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Effects of Some Environmental Variables on the Benthic Shore Algae (*Excluding Bacillariophyta*) of Asartepe Dam (Ankara)

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Abstract

In order to determine the shore algae, excluding Bacillariophyta of the Asartepe Dam Lake, were observed in the samples taken from different habitats (Epipelic, Epiphytic, Epilitic). Those samples took from 7 stations between April 2003 and June 2004. In the investigation, a total of 95 taxa were identified. Of those, 55 belong to Chlorophyta, 23 to Cyanophyta, 13 to Euglenophyta, 3 to Pyrrophyta and 1 to Chrysophyta, respectively.

Key words: Asartepe Dam, Algae, Cyanophyta, Chlorophyta, Chrysophyta, Euglenophyta, Pyrrophyta.

INTRODUCTION

Algae considered important biological organisms. They are the source of oxygen and the first ring of the food chains in aquatic systems. Algae used in textile, paper, buildings, cosmetic, fertilizer, food, medicine industries and produce single cell protein in biotechnology. The number of algae and richness of species indicator of productivity in water systems [1]. Some indicator algae species important criteria for defining water pollution. Waste waters, which come from the domestically and industrial sources and consists of organic and inorganic compounds [2].

Study Area

Asartepe Dam was built on İlhan Stream, which is the side of Kirmir Stream. It is 825 m. high above the sea level (Figure 1). It has 177-hectare surface area. Depth is 36 m in dam and has reserve of water maximum 20 x 10^6 m^3 [3]. Structure of bottom is very thick and has a brown color. Nevertheless, salt in the soil is widespread; the bottom deposits extensive salt [4]. Vein gypsum exists on the hill top of the study area. This salt is to raise salt of the bottom water. Cereal grains, sugar beet, tomato, pepper, chickpea; lentil is grown in the area also forest and heath surround the area. In addition to *Populus sp., Salix sp.*, some fruit trees are found near the lake [4-6].

Climate of the Area

Anatolian climate is dominant in the area. Winter is cold, rainy, and summer is hot and dry. There is a difference in temperature of nights and daytime. Average annual temperature is 11, 7 C^0 in Ankara [7].

MATERIAL AND METHODS

Some chemical and physical analyses were done in the D.S.I. laboratory. It was given peculiarity about years of 2003-2004 in Table 1. Benthic algae were taken monthly. Epipelic, epiphytic and epilitic algae from 7 stations between April 2003 and July 2004 in Asartepe Dam. Sampling stations were chosen in different areas, which was near the different source of waters. First station distance from 1 km to Orta Bereket village and joins to Sulu Stream in station first. Station 2 distances to 350 m approximately from station 1. Sediment is sandy. *Salix* sp. and

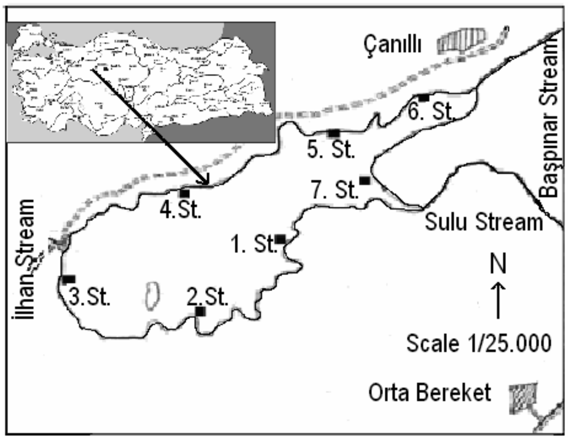

Figure 1. The map of Asartepe Dam Lake and Study Stations

Ranunculus sp. are widespread macrophytes around the shore. Station 3 is near the dam. Sediment is big pebble. Station 4 distances 500 m from station 3. Station 5 distances 600 m from station 4. The bottom is sand and pebble. *Ranunculus* and *Salix* are widespread macrophytes around the shore. In addition, there is a lot of *Chara sp.* in the shore of lake. Başpınar Stream joins to the dam at station 6. The coast is completely mud. Station 7 distances 800-850 m from station 6 is 1,5-2 km to Çanıllı. The bottom is sandy.

Epipelic samples are taken over the sediment with the glass tube which has diameter of 0,8 cm and length of 100-150 cm. Epiphytic samples are taken from stem and leaves of plants (Populus sp., Ranunculus sp.), and Salix roots and algae in water (*Spyrogyra* sp., *Chara* sp.). Epilitic samples were taken over the stones and pebbles in water. Samples were brought to the laboratory and mixed with 1 lt alcohol, 1 lt glycerin and 1 lt formaldehyde (37 %) [8].

Epipelic, Epiphytic and Epilitic samples were studied and photographs were taken in order to find relationships physical and chemical structure to the presence of algae.

Phytoplankton Count

Thoma microscope slide was used for counting algae. Numerical values of different algae groups were determined. There are 2 count regions to separate from each other over the microscope slide. Count regions are available below 1/10 mm according to the surfaces that contacts slide. Counting was made in a small square which has volume 10^{-4} ml. Algae were counted and the average of 64 small squares was taken [9].

RESULTS

Physical and Chemical Features

Biological Features

95 algae species were identified with a qualitative and quantitative study of the benthic shore algae in Asartepe Dam. Of those 55 belong to *Chlorophyta*, 23 to *Cyanophyta*, 13 to to *Euglenophyta,* 3 *Pyrrophyta* and 1 to *Chrysophyta*. Taxa were written in Table 2 according to the Round's [10] system and alphabetic order. Necessary sources were used for identification [11-19].

Table 1: Some Physical and Chemical Features of Asartepe Dam

	April 03	May 03	June 03	July 03	August 03	September03	October 03	November03	December 03	February 04	March 04	April 04	May 04	June 04
Temperature(^{0}C)	7	14	19	22	24,5	18	15	7,5	3,5	2	4	8	16	21
pH	8,32	8,35	8,10	8,60	8,58	8,50	7,59	6,46	8,19	6,06	8,47	8,64	8,60	8,20
EC (µmhos/cm)	395	372	380	386	397	420	433	404	402	402	390	385	396	400
O_2 (mg/l)	6,0	7,2	7,4	8,6	11,4	-	-	-	10,4	9,5	-	11,2	8,2	12,6
Na (mg/l)	0,69	0,69	0,42	0,44	0,44	0,69	0,65	0,65	0,73	0,65	0,65	0,60	0,40	0,40
K (mg/l)	0,21	0,09	0,09	0,06	0,06	0,06	0,06	0,05	0,05	0,02	0,01	0,05	0,07	0,06
Ca+Mg (mg/l)	3,89	3,40	4,00	3,70	3,50	3,79	3,82	3,99	4,18	3,90	3,94	3,72	3,45	3,62
CO_3 (mg/l)	0,32	0,32	0,32	0,60	0,82	1,04	0,28	0,01	0,20	0,01	0,46	0,68	0,65	0,65
HCO_3(mg/l)	3,43	4,00	3,20	3,60	2,70	2,75	3,52	4,01	4,07	2,50	3,41	3,11	3,65	3,52
Cl (mg/l)	0,36	0,36	0,50	0,56	0,41	0,38	0,48	0,43	0,40	0,37	0,38	0,30	0,45	0,50
SO_4 (mg/l)	0,68	0,30	0,78	0,30	0,31	0,36	0,24	0,25	0,29	1,70	0,34	0,28	0,36	0,46
% Na	14,41	15,50	16,20	16,25	16,27	15,23	14,38	13,86	14,7	14,2	14,1	13,7	14,4	15,2
SAR	0,49	0,54	0,56	0,56	0,52	0,50	0,47	0,46	0,50	0,47	0,46	0,44	0,52	0,52
Hardness (F.S^0)	19,55	19,50	19,20	19,15	19,15	19,10	19,10	19,95	20,90	19,50	19,70	18,60	17,50	17,20
Total Salt (ppm)	260	257	256	255	258	260	269	277	292	292	259	259	245	240
NH_3 (mg/l)	0,113	0,027	0,150	-	0,063	-	0,173	-	0,315	0,212	-	-	0,011	0,150
Kal. Sod. Kar. (RSC)	0,00	0,00	0,02	0,00	0,02	0,00	0,00	0,02	0,09	0,00	0,00	0,07	0,02	0,02
(-)	Not Measured (some technical problems occured)													

Table 2: Benthic Algae of Asartepe Dam

TAXON	**Habitat**		
	Ep	**Ef**	**El**
CYANOPHYTA			
Anabaena affinis Lemmermann (Figure 9.1.e.)	-	+	+
Anabaena inaequalis (Kuetz.) Bornet & Flahault (Figure 9.1.f.)	+	+	+
Chroococcus turgidus (Kuetz.) Naeg. (Figure 9.1.b.)	-	+	+
Dactylococcopsis acicularis Lemmermann (Figure 9.1.c.)	+	+	+
Lyngbya taylorii Drouet & Stricklan (Figure 9.2.f.)	-	+	+
Merismopedia elegans Lemmermann (Figure 9.1.d.)	+	+	+
Merismopedia punctata Meyen	-	+	+
Microcystis viridis (A. Br.) Lemm. (Figure 9.1.a.)	-	+	+
Nostoc commune Vaucher	-	+	+
Nostoc pruniforme Ag.	-	+	+
Oscillatoria curviceps C.A. Agardh (Figure 9.2.a.)	-	+	+
Oscillatoria granulata Gardner	-	+	+
Oscillatoria prolifica (Grev.) Gomont. (Figure 9.2.b.)	+	+	+
Oscillatoria splendida Graville	-	+	+
Oscillatoria subbrevis Schmidle (Figure 9.2.d.)	+	+	-
Oscillatoria tenuis C.A. Agardh (Figure 9.2.c.)	-	+	+
Phormidium favosum (Bory) Gomont	-	+	-
Phormidium subfuscum Kuetzing	+	+	-
Phormidium tenue (Menegh) Gomont (Figure 9.2.e.)	-	+	+
Spirulina laxa G.M. Smith (Figure 9.1.g.)	-	+	+
Spirulina major Kuetzing (Figure 9.1. h.)	-	+	+
Spirulina princeps (West & West) G.S. West	-	+	+
Spirulina subsalsa Oersted	-	+	+
CHLOROPHYTA			
Actinastrum hantzschii Lagerheim. (Figure 9.4 j-k.)	+	+	+
Ankistrodesmus lundbergii (Lundb.) Korsh. (Figure 9.3.k.)	+	+	+
Chara vulgaris L.	-	+	-
Chlamydomonas polypyrenoideum Prescott (Figure 9.2.ı.)	+	+	+
Chlamydomonas snowii Printz. (Figure 9.2.g-h.)	+	+	+
Chlorella vulgaris Beyernick	+	-	+
Closterium acutum Breb.	+	+	+
Closterium acutum var. variabile (Lemm.) Krieg.	-	-	+
Closterium dianae Ehrenberg (Figure 9.4.n.)	-	+	+
Closterium gracile Breb ex. Ralfs	+	+	-
Closterium leibleinii Kütz. Ex Ralfs	-	+	+
Coelastrum microsporum Naeg. (Figure 9.3. f.)	-	+	+
Coelastrum reticulatum (Dang.) Lemm.	+	-	-
Coelastrum sphaericum Naeg. (Figure 9.3.g.)	+	-	+
Cosmarium botrytis Menegh. (Figure 9.4.o.)	+	+	-
Cosmarium granatum Breb. (Figure 9.5.a.)	-	+	+
Cosmarium monomazum Lund. (Figure 9.5.b.)	+	+	+
Cosmarium obtusatum (Schmidle) Schmidle (Figure 9.5.c-d.)	-	+	+
Cosmarium sp. (Figure 9.5.e.)	-	+	-
Dictyosphaerium pulchellum Wood. (Figure 9.3.j.)	+	+	-
Lagerheimia citriformis (Snow) G.M. Smith	-	+	+
Lagerheimia subsalsa Lemm.	-	+	+
Micractinium pusillum Fres.	+	-	+
Oedogonium inclusum Hirn.	-	+	-
Oocystis borgei Snow	+	+	+
Oocystis crassa Wittrock in Wittrock & Nodrstedt (Figure 9.3.h.)	-	+	-
Oocystis gigas Archer (Figure 9.3.ı-i.)	-	-	+
Oocystis pusilla Hansgirg	+	+	+
Palmadictyon viride Kuetzing	-	+	-
Pediastrum boryanum (Turp.) Menegh. (Figure 9.3.c.)	+	+	+
Pediastrum duplex Meyen	-	-	+
Pediastrum simplex Meyen (Figure 9.3.d-e.)	-	+	-

Scenedesmus acuminatus (Lagerh) Chod.	+	+	+
Scenedesmus acuminatus var. biseriatus Reinsch	+	+	+
Scenedesmus arcuatus Lemmerman	+	+	+
Scenedesmus bijugatus (Turp.) Lagerheim. (Figure 9.4.c.)	+	+	+
Scenedesmus dimorphus (Turp.) Kuetzing (Figure 9.4.d.)	+	+	+
Scenedesmus obliquus var. alternans Christjuk (Figure 9.4.e.)	+	+	+
Scenedesmus quadricauda (Turp.) Breb. & Goodey (Figure 9.4.f-g.)	+	+	+
Scenedesmus quadricauda var. abundans Kirchn.	+	+	+
Scenedesmus quadricauda var. quadrispina (Chod.) G. M. Smith. (Figure 9.4.h.)	+	+	-
Scenedesmus quadricauda var. longispina Smith	-	+	+
Scenedesmus spinosus Chod.	+	+	-
Scenedesmus sp. (Figure 9.4.ı.)	-	+	-
Spirogyra daedaleoides Czurda	+	+	+
Spirogyra ellipsospora Transeau (Figure 9.4.l.)	-	+	-
Spirogyra gratiana Transeau (Figure 9.4.m.)	-	+	+
Spirogyra subsalsa Kuetzing	-	+	+
Staurastrum cyclacentum G.S. Mest. (Figure 9.5. f-g.)	+	+	+
Tetraedron incus (Teiling) G.M. Smith (Figure 9.4.a.)	+	+	-
Tetraedron minimum Hansg. (Figure 9.4. b.)	+	+	+
Tetraedron pentaedricum West & West	-	-	-
Tetrastrum triacanthum Korsh. (Figure 9.4.i.)	-	+	+
Ulothrix aequalis Kuetzing (Figure 9.3.a.)	-	+	+
Ulothrix subtilissima Rabenhorst (Figure 9.3.b.)	-	+	+
EUGLENOPHYTA			
Euglena acus Ehr. (Figure 9.5.h-ı.)	+	+	+
Euglena acus var. rigida Huebner (Figure 9.5.i.)	-	-	+
Euglena polymorpha Dang. (Figure 9.5.j.)	+	+	+
Euglena proxima Dangeard (Figure 9.5. k.)	-	+	+
Euglena spirogyra Ehrenberg	+	+	-
Euglena sp.	-	+	+
Phacus acuminatus Stokes (Figure 9.6. a.)	+	-	+
Phacus caudatus Huebner (Figure 9.6. b.)	+	+	-
Phacus lemmermannii (Swir.) Skvortzow	-	+	+
Trachelomonas dybowskii Drezepolski ex Deflandre	+	+	-
Trachelomonas hispida var. coronata Lemmermann ex Deflandre (Figure 9.6.c-d.)	+	+	+
Trachelomonas lacustris Drezepolski	-	+	+
Trachelomonas volvocina Ehrenberg (Figure 9.6.e.)	-	+	+
CHRYSOPHYTA			
Dinobryon sertularia Ehrenberg (Figure 9.6. f.)	+	+	+
PYRROPHYTA			
Ceratium hirundinella (Müll.) Schrank (Figure 9.6. h-ı.)	+	+	+
Glenodinium quadridens (Stein) Schiller (Figure 9.6. g.)	+	+	+
Peridinium aciculiferum (Lemm.) Lemm.	+	-	+

Ep: Epipelic, Ef: Epiphytic, El: Epilitic

DISCUSSION

In this study, a total of 95 algae species were identified. 55 species were belong to *Chlorophyta*, 23 to *Cyanophyta*, 13 to *Euglenophyta*, 3 to *Pyrrophyta* and 1 to *Chrysophyta, respectively.*. *Chlorophyta* made 57, 8 % of total species.

Seasonal variation influenced physical and chemical factors in Dam, especially water flow can influence algal population density and by reason of influence to food chain.

Chlamydomonas, Oocystis, Ulothrix, Spirogyra, Pediastrum from Chlorophyta members were seen in high numbers than *Oscillatoria* on 1th of April 2003*, Spirulina* was dominant organism at many stations.

Scenedesmus, Pediastrum, Spirogyra, Coelastrum, Oscillatoria and *Spirulina* were dominant organisms on 11th of May 2003. *Ooedogonium, Ulothrix* and *Merismopedia* were seen in low numbers in May 2003.

Phacus and *Trachelomonas* were dominant organisms on 8th of June 2003. *Euglena, Ceratium* and *Cosmarium* were seen in low numbers in this month.

Dinobryon was dominant at each station on 13th of July 2003. *Scenedesmus, Spirogyra, Glenodinium*, *Pediastrum, Oscillatoria, Merismopedia, Euglena* were moderately abundant. Particularly members of *Chlorophyta* and *Chrysophyta* showed an important numerical increase on this date. *Lyngbya, Spirulina, Closterium* were seen in low numbers on date.

Glenodinium and *Dinobryon* were dominant organisms at all stations on 9th of August 2003. *Glenodinium* and *Ceratium* were first seen on June 2003 and reached the highest density in this period. *Lyngbya, Spirulina, Phacus, Pediastrum* were seen in low numbers on this date.

Oscillatoria was the most dominant organism on 14th of September 2003, 880 individual/ml, followed by *Tetraedron* with 840 individual/ml. *Chroococcus, Spirulina* and *Cosmarium* were seen in low numbers in that month. *Oscillatoria* (1620 individual/ml) and *Trachelomonas* (1280 individual/ml) were seen in the highest density on 5th of October 2003. *Chlamydomonas, Tetraedron* and *Merismopedia* were moderatelly abundant. *Oocystis*, *Spirulina* and *Glenodinium* were commonly seen on that date, *Dinobryon, Lyngbya, Ulothrix* and *Coelastrum* were rarely seen during the same period.

Oscillatoria (880 individual/ml) was the dominant organism on 9th of November 2003 followed by *Chlamydomonas* (720 individual/ml). *Spirulina* (500 individual/ml) was seen in the highest numbers during the whole study period. *Trachelomonas, Oocystis, Scenedesmus* and *Tetraedron* were moderatelly abundant. *Ulothrix, Lyngbya* and *Phacus* were seen in low numbers.

Chlamydomonas (2000 individual/ml) was seen at the highest density on 14th of December 2003. *Coelastrum, Spirogyra, Dinobryon, Merismopedia* and *Trachelomonas* were rare.

Samples were not taken due to bad weather conditions in January 2004.

Oocystis was the dominant organism on 8th of February 2004. *Oscillatoria, Chlamydomonas* and *Staurastrum* were moderately abundant. Nevertheless, the total numbers of organism were moderately abundant at all stations. *Closterium, Pediastrum, Scenedesmus, Phormidium, Spirulina* and *Euglena* were seen in low numbers that time.

Chlamydomonas was the dominant genus on 14th of March 2003 and followed by *Oscillatoria* and *Oocystis*. Other genus was seen in low numbers. The total number of organisms and diversity increased on 18th of April 2004. *Chlamydomonas* (1660 individual/ml) was the dominant organism. *Pediastrum, Anabaena* and *Lyngbya* were seen in low numbers.

All organisms' number increased on 23th of May 2004. *Actinastrum* (820 individual/ml/), which was seen first, was dominant organism in this month. *Scenedesmus, Coelastrum, Chlamydomonas, Pediastrum, Tetraedron, Merismopedia, Oscillatoria,* and *Trachelomonas* were abundant. *Cosmarium, Lyngbya* and *Phacus* were seen in low numbers.

Actinastrum, which became dominant organism in the previous month, was seen in low numbers on June 2004. Besides *Cosmarium,* which was seen in low numbers in the previous month, was dominant organism in this month. *Scenedesmus, Tetraedron, Merismopedia, Glenodinium* and *Trachelomonas* were moderatelly abundant. *Lyngbya, Spirulina, Spirogyra* and *Dictyosphaerium* were seen in low numbers.

95 species were identified in Asartepe Dam Lake. *Scenedesmus* was represent by 12 species in Dam;*Oscillatoria* and *Euglena* were represented by 6 species, *Closterium* and *Cosmarium* by 5 species; *Oocystis, Spirogyra, Spirulina* and *Trachelomonas* by 4 species, respectively (Figure 2).Other genus was represented in low numbers.

Chlorophyta made 57,8 % (Fig.3), *Cyanophyta* made 24,2 % (Fig.4), *Euglenophyta* made 13,6 % (Fig.5), *Pyrrophyta* made 3,15 % (Fig.6) and *Chrysophyta* made 1,05 % (Fig.7) of the littoral algae of the dam .

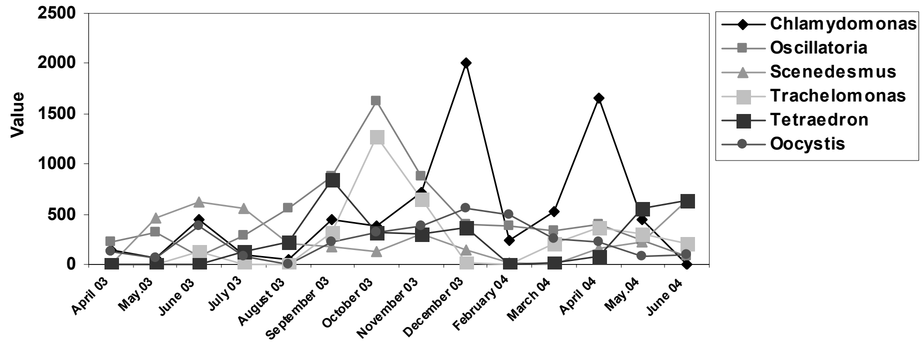

Figure 2. Seasonal variations in the algae of Asartepe Dam.

Chlamydomonas species are oftenly collected in dams around Ankara [20]. They were abundant in Samsun-İncesu River [21] but they were very rare in Sakarya River [22], Ankara River [23] and Çubuk River [24-25]. *Chlamydomonas* was seen in high abundance (7180 individual/ml) in all months in Asartepe Dam although it was represented by two species.

Chlorophyta members were dominant in Manisa-Marmara Lake [18], in Gölcük planktonic algae [26], in Kurtboğazı and Çubuk Dams [20] and many species were the same as in Asartepe Dam. Algae of Sarıyar Dam Lake were similar to Asartepe Dam [27]. Although Ankara [23], Çubuk [24-25] and Sakarya Rivers' [22] species of *Scenedesmus* were the same as Asartepe Dam, species numbers were lower.

Scenedesmus sp. (3620 individual/ml), which represents by 12 species, was the third abundant organism in all month in Asartepe Dam. *Tetraedron* genus was not seen in Ankara and Sakarya River but it was seen as the forth species in all months in Asartepe Lake (3460 individual /ml).

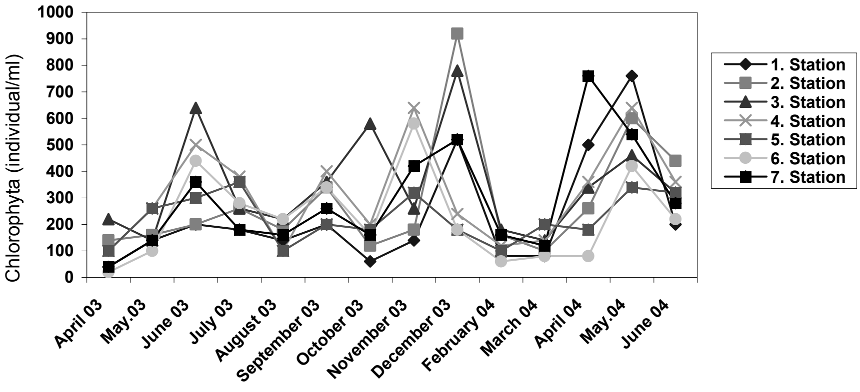

Figure 3. Seasonal variations Chlorophyta members from the sampling stations in Asartepe Dam.

Species diversity of *Cyanophyta* was low. Generally, members of *Oscillatoria* were widespread during the study period in all months. Species of *Spirulina* were low in Sakarya River and Çubuk Stream and so in Asartepe Lake.

Species diversity of *Euglenophyta* was low Euglena *polymorpha* was collected in Sakarya River, Ankara Stream, Çubuk Stream and Asartepe Dam.

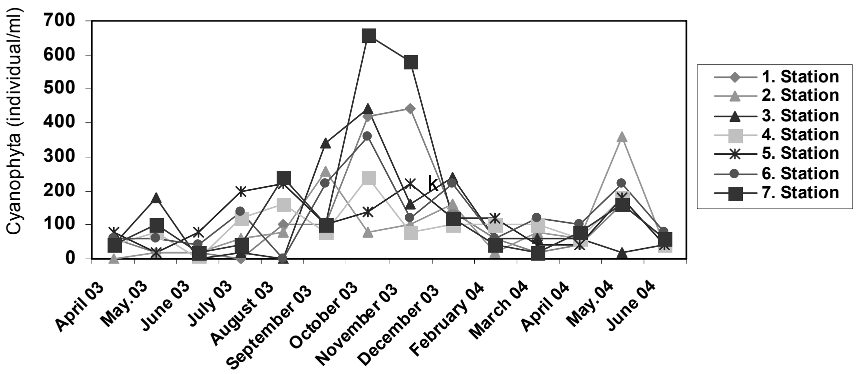

Figure 4. Seasonal variations Cyanophyta from the sampling stations in Asartepe Dam.

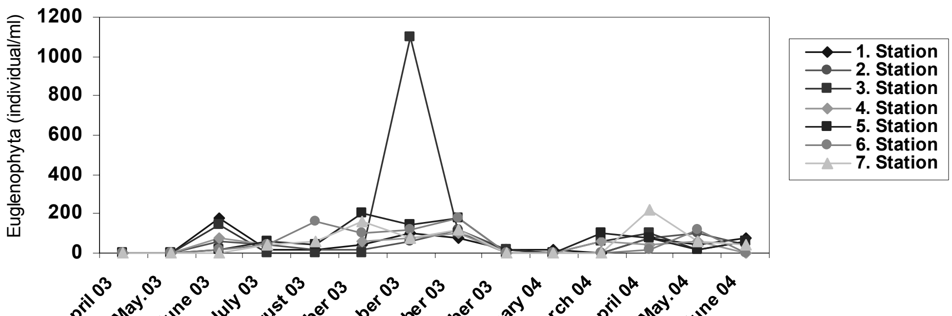

Figure 5. Seasonal variation Euglenophyta from the sampling stations in Asartepe Dam.

Pyrrophyta and *Chrysophyta* were seen Asartepe Dam although they were not seen in Sakarya River and Ankara Stream. Generally, species of *Glenodinium* and *Dinobryon* were seen very in some months. *Dinobryon sertularia* and *Ceratium hirundinella* were determined in Çubuk Stream and Asartepe Dam.

Sunlight, temperature, salt of nutrient and physical-chemical characteristics have a great influence on the algae. Algae have a maximum density on spring and autumn [9]. Temperature influence biological, chemical and physical activities in the water. Thus, oxygen consumption increases. Oxygen level is related to temperature, salinity and current, photosynthetic activities (algae and macrofits) and atmospheric pressure in the natural waters. Values of water temperature change between 2-

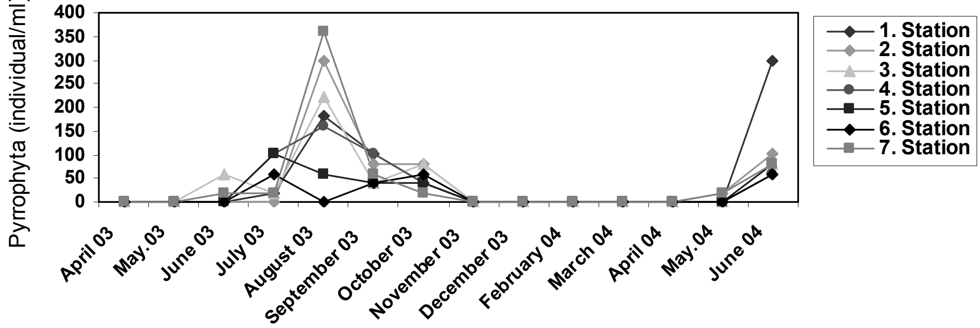

Figure 6. Seasonal variation Pyrrophyta from the sampling stations in Asartepe Dam

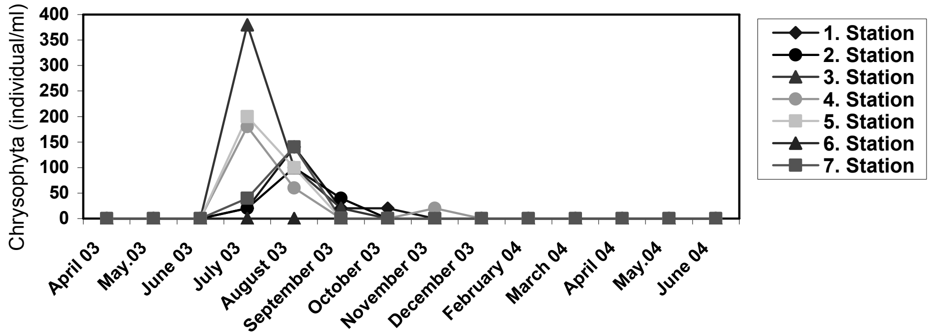

Figure 7. Seasonal variation Chrysophyta from the sampling stations in Asartepe Dam

24, 5 ^{0}C in Asartepe Dam (Fig. 8). Water temperature increases in spring months than decreases in winter months depending upon changes of air temperature [28].

Values of oxygen solubility different based rate on photosynthesis and level of nutrients in the aquatic environment. Solubility of oxygen decreases in water when temperature increases [29]. Generally, concentration of oxygen is 10 mg/l in natural oligotrophic water (20 ^{0}C) [30].

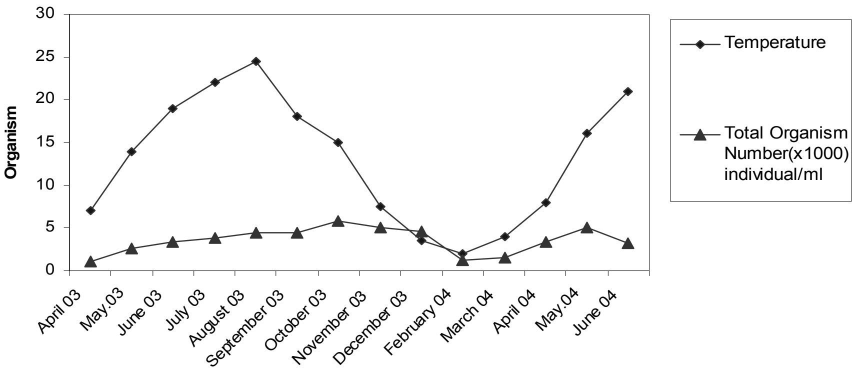

Figure 8. Seasonal variation in Temperature and Total Organism in Asartepe Dam.

pH is shown between 6,06-8,64 in Asartepe Dam. Ph 8.64 was measured on April 2004. The ions carried by spring rains are the cause of this increase. Ph changes between 6-9 in natural lakes and streams [31].

Temperature and conductivity, which were measured in Asartepe Dam, were related. Nutrients increased in spring months. In addition, density of salts increases because of evaporation as linked with increase of temperature. Therefore conductivity shows a parallel increase with temperature of water. Conductivity was 105-500 µmhos/cm [32].

In addition, particularly Cl^- and Na^+ determine conductivity. This and same minerals are important source of salinity. Generally, salinity value increases with evaporation in shallow lakes [30]. The diversity of all algae decreased in December 2003 and February 2004 due to increase of salinity. The source of nitrogen compounds has atmospheric nitrogen and agricultural activity, domestic and industrial wastes in lake water. Source of ammonia was the waste from fish and other organisms.

Values of ammonia changes between 0,01-0,31 mg/l in Asartepe Dam. *Cyanophyta* members were lower than *Chlorophyta*. Ca^{++} and Mg^{++} have vital importance in plants, which photosynthesize in the aquatic environment. Mg is in the structure of chlorophylls. Concentration of Mg has a great effect on algae growing in lakes. Of this result, level of trophic is influenced [29]. Concentration of Ca increases with rains in winter. The life becomes active with the increase in the temperature of water and environment after 2003 April. Consumption of Ca begins in lake. Therefore decrease of values of Ca was observed.

Values of Sulphate changes between 0,27-1,70 mg/l in Asartepe Dam. Alkalinity, which shows the water getting proton capacity, is formed by the reaction of CO_2 and water and producing H_2CO_3 and the disintegration of structure. It becomes HCO_3, CO_3 and OH. These ions adjust the pH of water and control the acidity [31]. Values of HCO_3 changed between 2,50 - 4,07 mg/l and CO_3 0,01-1,04 mg/l.

Hardness consist Ca^{++} and Mg^{++} in water. Hardness values changed between 17,20-20,9 Franch hardness unit in Asartepe Dam. Value of 17-27 is defined as low hard water according to Franch hardness units [31]. Hardness level is fallen during the study. Asartepe Dam waters are fed by two streams and precipitation. Plant cover was poor in lake surroundings. *Populus sp*. and *Salix sp*. are available in side of the dam.

Precipitation waters arrive at lake in short time because plant cover is little. Also due to a pasture, Organic material is mixed to lake water. These mixes have influence on the chemistry of lake water. Also this affects turbidity [5].

CONCLUSION

Asartepe Dam Lake, which becomes important freshwater source of Ankara. Use of this water can dangerous for human health because of over growing of algae. Especially, Cyanophyceae population produces toxic substance. This situation causes death of fish. The physical and chemical parameters are evaluated. The lake is in a transition period to eutrophic from mesotrophic, according to the Wetzel [29]. Eutrophic lakes are productive algal density is high in spring months. Asartepe Dam is to be protected, otherwise economic, ecological and biological loss is inevitable.

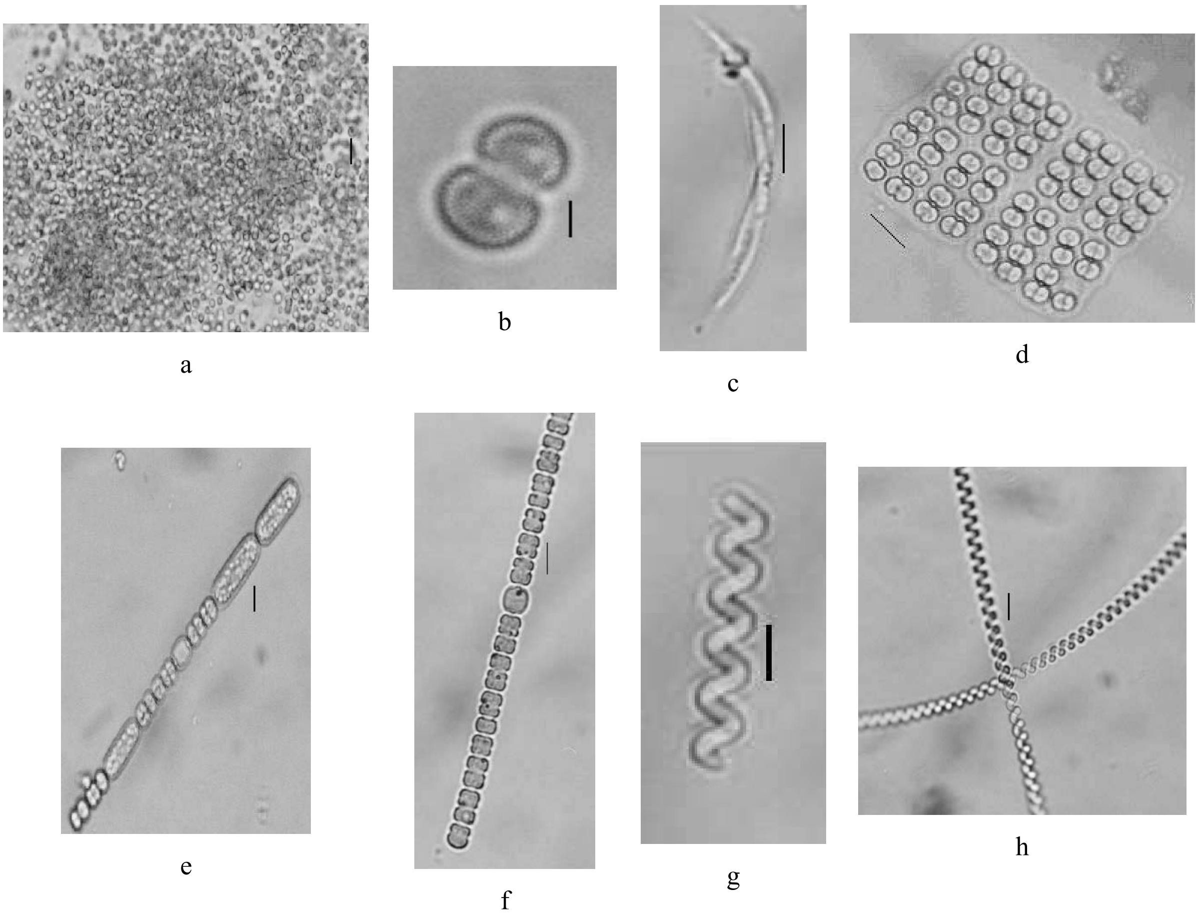

Figure : 9.1.
a. Microcystis viridis (A. Br.) Lemm. b. Chroococcus turgidus (Kuetz.) Naeg.
c. Dactylococcopsis acicularis Lemmermann d. Merismopedia elegans Lemmermann
e. Anabaena affinis Lemmermann f. Anabaena inaequalis (Kuetz.) Bornet & Flahault
g. Spirulina laxa G.M. Smith h. Spirulina major Kuetzing

(Scales 10 µm)

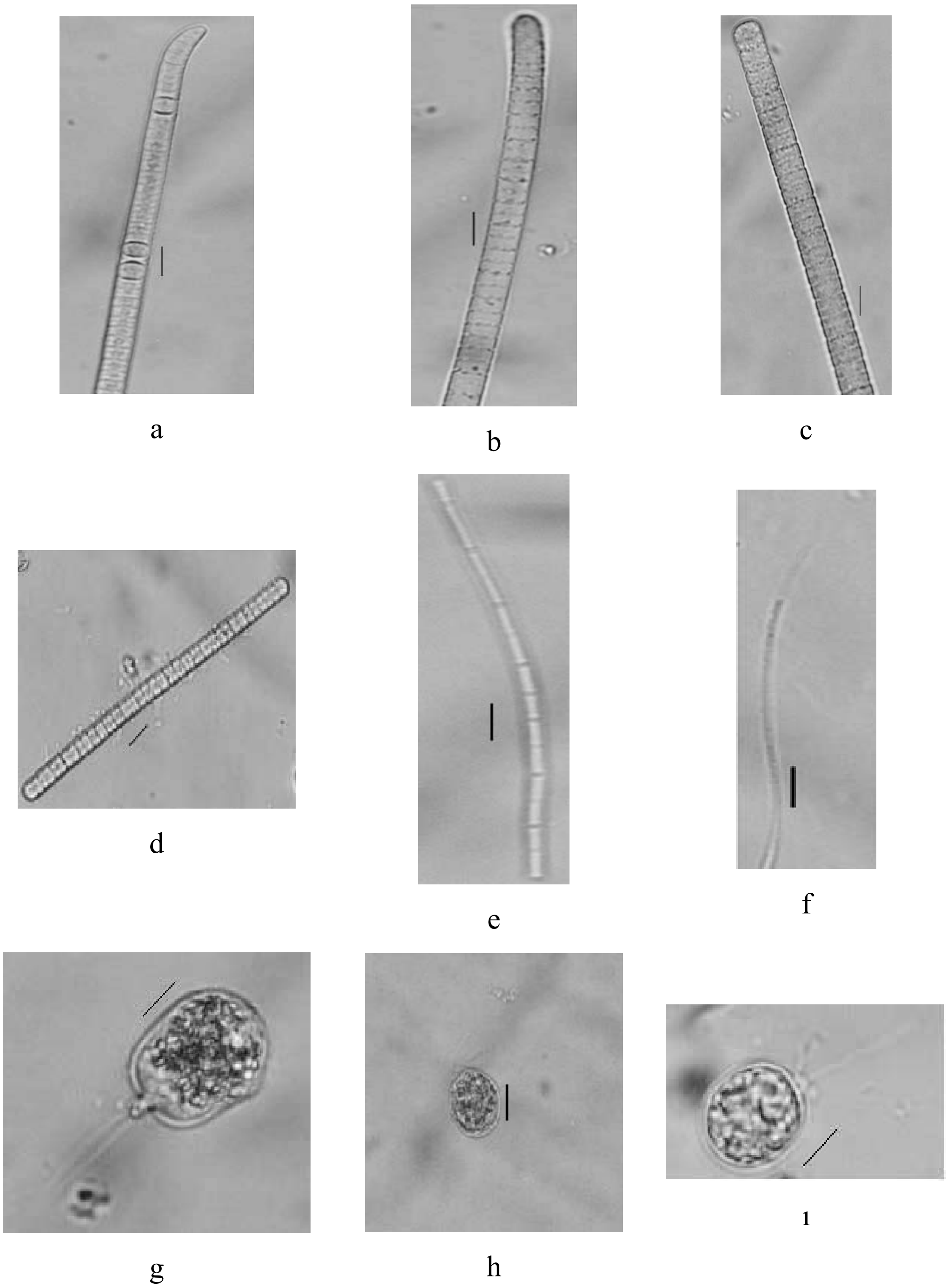

Figure: 9.2.
a.Oscillatoria curviceps C.A. Agardh b. Oscillatoria prolifica (Grev.) Gomont.
c. Oscillatoria tenuis C.A. Agardh. d. Oscillatoria subbrevis Schmidle e. Phormidium tenue (Menegh) Gomont f. Lyngbya taylorii Drouet & Strickland g-h. Chlamydomonas snowii Printz. I. Chlamydomonas polypyrenoideum Prescott

(Scales 10 µm)

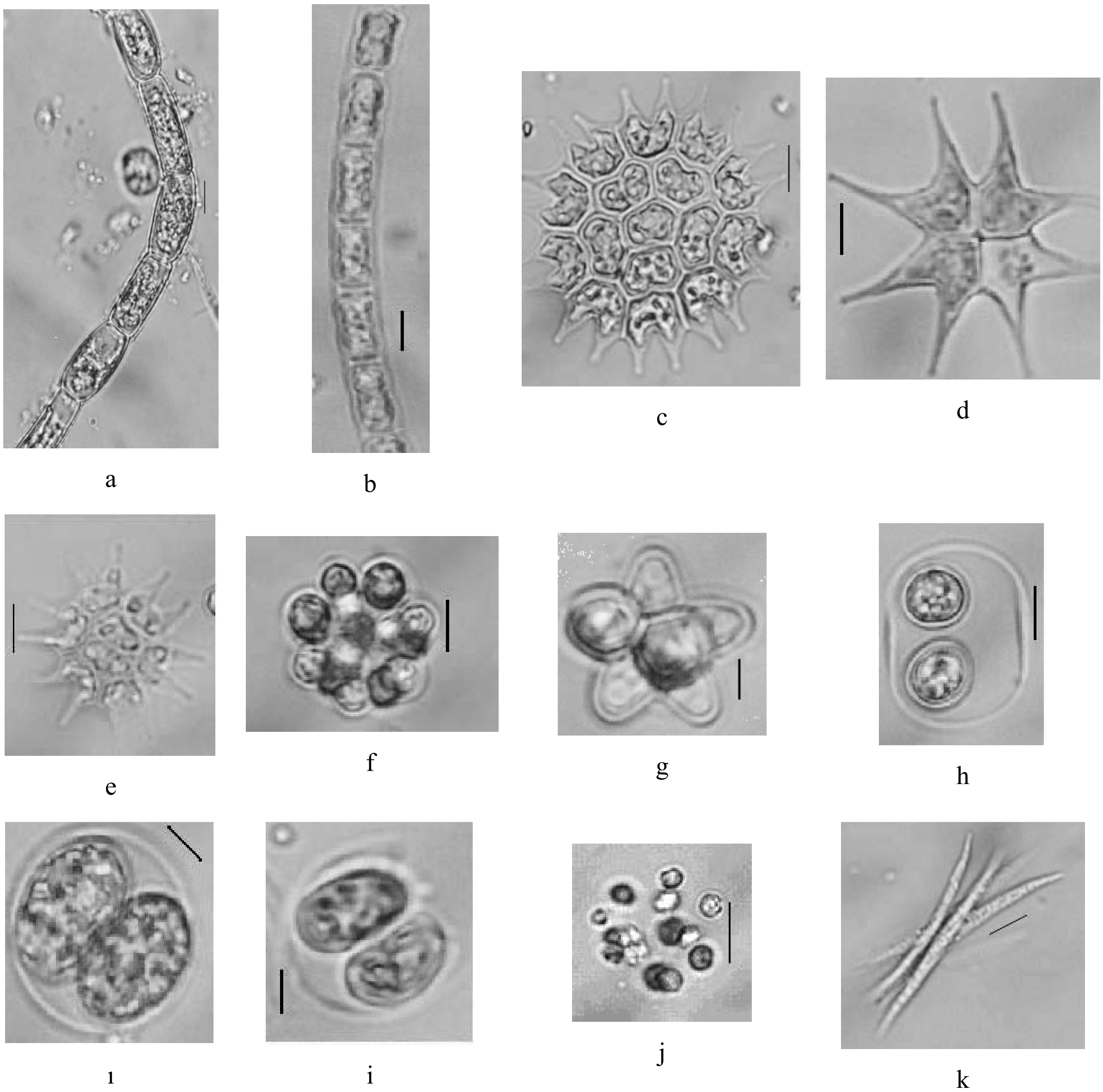

Figure: 9.3.
a. Ulothrix aequalis Kuetzing b. Ulothrix subtilissima Rabenhorst c. Pediastrum boryanum (Turp.) Menegh. d-e. Pediastrum simplex Meyen f. Coelastrum microsporum Naeg.
g. Coelastrum sphaericum Naeg. h. Oocystis crassa Wittrock in Wittrock & Nodrstedt
ı-i. Oocystis gigas Archer j. Dictyosphaerium pulchellum Wood. k. Ankistrodesmus lundbergii (Lundb.) Korsh.
(Scales 10 µm)

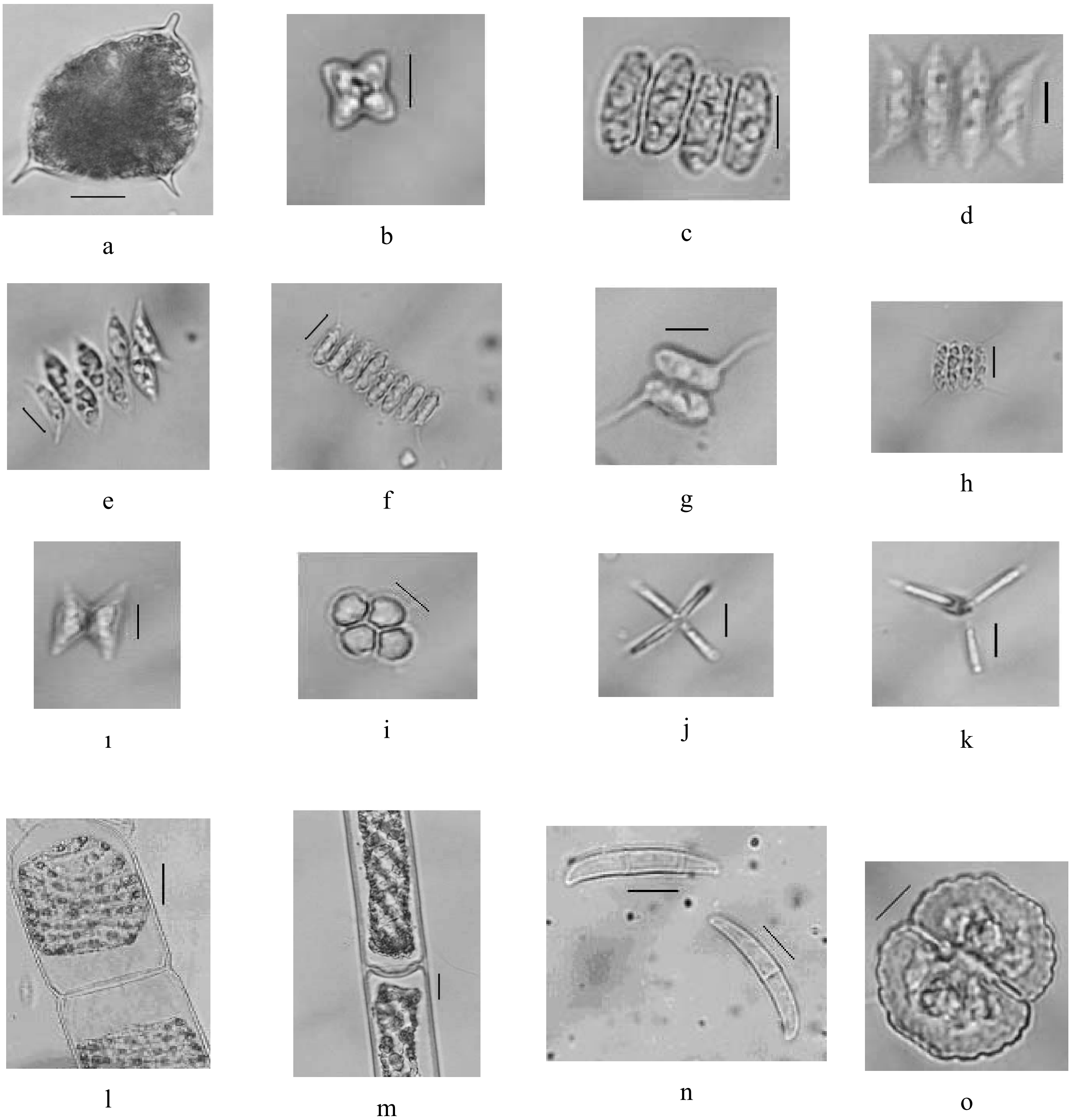

Figure: 9.4.
a. Tetraedron incus (Teiling) G.M. Smith b. Tetraedron minimum Hansg. c. Scenedesmus bijugatus (Turp.) Lagerheim. d.Scenedesmus dimorphus (Turp.) Kuetzing e. Scenedesmus obliquus var. alternans Christjuk f-g. Scenedesmus quadricauda (Turp.) Breb.&Goodey h. Scenedesmus quadricauda var. quadrispina (Chod.) G. M. Smith. ı. Scenedesmus sp. i. Tetrastrum triacanthum Korsh. j-k. Actinastrum hantzschii Lagerheim. l. Spirogyra ellipsospora Transeau m. Spirogyra gratiana Transeau n. Closterium dianae Ehrenberg o. Cosmarium botrytis Menegh.

(Scales 10 µm)

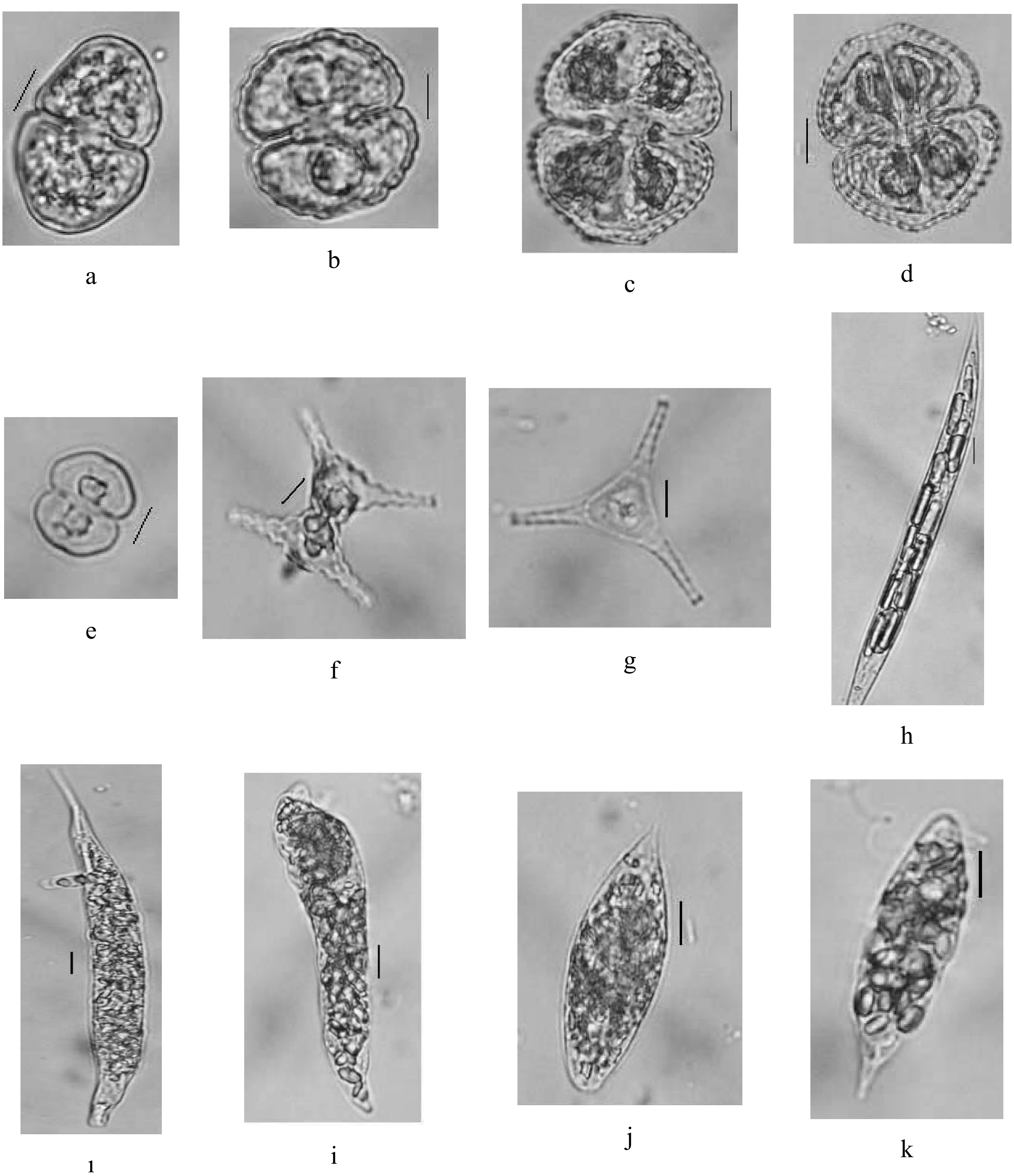

Figure: 9.5.

a. Cosmarium granatum Breb. b. Cosmarium monomazum Lund. c-d. Cosmarium obtusatum (Schmidle) Schmidle e. Cosmarium sp. f. Staurastrum cyclacentum G.S. West. (yandan görünüşü) g. (üstten görünüşü) h-ı. Euglena acus Ehr. i. Euglena acus var. rigida Huebner j. Euglena polymorpha Dang. k. Euglena proxima Dangeard

(Scales 10 µm)

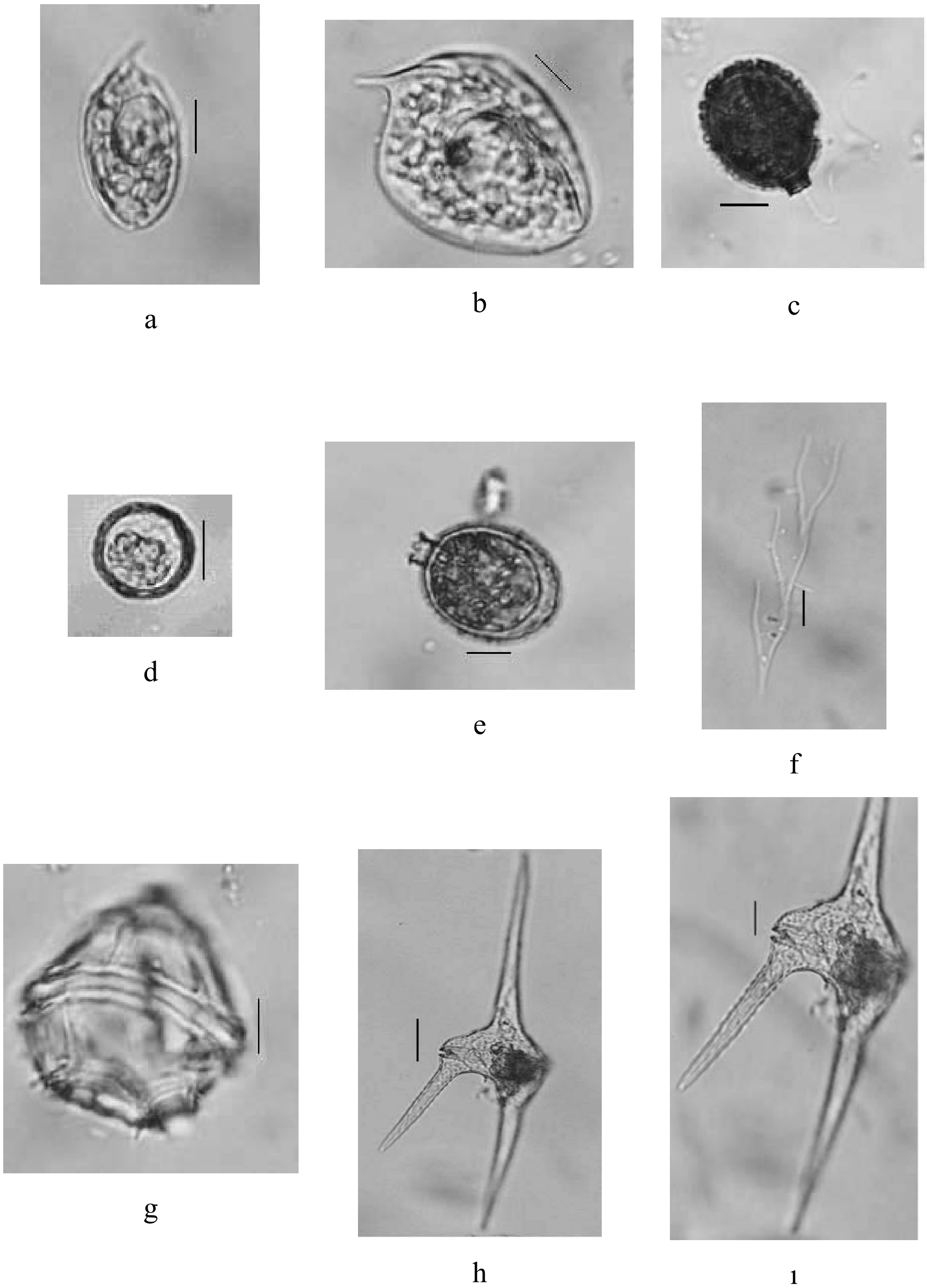

Figure: 9.6.
a. Phacus acuminatus Stokes b. Phacus caudatus Huebner c-d. Trachelomonas hispida var. coronata Lemmermann ex Deflandre
e. Trachelomonas volvocina Ehrenberg
f. Dinobryon sertularia Ehrenberg g. Glenodinium quadridens (Stein) Schiller
h-ı. Ceratium hirundinella (Müll.) Schrank

(Scales 10 µm)

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