Turkish Journal of Botany

Volume 25 | Number 4 Article 2

1-1-2001

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Turk J Bot
25 (2001) 177-186

Research Article

Epipelic and Epilithic Algae of Değirmendere River (Trabzon-Turkey)

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Received: 30.03.2000
Accepted: 19.01.2001

Abstract: The algae of Değirmendere River were investigated in the samples collected from different habitats (epipelic, epilithic) in five stations between October 1998 and September 1999. The flora consisted of 74 taxa belonging to *Bacillariophyta* (52), *Chlorophyta* (10), *Cyanophyta* (9) and *Euglenophyta* (3). *Bacillariophyta* was dominant in the algal flora. *Aulacosira varians* Ag. (*Coscinodiscaceae*), *Amphora ovalis* Kütz. (*Cymbellaceae*), *Cocconeis placentula* var. *euglypta* (Ehr.) Cleve (*Achnanthaceae*), *Ceratoneis arcus* Kütz. (*Fragilariaceae*), *Cymbella minuta* Hilse ex Rabh. (*Cymbellaceae*), *Didymosphenia geminata* (Lyngb.) M. Schmidt. (*Gomphonemaceae*), *Navicula odiosa* Wallace (*Naviculaceae*), *Surirella ovata* Kütz. (*Surirellaceae*) and *Synedra ulna* (Nitzsch) Ehr. (*Fragilariaceae*) were the most common taxa in the algal flora. While the maximum density of the epipelic community was found to be 12083 cells/cm^2 in August, the minumum density was 3855 cells/cm^2 in December. The speed of the water current has a great impact on the development of the algal flora.

Key Words: Epipelic, Epilithic, Algal Community, Değirmendere River

Değirmendere (Trabzon/Türkiye) Deresi'nin Epipelik ve Epilitik Alg Florası

Özet: Değirmendere deresi algleri Ekim 1998 ve Eylül 1999 tarihleri arasında seçilen beş istasyonda, farklı habitatlardan (epipelik, epilitik) toplanan örneklerde incelenmiştir. Flora *Bacillariophyta*, *Chlorophyta*, *Cyanophyta* ve *Euglenophyta* bölümlerine ait toplam 74 taksondan oluşmuştur. *Bacillariophyta* florada hakim alg grubudur. *Aulacosira varians* Ag. (*Coscinodiscaceae*), *Amphora ovalis* Kütz. (*Cymbellaceae*), *Cocconeis placentula* var. *euglypta* (Ehr.) Cleve (*Achnanthaceae*), *Ceratoneis arcus* Kütz. (*Fragilariaceae*), *Cymbella minuta* Hilse ex Rabh. (*Cymbellaceae*), *Didymosphenia geminata* (Lyngb.) M. Schmidt (*Gomphonemaceae*), *Navicula odiosa* Wallace (*Naviculaceae*), *Surirella ovata* Kütz. (*Surirellaceae*) ve *Synedra ulna* (Nitzsch.) Ehr. (*Fragilariaceae*) florada en yaygın taksonlar olmuştur. Epipelik kommunitenin maksimum yoğunluğu Ağustos da 12083 cells/ cm^2 iken, minimum yoğunluk Aralık ayında 3855 cells/cm^2 oldu. Su akış hızı alg florasının gelişimi üzerinde büyük bir etkiye sahiptir.

Anahtar Sözcükler: Epipelik, Epilitik, Alg Topluluğu, Değirmendere Deresi

Introduction

Değirmendere River, which has fast-flowing water, is about 53 km. It rises in the Horos and Kalkanlı mountains and flows through Maçka, Mataracı, Esiroğlu, Ayvasıl and reaches Black Sea in Trabzon (Fig. 1) (Beret, 1956).

The study area is under the influence of the North East Black Sea Region climate. In general, this region is rainy every season. There are trees, which are *Alnus* Mill., *Salix* L.and *Ulmus* L. spp. some part along the river. The river gets polluted with irrigational return flows, pollution coming from small villages, municipal wastes and organized industrial district (pers. obs.).

The aim of the study was to determine epipelic and epilithic algal flora and to examine seasonal variations of the epipelic algae in Değirmendere River.

Materials and Methods

In order to examine epipelic and epilithic algal flora of Değirmendere River five stations were chosen (Fig. 1).

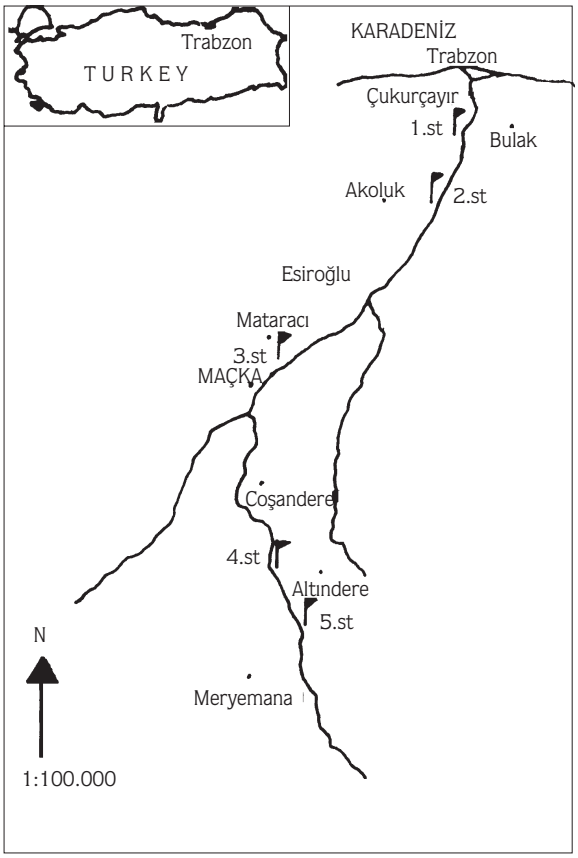


Fig. 1. Map of the Değirmendere River.

The communities were sampled as follows between October 1998 and September 1999.

Epipelic community: This community was collected by drawing a glass tube across the surface of the sediment at station IV, allowing it to fill with a mixture of sediment and water which was transferred to collecting bottles.

Epilithic community: Stones from the river bed (all stations) were brushed clean of algae and the washings cleaned with acid as outlined below.

Permanent slides were prepared after boiling in 1:1 of mixture of concentrated H_2SO_4 and HNO_3 and the clean diatoms were mounted in Naphrax high optical density mounting medium. Three hundred diatom valves were counted on each slide and used to give an estimate of their relative abundance (Round, 1953, Sladeckova, 1962). The algae except for *Bacillariophyta* were examined in temporary slides. The following works were used for identification: Hustedt (1930), Patrick and Reimer (1966, 1975), Huber-Pestalozzi (1982) and Prescott (1973). Some algae were photographed with an Olympus BH-2 research microscope.

With each sampling, the water temperature and pH were using a mercury thermometer and a WTW Dıgı 88 model pH meter. The dissolved-oxygen concentration was measured using the method of Winkler.

Results

The water temperature (mean montly values) varied from 3ºC to 20ºC ($\bar{X}$:11.5ºC). Low temperatures occured in January and the highest temperatures were found in August. The pH values fluctuated between 6.6 and 9.15 ($\bar{X}$:7.87), indicating the circum-alcaline character of the water-body. Dissolved oxygen showed fluctuations between 8.84 and 13.04 mg/lt ($\bar{X}$:10.94 mg/lt) (Table 1).

Algal Flora

A total of 74 species and varieties of algae were recorded in the Değirmendere River. *Bacillariophyta* was dominant, accounting for 52 taxa, followed in importance by *Chlorophyta* with 10 taxa, *Cyanophyta* with 9 taxa and *Euglenophyta* with 3 taxa (Table 2). The members of *Bacillariophyta* made up 70.27 % of the total taxa.

Epipelic Algal Flora

Among the taxa identified in the epipelic community, 38 to them belonged to *Bacillariophyta*, 5 to *Cyanophyta*, 4 to *Chlorophyta* and 2 to *Euglenophyta* (Table 2). The taxa belonging to *Bacillariophyta* were predominant and constituted 77.55 % of the epipelic community.

During the study period, the total density of the epipelic community showed variability and it was only represented by the members of *Bacillariophyta* in some months. While the highest numbers of the total density was 12083 cells/cm^2 in August, the lowest density was 3855 cells/cm2 in December. No algae could be found in May and June because of flooding (Fig. 4).

Most of the algal species in the epipelic community exhibited variation during the study. *Ceratoneis arcus*, for example, reached its greatest abundance (2728 cells/cm^2) in February 1999. The same sort of pattern was exhibited by *Cymbella minuta* (2827 cells/cm^2) in September 1999 (Fig. 5).

Members of *Cyanophyta*, *Chlorophyta* and *Euglenophyta* were not important in the epipelic algal flora.

Table 1. Some physical and chemical characteristics of Değirmendere river.

Months	Stations	pH	Dis. Ox. (mg/l)	Tem. (ºC)	Months	Stations	pH	Dis. Ox. (mg/l)	Tem. (ºC)
	I	8.1	9.37	17.5		I	8.3	9.80	14.5
	II	9.1	9.18	18.5		II	7.7	9.76	15.0
10.10.1998	III	7.9	9.56	16.5	21.04.1999	III	7.4	9.97	14.0
	IV	7.6	10.67	11.0		IV	7.0	10.92	10.0
	V	7.4	11.30	8.5		V	6.9	11.19	9.0
	I	7.2	10.67	11.0		I	7.8	9.37	17.0
	II	7.0	10.92	10.0		II	7.6	9.37	17.0
10.11.1998	III	7.0	10.92	10.0	26.05.1999	III	7.5	10.00	13.5
	IV	6.9	11.25	8.3		IV	7.3	10.30	12.5
	V	6.7	12.00	5.9		V	6.8	10.20	13.0
	I	7.0	11.20	8.7		I	8.3	9.97	14.0
	II	6.9	11.47	8.0		II	8.2	9.97	14.0
21.12.1998	III	7.0	11.47	8.0	18.06.1999	III	7.7	9.97	14.0
	IV	6.6	12.06	6.0		IV	7.0	10.30	12.5
	V	7.0	12.50	4.5		V	6.9	10.43	12.0
	I	8.0	11.55	7.5		I	7.9	9.01	19.0
	II	7.9	11.75	7.0		II	7.6	9.10	18.5
21.01.1999	III	7.9	11.75	7.0	22.07.1999	III	7.2	9.37	17.0
	IV	7.0	12.70	4.0		IV	6.9	9.97	14.0
	V	6.8	13.04	3.0		V	6.8	10.43	12.0
	I	7.3	10.67	11.0		I	7.3	8.84	20.0
	II	7.5	10.67	11.0		II	7.4	8.84	20.0
21.02.1999	III	7.6	10.92	10.0	22.08.1999	III	7.2	9.37	17.0
	IV	7.0	11.47	8.0		IV	7.5	9.56	16.0
	V	6.9	11.75	7.0		V	7.8	9.97	14.0
	I	7.9	10.43	12.0		I	7.2	9.97	14.0
	II	7.8	10.43	12.0		II	7.4	9.97	14.0
21.03.1999	III	7.6	11.19	9.0	19.09.1999	III	7.2	10.43	12.0
	IV	7.0	11.75	7.0		IV	7.5	10.92	10.0
	V	7.9	11.50	6.5		V	7.8	11.19	9.0

Epilithic Algal Flora

There were at least 59 taxa found in the epilithic communities, the majority of which belonged to *Bacillariophyta* (42) and it constituted 71.18 % of the epilithic algal flora. There were also 9 taxa of *Chlorophyta*, 6 of *Cyanophyta* and 2 of *Euglenophyta* (Table 2).

The most common diatoms were *Aulacosira varians* (III. station), *Ceratoneis arcus*, *Cocconeis placentula* var. *euglypta* (II. station), *Cymbella minuta*, *Didymosphenia geminata*, *Navicula odiosa* (II. and III. stations), *Surirella ovata* (I., II. and III. stations) and *Synedra ulna*, while *Cladophora sp.* was the most frequently encountered green algae especially in the summer and the autumn. *Oscillatoria spp.* were always the most abundant members of the *Cyanophyta*. *Euglenophyta* was not important in the epilithic algal flora.

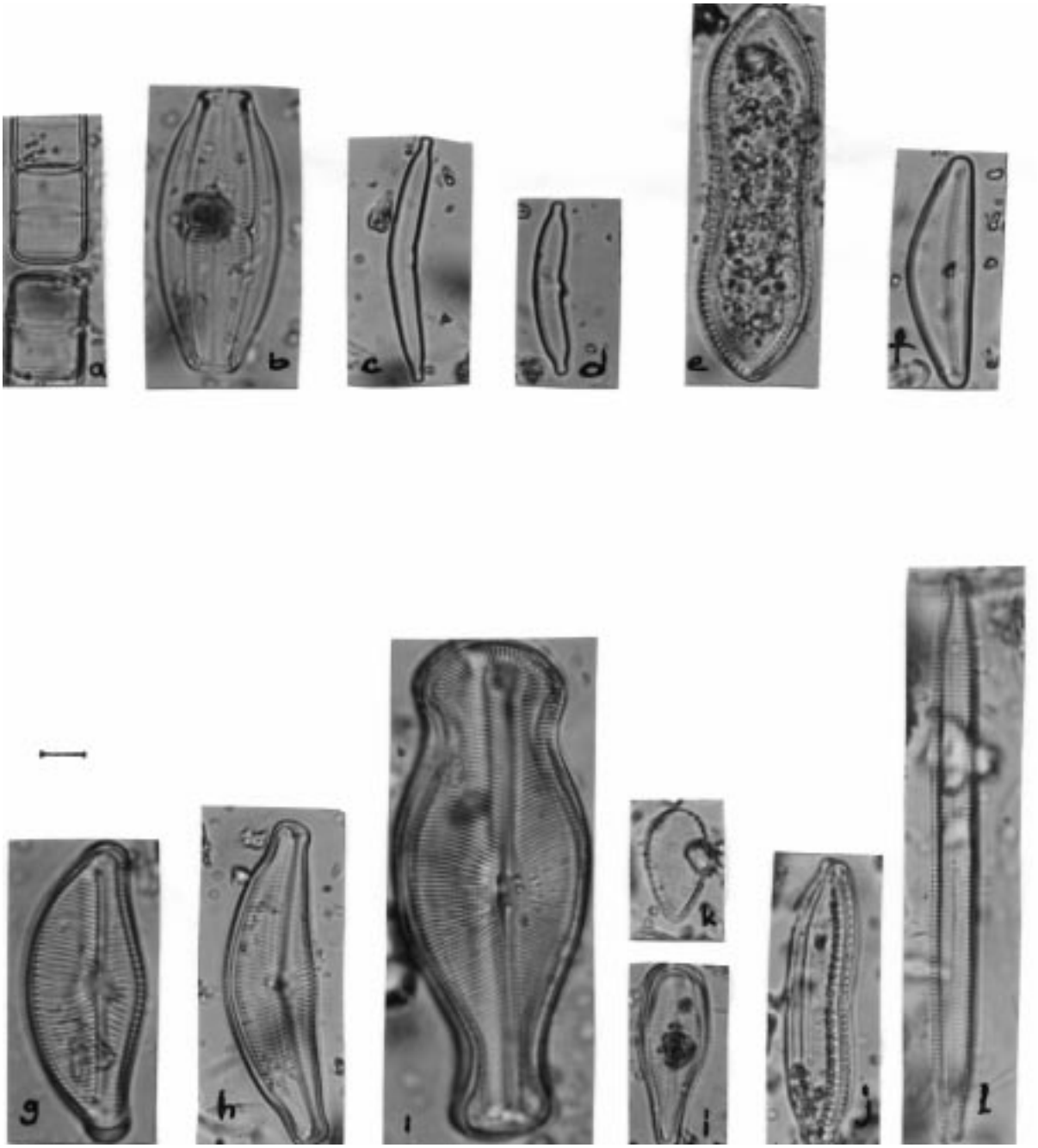
The abundances of some epilithic diatoms are presented in Table 3-6.

Table 2. List of epipelic and epilithic algae collected in Değirmendere river.

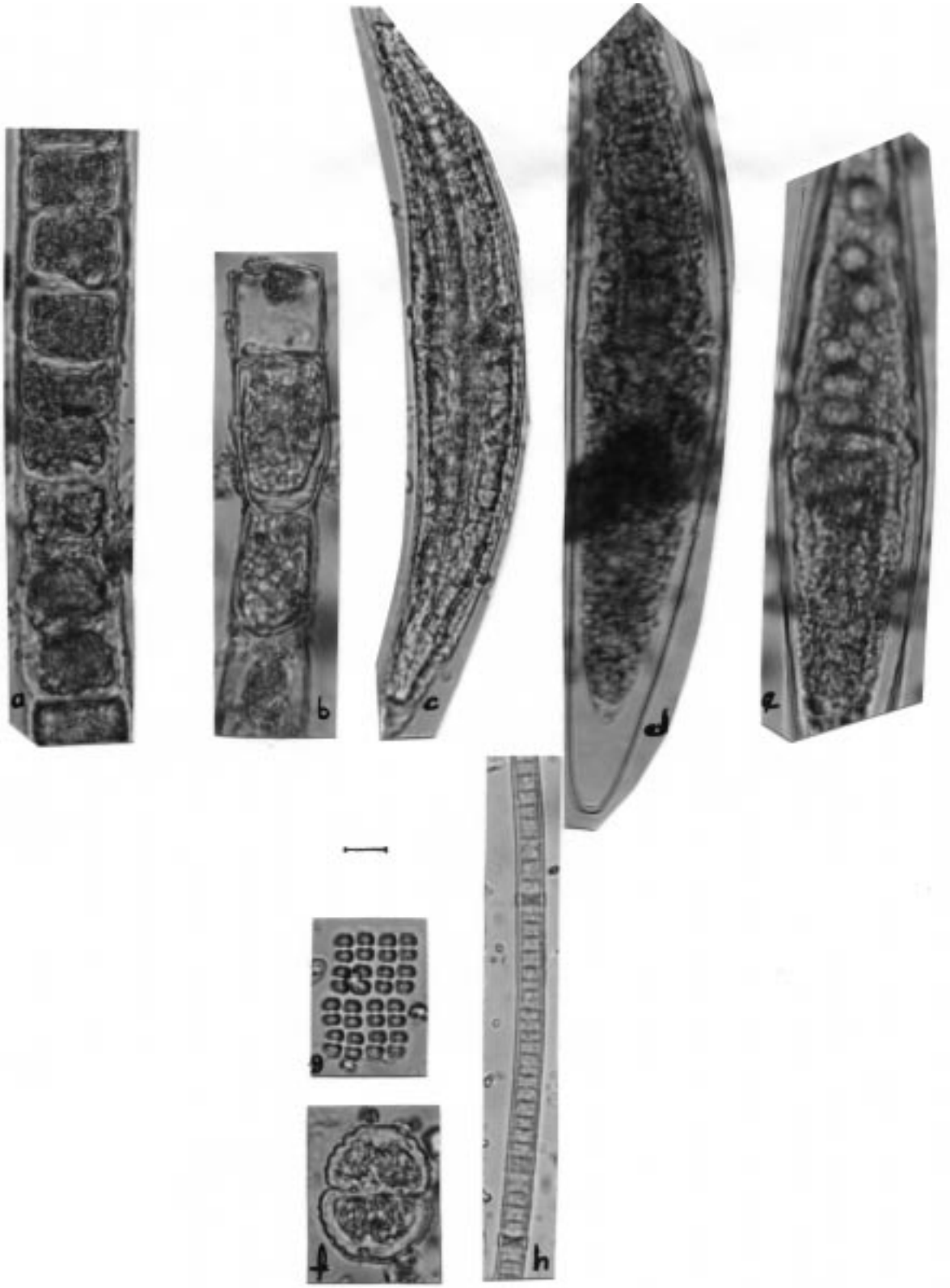
Taxa	Epipelic	Epilithic
Divisio : BACILLARIOPHYTA		
Classis : Centrobacillariophyceae		
Ordo : Centrales		
Cyclotella kützingiana Thwaites		+
Aulacosira varians A. Ag. (Fig. 2.a)	+	+
Classis : Pennatibacillariophyceae		
Ordo : Pennales		
Achnanthes minutissima Kütz.		
Amphora ovalis Kütz. (Fig. 2.b)	+	+
A. ovalis var. pediculus Kütz.	+	+
A. veneta Kütz.	+	+
Ceratoneis arcus Kütz. (Fig. 2.c)	+	+
C. arcus var. amphioxys Rabh. (Fig. 2.d)	+	+
C. arcus var. linearis Holmboe	+	+
Cocconeis placentula var. euglypta (Ehr.) Cleve	+	+
Caloneis silicula (Ehr.) Cleve	+	
Cymatopleura solea (Breb.) W. Smith (Fig. 2.e)	+	+
Cymbella affinis Kütz. (Fig. 2.f)	+	+
C. cistula (Hemprich) Grun.		+
C. cymbiformis (Ag. & Kütz) van Heurck	+	+
C. minuta Hilse ex Robh	+	+
C. prostrata (Berkeley) Cleve (Fig. 2.g)		+
C. sinuata Gregory	+	
C. tumida (Brebission) van Heurck (Fig. 2.h)	+	+
C. turgida (Gregory) Cleve	+	+
Diatoma vulgare var. brevis Grun	+	+
Didymosphenia geminata (Lyngb.) M. Schidt (Fig. 2.ı)	+	+
Eunotia pectinalis (Kütz.) Rabh.	+	
E. praerupta var. inflata Grun.		+
Fristulia vulgaris (Thwaiters) DeT	+	
Gyrosigma acuminatum Ehr.	+	
G. scalpoides var. eximia (Thwaiter)		+
Gomphonema olivaceum (Lyngb.) Kütz. (Fig. 2.i)	+	+
G. olivacoides Hust.		+
Hantzschia amphioxys (Ehr.) Grun. (Fig. 2.j)	+	+
Navicula bacillum Ehr.	+	
N. cryptocephala Kütz.	+	+
N. crtptocephala var. intermedia Grun.	+	+
N. cryptocephala var. venata (Kütz.) Grun.	+	
N. falaisiensis var. lanceola Grun.		+
N. hustedtii KraBke		+
N. radiosa Kütz.	+	+
N. rhynchocephala Kütz.		+
N. odiosa Wallace	+	+
Nitzschia sigmoidea (Ehr.) W. Smith		+
N. sublinearis Hust.	+	+
N. thermalis Kütz.	+	
Pinnularia borealis Ehr.		+
P. gibba W. Sm.		+
P. maior (Kütz.) Cleve	+	+
Rhoicospheniaa cruvata (Kütz.) Grun.		+
Surirella angustata Kütz.	+	
S. ovata Kütz. (Fig. 2.k)	+	+
S. tenera Gregory	+	
Synedra ulna (Nitzsch.) Ehr. (Fig. 2.l)	+	+
S. ulna var. oxyrhynchus (Kütz.) Van Heurck	+	+
Divisio : CHLOROPHYTA		
Classis : Chlorophyceae		
Ordo : Ulotrichales		
Ulothrix variabilis Kütz.		+
U. zonata (Weber & Mohr) Kütz. (Fig. 3.a)	+	+
U. sp.		
Classis : Oedogoniophyceae		
Ordo : Oedogoniales		
Oedogonium sp. (Fİg. 3.b)		+
Classis : Bryopsidophyceae		
Ordo : Cladophorales		
Cladophora sp.		+
Classis : Zygnemaphyceae		
Ordo : Desmidiales		
Closterium littorale Gay. (Fig. 3.c)	+	+
Cl. tumidum Johns. var. tumidum (Fig. 3.d)		+
Cl. sp. (Fig. 3.e)	+	+
Cosmarium botrytis Menegh. ex. Ralfs.		+
C. blyttii (Fig. 3.f)	+	
Divisio : CYANOPHYTA		
Classis : Cyanophyceae		
Ordo : Chroococcales		
Merismopedia sp. (Fig. 3.g)		+
Ordo : Hormogonales		
Anabaena sp.	+	
Oscillatoria agardhii Gom.	+	
O. amoena (Kütz.) Gom.	+	+
O. formosa Bory (Fig. 3.h)		+
O. limnetica Lemmermann		+
O. limosa (Roth.) C. A. Agardh	+	+
O. sancta (Kütz.) Gom.		+
O. tenuis C. A. Agardh	+	
Divisio : EUGLENOPHYTA		
Classis : Euglenophyceae		
Ordo : Euglenales		
Euglena sp.	+	+
Phacus sp.	+	
Trachelomonas sp.		+

Discussion

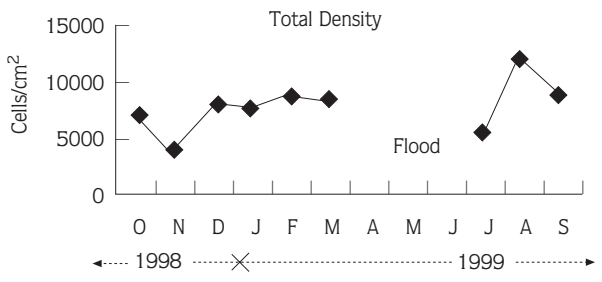
According to the results of our study, 70.27 % of the total algal flora of Değirmendere River was represented by members of *Bacillariophyta*. It was once again found predominant. The same result has been observed in the Aras (Altuner, 1988), Meram (Yıldız, 1984, 1985), Porsuk (Yıldız, 1987), Kızılırmak (Yıldız, Özkıran, 1991), Çubuk (Yıldız, Özkıran, 1994), Karasu (Altuner, Gürbüz, 1991), İncesu (Gönülol, Arslan, 1992), Şana (Kolaylı et al., 1998), Sera (Şahin, 1998), Aksu (Ertan, Morkoyunlu, 1998) and Keban (Akşin et al., 1999) rivers and streams in Turkey. Round (1984) pointed out that the development of large algal flora on the sediments of rivers, epipelic flora consisting of diatoms and attached species of algae, generally consisting of diatoms (90 %) have been determined. Moore (1974) also pointed out that in more temperate climates diatoms are usually the most common element of epipelic communities.



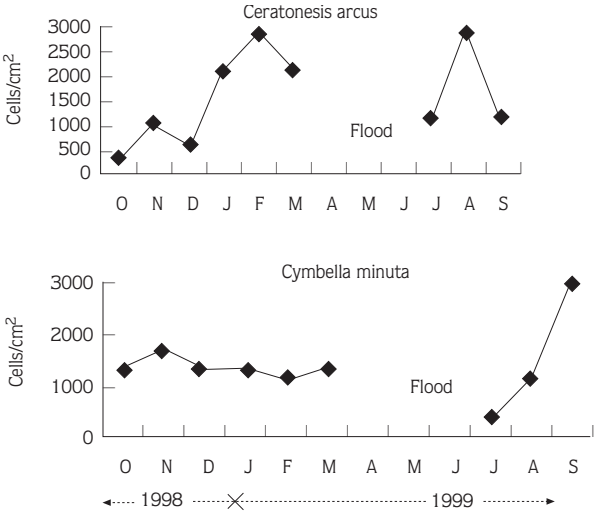
Şekil 2. a. Aulacosira varians, b. Amphora ovalis, c. Ceratoneis arcus, d. C. arcus var. amhioxys, e. Cymatopleura solea, f. Cymbella affinis, g. C. prostrata, h. C. tumida, ı. Didymosphenia geminata, i. Gomphonema olivaceum, j. Hantzschia amphioxys, k. Surirella ovata, l. Synedra ulna (Scala 10 µm).



Şekil 3. a. Ulothrix zonata, b. Oedogonium sp., c. Closterium littorale, d. C. tumidum var. tumidum, e. C. sp., f. Cosmarium blyttii, g. Merismopedia sp., h. Oscillatoria formosa (Scala 10 µm).



Şekil 4. Seasonal changes in the total density of the epipelic community.



Şekil 5. Seasonal changes in the density of common epipelic algae.

Table 3. The abundance of some epilithic diatom communities at station I (The numbers indicate the numbers of species present in 100 diatoms. Diatoms found in every count are marked +).

Species	Months											
	10.10.1998	21.11.1998	21.12.1998	21.01.1999	21.02.1999	21.03.1999	21.04.1999	26.05.1999	18.06.1999	22.07.1999	22.08.1999	19.09.1999
Aulacosira varians	20	22	7	2	2	.	3	-	-	21	11	14
Amphora ovalis var. pediculus	4	.	3	4	8	2	.	-	-	.	6	.
Ceratoneis arcus	.	2	14	5	12	3	18	-	-	.	+	.
Cocconeis placentula var. euglypta	3	.	+	.	5	.	.	-	-	.	6	14
Cymbella affinis	10	.	.	.	+	2	2	-	-	+	.	.
C. minuta	24	4	8	27	20	13	7	-	-	.	.	10
C. tumida	2	.	.	.	+	2	.	-	-	.	43	4
Diatoma vulgare var. brevis	.	.	.	.	2	.	.	-	-	6	.	.
Didymosphenia geminata	10	9	.	.	.	.	.	-	-	15	2	10
Gyrosigma acuminatum	5	8	.	.	.	.	.	-	-	.	+	5
Hantzschia amphioxys	15	4	.	.	.	.	.	-	-	.	.	.
Navicula cryptocephala var. intermedia	.	35	10	.	.	7	16	-	-	3	10	.
N. odiosa	.	.	34	.	6	27	18	-	-	.	+	19
N. radiosa	.	.	.	.	8	27	26	-	-	.	.	.
Surirella ovata	6	16	21	59	34	15	10	-	-	.	.	6
Synedra ulna	+	.	.	3	+	2	.	-	-	54	19	18

Table 4. The abundance of some epilithic diatom communities at station II (The numbers indicate the numbers of species present in 100 diatoms. Diatoms found in every count are marked +).

Species	Months											
	10.10.1998	21.11.1998	21.12.1998	21.01.1999	21.02.1999	21.03.1999	21.04.1999	26.05.1999	18.06.1999	22.07.1999	22.08.1999	19.09.1999
Aulacosira varians	23	45	21	2	+	7	4	-	-	13	15	13
Amphora ovalis	.	.	2	4	8	.	+	-	-	2	+	.
Ceratoneis arcus	2	10	11	5	16	33	21	,	-	.	3	3
Cocconeis placentula var. euglypta	6	6	2	.	.	.	+	-	-	.	7	5
Cymbella affinis	6	.	.	.	+	13	4	-	-	.	.	.
C. minuta	2	7	.	27	22	13	14	-	-	2	4	5
C. tumida	.	.	.	.	+	.	.	-	-	.	12	8
Diatoma vulgare var. brevis	.	8	.	.	2	.	.	-	-	4	2	.
Didymosphenia geminata	3	12	5	.	.	13	50	-	-	14	.	3
Gyrosigma acuminatum	30	.	.	.	.	.	.	-	-	37	2	2
Navicula cryptocephala	28	.	3	.	+	.	.	-	-	4	24	.
N. cryptocephala var. intermedia	.	12	.	.	.	.	.	-	-	.	4	36
N. odiosa	.	.	30	.	12	7	5	-	-	2	5	5
Surirella ovata	.	.	13	59	34	7	.	-	-	.	+	.
Synedra ulna	.	.	.	3	2	.	.	-	-	22	20	20

Table 5. The abundance of some epilithic diatom communities at station III (The numbers indicate the numbers of species present in 100 diatoms. Diatoms found in every count are marked +).

Species	Months											
	10.10.1998	21.11.1998	21.12.1998	21.01.1999	21.02.1999	21.03.1999	21.04.1999	26.05.1999	18.06.1999	22.07.1999	22.08.1999	19.09.1999
Aulacosira varians	12	5	3	.	.	.	6	-	-	2	3	5
Amphora ovalis	2	.	2	20	8	3	.	-	-	.	4	5
Ceratoneis arcus	.	8	26	7	9	46	39	-	-	4	.	4
C. arcus var. amphioxys	.	2	4	.	3	.	.	-	-	.	.	3
Cocconeis placentula var. euglypta	4	.	.	2	2	7	.	-	-	.	4	2
Cymbella affinis	.	2	3	5	15	.	.	-	-	.	3	5
C. minuta	26	38	18	32	32	17	16	-	-	7	8	8
C. tumida	.	.	2	.	.	.	.	-	-	.	9	10
Diatoma vulgare var. brevis	.	.	11	.	4	2	.	-	-	3	+	.
Didymosphenia geminata	+	13	.	.	.	9	24	-	-	78	2	10
Navicula cryptocephala	40	.	.	+	3	7	.	-	-	.	+	.
N. cryptocephala var. intermedia	.	22	.	.	.	.	.	-	-	.	32	18
N. falaisiensis var. lanceola	.	.	.	.	.	.	.	-	-	.	19	29
N. odiosa	11	.	26	6	9	7	6	-	-	.	2	.
Surirella ovata	3	.	.	26	13	2	3	-	-	.	+	.
Synedra ulna	+	10	5	+	2	.	6	-	-	6	11	+

Table 6. The abundance of some epilithic diatom communities at station V (The numbers indicate the numbers of species present in 100 diatoms. Diatoms found in every count are marked +).

Species	Months											
	10.10.1998	21.11.1998	21.12.1998	21.01.1999	21.02.1999	21.03.1999	21.04.1999	26.05.1999	18.06.1999	22.07.1999	22.08.1999	19.09.1999
Amphora ovalis	2	6	7	6	5	.	3	-	-	.	+	.
Ceratoneis arcus	2	20	26	40	47	66	12	-	-	46	11	17
Cocconeis placentula var. euglypta	66	+	.	4	+	3	.	-	-	.	4	7
Cymbella affinis	.	3	.	7	9	5	8	-	-	.	+	8
C. cymbiformis	.	.	3	.	+	2	.	-	-	.	.	2
C. minuta	7	18	27	20	24	4	23	-	-	.	14	24
C. tumida	.	.	2	.	.	.	.	-	-	.	9	10
Didymosphenia geminata	4	35	28	14	7	15	50	-	-	40	24	19
Navicula radiosa	.	.	.	.	+	.	2	-	-	3	9	.
Nitzschia sublinearis	.	.	.	.	.	.	.	-	-	.	20	2
Pinnularia borealis	.	.	.	.	.	.	.	-	-	3	2	2
Rhoicosphenia cruvata	13	.	.	2	.	.	.	-	-	3	+	.
Synedra ulna	6	17	6	5	4	5	2	-	-	5	8	18

In the epipelic and epilithic communities of Değirmendere River the dominant taxa, which are *Aulacosira varians*, *Amphora ovalis*, *Cocconeis placentula* var. *euglypta*, *Ceratoneis arcus*, *Cymbella minuta*, *Didymosphenia geminata*, *Navicula odiosa*, *Surirella ovata* and *Synedra ulna*, have been found in varying numbers in Aras (Altuner, 1988), Meram (Yıldız, 1984,1985), Porsuk (Yıldız, 1987), Kızılırmak (Yıldız, Özkıran, 1991), Çubuk (Yıldız, Özkıran, 1994), Karasu (Altuner, Gürbüz, 1991), İncesu (Gönülol, Arslan, 1992), Şana (Kolaylı et al., 1998), Sera (Şahin, 1998), Aksu (Ertan, Morkoyunlu, 1998) and Keban (Akşin et al., 1999) rivers and streams of Turkey. These taxa tolerate a broad range of light, temperature and other ecological factors (Moore, 1979).

In Değirmendere River, Centric diatoms were represented by *Cyclotella meneghiniana* and *Aulacosira varians*. According to Yıldız (1994), Centric diatoms usually live as plankton but they can exist in benthic habitats in some periods of their lives or when thet die. *Cyclotella meneghiniana* was observed in small numbers while *Aulacosira varians* was commonly found in the epipelic and epilithic communities.

During the study period, the taxa of *Chlorophyta*, *Cyanophyta* and *Euglenophyta* were observed in varying numbers in different months but they were not as important in the total algal flora in Değirmendere River as in Şana (Kolaylı et al., 1998) and Sera (Şahin, 1998) rivers, because they are under the influence of the North East Black Sea Region climate.

In Değirmendere River, there is no doupt that the speed of the water current was the main factor influencing development of the algal flora. For example, although light and temperature were found to be normal during the spring and summer, no organisms could be found in May and June because of flooding (Fig. 4). In addition, it was caused a mixture of the epipelic and epilithic communities. The same conditions have been observed in Meram Stream (Yıldız, 1985), Karasu (Altuner, Gürbüz, 1991), İncesu (Gönülol, Arslan, 1992), Şana (Kolaylı et al., 1998) and Sera (Şahin, 1998) rivers.

Palmer (1980) and Şen (1990) pointed out that *Aulacosira varians*, *Cymbella affinis, C. amphicephala, Hantzschia amphioxys, Nitzschia sigmoidea, Navicula cryptocephala, N. radiosa*, *Surirella ovata*, *Synedra ulna* and members of the *Oscillatoria* and *Euglena*, which were observed in varying numbers in different months in Değirmendere River, are important to determine water pollution as indicator species.

As a result, flood has a great impact on the development of the algal flora in Değirmendere River. To make a clear decision about the level of water pollution, it is necassary to examine all physical and chemical analysis of the river water.

Acknowledgements

This study was funded by Karadeniz Technical University (K. T. Ü.), Trabzon, Turkey. Contract no: 99.116.002.1.

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