Case Study

Common Diatoms of Phytobenthos in Gediz River Basin

Gediz Nehir Havzasındaki Fitobentozun Yaygın Diyatomeleri

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Abstract

Diatoms (important representatives of phytobenthos) are ecologically significant quality elements for rivers and lakes according to the EU Water Framework Directive (2000/60/EC). We aimed to investigate common diatoms of Gediz River Basin within the scope of the studies for preparation of Gediz River Basin Management Plan. Samples were collected from epilithon and epipelon substrates of 17 rivers, 2 lakes (Gölcük and Marmara) and 4 dams (Demirköprü, Küçükler, Buldan, Afşar) from November 2017 to April 2018. The samples were boiled with H_2O_2 and HCl for removing the organic matter from frustules. Permanent slides were mounted with Naphrax solution. As a result, 28 taxa were found as common diatoms of Gediz River Basin. Many of the taxa were commonly found also in Turkish rivers and lakes. *Amphora pediculus* (Kützing) Grunow, *Navicula reichardtiana* Lange-Bertalot, *Navicula veneta* Kützing, *Nitzschia dissipata* (Kützing) Rabenhorst and *Nitzschia inconspicua* Grunow were most common diatoms in sampling points. On the other hand, *Navicula erifuga* Lange-Bertalot, *Navicula reichardtiana* Lange-Bertalot and *Nitzschia archibaldii* Lange-Bertalot were rarely found in Turkish rivers and lakes.

Keywords: *Common diatoms, Gediz River Basin, phytobenthos*

Öz

AB Su Çerçeve Direktifine (2000/60/EC) göre; fitobentozun önemli temsilcilerinden olan diatomlar, nehir ve göller için önemli ekolojik kalite göstergelerindendir Gediz Havzası Yönetim Planı hazırlanması çalışmaları kapsamında Gediz Nehir Havzası için yaygın diyatomelerin araştırılmasını amaçladık. Örnekler 17 nehir, 2 göl (Gölcük ve Marmara) ve 4 barajdan (Demirköprü, Küçükler, Buldan, Afşar) Kasım 2017 ve Nisan 2018'de epiliton ve epipelon substratlardan toplanmıştır. Organik maddenin frustullerden uzaklaştırılması için örnekler H_2O_2 ve HCl ile kaynatılmıştır. Daimi preparatlar Naphrax solüsyonu ile hazırlanmıştır. Sonuç olarak, Gediz Nehir Havzasında 28 diyatome taksonu yaygın olarak bulunmuştur. Taksonların pek çoğu Türkiye nehir ve göllerinde yaygın olarak bulunan taksonlardır. *Amphora pediculus* (Kützing) Grunow, *Nitzschia dissipata* (Kützing) Rabenhorst ve *Nitzschia inconspicua* Grunow örnekleme noktalarında tespit edilen en yaygın türler olmuştur. Ancak, *Navicula erifuga* Lange-Bertalot, *Navicula reichardtiana* Lange-Bertalot ve *Nitzschia archibaldii* Lange-Bertalot Türkiye nehir ve gölleri için nadir bulunan türlerdendir.

Anahtar kelimeler: *Yaygın diyatomeler, Gediz Nehir Havzası, fitobentoz*

Introduction

Water Framework Directive (2000/60/EC) (Anonymous, 2000) aims to establish a framework for the protection of rivers, lakes, transitional waters, coastal waters and groundwater. Member States shall ensure that a river basin management plan is produced for each river basin. Establishment of river basin management plans has been accelerated last years in Turkey. Turkey has 25 river basins and for 11 river basins (Konya, Susurluk, Meriç-Ergene, Büyük Menderes, Gediz, Yeşilırmak, Akarçay, Batı Akdeniz, Burdur, Küçük Menderes, Kuzey Ege) preparation of river basin management plans are still on-going.

A river basin management plan shall cover the surface waters ecological status. Ecological status is an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters. Phytoplankton, macrophyte and phytobenthos, benthic invertebrates and fish are the biological quality elements for the classification of ecological status (Anonymous, 2000). There are some studies (Demir et al., 2017; Çelekli et al., 2018; Solak et al., 2018a) for identifying the ecological status of water bodies in Turkey within the scope of the river basin based monitoring studies.

Regarding the diatom studies of Gediz River Basin, some works were done in the basin. Karagöl was one of the pioneer works for Turkish inland waters by Güner (1969). Then, Marmara Lake was investigated by Cirik (1983, 1994) and Demirköprü Reservoir was worked by GezerlerŞipal et al. (1999) in the basin. Also, Gürle River was examined by Yurterin & Öztürk (2001) as lotic system. This study aims to investigate the distribution of common benthic diatoms in the Gediz River Basin.

Method

Study Site

Gediz River Basin is located between 38° 04'-39°-13' northern latitudes with 26° 42'-29° 45' eastern longitudes. The main water source of the basin is Gediz River. The Gediz River is 275 km. long and is fed by 17220 km^2 of precipitation area in Western Anatolia. There are very few natural lakes in the basin. The most important natural lake is Marmara. The minimum and maximum elevation of the lake is 73.2-79.2 m and the minimum and maximum volume is 8.5-320 hm^3. There is Gölcük Lake as a natural lake in the basin except Lake Marmara. This lake is a crater lake, 80 ha wide and 10 m deep.

There are 5 dams in the river basin. The larger dam in the basin is Demirköprü Dam with a storage capacity of 1.022 million m^3. A hydroelectric power plant was established to produce energy on the dam. Küçükler Dams are also used for drinking water supply. The other dams are used for irrigation, flood protection and energy production. Demirköprü, Afşar and Buldan Dams are located in Manisa and Küçükler Dam is located in Uşak (Tarım ve Orman Bakanlığı, Su Yönetimi Genel Müdürlüğü, 2018).

Sampling

Samples were collected from 17 rivers, 2 lakes (Gölcük and Marmara) and 4 dams (Demirköprü, Küçükler, Buldan, Afşar) (Table 1) in Gediz River Basin (Figure 1) in November 2017 and April 2018 from 23 sampling points. Epilithic samples were taken by brushing the submerged stones and epipelic samples were taken by using a pipette aspirator from the sediment.

Table 1
The Coordinates of the Sampling Points of the Water Bodies in Gediz River Basin

Stations	Water Bodies	Coordinates	
		X	Y
1	G1-Buldan Reservoir	38° 09' 25.235"	28° 50' 41.002"
2	G2-Demirköprü Reservoir	38° 39' 56.785"	28° 22' 14.717"
3	G3-Marmara Lake	38° 36' 54.525"	28° 00' 47.469"
4	G4-Gölcük Lake	38° 19' 02.038"	28° 01' 30.273"
5	G5-Küçükler Reservoir	38° 52' 21.664"	29° 37' 08.719"
6	G6-Afşar 2 Reservoir	38° 13' 59.251"	28° 35' 50.661"
7	N1-Demirci Stream	38° 47' 51.690"	28° 29' 54.949"
8	N2-Gürdük Stream	39° 03' 13.752"	27° 55' 21.694"
9	N3-Gediz River	38° 40' 55.351"	27° 21' 44.960"
10	N4-Gediz River	38° 36' 06.540"	28° 48' 46.854"
11	N5-Gürlevik Stream	38° 28' 58.543"	27° 49' 59.015"
12	N6-Bahçeler Stream	38° 58' 32.408"	29° 23' 31.106"
13	N7-Diken Stream	38° 45' 12.438"	29° 11' 36.873"
14	N8-Derbent Stream	38° 10' 55.692"	28° 32' 35.872"
15	N9-Selendi Stream	38° 44' 27.451"	28° 51' 59.706"
16	N10-Alaşehir Stream	38° 30' 27.337"	28° 08' 55.644"
17	N11-Gediz River	38° 36' 55.182"	27° 33' 15.366"
18	N12-Nif Stream	38° 34' 15.362"	27° 34' 11.112"
19	N13-Sarıkız Springs	38° 46' 16.611"	27° 39' 49.604"
20	N14-Canburt Stream	38° 39' 07.524"	27° 01' 44.680"
21	N15-Murat Stream	38° 58' 12.143"	29° 42' 53.063"
22	N16-Ağıl Stream	39° 04' 27.436"	28° 40' 20.049"
23	N17-Gürdük Stream	39° 08' 13.548"	28° 00' 24.678"

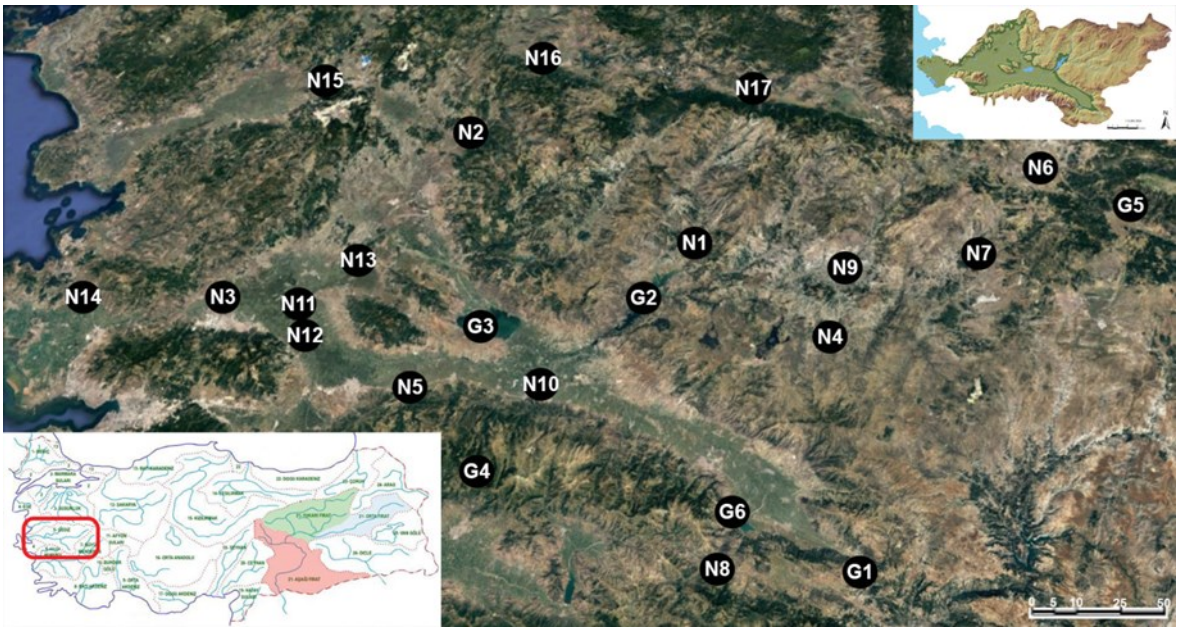

Figure 1. Distribution of sampling points in Gediz River Basin.

Sample Processing, Observation and Identification

Samples were boiled with H_2O_2 and HCl to remove the organic matter from frustules (Swift 1967). After washing three times of diatoms with distilled water, the material was air-dried on cover glasses and mounted with Naphrax solution. Diatoms were observed with a Nikon Ci Light Microscope (LM) in Dumlupınar University, Turkey. The literature used for identification and dimensions (Krammer 2002, Krammer & Lange-Bertalot 1986, 1991, Lange-Bertalot et al. 2017).

Diatom Distribution

Description of the distribution of Turkish diatom flora was made according to Gönülol (2018). The taxa reported from Turkey by Gönülol (2018) which cover 10% of the literature are categorized as "*common*" diatoms, the ones cover less than 10% are noted as "*rare*" diatoms. If a taxon exists in more than 10 stations, it was named as "*common*" in this study.

Results

In this work, common diatoms of Gediz River Basin was evaluated and as a result, totally 28 taxa were commonly found in the sampling stations (Table 2, Figure 2).

***Amphora pediculus* (Kützing) Grunow**
Ref. Hustedt 1930 (p. 343, Fig. 629); Patrick & Reimer 1975 (p. 253, Fig. 16: 9 – 10); Krammer & Lange-Bertalot 1986 (p. 346, Fig. 150: 8 – 13); Levkov 2009 (p. 101, Figs. 55: 31 – 34; 78: 40 – 47); Hofmann *et al.* 2011 (p. 98, Fig. 91: 29 – 33).

***Cocconeis pediculus* Ehrenberg**
Ref. Hustedt 1930 (p. 188, Fig. 259); Patrick & Reimer 1966 (p. 240, Fig. 15: 3 – 4); Krammer & Lange-Bertalot 1991 (p. 88, Fig. 57: 1 – 4); Hofmann *et al.* 2011 (p. 132, Fig. 19: 17 – 19).

***Cyclotella meneghiniana* Kützing**
Ref. Krammer and Lange-Bertalot, 1991 (p. 44, fig. 44: 1 – 10); Håkansson, 2002 (p. 79, figs. 263 – 268); Wojtal and Kwandrans, 2006 (p. 186, fig. 4: 18 – 21, 7: 1 – 13, 9: 1 – 8, 10: 1 – 5); Kiss et al., 2012 (p. 337, fig. 14: A – C); Bey and Ector, 2013 (Vol. 1, p. 30); Cavalcante et al., 2013 (p. 243, fig. 8: A – O); Houk et al., 2010 (p. 16, fig. 143: 1 – 15).

***Cymbella excisa* Kützing**
Ref. Krammer 2002 (p. 26, pl. 8: 1 - 26); Hofmann *et al*. 2011 (p. 150, pl. 77: 23 - 28); Bąk *et al*. 2012 (p. 81, pl. 54).

***Diatoma moniliformis* (Kützing) D.M.Williams**
Ref. Hofmann *et al*. 2011 (p. 174, pl. 2: 11 - 15); Bąk *et al*. 2012 (p. 99, pl. 4).

***Encyonema minutum* (Hilse) D.G.Mann**
Ref. Krammer 1997 (p.53-pl.25:1-19); Hofmann *et al*. 2011 (p. 188, pl. 87: 33 - 40); Bąk *et al*. 2012 (p. 111, pl. 61).

***Epithemia sorex* Kützing**
Ref. Hustedt 1930 (p. 388, Fig. 736); Patrick & Reimer 1975 (p. 188, Fig. 27: 4); Krammer & Lange-Bertalot 1988 (p. 154, Fig. 106: 1 – 13); Hofmann *et al.* 2011 (p. 206, Fig. 121: 1 – 7)

***Gomphonema olivaceum* (Hornemann) Brébisson**
Ref. Hustedt 1930 (p. 378, Fig. 719); Patrick & Reimer 1975 (p. 139, Fig. 8: 13 – 14); Krammer & Lange-Bertalot 1986 (p. 374, Fig. 165: 1 – 8); Hofmann *et al.* 2011 (p. 310, Fig. 95: 1 – 6).

***Gomphonema parvulum* (Kützing) Kützing**
Ref. Hustedt 1930 (p. 372, Fig. 713a); Patrick & Reimer 1975 (p. 122, Fig. 17: 7 – 12); Krammer & Lange-Bertalot 1986 (p. 358, Fig. 154: 1 – 25); Hofmann *et al.* 2011 (p. 312, Fig. 99: 1 – 10).

***Melosira varians* C.Agardh**
Ref. Krammer and Lange-Bertalot, 1991 (p. 7, fig. 4: 1 – 8); Wojtal, 2009 (p. 238, fig. 1: 1 – 4); Bey and Ector, 2013 (Vol. 1, p. 48); Cavalcante et al., 2013 (p. 246, fig. 11: A).

***Navicula capitatoradiata* H.Germain**
Ref. Hofmann *et al*. 2011 (p. 374, pl. 36: 28 - 34); Bąk *et al*. 2012 (p. 215, pl. 31).

***Navicula cryptotenella* Lange-Bertalot**
Ref. Hofmann *et al*. 2011 (p. 378, pl. 32: 1 - 5); Bąk *et al*. 2012 (p. 217, pl. 29).

***Navicula tripunctata* (O.F.Müller) Bory**
Ref. Hustedt 1930 (p. 299, Fig. 514); Patrick & Reimer 1966 (p. 513, Fig. 49: 3); Krammer & Lange-Bertalot 1986 (p. 95, Fig. 27: 1 – 3); Lange-Bertalot 2001 (p. 73, Fig. 1: 1 – 8); Hofmann *et al.* 2011 (p. 403, Fig. 35: 11 – 16).

***Navicula veneta* Kützing**
Ref. Hustedt 1930 (p. 295, Fig. 497a); Patrick & Reimer 1966 (p. 504, Fig. 48: 5); Krammer & Lange-Bertalot 1986 (p. 104, Fig. 32: 1 – 4); Lange-Bertalot 2001 (p. 74, Fig. 14: 23 – 30); Hofmann *et al.* 2011 (p. 406, Fig. 9: 8 – 12).

***Nitzschia archibaldii* Lange-Bertalot**
Ref. Krammer & Lange-Bertalot 1991 (p. 115, pl. 81: 10 – 12), Hofmann et al. 2011 (p. 435, pl. 111: 30 – 34).

***Nitzschia capitellata* Hustedt**
Ref. Krammer & Lange-Bertalot 1991 (p. 88, pl. 62: 1 – 12), Hofmann et al. 2011 (p. 438, pl. 113: 11 – 16).

***Nitzschia dissipata* (Kützing) Rabenhorst**
Ref. Hustedt 1930 (p. 412, Fig. 789); Krammer & Lange-Bertalot 1988 (p. 19, Fig. 11: 1–7); Hofmann *et al.* 2011 (p. 441, Fig. 109: 8–18).

***Nitzschia fonticola* (Grunow) Grunow**
Ref. Hustedt 1930 (p. 415, Fig. 800); Krammer & Lange-Bertalot 1988 (p. 103, Fig. 75: 1–22); Hofmann *et al.* 2011 (p. 259, Fig. 9: 8–12).

***Nitzschia inconspicua* Grunow**
Ref. Krammer & Lange-Bertalot 1991 (p. 95 - pl. 69: 1–13); Hofmann et al. 2011 (p. 446 - pl. 112: 35–40).

***Nitzschia intermedia* Hantzsch**
Ref. Hofmann *et al*. 2011 (p. 449, pl. 107: 1-6); Bąk *et al*. 2012 (p. 251, pl. 72).

***Nitzschia linearis* W.Smith**
Ref. Hustedt 1930 (p. 409, Fig. 784); Krammer & Lange-Bertalot 1988 (p. 69, Fig. 55: 1 – 4); Hofmann *et al.* 2011 (p. 452, Fig. 106: 1 – 3).

***Nitzschia media* Hantzsch**
Ref. Krammer & Lange-Bertalot 1991 (p. 19, pl. 11: 8 – 14), Hofmann *et al.* 2011 (p. 441: 14 – 18).

***Nitzschia palea* (Kützing) W.Smith**
Ref. Hustedt 1930 (p. 416, Fig. 801); Krammer & Lange-Bertalot 1988 (p. 85, Figs 59: 1 – 24; 60: 1 – 6); Hofmann *et al.* 2011 (p. 454, Fig. 111: 1 – 20).

***Tryblionella apiculata* W.Gregory**
Ref. Krammer & Lange-Bertalot 1991 (p. 43, pl. 35: 1 – 6); Hofmann *et al*. 2011 (p. 439, pl. 104: 18 - 22); Bąk *et al*. 2012 (p. 246, pl. 71).

Table 2
Common and Rare Diatoms in Turkey (Gönülol, 2018) and in This Study

		In this study	
	Status in Turkey	Status	Station(s)
Amphora pediculus (Kützing) Grunow	C	C	G2, G3, G4, G5, G6, N1, N2, N4, N5, N7, N8, N9, N10, N11, N12, N15, N16, N17
Cocconeis pediculus Ehrenberg	C	C	N3, N4, N5, N6, N7, N8, N9, N10, N11, N12, N15, N16, N17
Cyclotella meneghiniana Kützing	C	C	G3, G4, G6, N3, N4, N6, N8, N9, N11, N14
Cymbella excisa Kützing	C	C	G1, G2, G3, N2, N3, N5, N7, N8, N9, N11, N12, N15, N17
Diatoma moniliformis (Kützing) D.M.Williams	C	C	N1, N2, N3, N4, N5, N6, N7, N9, N11, N12, N15, N16, N17
Encyonema minutum (Hilse) D.G.Mann	C	C	G1, G3, G6, N3, N5, N6, N8, N9, N10, N11, N15
Epithemia sorex Kützing	C	C	G1, G2, G3, G4, G5, N5, N12, N15, N16, N17
Gomphonema olivaceum (Hornemann) Brébisson	C	C	G1, N1, N2, N3, N4, N5, N6, N7, N8, N9, N11, N12, N15, N16, N17
Gomphonema parvulum (Kützing) Kützing	C	C	G6, N1, N4, N6, N7, N8, N9, N10, N11, N12, N14, N16
Melosira varians C.Agardh	C	C	G2, G5, G6, N1, N3, N4, N6, N8, N9, N11, N14
Navicula capitatoradiata H.Germain	C	C	G1, G2, G3, G5, G6, N2, N4, N5, N7, N8, N9, N11, N12, N16, N17
Navicula cryptotenella Lange-Bertalot	C	C	G4, G5, G6, N1, N2, N4, N5, N7, N9, N10
Navicula exifuga Lange-Bertalot	R	C	G1, G6, N1, N2, N4, N8, N9, N11, N12, N14
Navicula gregaria Donkin	C	C	G6, N1, N2, N3, N4, N5, N7, N8, N9, N10, N11, N12, N16
Navicula novaesiberica Lange-Bertalot	C	C	G1, G2, G6, N2, N3, N4, N5, N8, N9, N10, N11, N12, N15
Navicula reichardtiana Lange-Bertalot	R	C	G1, G2, G3, G6, N1, N2, N4, N5, N7, N8, N9, N10, N11, N15, N16, N17
Navicula tripunctata (O.F.Müller) Bory	C	C	G4, N2, N4, N5, N9, N10, N11, N12, N15, N16, N17
Navicula veneta Kützing	C	C	G1, G2, G3, G6, N1, N2, N3, N4, N6, N8, N9, N10, N11, N12, N15, N16
Nitzschia archibaldii Lange-Bertalot	R	C	G1, G2, G3, G4, N2, N3, N5, N7, N12, N16
Nitzschia capitellata Hustedt	C	C	G6, N1, N2, N3, N4, N6, N8, N9, N10, N11, N12, N13, N14
Nitzschia dissipata (Kützing) Rabenhorst	C	C	G1, G2, G3, N1, N2, N4, N5, N6, N7, N9, N10, N11, N12, N15, N16, N17
Nitzschia fonticola (Grunow) Grunow	C	C	G1, G2, G6, N1, N2, N9, N11, N12, N15, N16, N17
Nitzschia inconspicua Grunow	C	C	G1, G2, G3, G4, G6, N1, N2, N4, N6, N8, N9, N10, N11, N12, N15, N16
Nitzschia intermedia Hantzsch	C	C	G3, G6, N1, N2, N3, N4, N8, N9, N11, N12, N14
Nitzschia linearis W.Smith	C	C	G3, G6, N1, N2, N6, N7, N8, N9, N10, N11, N15, N16
Nitzschia media Hantzsch	C	C	G1, G2, G3, G6, N1, N2, N4, N5, N15, N16, N17
Nitzschia palea (Kützing) W.Smith	C	C	G1, G2, G3, G6, N1, N2, N3, N4, N6, N7, N8, N9, N10, N11, N12, N13, N14, N16
Tryblionella apiculata W.Gregory	C	C	G3, N1, N2, N3, N4, N6, N7, N9, N10, N11, N14, N16, N17

Note. C: common ; R: rare

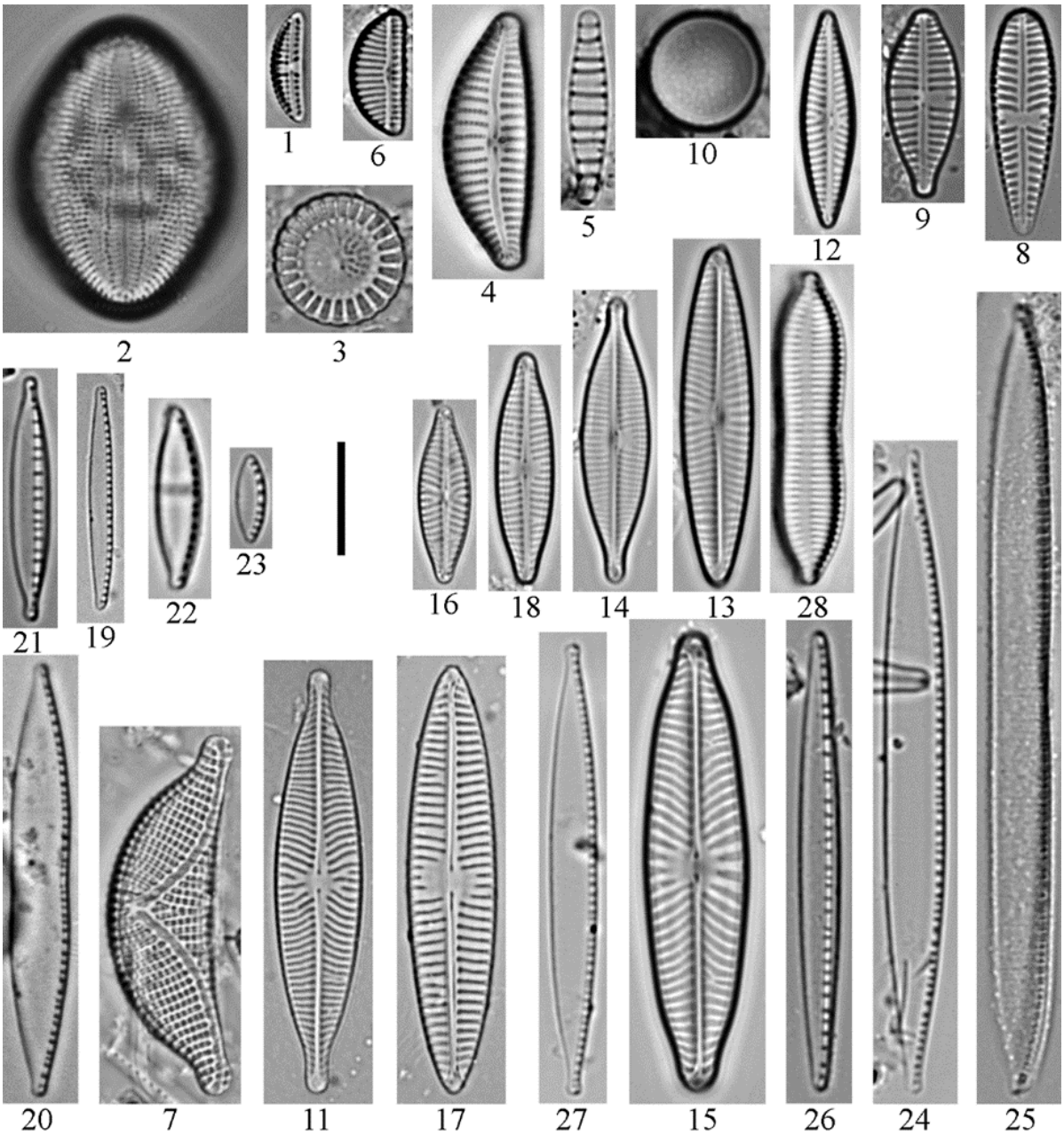

Figure 2. Common Diatoms of Gediz River Basin **1-** *Amphora pediculus;* **2-** *Cocconeis pediculus;* **3-** *Cyclotella meneghiniana;* **4-** *Cymbella excisa;* **5-** *Diatoma moniliformis;* **6-** *Encyonema minutum;* **7-** *Epithemia sorex;* **8-** *Gomphonema olivaceum;* **9-** *G. parvulum;* **10-** *Melosira varians;* **11-** *Navicula capitatoradiata;* **12-** *N. cryptotenella;* **13-** *N. erifuga;* **14-** *N. gregaria;* **15-** *N. novaesiberica;* **16-** *N. reichardtiana;* **17-** *N. tripunctata;* **18-** *N. veneta;* **19-** *Nitzschia archibaldii;* **20-** *N. capitellata*; **21-** *N. dissipata;* **22-** *N. fonticola;* **23-** *N. inconspicua;* **24-** *N. intermedia;* **25-** *N. linearis;* **26-** *N. media;* **27-** *N. palea;* **28-** *Tryblionella apiculata*. Scale bar: 10 µm.

Discussion and Conclusion

Regarding to distribution of the taxa, many of them were also common diatoms in Turkish inland waters (e.g. *Amphora ovalis, C. placentula, C. placentula var. euglypta, Craticula accomoda, Cyclostephanos dubius, Cymbella neocistula* etc.) (Solak and Wojtal, 2012, Solak et al. 2018b). However, *Navicula erifuga, N. reichardtiana,* and *Nitzschia archibaldii* were rarely found in the Turkish waters. Taxonomically, *Navicula erifuga* close to *N.simulata* Manguin. However, the latter is radiate striae. The taxon was found in Uluabat Lake (Karacaoğlu et al. 2004; Dalkıran et al. 2017) and Küçük Menderes river basin (Solak et al. 2018a). *N. reichardtiana* similar to *N. moskalii* Metzeltin et al. and *N. caterva* Hohn & Hellerman. *N. moskalii* is wider outline while, *N. caterva* has a higher stria density. The taxon was found in Asartepe reservoir (Atıcı et al. 2010), Küçük Menderes river basin (Solak et al. 2018a) and Kütahya flowing waters (Solak et al. 2016). *Nitzschia archibaldii* similar to *N. pumila* Hustedt but *N. pumila* is characterised by long protracted ends (Lange -Bertalot et al., 2017). The taxon was found in Küçük Menderes river basin (Solak et al. 2018a). *Cocconeis pediculus* is close to *C. placentula* sensu lato. However, *C. pediculus* has typical striation and structure on RLV. *Cymbella excisa* was described by Lange-Bertalot (2002). The taxa is very common in the inland waters (identified as *C. affinis* according to Krammer & Lange-Bertalot (1986). Generally, *Nitzschia dissipata* is often found together with *N. media.* The latter is longer while, the former has typical axial area.

Ecologically, *A. pediculus* exists in oligo- and β-mesosaprobic habitats. However, its ecology needs to be revised because the taxon is not easy to identify under LM. *C. pediculus* are characteristics of alkaline, lentic and lotic systems with medium to high trophic levels. *C. excisa* is cosmopolitan and abundant in the mountains. *D. moniliformis* tolerates brackish conditions. *E. minutum* is in anthropogenically little affected habitats. *E. sorex* exists in medium to high trophic levels. *G. olivaceum* is in mostly eutrophic and moderately electrolyte-rich and, *G. parvulum* is in oligosaprobic and mesosaprobic habitats. *Navicula capitatoradiata* is in eutrophic to polytrophic running waters and lakes with in weakly brackish waters. *N. cryptotenella* is indicator of β-mesosaprobic and better conditions. *N. erifuga* is in brackish waters. *N. gregaria* is tolerates up to the α-mesosaprobic level. *N. veneta* is dominant in industrial waste water. *Nitzschia amphibia* is tolerant to the α-mesosaprobic zone while, *N. capitellata* is tolerant to polysaprobic level (Lange-Bertalot et al., 2017; Krammer, 2002).

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Extended Turkish Abstract
(Genişletilmiş Türkçe Özet)

Gediz Nehir Havzasındaki Fitobentozun Yaygın Diyatomeleri

Avrupa Birliği Su Çerçeve Direktifi; su kaynaklarının korunması, geliştirilmesi ve kalitedeki kötüye gidişin engellenmesi amacıyla yürürlüğe konmuştur. Direktifin ana hedefi su kütlelerinde ekolojik iyi duruma ulaşılabilmesidir. Direktifin uygulanabilmesi için her bir havza için nehir havzası yönetim planlarının oluşturulması gerekmektedir. Türkiye'de bulunan 25 nehir havzasından 11 havza (Konya, Susurluk, Meriç-Ergene, Büyük Menderes, Gediz, Yeşilırmak, Akarçay, Batı Akdeniz, Burdur, Küçük Menderes ve Kuzey Ege) için yönetim planı hazırlanması çalışmaları devam etmektedir. Nehir havzası yönetim planlarının hazırlanması sürecinde havzada bulunan su kütlelerinin ekolojik durumunun ortaya konulması gerekmektedir. Ekolojik durumun ortaya konulması için fitoplankton, makrofit, fitobentoz, bentik makroomurgasızlar ve balık gibi biyolojik kalite bileşenleri nehir havzalarında izlenmektedir.

Gediz Havzası coğrafi bakımdan 38°04'-39°-13' kuzey enlemleri ile 26°42'-29°45' doğu boylamları arasında yer almaktadır. Havzanın temel su kaynağı olan Gediz Nehrine birçok yan dere katıldıktan sonra Manisa ve Menemen Ovalarını sulayarak denize dökülmektedir. 275 km uzunluğunda olan Gediz Nehri Batı Anadolu'da 17.220 km^2'lik bir yağış alanından beslenmektedir. Gediz Havzası'nda doğal göl sayısı yok denecek kadar azdır. Havzada yer alan en önemli doğal göl, Akhisar'ın Marmara beldesi yakınlarındaki Marmara Gölü'dür. Marmara Gölünün minimum ve maksimum kotu 73.2–79.2 m, hacmi 8,5–320 hm^3'tür. Havzada Marmara Gölü'nün dışında doğal göl olarak Gölcük Gölü vardır. Bir krater gölü olan Gölcük Gölü, 80 ha genişliğinde ve 10 m derinliğindedir. Havzada 5 baraj bulunmaktadır. Havzadaki en büyük baraj 1.022 milyon m^3 depolama kapasitesiyle Demirköprü Barajı'dır. Barajın üzerine enerji üretmek üzere HES kurulmuştur. Küçükler Barajları içmesuyu temini için, diğer barajlar sulama, taşkın koruma ve enerji üretimi amaçlı kullanılmaktadır. Demirköprü, Afşar ve Buldan Barajları Manisa'da, Küçükler Barajı ise Uşak'ta yer almaktadır.

AB Su Çerçeve Direktifi kapsamında diyatomeler, fitobentoz biyolojik kalite bileşeninin nehir ve göllerde temsil eden en önemli organizma gruplarındandır. Nehir havzası yönetim planlarının hazırlanması sürecinde yerüstü su kütlelerinde ekolojik durumun ortaya konulması maksadıyla diyatomeler birçok nehir havzasında izlenmektedir. Diyatome örnekleri havzada bulunan 17 nehir (Demirci, Gürdük, Gediz, Gürlevik, Bahçeler, Diken, Derbent, Selendi, Alaşehir, Nif, Sarıkız, Canburt, Murat, Ağıl ve Gürdük akarsuları), 2 göl (Gölcük ve Marmara) ve 4 barajdan (Demirköprü, Küçükler, Buldan, Afşar) Kasım 2017 ve Nisan 2018'de epiliton ve epipelon substratlardan toplanmıştır. Epilitik örnekler nehir yatağında yer alan taşların fırçalanmasıyla, epipelik örnekler ise pipet yardımıyla sedimentten toplanmıştır. Organik maddenin frustullerden uzaklaştırılması maksadıyla örnekler H_2O_2 ve HCl ile kaynatılmıştır. Daimi preparatlar Naphrax solüsyonu ile hazırlanmıştır. Diyatomeler mikroskop yardımıyla incelenmiş ve taksonomik literatüre göre teşhis edilmiştir. Havzada yaygın olarak bulunan taksonların görsel katalogları hazırlanmış ve Türkiye florasındaki durumu ile karşılaştırılmıştır. Tür, literatürde %10 dan fazla yer alıyorsa "*yaygın*", % 10 dan daha azında yer alıyorsa "*az rastlanır*" olarak sınıflandırılmıştır.

Sonuç olarak, Gediz Nehir Havzasında 28 diyatome taksonu yaygın olarak bulunmuştur. Çalışmada tespit edilen taksonların pek çoğu Türkiye nehir ve göllerinde yaygın olarak bulunan taksonlardır. *Amphora pediculus* (Kützing) Grunow, *Nitzschia dissipata* (Kützing) Rabenhorst ve *Nitzschia inconspicua* Grunow örnekleme noktalarında en yaygın tespit edilen türler olmuştur. Ancak, *Navicula erifuga* Lange-Bertalot, *Navicula reichardtiana* Lange-Bertalot ve *Nitzschia archibaldii* Lange-Bertalot Türkiye nehir ve gölleri için nadir bulunan türlerdendir. *Navicula erifuga* ülkemizde Marmara ve Küçük Menderes nehir havzalarında rastlanmıştır. Diğer bir baskın takson *N. reichardtiana* ise Sakarya ve Küçük Menderes nehir havlalarında tespit edilmiştir. Türlerin taksonomik özellikleri dikkate alındığında, *Cocconeis pediculus* ile *C. placentula* birbirine oldukça benzer durumda olup, raphe içermeyen kabuk yapısı (stria yapısı) farklılık göstermektedir. *Cymbella excisa* ise yine yaygın diyatomelerden biridir. Bu tür ilk olarak *C. affinis* olarak tanımlanmıştır. Türlerin ekolojik özellikleri gözönüne alındığında, *Amphora pediculus* temiz sularda bulunur. *Cymbella excisa* az kirli alkalinsularda bulunur. *Diatoma moniliformis* hafif tuzlu suların karakteristik türlerinden birisidir.

*Gomphonema olivaceum*daha ziyade ötrofik ve orta derecede iletkenlik seviyesine sahip sularda bulunur. Diğer yaygın bir tür olan G. parvulum ise ekolojik toleransı geniş türlerden biridir. *Navicula capitatoradiata* daha ziyade kirli sularda yayılış gösterir. *Navicula gregaria* ve *Nitzschia amphibia* kirliliğe nispeten toleranslı türlerden biridir. *Nitschia capitellata* ise çok kirli sulara toleranslı türler arasındadır.