

## Epilithic diatom of the Güvercinlik pond (Arguvan/ Malatya, Turkey)

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### Abstract

In this study, the epilithic diatoms of the Güvercinlik Pond, which is located in Arguvan, Malatya, were investigated between March and November of 2016. During the study, a total of 39 taxa, 3 belonging to centric diatoms and 36 belonging to pennate diatoms, were recorded. The diatom types represented by the highest number of species were *Cymbella* (5 taxa), *Nitzschia* (4 taxa) and *Navicula* (7 taxa). Diatoms showed their best growth in late spring and summer, when water temperature and light began to increase. Sorensen similarity index between the diatoms at both stations was found as 58.18%.

**Keywords:** Epilithic, Diatom, Güvercinlik, Pond, Malatya-Turkey

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## Introduction

Algae, which are the primary producers of aquatic environments, exist in waters in planktonic and benthic forms. The number and diversity of algae affect all living things, including fish in the aquatic environment. Surrounded by seas on three sides, our country has a large water potential with its rivers and lakes. Eastern Anatolia is the region with the greatest potential for lakes and rivers in Turkey. The structure of diatom communities is directly related to the physical and chemical state of water. Therefore, diatoms are used in the calculation and comparison of water quality of rivers with different morphodynamics (Allan, 1995).

In general, the diatoms in the form of colonies with mucilage and filamentous masses on the sediments form the epipsammic flora while the diatom species clinging to the stones in the benthic region constitute the epilithic flora (Round, 1984). Together with the understanding of the importance of algae in waters, as well as their significance in economic terms, the number of studies on algae in rivers, lakes, ponds and dam lakes in different parts of our country has rapidly increased. There are many studies on epilithic and epiphytic diatoms in our country. While some of these studies are on rivers (Altuner and Gürbüz, 1989; Dere and Sıvacı, 1995; Yıldız and Atıcı, 1996; Pala and Çağlar, 2006; Pala and Çağlar, 2008; Kıvrak and Gürbüz 2010; Çiçek *et al.*, 2010, Fakıoğlu *et al.*, 2012; Çağlar and Pala, 2016), some

are on lakes and ponds (Şen *et al.*, 2001; Özer and Pala, 2009; Pala, 2014; Çağlar and Pala, 2016).

The present study is of importance as it is the first algal study of the Güvercinlik Pond located in Arguvan district of Malatya and provides the first data acquired in the pond.

## Materials and methods

The Güvercinlik Pond, which is located in the northeast of Malatya, is 65 km away from the province. The pond's construction started in 1970 and it has a water storage volume of 3650 hm<sup>3</sup>. The pond is supplied with rainwater from stream beds (URL, 1). Samplings from the Güvercinlik Pond were taken once a month between March and November 2016. The first station is between 38° 43'58" north latitude and 38° 20' 02" east longitudes while the second one is between 38° 43' 50" north latitude and 38° 20' 03" east longitudes (Fig. 1).

Epilithic samples were scraped from the stones at the stations using hard objects such as toothbrushes or knives. The scraped part was cleaned with pure water and taken into sampling bottles. Bacillariophyta members were identified from the permanent preparations. Permanent preparates were made after boiling certain volumes of samples in a mixture of concentrated sulfuric acid and nitric acid (1:1, v/v). Some of the neutralized samples were transferred to previously labeled bottles. Permanent preparates were made by taking a drop of suspension of diatom shells, placing it on a slide and then

allowing it to dry. The cover glasses were placed with forceps after some entellan was dripped on the dried slides. A Nikon branded microscope was used for species identification and counting of the diatoms whose permanent preparates were made. The counting in the permanent preparates was based on relative density and the results were given as “organism%”.

Relative density (Rd) =  $NA/N \times 100$

NA = Total number of A species individuals, N=Number of all species individuals (Kocataş, 1999).

The Sorensen Similarity Index was applied to determine the similarity

between the epilithic algae at the stations.

The Sorensen Similarity Index:  $Q = \frac{2J}{A+B}$

A= Total number of species in the first sample

B= Total number of species in the second sample

J= Number of common species in both samples (Sorensen, 1948).

A Nikon branded research microscope was used in the diatom sample identification, and Krammer and Lange-Bertalot (1991a, 1991b, 1999a and 1999b) were benefited from for the species identification.



**Figure 1:** General view of the stations in the Güvercinlik Pond from which the epilithic samples were taken (URL, 2).

## Results

Among the total organisms in the Güvercinlik Pond, 3 species from Centrales and 36 species from Pennales were found (Table 1). At both stations, the species reached the maximum number of individuals in spring and autumn months (Tables 2 and 3). The

habitat characteristics of the diatoms recorded in the Güvercinlik Pond are given in Table 1.

The monthly changes in the relative density of the diatoms recorded at the first station are shown in Table 2. At this station, *Navicula* (7 taxa) and *Nitzschia* (6 taxa) were the types with the highest taxa numbers.

**Table 1: The habitat characteristics of the diatoms recorded in the Güvercinlik Pond.**

Diatom taxa	Station 1	Station 2
<b>Centrales</b>		
<i>Cyclotella glomerata</i> (H. Bachmann) Houk&Klee	+	-
<i>Pantocsekiella ocellata</i> (Pantocsek) K.T. Kiss & E.Acs	+	-
<i>Stephanodiscus astrea</i> (Kützing)Grunow	+	+
<b>Pennales</b>		
<i>Amphora pediculus</i> ( Kützing)Grunow ex A. Schmidt	+	+
<i>Cocconeis placentula</i> Ehr.	+	-
<i>Cymbella affinis</i> Kütz.	+	-
<i>Cymbella cistula</i> (Ehr.) O. Kirchner	+	+
<i>Cymbella leptoceros</i> (Ehr.) Kütz.	-	+
<i>Cymbella prostrata</i> (W.Smith) Cleve	+	+
<i>Cymbella tumidula</i> Grunow	-	+
<i>Cymatopleura solea</i> (Breb.) W. Smith	+	-
<i>Cymbopleura lata</i> (Grunow) Krammer	+	-
<i>Diatoma vulgare</i> Bory.	+	-
<i>Encyonema minutum</i> (Hilse) D.G. Mann	+	-
<i>Encyonema caespitosum</i> Kützing	+	-
<i>Epithemia turgida</i> (Ehr) Kütz.	+	-
<i>Epithemia sorex</i> Kütz.	-	+
<i>Gomphonema angustatum</i> (Kütz.) Rabh.	+	+
<i>Gomphonema olivaceum</i> (Hornemann) Brebisson	-	+
<i>Gomphonema parvulum</i> (Kütz.) Kütz.	+	+
<i>Gyrosigma acuminatum</i> (Kütz.) Rabenhorst	+	+
<i>Sellaphora bacillum</i> (Ehr.) D.G. Mann	+	-
<i>Navicula cincta</i> (Ehrenberg)Ralfs	+	+
<i>Navicula cari</i> Ehr.	+	-
<i>Navicula gregaria</i> Donkin	+	+
<i>Navicula lanceolata</i> Ehr.	+	+
<i>Navicula radiosa</i> Kütz.	+	-
<i>Navicula tripunctata</i> (O.F.Müller) Bory	+	-
<i>Navicula viridula</i> (Kütz.) Ehr.	+	+
<i>Nitzschia amphibia</i> Grun.	+	-
<i>Nitzschia dissipata</i> (Kütz.) Rabenhorst	+	+
<i>Nitzschia palea</i> (Kütz.) W. Smith	+	-
<i>Nitzschia sigma</i> (Kütz.) W.Smith	+	+
<i>Nitzschia tenuis</i> W.Smith	+	+
<i>Nitzschia tryblionella</i> Hantzsch	+	-
<i>Pinnularia viridis</i> (Nitzsch.) Ehr.	+	-
<i>Surirella ovalis</i> Brebbisson	+	+
<i>Surirella minuta</i> Breb ex Kütz.	+	-
<i>Ulnaria ulna</i> (Nitzsch.) Compere	+	+

*Stephanodiscus astrea*, *Amphora pediculus*, *Cymbella cistula*, *Cymbella prostrata*, *Gomphonema angustatum*, *Gomphonema parvulum*, *Gyrosigma acuminatum*, *Navicula cincta*, *Navicula gregaria*, *Navicula lanceolata*, *Navicula viridula*, *Nitzschia dissipata*,

*Nitzschia sigma*, *Nitzschia tenuis*, *Surirella ovalis* and *Ulnaria ulna* were common species recorded at both stations. The monthly changes in the relative density of the species recorded at the first station are shown in Table 2.

**Table 2: The monthly changes in the relative density of the diatoms recorded at the first station.**

Diatom taxa	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
<b>Centrales</b>									
<i>Cyclotella glomerata</i>	2.86	2.61	2.60	2.34	2.31	2.25	2.26	2.50	2.90
<i>Pantocsekiella ocellata</i>	2.22	2.37	2.23	2.14	2.55	2.46	2.64	3.17	3.38
<i>Stephanodiscus astrea</i>	1.91	2.13	2.04	1.90	1.96	2.05	2.13	2.17	2.66
<b>Pennales</b>									
<i>Amphora pediculus</i>	3.18	3.08	2.74	2.63	2.67	2.56	2.89	3.17	3.38
<i>Cocconeis placentula</i>	2.54	2.37	2.42	2.34	2.55	2.46	2.51	2.84	3.14
<i>Cymbella affinis</i>	3.50	3.32	2.97	2.93	2.79	2.77	1.76	1.67	1.93
<i>Cymbella cistula</i>	2.86	2.85	2.79	2.78	3.04	2.82	3.14	3.67	3.63
<i>Cymbella prostrata</i>	3.82	3.56	3.35	3.37	3.28	3.08	3.27	3.17	3.38
<i>Cymatopleura solea</i>	2.54	2.61	2.60	2.63	2.43	2.46	2.38	2.67	2.66
<i>Cymatopleura lata</i>	3.50	3.08	2.97	3.22	2.91	2.66	2.76	2.84	2.90
<i>Diatoma vulgare</i>	4.45	3.80	3.53	3.66	3.40	3.28	3.14	3.17	2.42
<i>Encyonema minutum</i>	2.22	2.37	2.42	2.49	2.55	2.66	2.64	2.67	2.66
<i>Encyonema caespitosum</i>	1.59	2.13	2.23	2.34	2.43	2.46	2.38	2.00	1.93
<i>Epithemia turgida</i>	2.54	2.61	2.60	2.78	2.91	2.77	2.89	2.50	3.14
<i>Gomphonema angustatum</i>	3.82	3.56	3.35	3.51	3.28	3.38	3.39	3.34	3.87
<i>Gomphonema parvulum</i>	4.45	4.03	3.72	3.81	3.64	3.59	3.64	3.67	3.38
<i>Gyrosigma acuminatum</i>	2.86	2.85	2.97	2.93	3.04	3.08	3.27	3.17	2.90
<i>Sellaphora bacillum</i>	2.22	2.37	2.42	2.78	2.79	2.82	3.01	2.84	2.42
<i>Navicula cincta</i>	3.82	3.80	3.91	3.66	3.52	3.49	3.77	4.01	4.35
<i>Navicula cari</i>	3.18	3.32	3.35	3.37	3.16	2.97	3.14	3.17	3.14
<i>Navicula gregaria</i>	2.86	2.85	2.79	2.49	2.55	2.77	2.89	2.34	1.93
<i>Navicula lanceolata</i>	3.50	3.08	2.97	2.78	2.91	2.66	2.76	2.84	2.90
<i>Navicula radiosa</i>	4.14	4.03	4.09	3.81	3.77	3.59	3.77	3.67	3.63
<i>Navicula tripunctata</i>	2.54	3.32	3.53	3.51	3.52	3.38	3.27	3.34	3.38
<i>Navicula viridula</i>	2.86	2.61	2.60	2.63	2.67	2.77	2.64	2.67	2.42
<i>Nitzschia amphibia</i>	1.91	1.90	2.04	2.19	2.18	2.46	2.38	2.17	1.69
<i>Nitzschia dissipata</i>	3.18	3.08	2.97	2.78	2.79	2.66	2.51	2.50	2.66
<i>Nitzschia palea</i>	2.54	2.37	2.42	2.34	2.55	2.56	2.13	2.00	2.17
<i>Nitzschia sigma</i>	2.86	3.32	3.16	3.07	3.16	3.08	3.14	3.17	2.90
<i>Nitzschia tenuis</i>	2.22	2.13	2.23	2.34	2.31	2.66	2.76	2.67	2.66
<i>Nitzschia tryblionella</i>	1.59	2.13	2.60	2.78	3.04	3.18	3.01	2.34	2.42
<i>Pinnularia viridis</i>	2.22	1.90	2.04	2.34	2.43	2.82	2.51	2.84	2.17
<i>Surirella ovalis</i>	1.91	2.37	2.79	2.78	2.67	3.08	2.89	2.34	2.66
<i>Surirella minuta</i>	1.27	1.66	1.86	2.19	2.18	2.25	2.13	1.83	1.45
<i>Ulnaria ulna</i>	4.14	4.27	4.46	4.10	3.89	3.69	4.02	4.68	4.60

*Navicula*, *Nitzschia* and *Cymbella* were the species represented by the highest number of taxa at the first station. At this station, relative densities of *Cymbella prostrata*, *Gomphonema angustatum*, *Gomphonema parvulum*, *Navicula cincta*, *Navicula cari*, *Navicula radiosa* and *Ulnaria ulna* never dropped below 3%. *Ulnaria ulna*'s relative density in October

(4.68%) was the highest among the relative densities of the other diatoms at this station. *Surirella minuta*'s relative density in March (1.27%) was the lowest relative density recorded at this station. The monthly changes in the relative density of the species recorded at the second station are shown in Table 3.

**Table 3: The monthly changes in the relative density of the diatoms recorded at the second station.**

Diatom taxa	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
<b>Centrales</b>									
<i>Stephanodiscus astrea</i>	2.75	4.00	4.10	3.83	3.65	3.78	3.46	3.85	4.31
<b>Pennales</b>									
<i>Amphora pediculus</i>	5.51	4.88	4.73	4.34	4.30	4.16	4.38	4.45	5.17
<i>Cymbella cistula</i>	4.13	4.00	3.76	3.58	3.87	3.78	3.92	4.15	4.31
<i>Cymbella leptoceros</i>	4.82	5.33	5.13	4.85	5.16	4.92	5.08	5.04	4.74
<i>Cymbella prostrata</i>	6.89	6.22	5.82	5.11	5.59	5.68	5.77	5.63	5.60
<i>Cymbella tumidula</i>	6.20	5.33	4.79	4.60	5.16	5.30	5.54	5.04	5.17
<i>Epithemia sorex</i>	4.13	4.44	4.10	4.09	4.73	4.73	4.84	4.45	4.31
<i>Gomphonema angustatum</i>	5.51	5.77	5.47	5.37	5.59	5.49	5.31	5.34	5.60
<i>Gomphonema olivaceum</i>	6.89	6.22	6.16	6.39	6.02	5.87	6.23	5.93	6.89
<i>Gomphonema parvulum</i>	6.20	5.33	5.13	5.62	5.16	5.30	5.54	5.63	6.03
<i>Gyrosigma acuminata</i>	4.82	4.44	4.79	4.85	4.73	5.11	5.08	4.74	5.17
<i>Navicula cincta</i>	6.89	6.66	5.82	5.88	5.37	5.30	5.31	5.04	4.31
<i>Navicula gregaria</i>	4.13	4.44	4.45	4.34	4.30	4.35	5.77	6.23	5.17
<i>Navicula lanceolata</i>	5.51	6.22	6.50	6.39	6.23	6.06	6.00	6.23	7.32
<i>Navicula viridula</i>	4.82	4.88	5.47	5.62	5.59	5.49	5.08	5.63	4.74
<i>Nitzscha dissipata</i>	4.13	4.00	4.79	4.85	4.94	5.11	4.61	4.45	5.17
<i>Nitzschia sigma</i>	4.82	4.44	5.13	5.37	5.16	4.92	4.15	4.15	3.87
<i>Nitzschia tenuis</i>	2.75	3.55	3.76	4.09	4.30	4.54	3.69	3.56	3.44
<i>Surirella ovalis</i>	2.06	3.11	3.42	3.83	3.87	3.97	3.92	3.26	2.58
<i>Ulnaria ulna</i>	6.89	6.66	6.50	6.90	6.23	6.06	6.23	7.12	6.03

At the second station, a total of 20 diatom taxa, 1 belonging to Centrales and 19 belonging to Pennales, were recorded. Diatoms represented by the most species at this station were *Cymbella* and *Navicula* (4 taxa). At the second station, the relative density of *Navicula lanceolata* (7.32%) in November and the relative density of *Ulnaria ulna* (7.12%) in October were the highest relative densities at both stations. The relative density of *Ulnaria ulna* never fell below 6% throughout the study. At the second station, *Ulnaria ulna* was followed by *Navicula lanceolata*, *Gomphonema olivaceum*, *Gomphonema angustatum*, *Gomphonema parvulum* and *Cymbella prostrata* in terms of relative density. The lowest relative densities recorded at this station belong to *Surirella ovalis* (2.06%) and *Nitzschia tenuis* (2.75%) in

March. Sorensen similarity index between the species at both stations was found as 58.18%.

### Discussion and Conclusion

The species belonging to Pennales have found to be predominant in the epilithic flora of the Güvercinlik Pond. This predominance was also reported in various other studies (Soylu and Gönülol, 2006; Sıvacı and Papuççu, 2007; Çağlar and Pala, 2016; Pala *et al.*, 2017; Çağlar *et al.*, 2017) carried out in the fresh waters of our country. In Çağlar and Pala's (2016) study titled "Epiphytic and Epipsammic Diatom Communities of Gölbaşı Lake", *Navicula*, *Nitzschia* and *Cyclotella* were reported to be the most remarkable species with their relative densities; and in our study, the most remarkable diatoms at both stations with their

relative densities were *Cymbella*, *Navicula*, *Nitzschia* and *Ulnaria*. In the epilithic flora of the Güvercinlik Pond, no new record for our country's diatom flora was detected.

In the Güvercinlik Pond, a total of 35 taxa were recorded at the first station while a total of 20 taxa were recorded at the second station. The diatoms recorded at the first station are more than those at the second station because the first station is located in shallower part and inlands compared to the second station and are also quite rich in macrophytes. The second station is in a more open area and is very poor in terms of macrophytes. The stones are washed with streams flowing to the pond. During the study, *Cyclotella glomerata*, *Pantocsekiella ocellata*, *Cocconeis placentula*, *Cymbella affinis*, *Cymatopleura solea*, *Cymbopleura lata*, *Diatoma vulgare*, *Encyonema minutum*, *Encyonema caespitosum*, *Epithemia turgida*, *Sellaphora bacillum*, *Navicula cari*, *Nitzschia amphibia*, *Nitzschia tryblionella*, *Pinnularia viridis* and *Surirella minuta* were the taxa recorded only at the first station while *Cymbella leptoceros*, *Cymbella tumidula*, *Epithemia sorex* and *Gomphonema olivaceum* were the diatom taxa recorded only at the second station.

Chessman (1986) indicated that *Navicula* and *Nitzschia* are cosmopolitan species. In our study in the Güvercinlik Pond, *Navicula* and *Nitzschia* species were the permanent species of both stations and they recorded with high relative densities each month.

In their study titled "Epilithic Diatoms of Upper Porsuk Stream (Kütahya)", Bingöl *et al.* (2007) identified 58 diatom taxa in the samples collected from three different stations on a monthly basis between December 2004 and August 2005. In these samples, the most prevalent species were *Navicula*, *Nitzschia* and *Cymbella*. The identification of *Navicula* and *Nitzschia* species in various studies (Pala and Çağlar, 2006; Pala and Çağlar, 2008) conducted in our country supports the finding that the types belonging to these species are cosmopolitan.

In studies on benthic algae in the lakes, dam lakes and ponds located in the other regions of Turkey, Centrales members, which are also referred to as planktonic forms, were also identified on the sediments, though in insignificant numbers. In our study on the epilithic diatoms of the Güvercinlik Pond, Centrales members were recorded every month with 3 taxa (*Cyclotella glomerata*, *Pantocsekiella ocellata*, *Stephanodiscus astrea*) at the first station, and with one taxon (*S. astrea*) at the second station.

With 7.32% in November, *Navicula lanceolata* from the pennate diatoms had the highest recorded relative density of the diatoms at the two stations. This was followed by *Ulnaria ulna* with 7.12% in October, and again at the same station, *Ulnaria ulna*, *Cymbella prostrata*, *Gomphonema olivaceum* and *Navicula cincta* with 6.89%. *Navicula lanceolata* reached its highest relative density at the first station in March with 3.50%. The

highest relative density of the first station belonged to *U. Ulna* with 4.68% in October. At this station *U. ulna*'s relative density was always higher than the other diatoms in every month. The fact that *Navicula lanceolata* and *Ulnaria ulna* were always recorded with high populations at both stations can be seen as an indication that these diatoms could make use of the conditions better than the others.

Akköz *et al.* (2000) identified 89 taxa in their study on the epiphytic and epipellic algae of the Beşgöz Lake and their seasonal changes. Considering the taxa identified, while the diatoms ranked first with 76 taxa, Chlorophyta was recorded with 7, Cyanophyta with 4, Euglenophyta and Xantophyta with 1 taxon each in the flora. The majority of the epipellic and epiphytic algal flora of the Beşgöz Lake is composed of Bacillariophyta members and some of it is composed of Cyanophyta and Chlorophyta members. As Euglenophyta and Chrysophyta members are represented by only one species, they do not show any importance in regard to population or floristics. In the same sense, the dominant algae in the epiphyton in the Güvercinlik Pond were diatoms, and other algal groups were neglected because they were recorded at very low numbers.

In their research on the epilithic algae of the Ladikli Lake, Maraşlıoğlu *et al.* (2005) reported that the prevalent species of the epilithon were *Aulacoseria distans*, *Cymbella affinis*, *Encyonema leibleinii*, *Navicula*

*cryptocephala*, *Navicula veneta*, *Craticula halophila* and *Surirella linearis*. Except for *Cymbella affinis*, the species identified in our study carried out in the Güvercinlik Pond show no similarity with those in the related study.

*Gomphonema olivaceum*, *Navicula cincta*, *Cymbella prostrata*, *Navicula lanceolata*, and *Nitzschia palea* were recorded in the epiphyton with high relative densities in the Güvercinlik Pond. These species are stated to be true epilithic and epiphytic species attached to stones or plants by a stem clothed with mucilage; and tubes released from their raphae; their thin ends or whole surfaces (Gönülol, 1993). The diatom species found in the Güvercinlik Pond are very similar to the diatoms found in other previously researched lakes (Yıldız, 1986; Yıldız 1986a; Yıldız 1986b; Akköz *et al.*, 2000). Some of the benthic flora in lakes and ponds are dragged by other physical factors such as wave movements and currents and they appear as dependent algae by joining the flora on stones and plants. However, species with mucilage clothed stems such as *Gomphonema olivaceum* and *Rhoicosphenia curvata* are indeed dependent algae.

Studies on the littoral zone algae of lakes and ponds have shown that a rich algal flora develops on sediments. This flora has been studied in detail especially in the lakes of England, Ireland and Finland (Round, 1984). According to Round and Hickman, benthic algae are defined as organisms



living in the confined space between solid and liquid surfaces (Nienhuis, 1980). In the Tortum Lake, *Navicula*, *Amphora* (Altuner and Aykulu, 1987); in the Tercan Dam Lake, *Navicula*, *Nitzschia*, *Cymbella* and *Amphora* (Altuner and Gürbüz, 1996); and in the Beytepe Pond, *Navicula*, *Nitzschia*, *Caloneis*, *Amphora* and *Synedra* have been observed to be widespread and in high numbers. In the Çubuk-I Dam Lake (Gönülol, 1980), *Amphora*, *Nitzschia*, *Navicula*, *Caloneis* and centric diatom species; in the Altınapa Dam Lake (Yıldız, 1982; Yıldız, 1986), *Navicula*, *Nitzschia*, *Cymbella*, *Pinnularia*, *Amphora* and *Caloneis* species were reported to be dominant and prevalent. Among the epilithic diatoms in the Güvercinlik Pond, *Navicula*, *Nitzschia*, *Cymbella* and *Gomphonema* as the prevalent species showed similarities with the above findings.

In the epilithic algal communities, *Ulnaria* species such as *Ulnaria ulna*, which are actually environment-dependent species, and *Gomphonoma parvulum*, *G. angustatum*, *Cymbella tumidula*, and *C. cistula* species are constantly and densely available in all seasons. Other than these species, *Navicula* and *Nitzschia* were also observed continuously. *Epithemia sorex* and *E. turgida*, which are seen as epiphytic and epilithic organisms by Round, have also been important in this flora (Round, 1957b).

As a result, no significant difference was observed between the selected stations in the pond in terms of the

number and diversity of species. It is believed that this can be because of the fact that the pond is supplied with rainwater from the stream beds.

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