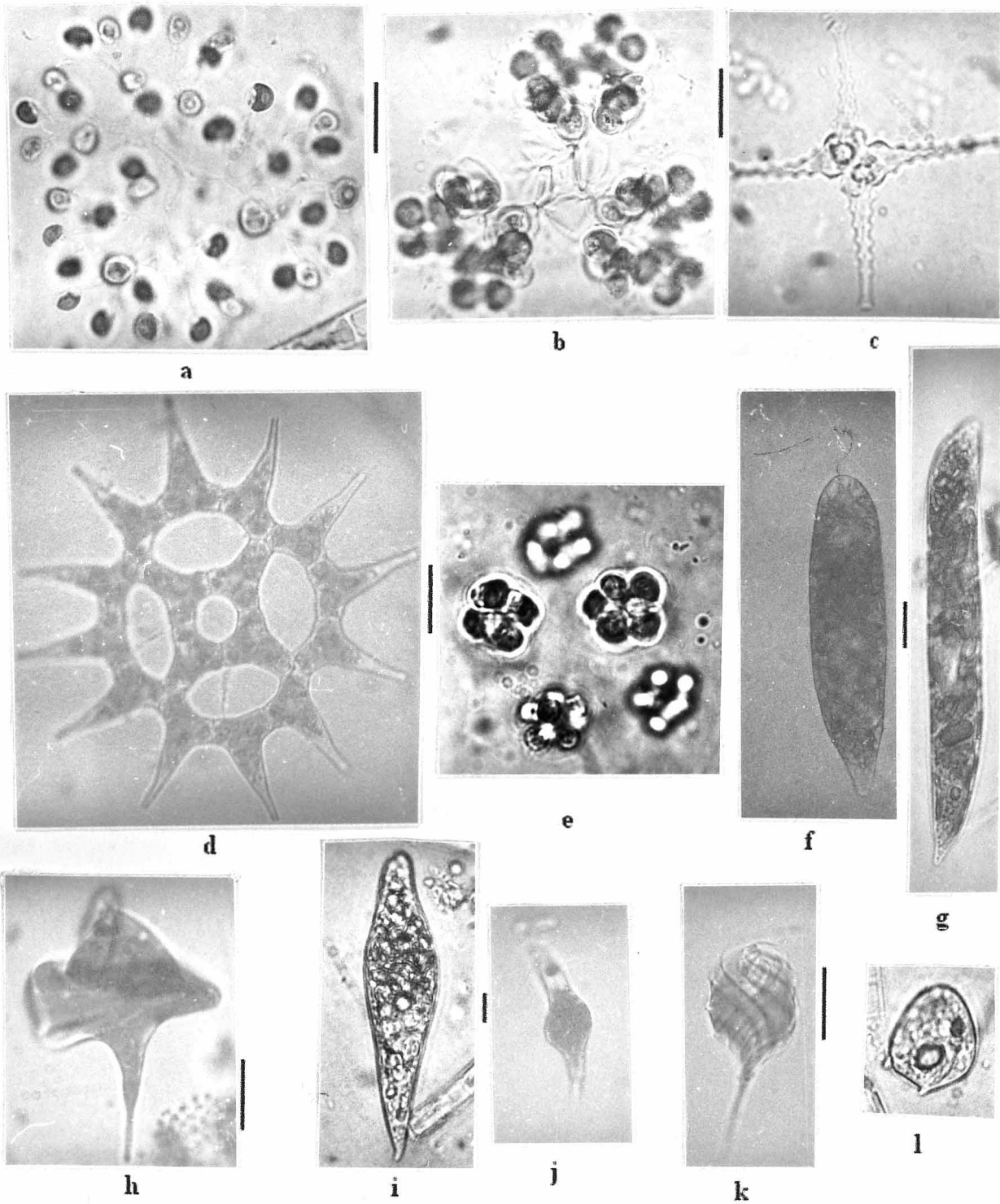


Figure 7. a. *Dictyosphaerium pulchellum*, b. *Westella botryoides*, c. *Staurastrum* sp., d. *Pediastrum clathratum* var. *punctatum*, e. *Sphaerocystis schroeteri*, f. *Euglena polymorpha*, g. *E. deses*, h. *E. spathirhyncha*, i. *E. proxima*, j. *E. elastica*, k. *Phacus nordstedtii*, l. *P. acuminatus* (Scale 10 μ).

Table 1. List of phytoplanktonic algal flora determined in Lake Uluabat.

DIVISION: BACILLARIOPHYTA	<i>F. intermedia</i> Grunow
CLASS: DIATOMATAE	<i>F. spp.</i> (2 taxa)
ORDER: CENTRALES	<i>F. vaucheriae</i> (Kütz.) J.B.Petersen var. <i>vaucheriae</i>
<i>Aulacoseira granulata</i> (Ehrenb.) Simonsen	<i>Gomphonema abbreviatum</i> C.Agardh
<i>A. granulata</i> var. <i>angustissima</i> (O.Müll.) Simonsen	<i>G. acuminatum</i> Ehrenb. var. <i>acuminatum</i>
<i>A. subarctica</i> (O.Müll.) E.Y.Haw.	<i>G. acuminatum</i> var. <i>elongatum</i> (W.Sm.) Carruth.
<i>Cyclotella chaetoceras</i> Lemmerm.	<i>G. affine</i> Kütz.
<i>C. comta</i> (Ehrenb.) Kütz.	<i>G. angustatum</i> Kütz.
<i>C. glomerata</i> H.Bachm.	<i>G. augur</i> Ehrenb. var. <i>augur</i>
<i>C. meneghiniana</i> Kütz.	<i>G. helveticum</i> Brun
<i>C. ocellata</i> Pant.	<i>G. olivaceum</i> (Hornem.) Bréb.
<i>C. spp.</i> (2 taxa)	<i>G. olivaceum</i> var. <i>calcareum</i> (Cleve) A.Cleve
<i>Melosira distans</i> var. <i>lirata</i> (Ehrenb.) O.Müll.	<i>G. parvulum</i> (Kütz.) Kütz. var. <i>parvulum</i>
<i>M. varians</i> C.Agardh	<i>G. sp.</i>
<i>Stephanodiscus dubius</i> (Fricke) Hust.	<i>G. truncatum</i> Ehrenb. var. <i>truncatum</i>
<i>S. niagarae</i> Ehrenb.	<i>G. truncatum</i> var. <i>capitatum</i> (Ehrenb.) R.M.Patrick
	<i>Gyrosigma acuminatum</i> (Kütz.) Rabenh. var. <i>acuminatum</i>
	<i>G. fasciola</i> (Ehrenb.) J.W.Griff. & Henfr. var. <i>fasciola</i>
	<i>G. wormleyi</i> (Sull.) Boyer var. <i>wormleyi</i>
ORDER: PENNALES	<i>Hantzschia amphioxys</i> (Ehrenb.) Grunow
<i>Achnanthes hungarica</i> (Grunow) Grunow	<i>Navicula anglica</i> Ralfs
<i>Achnantheidium lanceolatum</i> Bréb.	<i>N. arvensis</i> Hust. var. <i>arvensis</i>
<i>A. minutissimum</i> (Kütz.) Czar.	<i>N. capitata</i> var. <i>hungarica</i> (Grunow) R.Ross
<i>Amphora coffeiformis</i> (C.Agardh) Kütz. var. <i>coffeiformis</i>	<i>N. cincta</i> (Ehrenb.) Ralfs
<i>A. ovalis</i> (Kütz.) Kütz. var. <i>ovalis</i>	<i>N. cryptocephala</i> Kütz.
<i>A. ovalis</i> var. <i>pediculus</i> (Kütz.) Van Heurck	<i>N. cryptocephala</i> var. <i>intermedia</i> Grunow
<i>A. perpusilla</i> (Grunow) Grunow var. <i>perpusilla</i>	<i>N. cryptocephala</i> var. <i>veneta</i> (Kütz.) Rabenh.
<i>A. veneta</i> Kütz. var. <i>veneta</i>	<i>N. cuspidata</i> var. <i>ambigua</i> (Ehrenb.) Cleve
<i>Anomoeoneis sphaerophora</i> (Ehrenb.) Pfitzer var. <i>sphaerophora</i>	<i>N. cuspidata</i> (Kütz.) Kütz. var. <i>cuspidata</i>
<i>Asterionella formosa</i> Hassall	<i>N. exiqua</i> var. <i>capitata</i> R.M.Patrick
<i>Bacillaria paxillifer</i> (O.F.Müll.) Hendeby	<i>N. gregaria</i> Donkin
<i>Caloneis permagna</i> (J.W.Bailey) Cleve var. <i>permagna</i>	<i>N. heufleri</i> var. <i>leptocephala</i> (Kütz.) H.Perag. & Perag.
<i>C. ventricosa</i> (Ehrenb.) F.Meister var. <i>ventricosa</i>	<i>N. menisculus</i> Schum.
<i>Cocconeis pediculus</i> Ehrenb.	<i>N. pupula</i> Kütz. var. <i>pupula</i>
<i>C. placentula</i> var. <i>euglypta</i> (Ehrenb.) Grunow	<i>N. pygmaea</i> Kütz. var. <i>pygmaea</i>
<i>C. placentula</i> Ehrenb. var. <i>placentula</i>	<i>N. radiosa</i> Kütz.
<i>C. placentula</i> var. <i>lineata</i> (Ehrenb.) Van Heurck	<i>N. radiosa</i> var. <i>tenella</i> (Bréb.) Grunow
<i>Cymatopleura elliptica</i> (Bréb.) W.Sm.	<i>N. rhynchocephala</i> Kütz.
<i>C. solea</i> (Bréb.) W.Sm.	<i>N. sp.</i>
<i>C. solea</i> var. <i>gracilis</i> Grunow	<i>N. tripunctata</i> (O.F.Müll.) Bory
<i>C. solea</i> var. <i>regula</i> (Ehrenb.) Grunow	<i>Neidium affine</i> (Ehrenb.) Pfitzer var. <i>affine</i>
<i>Cymbella affinis</i> Kütz. var. <i>affinis</i>	<i>N. dubium</i> (Ehrenb.) Cleve var. <i>dubium</i>
<i>C. cistula</i> (Ehrenb.) Kirchn. var. <i>cistula</i>	<i>N. iridis</i> var. <i>ampliatum</i> (Ehrenb.) Cleve
<i>C. cistula</i> var. <i>gibbosa</i> Brun	<i>Nitzschia acicularis</i> (Kütz.)W.Sm.
<i>C. cymbiformis</i> C.Agardh var. <i>cymbiformis</i>	<i>N. amphibia</i> Grunow
<i>C. lanceolata</i> (C.Agardh) C.Agardh var. <i>lanceolata</i>	<i>N. angustata</i> (W.Sm.) Grunow
<i>C. minuta</i> Hilse var. <i>minuta</i>	<i>N. angustata</i> var. <i>acuta</i> Grunow
<i>C. minuta</i> var. <i>silesiaca</i> (Bleisch) Reimer	<i>N. apiculata</i> (Greg.) Grunow
<i>C. prostrata</i> var. <i>auerwaldii</i> (Rabenh.) Reimer	<i>N. dissipata</i> (Kütz.) Grunow
<i>C. sinuata</i> W.Greg. var. <i>sinuata</i>	<i>N. filiformis</i> (W.Sm.) Van Heurck
<i>C. sp.</i>	<i>N. fonticola</i> Grunow
<i>Diatoma vulgare</i> Bory. var. <i>vulgare</i>	<i>N. frustulum</i> var. <i>perpusilla</i> Rabenh.
<i>Diploneis elliptica</i> (Kütz.) Cleve var. <i>elliptica</i>	<i>N. gracilis</i> Hantzsch
<i>Epithemia adnata</i> (Kütz.) Bréb.	<i>N. holsatica</i> Hust.
<i>E. adnata</i> var. <i>minor</i> (Perag. & Héríb.) R.M.Patrick	<i>N. hungarica</i> Grunow
<i>E. sorex</i> Kütz. var. <i>sorex</i>	<i>N. linearis</i> (C.Agardh) W.Sm.
<i>E. turgida</i> (Ehrenb.) Kütz. var. <i>turgida</i>	<i>N. Lorenziana</i> var. <i>subtilis</i> Grunow
<i>Eunotia curvata</i> (Kütz.) Lagerst.	<i>N. obtusa</i> W.Sm.
<i>Fragilaria capucina</i> Desm. var. <i>capucina</i>	
<i>F. capucina</i> var. <i>mesolepta</i> Rabenh.	

N. palea (Kütz.) W.Sm.
N. paleacea Grunow
N. recta Hantzsch
N. sigma (Kütz.) W.Sm.
N. sigmoidea (Nitzsch) W.Sm.
N. spectabilis (Ehrenb.) Ralfs
N. sublinearis Hust.
N. thermalis (Kütz.) Auersw.
N. tryblionella Hantzsch
N. tryblionella var. *levidensis* (W.Sm.) Grunow
N. tryblionella var. *victoriae* (Grunow) Grunow
N. vermicularis (Kütz.) Hantzsch
Pinnularia brebissonii (Kütz.) Rabenh. var. *brebissonii*
P. maior (Kütz.) Rabenh. var. *maior*
Rhoicosphenia curvata (Kütz.) Grunow var. *curvata*
Rhopalodia gibba (Ehrenb.) O.Müll.
R. gibba var. *ventricosa* (Kütz.) H.Perag. & Perag.
Surirella angusta Kütz.
S. biseriata Bréb.
S. islandica Østrup
S. linearis W.Sm.
S. ovata Kütz.
S. ovata var. *pinnata* (W.Sm.) Brun
S. robusta var. *splendida* (Ehrenb.) Van Heurck
Synedra acus Kütz. var. *acus*
S. amphicephala Kütz.
S. capitata Ehrenb.
S. delicatissima W.Sm. var. *delicatissima*
S. delicatissima var. *angustissima* Grunow
S. filiformis var. *exilis* Cleve-Euler
S. nana F.Meister
S. parasitica (W.Sm.) Hust.
S. pulchella var. *lanceolata* O'Meara
S. rumpens var. *familiaris* (Kütz.) Hust.
S. rumpens var. *fragiloides* Grunow
S. ulna (Nitzsch) Ehrenb.
S. ulna var. *amphirhynchus* (Ehrenb.) Grunow
S. ulna var. *biceps* (Kütz.) Kirchn.
S. ulna var. *oxyrhynchus* (Kütz.) Van Heurck

DIVISION: CHLOROPHYTA

CLASS: CHLOROPHYCEAE

ORDER: VOLVOCALES

Carteria cordiformis (Carter) Diesing
C. Klebsii (P.A.Dang.) O.Dill
Chlamydomonas epiphytica G.M.Sm.
C. globosa J.Snow
C. snowii Printz
C. sp.
Eudorina elegans Ehrenb.
E. unicocea G.M.Sm.
Pandorina morum (O.F.Müll.) Bory

ORDER: TETRASPORALES

Sphaerocystis Schroeteri Chodat

ORDER: ULOTRICHALES

Ulothrix sp.

ORDER: CLADOPHORALES

Cladophora sp.

ORDER: OEDOGONIALES

Oedogonium spp. (2 taxa)

ORDER: CHLOROCOCCALES

Ankistrodesmus convolutus Corda
A. falcatus var. *acicularis* (A.Braun) G.S.West
A. falcatus var. *mirabilis* (West & W.West) G.S.West
A. falcatus var. *tumidus* (West & W.West) G.S.West
A. setigerus (Schröd.) G.S.West
Actinastrum Hantzschii Lagerh.
A. Hantzschii var. *fluviatile* Schröd.
Cerasterias staurastroides West & W.West
Chlorella ellipsoidea Gerneck
C. vulgaris Beij.
Closteriopsis longissima Lemmerm.
Coelastrum microporum Nägeli
Coenocystis subcylindrica Korshikov
Crucigenia quadrata Morren
C. rectangularis (A.Braun) Gay
Diacanthos belenophorus Korsh.
Dictyosphaerium elegans Bachm.
D. pulchellum H.C.Wood
Echinospaerella sp.
Golenkinia paucispina W.West & G.S.West
G. radiata (Chodat) Wille
G. sp.
Kirchneriella obesa (W.West) Schmidle
Lagerheimia subsalsa Lemmerm.
Micractinium pusillum Fresen.
Monoraphidium contortum (Thur.) Komárk.-Legn.
M. minutum (Nägeli) Komárk.-Legn.
Nephrocytium agardhianum Nägeli
Oocystis Borgei J.Snow
O. parva West & G.S.West
Pediastrum boryanum (Turpin) Menegh.
P. clathratum (Schröd.) Lemmerm. var. *punctatum* Lemmerm.
P. duplex Meyen
P. duplex var. *clathratum* (A.Braun) Lagerh.
P. duplex var. *cohaerens* Bohlin
P. duplex var. *reticulatum* Lagerh.
P. simplex (Meyen) Lemmerm.
P. simplex var. *duodenarium* (Bailey) Rabenh.
P. sp.
Scenedesmus acuminatus (Lagerh.) Chodat
S. bijuga (Turpin) Lagerh.
S. bijuga var. *alternans* (Reinsch) Hansg.
S. dimorphus (Turpin) Kütz.
S. opoliensis P.G.Richt.
S. quadricauda (Turpin) Bréb.
S. quadricauda var. *longispina* (Chodat) G.M.Sm.
S. quadricauda var. *maximus* West & W.West
S. spp. (2 taxa)
Schroederia setigera (Schröd.) Lemmerm.
Schroederiella papillata Korshikov
Selenastrum gracile Reinsch
Tetraedron minimum (A.Braun) Hansg.
T. muticum (A.Braun) Hansg.
T. regulare var. *torsum* (Turner) Brunth.
T. trigonum (Nägeli) Hansg.
T. trigonum var. *gracile* (Reinsch) DeToni
Westella botryoides (W.West) De.Wild.

CLASS: CONJUGATOPHYCEAE**ORDER: DESMIDIALES**

Closterium acutum (Lyngb.) Bréb.
C. spp. (4 taxa)
Cosmarium depressum (Nägeli) P.Lundell
C. sp.
Staurastrum spp. (2 taxa)

ORDER: ZYGNEMATALES

Mougeotia sp.
Spirogyra novae-angliae Transeau
S. spp. (6 taxa)

DIVISION: CHRYSOPHYTA**CLASS: CHRYSOPHYCEAE****ORDER: CHRYSOMONADALES**

Dinobryon divergens O.E.Imhof

ORDER: RHIZOCHRYSIDALES

Rhizochrysis limnetica G.M.Sm.

DIVISION: EUGLENOPHYTA**CLASS: EUGLENOPHYCEAE****ORDER: EUGLENALES**

Euglena acus Ehrenb.
E. acus var. *rigida* Huebner
E. caudata Hübner
E. deses Ehrenb.
E. ehrenbergii G.A.Klebs
E. elastica Prescott
E. gracilis G.A.Klebs
E. oxyuris Schmarda
E. oxyuris var. *minor* Defl.
E. pisciformis G.A.Klebs
E. polymorpha P.A.Dang.
E. proxima P.A.Dang.
E. sp.
E. spathirhyncha Skuja
E. texta (Dujard.) Hübner
E. tripteris (Dujard.) G.A.Klebs
E. tripteris var. *major* Svireenko
Lepocinclis fusiformis (H.J.Carter) Lemmerm.
L. spp. (4 taxa)
L. wangi S.P.Chu
Phacus acuminatus A.Stokes
P. caudatus Huebner
P. helikoides Pochm.
P. longicauda (Ehrenb.) Dujard.
P. Nordstedtii Lemmerm.
P. pleuronectes (O.F.Müll.) Dujard.
Trachelomonas sp.
T. volvocina Ehrenb.

DIVISION: DINOPHYTA**CLASS: DINOPHYCEAE****ORDER: GYMNODINIALES**

Gymnodinium excavatum Nygaard

ORDER: PERIDINIALES

Glenodinium borgei (Lemmerm.) J.Schiller

G. penardiforme (Er.Lindem.) J.Schiller

G. quadridens (F.Stein) J.Schiller

G. spp. (3 taxa)

Peridinium cinctum (O.F.Müll.) Ehrenb.

P. palatinum Lauterborn

P. spp. (2 taxa)

DIVISION: CRYPTOPHYTA**CLASS: CRYPTOPHYCEAE****ORDER: CRYPTOMONADALES**

Chroomonas sp.
Cryptomonas ovata Ehrenb.
C. spp. (2 taxa)

DIVISION: CYANOPHYTA**CLASS: MYXOPHYCEAE****ORDER: CHROOCOCCALES**

Aphanocapsa delicatissima W.West & G.S.West
A. elachista W.West & G.S.West
A. pulchra (Kütz.) Rabenh.
A. rivularis (Carmich.) Rabenh.
Aphanothece nidulans P.G.Richt.
Chroococcus limneticus Lemmerm.
C. limneticus var. *subsalsus* Lemmerm.
C. minor (Kütz.) Nägeli
Coelosphaerium dubium Grunow
C. kuetzingianum Nägeli
Gloeocapsa aeruginosa (Carmich.) Kütz.
G. rupestris Kütz.
Gomphosphaeria aponina Kütz.
G. lacustris Chodat
Merismopedia glauca (Ehrenb.) Nägeli
M. punctata Meyen
M. tenuissima Lemmerm.
Microcystis aeruginosa Kütz.

ORDER: HORMOGONALES

Anabaena affinis Lemmerm.
A. circinalis Rabenh.
A. spiroides Kleb.
Aphanizomenon gracile Lemmerm.
Lyngbya angustissima (West & G.S.West) A.Itis
L. endophytica Elenkin & Hollerb.
L. epiphytica Hieron.
Nostoc sp.
Oscillatoria amphibia C.Agardh
O. angustissima W.West & G.S.West
O. formosa Bory
O. granulata Gardner
O. limnetica Lemmerm.
O. minima Gicklhorn
O. mougeotii (Kütz.) Lemmerm.
O. quadripunctulata Brühl & Biswas
O. subbrevis Schmidle
Phormidium tenue (Menegh.) Gomont
Plectonema nostocorum Bornet & Thur.
P. sp.
Pseudanabaena catenata Lauterborn
Raphidiopsis curvata F.E.Fritsch & M.Rich
Spirulina laxa G.M.Sm.
S. laxissima G.S.West

(Fricke) Hust. *Asterionella formosa* Hassall, *Cymatopleura solea* (Bréb.) W.Sm., *Synedra delicatissima* var. *angustissima* Grunow, *Synedra ulna* (Nitzsch) Ehrenb., *Nitzschia acicularis* (Kütz.) W.Sm., *N. holsatica* Hust., *N. palea* (Kütz.) W.Sm., *N. lorenziana* var. *subtilis* Grunow and *Surirella biseriata* Bréb. were the most common pennate diatoms in the phytoplankton. Although centric diatoms had fewer species in the phytoplankton, they were more abundant than pennate diatoms.

Most diatoms were of benthic origin (epipellic, epiphytic, epilithic), resuspended by waves into the water. Hutchinson (1967) stated that *Cyclotella*, *Stephanodiscus* and *Melosira* among centric diatoms and *Fragilaria*, *Asterionella* and *Synedra* among pennate diatoms are common in phytoplankton. *Cymbella*, *Nitzschia*, *Surirella* and *Cymatopleura* are generally benthic and many such species were found in the phytoplankton of Lake Uluabat. Mooney (1989) stated that *Surirella* and *Cymatopleura* in particular are strongly benthic forms and that it is difficult to find them in phytoplankton due to their weight. Even so, the above 2 genera were frequently detected in the phytoplankton of Lake Uluabat. Akşıray stated that in Artüz and Korkmaz's reports, *Cocconeis*, a benthic diatom, was more common in the phytoplankton in spring and winter and formed 22.12% of the total phytoplankton in Lake Uluabat in 1977 (Dalkıran et al., 2003). This lake is shallow and wave disturbance will tend to introduce such forms to the plankton; free planktonic forms may then be comparatively scarce. Other studies confirm this (Demirhindi, 1972; Akbulut & Yıldız, 2002). In deep lakes with small areas of shallow water, few benthic diatoms have been detected in the plankton (Aykulu and Obalı, 1981).

Chlorophyta was the second dominant group. *Chlorococcales* were dominant with 59 taxa, most commonly *Actinastrum*, *Ankistrodesmus*, *Chlamydomonas*, *Coelastrum*, *Eudorina*, *Micractinium*, *Monoraphidium*, *Pandorina*, *Pediastrum*, *Scenedesmus*, *Sphaerocystis* and *Tetraedron*. These genera are often found in shallow and eutrophic lakes (Hutchinson, 1967).

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The cyanophytes *Anabaena affinis* Lemmerm., *Anabaena spiroides* Kleb. and *Microcystis aeruginosa* Kütz. formed blooms in summer. Other *Cyanophyta*, *Aphanocapsa* spp., *Chroococcus* spp. and *Gloeocapsa* spp., were also frequently observed.

Euglena and *Lepocinclis* (*Euglenophyta*), which grow rapidly in rich organic media, were important. *Euglena caudata* Hübner, *E. proxima* P.A.Dang. and *Lepocinclis wangi* S.P.Chu were frequent, but not abundant. *Chrysophyta*, *Cryptophyta* and *Dinophyta* were less important than other divisions.

A further study on Lake Uluabat showed that the lake has typical eutrophic characteristics (Dalkıran et al., 2003). Average values of some physical and chemical parameters for 10 observation stations were as follows: temperature: 4.80-29.08 °C, dissolved oxygen: 5.5-9.9 mg/l, pH: 7.5-9.0, NO₃-N: 0-4.20 mg/l, O-PO₄⁻²: 0.0045-0.0452 mg/l, Si: 0.733-3.620 mg/l, SO₄⁻²: 50.52-132.55 mg/l. Nutrient load was high with large variations with respect to time and sampling stations (Dalkıran et al., 2003). The high nutrient content in Lake Uluabat is associated with large algal blooms in summer.

Waters having a eutrophic character may shelter species which can adapt to quite different ecosystems (Round, 1984). Algal populations adapted to oligotrophic and eutrophic ecosystems are different from each other. For this reason, the productivity of the lake affects the algal community to a large extent. Various factors may influence the species diversity of the lake such as the intensity of residential and industrial areas around the lake, inflow of nutrient and suspended materials from Mustafakemalpaşa, Orhaneli and Emet creeks, dynamics of nutrients in the lake, rich boron reserves in the surrounding environment, geological and sedimental structure of the lake, shallow water depth and continuous agitation caused by the winds, sediment infill, emergent wetlands around the lake, and local climatic conditions.

In this study, a very rich phytoplankton composition was observed in Lake Uluabat, with eutrophic species dominant. This species diversity in Lake Uluabat is the highest yet found among all the lakes of Turkey.

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