

DIATOMS IN SPRINGS AND STREAMS OF TÜRKMEN MT. (SAKARYA RIVER BASIN) COMMON IN TURKISH INLAND WATERS

CÜNEYT NADIR SOLAK & AGATA Z. WOJTAL

Abstract. In a study of diatoms from ten springs and five streams of Türkmen Mt. we identified over 300 diatom species, 59 of which are among the most commonly reported diatoms from Turkey. Several of these diatoms are truly widespread but can also be accompanied or replaced by taxa of more limited distribution. Some commonly reported diatom species [e.g., *Caloneis bacillum* (Grunow) Cleve, *Cymbella leptoceros* (Ehrenberg) Kützing, *Pinnularia viridis* (Nitzsch) Ehrenberg] were not found in the material studied, but morphologically similar diatoms (e.g., *P. viridiformis* Krammer, *Cymbella subleptoceros* Krammer) were found in the springs and streams. We identified some taxa included previously in the broad *Caloneis bacillum* concept [i.e., *C. lancettula* (Schulz) Lange-Bertalot & Witkowski, *C. fontinalis* (Grunow) Lange-Bertalot & Reichardt]. Previous records of several diatoms regarded as common but which we did not confirm in the Türkmen Mt. area may very well be correct, as the reports from Turkey are from very diverse environments, including large rivers and lakes. However, the published data are largely unverifiable due to a general lack of collections and/or documentation. All the diatoms presented here are documented by light micrographs, and brief notes on their dimensions, distribution and ecology are provided. *Caloneis lancettula*, *C. fontinalis*, *Cymbella affinitiformis* Krammer, *C. subleptoceros* and *Pinnularia viridiformis* are reported for the first time from Turkey.

Key words: Bacillariophyta, taxonomy, ecology, springs, streams, mountains, distribution, Turkey

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INTRODUCTION

The structure of diatom assemblages reflects environmental conditions and the water quality of springs, streams (Battagazzore *et al.* 2004; Cantonati & Spitale 2009; Wojtal *et al.* 2009) and rivers (Vilbaste 2004; Blanco *et al.* 2006; Ács *et al.* 2009; Barinova & Tavassi 2009; Kelly *et al.* 2009; Angeli *et al.* 2010; Torrisi *et al.* 2010; Wojtal & Sobczyk 2012). Diatoms are also one of the most common producers of organic matter in springs and small streams (Cantonati *et al.* 2006; Wojtal 2009) and one of the most important components of aquatic biodiversity (e.g., Gillett *et al.* 2011). The worldwide application of the most commonly used keys (i.e., Patrick & Reimer (1966); Krammer & Lange-Bertalot 1986–1991b) has created the impression that a large part of the European diatom flora is of cosmopolitan distribution, due to the common practice of fitting the taxon to the name (Van de Vijver *et al.* 2004). High-resolution taxonomy has

shown, however, that the distribution of several diatoms is influenced by geographic and climatic factors (Vanormelingen *et al.* 2008).

Situated between large continents (Eurasia and Africa), Turkey comprises areas of very diverse geological, climatic and environmental conditions, including the Mediterranean region with many endemic vascular plants (Anonymous 2003; Solak *et al.* 2012), so we should expect that other organisms including diatoms will show high diversity in this region.

Although long lists of algal names from Turkey have been published (Gönülol *et al.* 1996; Aysel 2005) there has been relatively little taxonomic study of the diatoms (Solak *et al.* 2012). Most publications merely list the observed organisms and are chiefly concerned with water quality (Barlas *et al.* 2001, 2002; Dalkıran *et al.* 2008; Gürbüz & Kıvrak 2002; Kalyoncu 2002; Karacaoğlu *et al.* 2008; Solak 2011;

Solak *et al.* 2007a, b, 2009; Kalyoncu *et al.* 2009) and floristic or seasonal changes in lakes, dam reservoirs and some large rivers (Yıldız 1987a; Altuner 1988; Şen 1988b; Şen & Çetin 1988; Altuner & Gürbüz 1989; Elmacı & Obalı 1992, 1998; Kolaylı *et al.* 1998; Şahin 1998; Aksın *et al.* 1999; Çevik *et al.* 1999, 2007; Obalı & Atıcı 2000; Yavuz & Çetin 2000; Atıcı *et al.* 2003; Soylu & Gönülol 2003; Pala-Toprak & Çağlar 2008; Akbulut 2010).

Here we have prepared verifiable taxonomic records of the diatoms most commonly reported from Turkey, as the first step toward a detailed elaboration of diatom distribution and taxonomy in this very poorly recognized area (Solak *et al.* 2012).

STUDY AREA

There are 26 river basins in seven climatic zones in Turkey, listed here with their mean annual temperature and precipitation (Ünal *et al.* 2003):

- Marmara zone (13.7°C, 686.2 mm; Meriç-Ergene, Marmara and part of Susurluk),
- Aegean zone (15.4°C, 682.0 mm; Northern Aegean, Gediz, Küçük Menderes, Büyük Menderes),
- Mediterranean zone (18.7°C, 797.2 mm;

Western Mediterranean, Antalya, Burdur, Eastern Mediterranean, Seyhan, Asi, Ceyhan),

- Inner Anatolia zone (10.9°C, 429.7 mm; Susurluk, Sakarya, Konya closed basin, part of Seyhan, Akarçay and Kızılırmak),

- Black Sea zone (13.7°C, 1175.8 mm; Western Black Sea, Yeşilırmak, East Black Sea, part of Kızılırmak),

- Eastern Anatolia zone (7.2°C, 417.5 mm; Van closed basin, Fırat, Çoruh, Aras),

- Southeastern Anatolia zone (15.2°C, 620.6 mm; Dicle).

The water of the river basins differs in quantity, from lowest in the Akarçay basin to highest in the Fırat and Dicle basins (Akin & Akin 2007), and also quality, from most polluted in the Marmara and Aegean basins to pristine in the Antalya basin (Solak *et al.* 2012). The Fırat and East Black Sea basins have drawn more attention because of their importance in the nation's water supply, with the largest volumes of freshwater in the country. On the other hand, the only published information about the algae of the Dicle basin is in one study of the Devegeçidi reservoir (Baykal *et al.* 2004) and another about some nearby wetlands (Açıkgöz *et al.* 2007).

In large cities administered by metropolitan municipal authorities, domestic wastewater is

Table 1. Sampling stations of Türkmen Mountain (* – spring, ** – stream).

Stations	Longitude E	Latitude N	Altitude m a.s.l.
Darıpınar*	30°15'23,53"	39°22'21,52"	1298
Çobanlar plt.*	30°20'25,26"	39°27'48,42"	1512
Dümbüldek plt.*	30°13'18,12"	39°21'51,60"	1130
Gölcük plt.*	30°22'25,92"	39°26'24,84"	1627
Güllüdere plt.*	30°21'47,16"	39°24'34,92"	1366
İdris plt.*	30°24'44,94"	39°24'00,96"	1421
İnli plt.*	30°20'02,28"	39°27'48,42"	1572
Lütfiye-Güllüdere**	30°19'00,30"	39°23'42,90"	1396
Sögüt-Lütfiye**	30°20'09,42"	39°24'14,76"	1340
Güllüdere-Türkmenbaba**	30°21'53,76"	39°23'42,30"	1358
Sögüt plt.*	30°15'46,56"	39°22'13,74"	1361
Türkmenbaba plt.*	30°23'01,74"	39°26'10,14"	1710
Uluköy plt.*	30°09'45,03"	39°29'13,99"	954
Seydi**	30°15'57,20"	39°22'06,02"	990
Akıdere**	30°21'42,34"	39°27'12,26"	1381

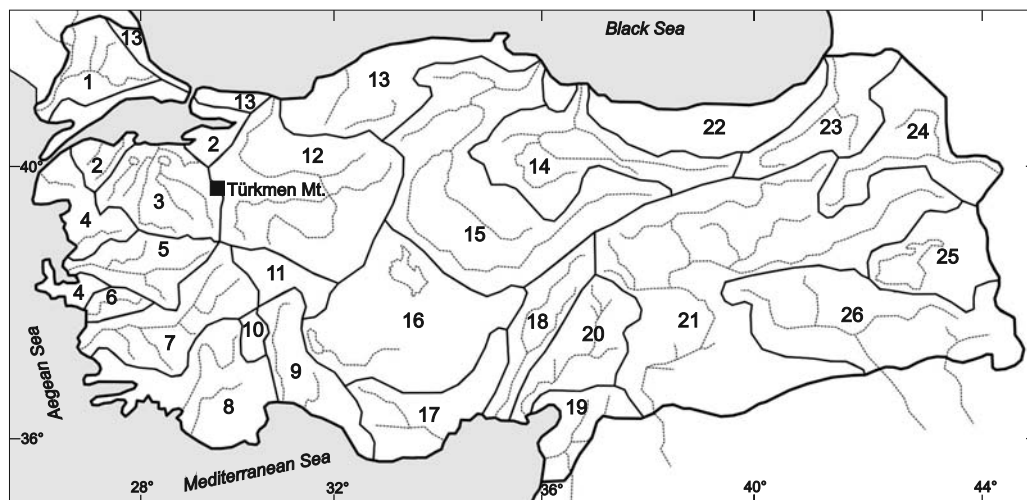


Fig. 1. Study area and the distribution of river basins in Turkey: 1 – Meriç-Ergene River Basin, 2 – Marmara River Basin, 3 – Susurluk River Basin, 4 – Northern Egean River Basin, 5 – Gediz River Basin, 6 – Küçük Menderes River Basin, 7 – Büyük Menderes River Basin, 8 – Western Mediterranean River Basin, 9 – Antalya River Basin, 10 – Burdur River Basin, 11 – Akarçay River Basin, 12 – Sakarya River Basin, 13 – Western Black Sea River Basin, 14 – Yeşilırmak River Basin, 15 – Kızılırmak River Basin, 16 – Konya Closed River Basin, 17 – Eastern Mediterranean River Basin, 18 – Seyhan River Basin, 19 – Asi River Basin, 20 – Ceyhan River Basin, 21 – Fırat River Basin, 22 – East Black Sea River Basin, 23 – Çoruh River Basin, 24 – Aras River Basin, 25 – Van Closed River Basin, 26 – Dicle River Basin (according to Akın & Akın 2007).

treated before being released into nearby streams, but many smaller towns have no or underutilized water treatment facilities. Despite the presence of sewage treatment plants, domestic pollution seems to be increasing in rivers that flow near large cities such as Ankara, Eskişehir and Kütahya (belonging to the Sakarya basin; Atıcı & Ahıska 2005; Solak *et al.* 2009; Solak 2011), and the aquatic environment is increasingly threatened by wastewater and nutrients from quickly developing urban areas and agriculture.

Türkmen Mt. (Aegean zone) is located in the Sakarya basin, which is moderately rich in waters (Akin & Akin 2007) and joins the Aegean and Inner Anatolian zones (Fig. 1). It is near the borders of the Irano-Turanean, Mediterranean and European-Siberian phytogeographical areas (Anonymous 2004). The Sakarya basin is an agricultural and industrial area. Anthropogenic pollution of waters is caused mainly by domestic sewage and industrial wastewater, and from irrigation return water. Türkmen Mt. and Murat Mt. are among the areas best preserved from anthropogenic changes in the Sakarya basin. Information about diatoms in the

Sakarya basin can be found in 44 publications, accounting for over 13% of all the papers mentioning diatoms from Turkey (Solak *et al.* 2012). As in other basins, the main interest has focused on lakes and large rivers (Solak *et al.* 2012), whereas springs and small streams have been much less studied. Due to that focus, there has been no physiological study of Türkmen Mt. and Murat Mt., where the least polluted water bodies can still be found. The localities we studied (Table 1) are situated at 954–1710 m a.s.l. and represent typical rheocene springs and small streams of the area. Some stations (Türkmenbaba, Güllüdere, Inli, Çobanlar) have near-natural conditions, and others (Darıpınar, Dümbüldek, Güllüdere-Türkmenbaba, Lütfiye-Güllüdere) are eutrophic due to agricultural and other human activities.

MATERIAL AND METHODS

The diatoms of ten mountain springs and five small streams were investigated between May and December 2007 (Table 1). The first author collected samples from the epilithon, periphyton and epipelton. Fifty samples

from submerged stones were collected monthly by brushing for epilithic samples and with a pipette aspirator for epipelon samples. The samples were boiled in H₂O₂ and HCl to remove calcium carbonate and organic matter. After washing several times with distilled water the material was air-dried on coverglasses and mounted in Naphrax[®]. The diatoms were observed with Nikon Eclipse 600 and Nikon Eclipse 80i light microscopes (LM). Micrographs were taken with Nikon DS-5M and Nikon DS-L1 cameras. Scanning electron microscopy (SEM) observations used cleaned, gold-coated material. SEM micrographs were taken in the Laboratory of Field Emission Microscopy, Scanning Electron Microscopy and Microanalysis (Institute of Geological Sciences of the Jagiellonian University and additionally at Goethe University in Frankfurt).

Species reported from Turkey in at least 10% of the literature by Solak *et al.* (2012) are noted here as diatoms most commonly reported from Turkey. The distribution of diatoms in Turkey is given according to Gönülol *et al.* (1996) and Aysel (2005), separately for the given river basins. The literature used for identification, dimensions, distribution and ecology (Hustedt 1930; Patrick & Reimer 1966, 1975; Krammer & Lange-Bertalot 1986–1991b; Krammer 1997, 2002, 2003; Lange-Bertalot 2001; Håkansson 2002; Levkov 2009; Hofmann *et al.* 2011) is indicated for every species separately. Species and infraspecific taxa are arranged alphabetically in the text and plates. The material studied is deposited in the collection of the Department of Biology of Dumlupınar University (Turkey), the Department of Phycology of the W. Szafer Institute of Botany, Polish Academy of Sciences (Poland), and the Department of Geological Science of Szczecin University (Poland).

RESULTS AND DISCUSSION

In this study we identified 304 diatom species in 10 springs and 5 streams of Türkmen Mt. The most common were representatives of the genera *Cymbella*, *Fragilaria*, *Gomphonema*, *Navicula* and *Nitzschia*; the distribution of *Chamaepinnularia*, *Eunotia*, *Neidium*, *Pinnularia* species was much more limited to the near-natural localities (Çobanlar, Gölcük, Türkmenbaba). In terms of commonness and abundance the most important diatoms in the springs and streams of Türkmen Mt. were *Cymbella neocistula* Krammer, *C. helvetica* Kützing, *Navicula cryptocephala* Kützing, *N. cryptotenella* Lange-Bertalot and *Planothidium*

lanceolatum (Brebisson *ex* Kützing) Round & Bukhtiyarova. Gönülol *et al.* (1996) prepared the first *Checklist of the Freshwater Algae of Turkey*. Aysel (2005) updated the list, giving 63 Coscinodiscophyceae, 102 Fragillariophyceae and 620 Bacillariophyceae and provided the list of 785 diatom taxa; more recent data (Baykal *et al.* 2009, Solak & Wojtal 2010) increase the number of diatoms reported from Turkey to 799 (not 631 as misquoted in Solak *et al.* 2012). Inclusion of an additional publication by Brunthaler (1903) and our identification of *Caloneis fontinalis*, *C. lanceolata*, *Cymbella affinisformis*, *C. subleptoceros* and *Pinnularia viridiformis*, not previously reported from Turkey, extend the list of diatom taxa reported from Turkish inland waters in the course of more than 150 years, raising it to 807. Many of the diatoms commonly reported from very diverse bodies of water in Turkey are taxa known from European and Asiatic areas (Solak *et al.* 2012). This indicates their broad range of tolerance and distribution but it also points to a problem. Because of the lack of taxonomic monographs on the whole diatom flora of Turkey or regional floras, Turkish phycologists have had to rely on various European or other non-native floras. This may be why mainly diatoms known from Europe have been identified and reported from Turkey.

Some of the commonly reported diatom names (e.g., *Achnantheidium minutissimum*, *Nitzschia palea*, *Sellaphora pupula*) probably concern species complexes such as *Achnantheidium minutissimum* complex, *Nitzschia palea* complex, or *Sellaphora pupula* complex (Mann *et al.* 2007, Hlúbíková *et al.* 2009, Wojtal *et al.* 2011). These diatoms were reported from very diverse water bodies, implying broad ecological tolerance ranges.

Unfortunately, the materials used for most of the previous studies in Turkey cannot be re-investigated because of the lack of collections where the materials should have been deposited. Of the 129 diatom species classified previously as common in Turkey in the *Checklist of the Freshwater Algae of Turkey* and other sources (Solak *et al.* 2012) we identified 59 in the material collected from Türkmen Mt. These 59 are known from very diverse water bodies sometimes quite different from

the springs and streams of Turkey. It is impossible to state definitively that a given taxon is not present in Turkey's many diverse aquatic environments; some that we did not find in the study area may occur there in low abundance.

Judging by the apparent morphological similarity of specimens described in older reports, some previously reported diatoms may actually be taxa unknown from Turkey until now but which we found commonly in the material we studied (*Caloneis fontinalis*, *C. lancettula*, *Cymbella affinis*, *C. subleptoceros*, *Pinnularia viridiformis*). On the other hand, several of the diatoms most commonly reported from Turkey seem to be truly widespread, though they may also be accompanied or replaced by taxa of more limited distribution. Some of the 245 taxa we found in the material from Türkmen Mt. need further taxonomical studies and will be published separately.

1. *Achnantheidium minutissimum* (Kützing)

Czarnecki Figs 2, 3, 123 & 124

Achnanthes minutissima Kützing

Ref. Hustedt 1930 (p. 198, Fig. 274); Patrick & Reimer 1966 (p. 253, Fig. 16: 9–10); Krammer & Lange-Bertalot 1991b (p. 56, Fig. 32: 1–24); Hofmann *et al.* 2011 (p. 83, Fig. 23: 15–21).

DIMENSIONS. Valves 6–24 µm in length, 2.5–4.0 µm wide, 24–30 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Türkmenbaba, Darıpinar, İdris, Söğüt-Lütfiye.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat, Aras, Çoruh), Black Sea (East Black Sea River Basin), Inner Anatolia (Akarçay, Kızılırmak, Konya Closed River Basin, Sakarya) and Egean (Küçük Menderes and Susurluk) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989,

1990a, b, 1991, 1994, 1996; Altuner & Pabuccu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Kızılırmak (Özdemir 1987; Kılınç & Dere 1988; Yıldız & Özkıran 1991; Dere & Sıvacı 1994; Kılınç 1998; Kılınç & Sıvacı 2001; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1996), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Sakarya (Obalı 1984; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Atıcı 2002; Yardımcı & Temel 2000), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic, mesosaprobous species (Denys 1991; Krammer & Lange-Bertalot 1991b; Hofmann 1994; Van Dam *et al.* 1994), classified as a circumneutral or alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

2. *Amphora ovalis* (Kützing) Kützing

Figs 4 & 5

Ref. Levkov 2009 (p. 96, Figs 1: 1–5; 2: 1–6); Hofmann *et al.* 2011 (p. 98, Fig. 90: 1–5); Krammer & Lange-Bertalot 1986 (p. 344, Fig. 149: 1, 2).

DIMENSIONS. Valves 47.4–64.4 µm long and 9.4–15.7 µm wide, 9–13 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Akındere, Güllüdere.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Skuja 1937; Vardar & Güner 1972; Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987; Atıcı & Obalı 1999), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001; Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen & Çetin 1988; Altuner & Pabuccu 1993,

1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; İşbakan *et al.* 1998; Gezerler *et al.* 1999), Kızılırmak (Kılınç & Dere 1988; Gönüloğlu & Çomak 1990, 1992; Gönüloğlu 1993; Yıldız & Özkıran 1991; Gönüloğlu & Arslan 1992; Hasbenli & Yıldız 1993; Dere & Sivacı 1994; Kılınç 1998; Kılınç & Sivacı 2001), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985b; 1986a, b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Küçük Menderes (Skuja 1937; Kolaylı & Güner 1988; Sukatar & Güner 1988; Aysel *et al.* 1998a, b, 2001, 2002, 2005; Gezerler *et al.* 1992, 1995; Balık & Gezerler-Şipal 1995; Erener *et al.* 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2001, 2002, 2003), North Aegean (Güner 1970; Gezerler 1986; Gezerler-Şipal *et al.* 1996), Sakarya (Gönüloğlu & Aykulu 1984; Obalı 1984; Ünal 1984; Gönüloğlu 1985a, b, 1987; Yıldız 1987a, b; Dere 1989; Obalı *et al.* 1989; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Temel 2001; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Gezerler *et al.* 1994; Dere *et al.* 2002; Karacaoğlu *et al.* 2004), West Black Sea River Basin (Aysel *et al.* 1992; Öztürk 1994), Yeşilirmak (Yazıcı & Gönüloğlu 1994; Altuner & Pabuççu 1996; Kır & Polat 1996; Gönüloğlu & Obalı 1998).

GENERAL DISTRIBUTION AND ECOLOGY. Tychoplanktonic, mesosaprobous and α -mesoeutraphentic species (Lange-Bertalot 1979; Denys 1991), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

3. *Amphora pediculus* (Kützing) Grunow Figs 6–8 & 125–127

Amphora ovalis var. *pediculus* Kützing

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).

DIMENSIONS. Valves 7–15 μm long and 2–4 μm wide, 14–24 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Darıpınar, İdris.

DISTRIBUTION IN TURKEY. Lakes and rivers in Black Sea (East Black Sea River Basin, Kızılırmak, Yeşilirmak), Eastern Anatolia (Fırat,

Aras, Çoruh), Eagen (Gediz, Susurluk, Küçük Menderes) and Inner Anatolia (Konya Closed River Basin, Kızılırmak, Sakarya) river basins (Fig. 1).

RIVER BASINS. Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönüloğlu 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Kızılırmak (Kılınç & Dere 1988; Yıldız & Özkıran 1991; Gönüloğlu & Arslan 1992; Dere & Sivacı 1994; Gönüloğlu & Obalı 1998; Kılınç 1998; Gönüloğlu & Çomak 1990, 1992; Gönüloğlu 1993; Kılınç & Sivacı 2001), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, Yıldız *et al.* 1994; Mitamura *et al.* 1997; Demirsoy 1996; Akköz & Obalı 1998; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1996), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Sakarya (Gönüloğlu & Aykulu 1984; Obalı 1984; Ünal 1984; Gönüloğlu 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaoğlu *et al.* 2004), Yeşilirmak (Altuner & Pabuççu 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychooplanktonic, mesosaprobous and eutraphentic species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994; Levkov 2009), classified as an alkaliphilous (Håkansson 1993; Van Dam *et al.* 1994).

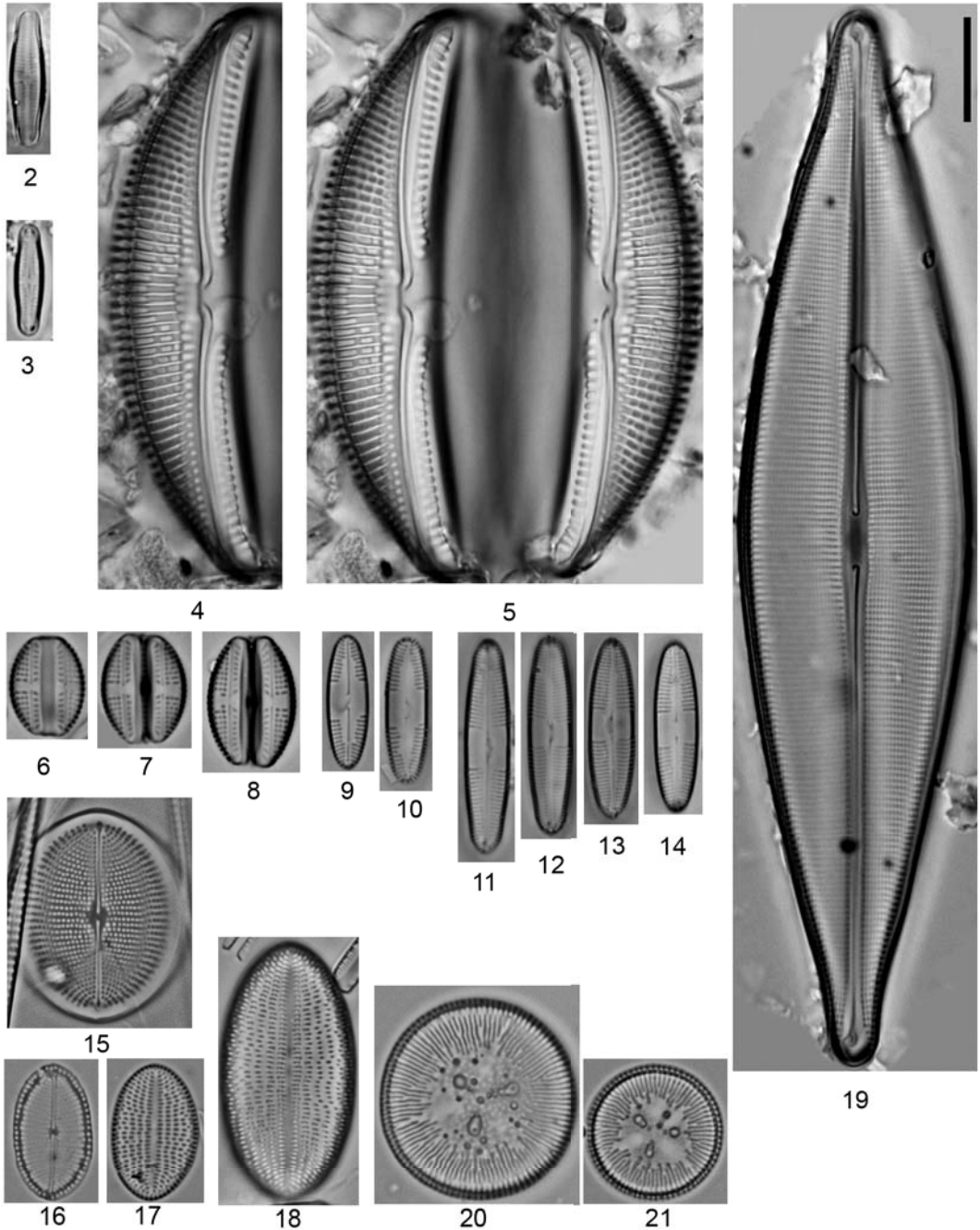
4. *Caloneis fontinalis* (Grunow) Lange-Bertalot & Reichardt Figs 9 & 10

Ref. Hofmann *et al.* 2011 (p. 117, Fig. 67: 15–19).

DIMENSIONS. Valves 12.5–16.0 μm long and 4.0–4.7 μm wide, 24–25 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Dümbüldek, İdris.

DISTRIBUTION IN TURKEY. New for flora of Turkey.



Figs 2–21. 2 & 3 – *Achnanthydium minutissimum* (Kützing) Czarnecki, 4 & 5 – *Amphora ovalis* (Kützing) Kützing, 6–8 – *A. pediculus* (Kützing) Grunow, 9 & 10 – *Caloneis fontinalis* (Grunow) Lange-Bertalot & Reichardt, 11–14 – *C. lancettula* (Schulz) Lange-Bertalot & Witkowski, 15 – *Cocconeis pediculus* Ehrenberg, 16 & 17 – *C. placentula* var. *euglypta* (Ehrenberg) Grunow, 18 – *C. placentula* var. *lineata* (Ehrenberg) Van Heurck, 19 – *Craticula cuspidata* (Kützing) D. G. Mann, 20 & 21 – *Cyclotella ocellata* Pantocsek. Scale bar = 10 μm .

GENERAL DISTRIBUTION AND ECOLOGY. According to Hofmann *et al.* (2011) *Caloneis fontinalis* is widespread species occurring locally in large number in calcium rich, mesotrophic and eutrophic waters of low saprobity; most common in springs and running waters.

5. *Caloneis lancettula* (Schulz) Lange-Bertalot & Witkowski Figs 11–14

Ref. Hofmann *et al.* 2011 (p. 117, Fig. 67: 1–9).

DIMENSIONS. Valves 14–24 μm long and 4.0–5.3 μm wide, 22–30 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Dümbüldek.

DISTRIBUTION IN TURKEY. New for flora of Turkey.

GENERAL DISTRIBUTION AND ECOLOGY. *Caloneis lancettula* is a common diatom in α -mesotrophic up to eutrophic waters; good indicator of elevated trophic level (Hofmann *et al.* 2011).

6. *Cocconeis pediculus* Ehrenberg

Figs 15 & 128–130

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

DIMENSIONS. Valves 15–24 μm long and 11–20 μm wide, 14–20 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Türkmenbaba.

DISTRIBUTION IN TURKEY. Lakes and rivers in Inner Anatolia (Konya Closed River Basin) (Fig. 1).

RIVER BASINS. Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Yüce *et al.* 1997; Savaş & Cirik 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin

& Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, 1991; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Kızılırmak (Yıldız & Özkıran 1991; Gönülol & Çomak 1990, 1992; Gönülol 1993; Dere & Sıvacı 1994; Gönülol & Obalı 1998), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Çirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998), Sakarya (Obalı 1984; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), Yeşilırmak (Yazıcı & Gönülol 1994; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Ty-choplanktonic, mesosaprobous and eutrathentic species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

7. *Cocconeis placentula* var. *euglypta* (Ehrenberg) Grunow Figs 16 & 17

Cocconeis placentula var. *euglypta* (Ehrenberg) Cleve Ref. Hustedt 1930 (p. 190, Fig. 261); Patrick & Reimer 1966 (p. 241, Fig. 15: 8); Krammer & Lange-Bertalot 1991b (p. 87, Figs 53: 1–14; 54: 12).

DIMENSIONS. Valves 12–40 μm long and 7–25 μm wide, 16–26 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. İdris.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Morkoyunlu *et al.* 1996; Ertan *et al.* 1996; Yüce *et al.* 1997; Savaş & Cirik 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen

et al. 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; Gezerler *et al.* 1996, 1999), Kızılırmak (Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sıvacı 1994; Gönülol & Obalı 1998), Konya Closed River Basin (Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Demirsoy 1996; Akköz & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 2001, 1996, 1999, 2002, 2003), Sakarya (Obalı 1984; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Atıcı 2002; Yardımcı & Temel 2000), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994; Cirik 1997), Yeşilirmak (Altuner & Pabuççu 1996).

GENERAL DISTRIBUTION & ECOLOGY. Tycho-planktonic, mesosaprobous and eutraphentic species (Denys 1991; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

8. *Cocconeis placentula* var. *lineata* (Ehrenberg) Van Heurck Figs 18, 131 & 132

Cocconeis placentula var. *lineata* (Ehrenberg) Cleve, *C. placentula* var. *lineata* (Ehrenberg) Van Heurck

Ref. Hustedt 1930 (p. 190, Fig. 262); Patrick & Reimer 1966 (p. 241, Fig. 15: 8); Krammer & Lange-Bertalot 1991b (p. 87, Fig. 52: 1–13).

DIMENSIONS. Valves 21.0–29.3 µm long and 12.0–15.3 µm wide, 19–21 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Türkmenbaba.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat, Aras, Çoruh) and Egean (Gediz, Küçük Menderes, Susurluk) river basins (Fig. 1).

RIVER BASINS. Antalya (Skuja 1937; Vardar & Güner 1972), Aras (Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Kızılırmak (Gönülol & Çomak 1990, 1992; Elmacı & Obalı 1992; Gönülol

1993; Gönülol & Obalı 1998), Konya Closed River Basin (Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Susurluk (Skuja 1937; Gezerler 1992; Dere *et al.* 2002; Karacaören *et al.* 2004).

GENERAL DISTRIBUTION AND ECOLOGY. Tycho-planktonic, mesosaprobous and eutraphentic species (Denys 1991; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

9. *Craticula cuspidata* (Kützing) D. G. Mann Figs 19 & 133–135

Navicula cuspidata Kützing

Ref. Hustedt 1930 (p. 268, Fig. 433); Patrick & Reimer 1966 (p. 464, Fig. 43: 9–10); Krammer & Lange-Bertalot 1986 (p. 126, Fig. 43: 1–8); Lange-Bertalot 2001 (p. 111, Figs 82: 1, 2; 83: 1, 2); Hofmann *et al.* 2011 (p. 139, Fig. 44: 1, 2).

DIMENSIONS. Valves 85–100 µm long and 20–22 µm wide, 14–17 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Darıpınar, İdris.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Morkoyunlu *et al.* 1996; Ertan *et al.* 1996; Yüce *et al.* 1997; Savaş & Cirik 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 2002), Fırat (Şen & Çetin 1988; Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Güner 1970; Cirik 1994; Gezerler *et al.* 1996, 1999), Kızılırmak (Özdemir 1987; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sıvacı 1994; Gönülol & Obalı 1998; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Akköz & Obalı 1998; Morkoyunlu *et al.* 1999; Mitamura *et al.* 1997;

Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönüloğlu & Aykulu 1984; Obalı 1984; Ünal 1984; Gönüloğlu 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Gezerler 1992; Dere *et al.* 2002; Karacaören *et al.* 2004).

GENERAL DISTRIBUTION & ECOLOGY. Widespread, tychoplanktonic, mesosaprobous and eutraphentic species (Lange-Bertalot 1979; Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994; Lange-Bertalot 2001), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

10. *Cyclotella ocellata* Pantocsek

Figs 20, 21 & 142

Ref. Hustedt 1930 (p. 100, Fig. 67); Krammer & Lange-Bertalot 1991a (p. 51, Figs 50: 1–11, 13, 14; 51: 1–5); Håkansson 2002 (p. 85, Figs 309–318).

DIMENSIONS. Valves 9–23 µm in diameter and 20–22 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Darıpınar, Söğüt-Lütfiye, Türkmenbaba, Uluköy.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat, Çoruh and Aras river basins), Egean (Küçük Menderes River Basin), Mediterranean (Antalya and Asi river basins) and Inner Anatolia (Konya Closed River Basin) (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Gönüloğlu & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Mitamura *et al.* 1997; Elmacı & Obalı 1998; Ertan & Morkoyunlu 1998; Morkoyunlu *et al.* 1999), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987; Atıcı 2002; Yardımcı & Temel 2000), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen & Çetin 1988; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000;

Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Akköz & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönüloğlu & Aykulu 1984; Obalı 1984; Ünal 1984; Gönüloğlu 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994), Kızılırmak (Özerm 1987; Kılınç & Dere 1988; Gönüloğlu & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönüloğlu & Arslan 1992; Gönüloğlu 1993; Dere & Sıvacı 1994; Gönüloğlu & Obalı 1998; Kılınç 1998; Kılınç & Sıvacı 2001; İşbakan *et al.* 2002; Akbulut 2003), Yeşilirmak (Yazıcı & Gönüloğlu 1994; Altuner & Pabuççu 1996; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Euplanktonic, oligosaprobous and meso-eutraphentic species (Denys 1991; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

11. *Cymatopleura elliptica* (Brébisson) W. Smith Fig. 23

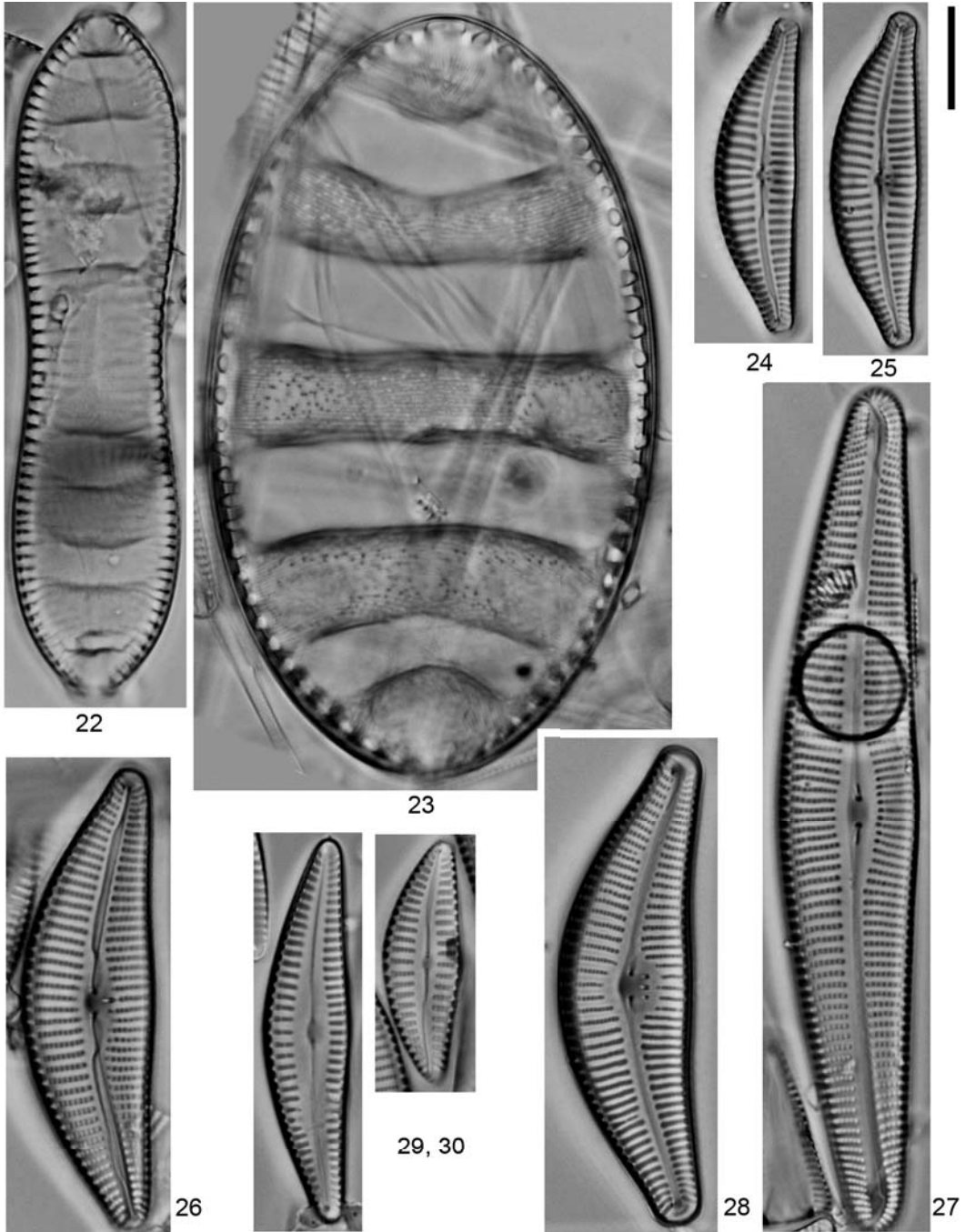
Ref. Hustedt 1930 (p. 426, Fig. 825); Krammer & Lange-Bertalot 1988 (p. 170, Figs 119: 1–4; 120: 1–6; 122: 3); Hofmann *et al.* 2011 (p. 143, Fig. 123: 1–4).

DIMENSIONS. Valves 65–89 µm long and µm 42–52 µm wide, 3–4 fibulae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Söğüt-Lütfiye, Güllüdere-Türkmenbaba.

DISTRIBUTION IN TURKEY. Lakes and rivers in all river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik



Figs 22–30. 22 – *Cymatopleura solea* (Brébisson) W. Smith, 23 – *C. elliptica* (Brébisson) W. Smith, 24, 25 – *Cymbella affinis* Krammer, 26 – *C. cymbiformis* Agardh, 27 – *C. helvetica* Kützing, 28 – *C. neocistula* Krammer, 29 & 30 – *C. subleptoceros* Krammer. Scale bar = 10 μ m.

1994; Gezerler *et al.* 1999), Kızılırmak (Özesm 1987; Kılınç & Dere 1988; Yıldız & Özkıran 1991; Gönüloğ & Arslan 1992; Dere & Sivacı 1994; Kılınç 1998; Kılınç & Sivacı 2001; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Akköz & Obalı 1998; Morkoyunlu *et al.* 1999; Mitamura *et al.* 1997; Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Marmara (Temel 1996, 1999, 2002), Sakarya (Gönüloğ 1985a, 1987; Yıldız 1987a; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Gezerler 1992; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994), Yeşilirmak (Yazıcı & Gönüloğ 1994; Altuner & Pabuççu 1996; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, euplanktonic, mesosaprobous and eutraphentic species (Krammer & Lange-Bertalot 1988; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

12. *Cymatopleura solea* (Brébisson) W. Smith

Fig. 22

Ref. Hustedt 1930 (p. 425, Fig. 823a); Krammer & Lange-Bertalot 1988 (p. 168, Figs 117: 1–5; 118: 1, 3); Hofmann *et al.* 2011 (p. 144, Figs 124–125).

DIMENSIONS. Valves 65–131 µm long and 13–23 µm wide, 7–8 fibulae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Söğüt-Lütfiye, Güllüdere.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Gönüloğ & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Ertan *et al.* 1996; Yüce *et al.* 1997; Savaş & Cirik 1997; Morkoyunlu & Ertan 1995a, b; Morkoyunlu *et al.* 1996; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönüloğ 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat

(Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen & Çetin 1988; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; Gezerler *et al.* 1996, 1999), Kızılırmak (Özesm 1987; Kılınç & Dere 1988; Gönüloğ & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönüloğ & Arslan 1992; Gönüloğ 1993; Dere & Sivacı 1994; Gönüloğ & Obalı 1998; Kılınç 1998; Kılınç & Sivacı 2001; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Yıldız *et al.* 1994; Demirsoy 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönüloğ & Aykulu 1984; Obalı 1984; Ünal 1984; Gönüloğ 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Kandemir-Çevik *et al.* 1994; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Atıcı 2002; Yardımcı & Temel 2000), Susurluk (Brunnthal 1903; Skuja 1937; Gezerler 1992; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994), Yeşilirmak (Yazıcı & Gönüloğ 1994; Altuner & Pabuççu 1996; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, euplanktonic, mesosaprobous and eutraphentic species (Krammer & Lange-Bertalot 1988; Lange-Bertalot 1979; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous (Håkansson 1993; Van Dam *et al.* 1994).

13. *Cymbella affiniformis* Krammer

Figs 24, 25 & 136–141

Ref. Krammer 2002 (p. 45, Fig. 25; 1–8).

DIMENSIONS. Valves 23.0–38.7 µm long and 6–10 µm wide, 10–12 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Darıpınar, Dümbüldek, Çobanlar, Türkmenbaba.

DISTRIBUTION IN TURKEY. New for flora of Turkey.

GENERAL DISTRIBUTION AND ECOLOGY. *Cymbella affiniformis* is probably widespread, though not distinguished from commonly reported taxa. The species ecology and distribution remain very poorly known. It has been described in 2002 by

Krammer from material collected from pond (Germany). Later, very similar diatom – *Cymbella yakii* Jüttner & Van de Vijver (2010) has been described from Asia (Nepal).

14. *Cymbella cymbiformis* Agardh Fig. 26

Ref. Hustedt 1930 (p. 362, Fig. 672); Patrick & Reimer 1975 (p. 54, Fig. 10: 3–4); Krammer & Lange-Bertalot 1986 (p. 317, Fig. 129: 2–6); Krammer 2002 (p. 76, Fig. 58; 59; 61; 62: 1–3; 63; 65); Hofmann *et al.* 2011 (p. 148, Fig. 80: 1–11).

DIMENSIONS. Valves 44–83 µm long and 13–16 µm wide, 9–11 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Türkmenbaba, Darıpinar, İdris, Söğüt-Lütfiye.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Büyük Menderes (Güner 1966; Skuja 1937), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Sen 1988b; Şen & Aksakal 1988; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1993, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000); Gediz (Güner 1970; Cirik 1994; Gezerler *et al.* 1996, 1999), Kızılırmak (Kılınç & Dere 1988; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sıvacı 1994; Kılınç 1998; Kılınç & Sıvacı 2001; İşbakan *et al.* 2002), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Skuja 1937; Cirik & Cirik 1989; Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Yardımcı & Temel 2000; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Aykulu *et al.* 1983; Gönülol & Aykulu 1984; Obalı 1984; Ünal 1984; Gönülol 1985b; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989;

Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Demirsoy 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaoğlu *et al.* 2004), West Black Sea River Basin (Öztürk 1994), Yeşilırmak (Yazıcı & Gönülol 1994; Altuner & Pabuççu 1996; Kır & Polat 1996; Gönülol & Obalı 1998).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, euplanktonic, oligosaprobous, oligo-mesotraphentic species (Denys 1991; Van Dam *et al.* 1994; Krammer 2002), classified as a circumneutral or alkaliphilous (Håkansson 1993; Van Dam *et al.* 1994).

15. *Cymbella helvetica* Kützing Fig. 27

Ref. Hustedt 1930 (p. 364, Fig. 678); Krammer & Lange-Bertalot 1986 (p. 324, Figs 132: 2–4; 133: 1–8); Krammer 2002 (p. 154, Figs 183: 1–3; 184: 1–4; 185: 1–6; 187: 1–5); Hofmann *et al.* 2011 (p. 151, Fig. 81: 3–4).

DIMENSIONS. Valves 40–120 µm long and 10–21 µm wide, maximal length/breadth ratio about 6.6 and 10–11 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Güllüdere.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat, Aras, Çoruh), Egean (Küçük Menderes, Gediz, Susurluk), Black Sea (East Black Sea River Basin, Yeşilırmak), Inner Anatolia (Konya Closed River Basin, Sakarya, Kızılırmak) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Gürbüz 2000; Gürbüz & Altuner 2000; Çetin & Şen 1998, 2004), Gediz (Gezerler *et al.* 1996), Kızılırmak (Yıldız & Özkıran 1991; Dere & Sıvacı 1994), Konya Closed River Basin (Skuja 1937; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Marmara (Albay & Aykulu

1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönülol 1985a, 1987; Yıldız 1987a; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994).

GENERAL DISTRIBUTION AND ECOLOGY. Euplanktonic, oligosaprobous, oligo-mesotraphentic or mesotraphentic species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994; Krammer 2002), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

16. *Cymbella neocistula* Krammer Fig. 28

Cymbella cistula (Hemprich) Grunow, *C. cistula* (Ehrenberg) Kirchner

Ref. Hustedt 1930 (p. 363, Fig. 676a); Patrick & Reimer 1975 (p. 62, Fig. 11: 3–4); Krammer & Lange-Bertalot 1986 (p. 316, Figs 127: 8–11; 128: 1–6); Krammer 2002 (p. 94, Figs 85: 1–4; 86: 1–7; 87: 1–9; 88: 1–8); Hofmann *et al.* 2011 (p. 155, Fig. 79: 11–15).

DIMENSIONS. Valves 32–82 µm long and 12.0–15.7 µm wide, maximal length/breadth ratio about 6.1 and 9–11 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Gölcük, Darıpinar.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya River Basin), Black Sea (East Black Sea River Basin and Kızılırmak), Egean (Gediz, Küçük Menderes), Inner Anatolia (Konya Closed River Basin, Sakarya), Eastern Anatolia (Fırat) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabucçu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner

2000), Gediz (Cirik 1994; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996, 1999); Kızılırmak (Kılınç & Dere 1988; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol 1993; Dere & Sıvacı 1994; Kılınç 1998; Kılınç & Sıvacı 2001), Konya Closed River Basin (Skuja 1937; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akkız & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Skuja 1937; Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Temel 1996, 1999, 2002), Sakarya (Obalı 1984; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Gezerler 1992; Dere *et al.* 2002; Karacaoğlu *et al.* 2004), Yeşilirmak (Gönülol & Obalı 1998).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic, mesosaprobous and eutraphentic species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994; Krammer 2002), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

17. *Cymbella subleptoceros* Krammer Figs 29 & 30

Ref. Krammer 2002 (p. 133, Figs 154: 2–17; 155: 1–7).

DIMENSIONS. Valves 14.0–40.7 µm long, 6–11 µm wide and 9–13 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Darıpinar.

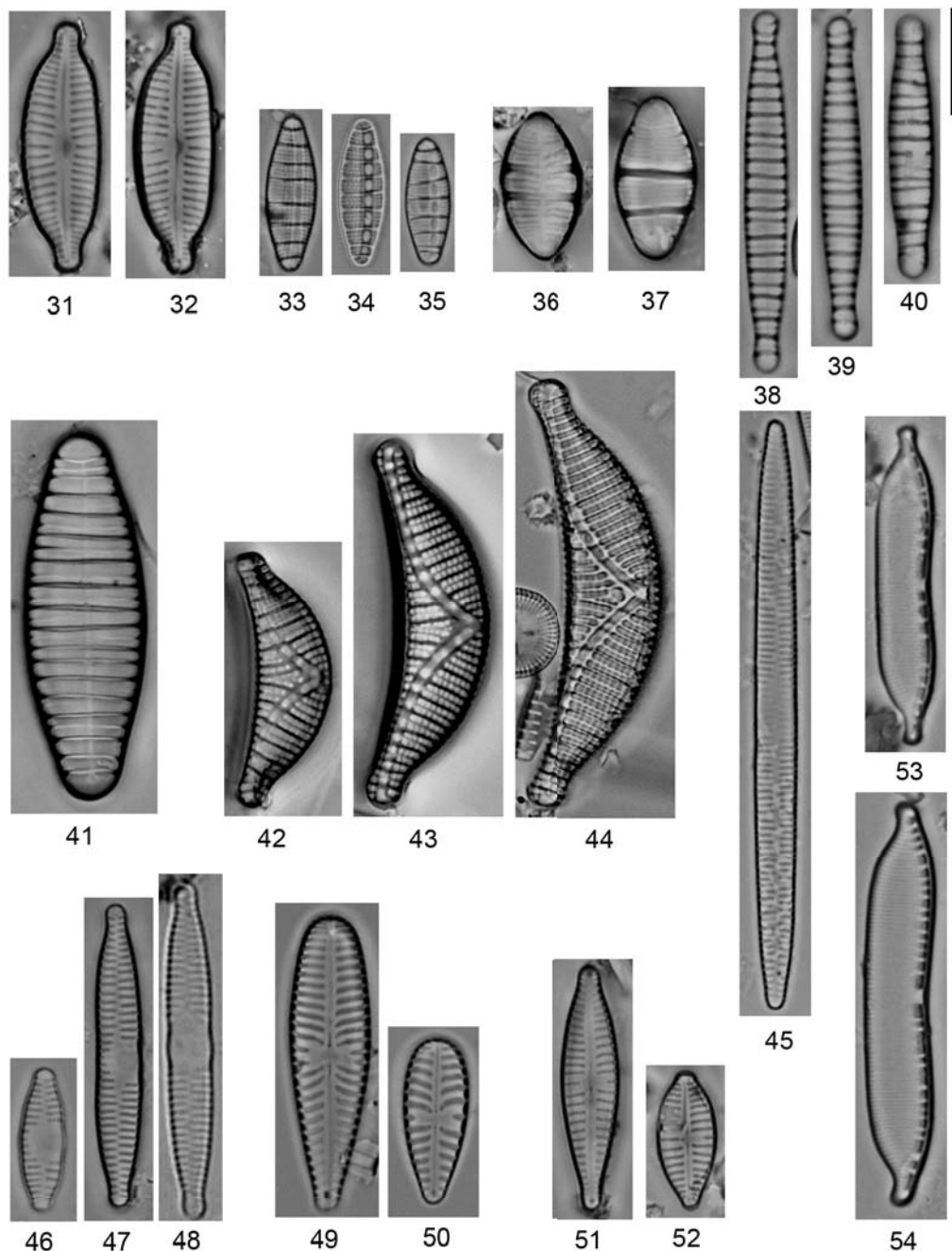
DISTRIBUTION IN TURKEY. New for flora of Turkey.

GENERAL DISTRIBUTION AND ECOLOGY. Tychoplanktonic, oligo- or mesosaprobous and oligotraphentic species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as alkaliphilous (Van Dam *et al.* 1994).

18. *Cymboplectra amphicephala* (Naegeli) Krammer Figs 31 & 32

SYNONYMS. *Cymbella amphicephala* Naegeli, *C. amphicephala* Naegeli *ex* Kützing

Ref. Hustedt 1930 (p. 355, Fig. 651); Patrick & Reimer 1975 (p. 33, Fig. 4: 11); Krammer & Lange-Bertalot 1986 (p. 335, Fig. 142: 3–14, 21); Krammer 2003 (p. 70, Figs 91: 1–18; 93: 2–8); Hofmann *et al.* 2011 (p. 160, Fig. 83: 11–15).



Figs 31–54. 31 & 32 – *Cymbopleura amphicephala* (Naegeli) Krammer, 33–35 – *Denticula tenuis* Kützing, 36 & 37 – *Diatoma mesodon* (Ehrenberg) Kützing, 38–40 – *D. tenuis* Agardh, 41 – *D. vulgaris* Bory, 42–44 – *Epithemia sorex* Kützing, 45 – *Fragilaria capucina* Desmazières, 46–48 – *F. vaucheriae* (Kützing) Petersen, 49 & 50 – *Gomphonema olivaceum* (Hornemann) Brébisson, 51, 52 – *G. parvulum* (Kützing) Kützing, 53, 54 – *Hantzschia amphioxys* (Ehrenberg) Grunow. Scale bar = 10 µm.

DIMENSIONS. Valves 23–36 μm long and 7–10 μm wide, maximal length/breadth ratio about 4.4 and 11–15 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Darıpnar, Güllüdere, Türkmenbaba, Akındere.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya River Basin), Eastern Anatolia (Fırat, Aras, Çoruh river basins), Inner Anatolia (Konya Closed River Basin, Sakarya, Kızılırmak river basins) (Fig. 1).

RIVER BASINS. Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen & Çetin 1988; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Kızılırmak (Yıldız & Özkıran 1991; Dere & Sıvacı 1994), Konya Closed River Basin (Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Demirsoy 1996; Akköz & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Sakarya (Gönülol & Aykulu 1984; Obalı 1984; Ünal 1984; Gönülol 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic, oligo- or oligo-mesosaprobous species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994; Krammer 2003), classified as a circumneutral diatom (Håkansson 1993; Van Dam *et al.* 1994).

19. *Denticula tenuis* Kützing Figs 33–35 & 143 Ref. Hustedt 1930 (p. 381, Fig. 723); Krammer & Lange-Bertalot 1988 (p. 139, Fig. 95: 4–25); Hofmann *et al.* 2011 (p. 169, Fig. 117: 32–37).

DIMENSIONS. Valves 11.5–18.0 μm long and 3.0–5.3 μm wide, 5–7 fibulae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Seydi.

DISTRIBUTION IN TURKEY. Lakes and rivers in Egean (Gediz, Küçük Menderes) and Black Sea (Yeşilırmak, Kızılırmak) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, 1991), Gediz (Gezerler *et al.* 1996), Kızılırmak (Özdemir 1987; Gönülol & Çomak 1990, 1992; Gönülol 1993; Akbulut 2003), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Sakarya (Obalı 1984; Obalı *et al.* 1989), Yeşilırmak (Gönülol & Obalı, 1998).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic, oligo- or mesosaprobous and mesotraphentic species (Krammer & Lange-Bertalot 1988; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as a circumneutral (Håkansson 1993) or alkaliphilous diatom (Van Dam *et al.* 1994).

20. *Diatoma mesodon* (Ehrenberg) Kützing Figs 36 & 37

Diatoma hiemale var. *mesodon* (Ehrenberg) Grunow Ref. Hustedt 1930 (p. 129, Fig. 116); Krammer & Lange-Bertalot 1991a (p. 100, Figs 98: 7; 99: 1–12); Hofmann *et al.* 2011 (p. 173, Fig. 2: 1–5).

DIMENSIONS. Valves 13–19 μm long and 6.5–9.0 μm wide, 3–4 transapical bars and 22–35 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Uluköy, İnli, Söğüt-Lütfiye, Türkmenbaba.

DISTRIBUTION IN TURKEY. Egean (Küçük Menderes, Gediz, Susurluk) river basins (Fig. 1).

RIVER BASINS. Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987; Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Pabuççu 1993, 1994; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Susurluk (Skuja 1937; Dere *et al.* 2002, Karacaoğlu *et al.* 2004).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, oligo- or oligo-mesosaprobous and oligo- or oligo-mesotraphentic species (Krammer

& Lange-Bertalot 1991a; Hofmann 1994; Van Dam *et al.* 1994), classified as a circumneutral (Van Dam *et al.* 1994) or an alkaliphilous diatom (Håkansson 1993).

21. *Diatoma tenuis* Agardh Figs 38–40

Diatoma elongatum var. *tenuis* Agardh, *D. tenue* var. *elongatum* Lyngbye

Ref. Hustedt 1930 (p. 127, Fig. 111); Patrick & Reimer 1966 (p. 109, Fig. 2: 6); Krammer & Lange-Bertalot 1991a (p. 97, Fig. 96: 1–9).

DIMENSIONS. Valves 24–36 µm long and 3.0–4.7 µm wide, 8–10 transapical bars in 10 µm.

DISTRIBUTION IN TÜRKMEN MT. Dümbüldek, Darıpinar, Uluköy.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya), Eastern Anatolia (Fırat), Inner Anatolia (Konya Closed River Basin, Sakarya), Egean (Küçük Menderes) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002), Asi (Şen *et al.* 1997), Büyük Menderes (Cirik *et al.* 1989), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen *et al.* 1995; Çetin & Şen 1998, 2004), Gediz (Gezerler *et al.* 1996), Kızılırmak (Kılınç & Dere 1988; Yıldız & Özkıran 1991; Dere & Sıvacı 1994; Kılınç 1998; Kılınç & Sıvacı 2001), Konya Closed River Basin (Skuja 1937; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Skuja 1937; Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Obalı 1984; Gönülol 1985a, 1987; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, euplanktonic, mesosaprobous and meso- or eutraphentic species (Lange-Bertalot 1979; Denys 1991; Krammer & Lange-Bertalot 1991a;

Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Van Dam *et al.* 1994).

22. *Diatoma vulgaris* Bory Figs 41 & 144–147

Ref. Hustedt 1930 (p. 127, Fig. 103); Krammer & Lange-Bertalot 1991a (p. 95, Fig. 93: 1–12; 94: 1–13; 97: 3–5); Hofmann *et al.* 2011 (p. 175, Fig. 3: 20–25).

DIMENSIONS. Valves 26–40 µm long and 5.0–13.3 µm wide, 6–10 transapical bars and over 40 striae in 10 µm.

DISTRIBUTION IN TÜRKMEN MT. Dümbüldek, Sögüt-Lütfiye.

DISTRIBUTION IN TURKEY. Lakes and rivers in Egean (Küçük Menderes, Susurluk, Gediz), Mediterranean (Antalya), Inner Anatolian (Sakarya, Konya Closed River Basin) and Black Sea (East Black Sea River Basin, West Black Sea River Basin, Kızılırmak, Yeşilırmak) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002), Asi (Şen *et al.* 1997), Büyük Menderes (Cirik *et al.* 1989), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen *et al.* 1995; Çetin & Şen 1998, 2004), Gediz (Gezerler *et al.* 1996), Kızılırmak (Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sıvacı 1994; Gönülol & Obalı 1998; İşbakan *et al.* 2002), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Aykulu *et al.* 1983; Gönülol & Aykulu 1984; Obalı 1984; Gönülol 1985a, b, 1987; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Demirsoy 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Güner *et al.* 1987; Gezerler 1992; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea

River Basin (Öztürk 1994), Yeşilirmak (Yazıcı & Gönülol 1994; Altuner & Pabuççu 1996; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Tycho planktonic, mesosaprobous and meso- or eutraphentic species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous-alkalibiontic (Håkansson 1993) or an alkalibiontic diatom (Van Dam *et al.* 1994).

23. *Epithemia sorex* Kützing Figs 42–44

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)

DIMENSIONS. Valves 23.5–47.3 μm long and 6.5–10.0 μm wide, 5–8 fibulae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Güllüdere, Seydi.

DISTRIBUTION IN TURKEY. Lakes and rivers in Inner Anatolia (Akarçay, Kızılırmak, Sakarya, Konya Closed River Basin), Eastern Anatolia (Fırat, Aras, Çoruh), Egean (Gediz, Küçük Menderes Susurluk) river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Gönülol & Obalı 1986; Şen *et al.* 1994), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996, 1999), Kızılırmak (Özesm 1987; Kılınç & Dere 1988; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol 1993; Dere & Sıvacı 1994; Gönülol & Obalı 1998; Kılınç 1998; Kılınç & Sıvacı 2001; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Sakarya (Gönülol 1985a, 1987; Yıldız 1987a; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Güner *et al.* 1987; Dere *et al.* 2002; Karacaoğlu *et al.* 2004).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tycho planktonic, mesosaprobous and meso- or eutraphentic species (Krammer & Lange-Bertalot 1988; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkalibiontic diatom (Håkansson 1993; Van Dam *et al.* 1994).

24. *Fragilaria capucina* Desmazières

Figs 45, 148 & 149

Ref. Hustedt 1930 (p. 138, Fig. 126); Patrick & Reimer 1966 (p. 118, Fig. 3: 5); Krammer & Lange-Bertalot 1991a (p. 121, Fig. 108: 1–8); Hofmann *et al.* 2011 (p. 259, Fig. 9: 8–12).

DIMENSIONS. Valves 22.0–65.3 μm long and 3.5–5.0 μm wide, 14–17 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Darıpınar, Dümbüldek.

DISTRIBUTION IN TURKEY. Lakes and rivers in Egean (Küçük Menderes, Gediz, Susurluk) river basins (Fig. 1).

RIVER BASINS. Aras (Altuner 1988; Akbulut & Yıldız 2002), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), Fırat (Şen *et al.* 1995; Çetin & Şen 1998, 2004), Gediz (Cirik 1994; Gezerler *et al.* 1999), Kızılırmak (Özesm 1987; Gönülol & Çomak 1990, 1992; Gönülol 1993; Gönülol & Obalı 1998; Akbulut 2003), Küçük Menderes (Cirik & Cirik 1989; Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 2000, 2003), Susurluk (Brunnthaler 1903, Skuja 1937; Gezerler 1992; Dere *et al.* 2002; Karacaoğlu *et al.* 2004), West Black Sea River Basin (Aysel *et al.* 1992).

GENERAL DISTRIBUTION AND ECOLOGY. Tycho planktonic, mesosaprobous and mesotraphentic species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as a circumneutral (Van Dam *et al.* 1994) or an alkaliphilous diatom (Håkansson 1993).

25. *Fragilaria vaucheriae* (Kützing) Petersen

Figs 46–48

Fragilaria vaucheriae (Grunow) Patrick, *F. capucina* Desmazières var. *vaucheriae* (Kützing) Lange-Bertalot

Ref. Hustedt 1930 (p. 139, Fig. 130); Patrick

& Reimer 1966 (p. 120, Fig. 3: 14, 15); Krammer & Lange-Bertalot 1991a (p. 124, Fig. 108: 10–15); Hofmann *et al.* 2011 (p. 277, Fig. 9: 1–7).

DIMENSIONS. Valves 13.0–36.7 μm long and 3–5 μm wide, 9–17 striae in 10 μm .

DISTRIBUTION IN TÜRKMEN MT. Söğüt-Lütfiye, Güllüdere-Türkmenbaba, Lütfiye-Güllüdere.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat, Aras, Çoruh) and Black Sea (Kızılırmak) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Pabucçu 1988, 1989, 1990a, b, 1991, 1993, 1994, 1996; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Güner 1970; Cirik 1994; Gezerler *et al.* 1999), Kızılırmak (Kılınç & Dere 1988; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol 1993; Dere & Sıvacı 1994; Gönülol & Obalı 1998; Kılınç 1998; Kılınç & Sıvacı 2001; İşbakan *et al.* 2002), Konya Closed River Basin (Yıldız 1985a, 1986a, b, 1987b; Cirik *et al.* 1991; Demirsoy 1996; Akköz & Obalı 1998), Sakarya (Obalı 1984; Gönülol 1985a, 1987; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004).

GENERAL DISTRIBUTION AND ECOLOGY. Tychoplanktonic, mesosaprobous and eutraphentic species (Lange-Bertalot 1979; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

26. *Gomphonema olivaceum* (Hornemann) Brébisson Figs 49 & 50

Gomphonema olivaceum (Lyngbye) Kützing

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).

DIMENSIONS. Valves 15–38 μm long and 5.5–8.7 μm wide, 8–12 striae in 10 μm .

DISTRIBUTION IN TÜRKMEN MT. Türkmenbaba, İdris.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Obalı 1982; Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Büyük Menderes (Cirik *et al.* 1989), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988b; Şen & Aksakal 1988; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabucçu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1981, 1994; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996, 1999), Kızılırmak (Kılınç & Dere 1988; Kılınç 1998; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sıvacı 1994; Kılınç & Sıvacı 2001; İşbakan *et al.* 2002), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Akköz & Obalı 1998; Morkoyunlu *et al.* 1999; Mitamura *et al.* 1997; Elmacı & Obalı 1998), Küçük Menderes (Skuja 1937; Aysel *et al.* 1992, 1998a, b, 2001, 2002; Erener *et al.* 1995), Marmara (Albay & Aykulu 1994a, b; Yardımcı & Temel 2000; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Aykulu *et al.* 1983; Gönülol & Aykulu 1984; Obalı 1984; Ünal 1984; Gönülol 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Demirsoy 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaoğlu *et al.* 2004), Yeşilirmak (Yazıcı & Gönülol 1994; Altuner & Pabucçu 1996; Kır & Polat 1996; Gönülol & Obalı 1998).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tycho planktonic, mesosaprobous and mesoeutraphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous-alkalibiontic (Håkansson 1993) or an alkalibiontic diatom (Van Dam *et al.* 1994).

27. *Gomphonema parvulum* (Kützing) Kützing
Figs 51, 52 & 152–157

Gomphonema parvulum (Kützing) Grunow

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).

DIMENSIONS. Valves 9.5–33.0 μm long and 5–8 μm wide, 9–16 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Türkmenbaba, Uluköy, Darıpınar, Çifteler, Çobanlar.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat, Aras, Çoruh), Mediterranean (Antalya, Asi), Black Sea (East Black Sea River Basin, Yeşilırmak, Kızılırmak), Egean (Gediz, Küçük Menderes) and Inner Anatolia (Sakarya, Konya Closed River Basin, Kızılırmak) river basins (Fig. 1).

RIVER BASINS. Akarçay (Obalı 1982; Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Kızılırmak (Özdemir 1987; Kılınç & Dere 1988; Gönülol & Obalı 1998; Kılınç 1998; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sıvacı 1994; Kılınç & Sıvacı 2001; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Temel 1992, 1996; Yıldız *et al.* 1994; Morkoyunlu *et al.* 1999; Mitamura *et al.* 1997; Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Sakarya (Aykulu *et al.* 1983; Gönülol & Aykulu 1984; Gönülol 1985b; Obalı 1984; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Demirsoy 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Yeşilırmak (Yazıcı & Gönülol 1994; Altuner & Pabuççu 1996; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic, polysaprobous and eutraphentic diatom (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as a circumneutral diatom (Håkansson 1993; Van Dam *et al.* 1994).

28. *Hantzschia amphioxys* (Ehrenberg) Grunow
Figs 53 & 54

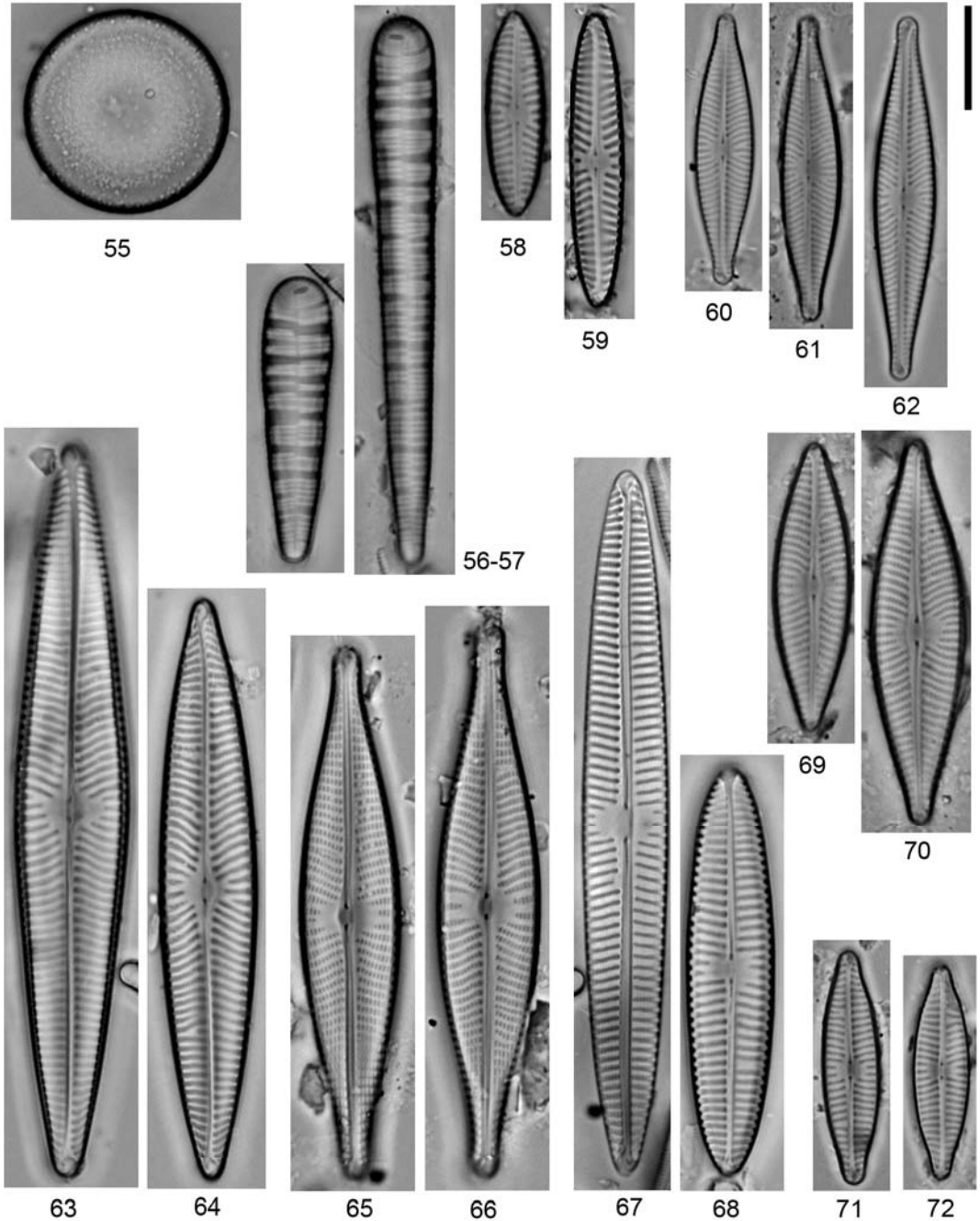
Ref. Hustedt 1930 (p. 394, Fig. 747); Krammer & Lange-Bertalot 1988 (p. 128, Fig. 88: 1–7); Hofmann *et al.* 2011 (p. 333, Fig. 102: 1–5).

DIMENSIONS. Valves 22–61 μm long and 5–9 μm wide, 23–25 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Darıpınar, Çobanlar, Akındere.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Obalı 1982; Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen & Çetin 1988; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Kızılırmak (Özdemir 1987; Kılınç & Dere 1988; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol 1993; Dere & Sıvacı 1994; Kılınç 1998; Kılınç & Sıvacı 2001; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönülol & Aykulu 1984; Obalı 1984; Ünal 1984; Gönülol 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı



Figs 55–72. 55 – *Melosira varians* Agardh, 56 & 57 – *Meridion circulare* (Gréville) Agardh, 58 & 59 – *Navicula cincta* (Ehrenberg) Ralfs, 60–62 – *N. cryptocephala* Kützing, 63 & 64 – *N. radiosa* Kützing, 65 & 66 – *N. rhynchocephala* Kützing, 67 & 68 – *N. tripunctata* (O.Müller) Bory, 69 & 70 – *N. trivialis* Lange-Bertalot, 71 & 72 – *N. veneta* Kützing. Scale bar = 10 µm.

& Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Gezerler 1992; Dere *et al.* 2002; Karacaören *et al.* 2004), Yeşilirmak (Gönüloğlu & Obalı 1998).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic and mesosaprobous species (Krammer & Lange-Bertalot 1988; Denys 1991; Van Dam *et al.* 1994), classified as a circumneutral diatom (Håkansson 1993; Van Dam *et al.* 1994).

29. *Melosira varians* Agardh Fig. 55

Ref. Hustedt 1930 (p. 85, Fig. 41); Krammer & Lange-Bertalot 1991a (p. 7, Fig 4: 1–8); Hofmann *et al.* 2011 (p. 357, Fig. 1: 6–9).

DIMENSIONS. Valves 7.0–23.3 µm in diameter.

DISTRIBUTION IN TURKMEN MT. Darıpınar.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya), Eastern Anatolia (Fırat, Aras, Çoruh), Egean (Küçük Menderes, Gediz), Inner Anatolia (Konya Closed River Basin, Kızılırmak, Sakarya) river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981), Antalya (Conk & Ciriş 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Ciriş 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönüloğlu 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Ciriş 1994; Gezerler *et al.* 1996, 1999), Kızılırmak (Gönüloğlu & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönüloğlu 1993; Dere & Sıvacı 1994; Gönüloğlu & Obalı 1998; İşbakan *et al.* 2002), Konya Closed River Basin (Skuja 1937; Ciriş *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002,

2003), Sakarya (Gönüloğlu & Aykulu 1984; Obalı 1984; Gönüloğlu 1985a, b, 1987; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Gezerler 1992; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994), Yeşilirmak (Altuner & Pabuççu 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Tychoplanktonic, mesosaprobous and eutraphentic species (Lange-Bertalot 1979; Denys 1991; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

30. *Meridion circulare* (Gréville) Agardh Figs 56, 57, 150 & 151

Ref. Hustedt 1930, (p. 130, Fig. 118); Patrick & Reimer 1966 (p. 113, Fig. 2: 15); Krammer & Lange-Bertalot 1991a (p. 101, Fig. 101: 1–3); Hofmann *et al.* 2011 (p. 359, Fig. 1: 1–14).

DIMENSIONS. Valves 27–62 µm long and 6–8 µm wide, 4–5 costae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Güllüdere, Güllüdere-Lütfiye, Gölçük.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya), Black Sea (East Black Sea River Basin, West Black Sea River Basin), Eastern Anatolia (Fırat, Aras, Çoruh) river basins (Fig. 1).

RIVER BASINS. Antalya (Conk & Ciriş 1991; Morkoyunlu & Ertan 1995a, b; Morkoyunlu *et al.* 1996; Ertan *et al.* 1996; Yüce *et al.* 1997; Savaş & Ciriş 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönüloğlu 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Kızılırmak (Yıldız & Özkıran 1991; Dere & Sıvacı 1994), Konya Closed River Basin (Skuja 1937; Yıldız 1985a, 1986a, b, 1987b; Temel 1992, 1996; Yıldız *et al.* 1994; Morkoyunlu *et al.* 1999; Mitamura *et al.* 1997; Elmacı & Obalı 1998), Mar-

mara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönülo 1985a, 1987; Yıldız & Özkıran 1994), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, tychoplanktonic, mesosaprobous and eutraphentic diatom (Lange-Bertalot 1979; Krammer & Lange-Bertalot 1991a; Denys 1991; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

31. *Navicula cincta* (Ehrenberg) Ralfs Figs 58, 59

Navicula cincta (Ehrenberg) Kützing, *N. cincta* (Ehrenberg) Ralfs in Pritchard

Ref. Hustedt 1930, (p. 298, Fig. 510); Patrick & Reimer 1966 (p. 516, Fig. 49: 8); Krammer & Lange-Bertalot 1986 (p. 98, Fig. 28: 8–15); Lange-Bertalot 2001 (p. 26, Fig. 41: 1–29); Hofmann *et al.* 2011 (p. 376, Fig. 32: 31–36).

DIMENSIONS. Valves 16.0–33.3 µm long and 5–7 µm wide, 8–13 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Türkmenbaba, Dümbüldek, Darıpınar, Güllüdere.

DISTRIBUTION IN TURKEY. Lakes and rivers in Egean (Gediz, Susurluk, Küçük Menderes) river basins (Fig. 1).

RIVER BASINS. Asi (Şen *et al.* 1997), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), Fırat (Şen *et al.* 1995; Çetin & Şen 1998, 2004), Gediz (Gezerler *et al.* 1996), Kızılırmak (Özesm 1987; Elmacı & Obalı 1992; Akbulut 2003), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Sakarya (Obalı 1984; Obalı *et al.* 1989), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), Yeşilirmak (Altuner & Pabuçcu 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, tychoplanktonic, mesosaprobous and eutraphentic diatom (Lange-Bertalot 1979, 2001; Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

32. *Navicula cryptocephala* Kützing Figs 60–62 & 158

Ref. Hustedt 1930 (p. 295, Fig. 496); Patrick & Reimer 1966 (p. 503, Fig. 48: 3); Krammer & Lange-Bertalot 1986 (p. 102, Fig. 30: 8–14); Lange-Bertalot 2001 (p. 27, Figs 17: 1–10, 18: 9–20); Hofmann *et al.* 2011 (p. 377, Fig. 31: 6–10).

DIMENSIONS. Valves 22.0–41.3 µm long and 5–7 µm wide, 13–18 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Darıpınar, Söğüt, Güllüdere, Türkmenbaba Çobanlar, Uluköy.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Obalı 1982), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Büyük Menderes (Skuja 1937; Güner 1966, Cirik *et al.* 1989), Çoruh (Altuner 1984), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülo 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen & Çetin 1988; Altuner & Pabuçcu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; Gezerler *et al.* 1996, 1999), Kızılırmak (Özesm 1987; Kılınç & Dere 1988; Gönülo & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülo & Arslan 1992; Gönülo 1993; Dere & Sıvacı 1994; Gönülo & Obalı 1998; Kılınç 1998; Kılınç & Sıvacı 2001; İşbakan *et al.* 2002; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akküz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Aykulu *et al.* 1983; Obalı 1984; Gönülo & Aykulu 1984; Ünal 1984; Gönülo 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Demirsoy 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004),

Van Closed River Basin (Gessner 1957; Öztüğ 1957), West Black Sea River Basin (Aysel *et al.* 1992; Öztürk 1994; Cirik 1997), Yeşilırmak (Yazıcı & Gönülol 1994; Altuner & Pabuççu 1996; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, tycho planktonic, mesosaprobous and eutrathentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994) classified as a circumneutral (Van Dam *et al.* 1994) or an alkaliphilous diatom (Håkansson 1993).

33. *Navicula radiososa* Kützing Figs 63 & 64

Ref. Hustedt 1930 (p. 299, Fig. 513); Patrick & Reimer 1966 (p. 509, Fig. 48: 15); Krammer & Lange-Bertalot 1986 (p. 99, Fig. 29: 1–4); Lange-Bertalot 2001 (p. 59, Fig. 8: 1–7); Hofmann *et al.* 2011 (p. 394, Fig. 35: 1–5).

DIMENSIONS. Valves 54–85 µm long and 7.0–13.3 µm wide, 7–13 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dömbüldek, İdris, Söğüt-Lütfiye, Lütfiye-Güllüdere.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya, Seyhan, Asi), Egean (Susurluk, Büyük Menderes, Küçük Menderes), Eastern Anatolia (Fırat, Aras, Çoruh), Black Sea (Kızılırmak, East Black Sea River Basin, West Black Sea River Basin) river basins (Fig. 1).

RIVER BASINS. Akarçay (Obalı 1982; Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Şen *et al.* 1997; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996, 1999), Kızılırmak (Kılınc & Dere 1988; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sivacı 1994; Gönülol & Obalı 1998; Kılınc 1998; Kılınc & Sivacı 2001),

Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Yıldız *et al.* 1994; Temel 1992, 1996; Demirsoy 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönülol & Aykulu 1984; Obalı 1984; Ünal 1984; Gönülol 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Cirik 1997), Yeşilırmak (Yazıcı & Gönülol 1994; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, tycho planktonic, mesosaprobous and meso-eutrathentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as circumneutral (Van Dam *et al.* 1994) or an alkaliphilous diatom (Håkansson 1993).

34. *Navicula rhynchocephala* Kützing

Figs 65 & 66

Ref. Hustedt 1930 (p. 296, Fig. 501); Patrick & Reimer 1966 (p. 505, Fig. 48: 6); Krammer & Lange-Bertalot 1986 (p. 101, Figs 30: 5–8; 31: 1, 2); Lange-Bertalot 2001 (p. 64, Fig. 9: 6–10); Hofmann *et al.* 2011 (p. 396, Fig. 39: 12–17).

DIMENSIONS. Valves 50–64 µm long and 8.0–11.3 µm wide, 7–11 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Çobanlar.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya), Eastern Anatolia (Fırat, Aras Çoruh), Egean (Gediz, Susurluk, Küçük Menderes), Inner Anatolia (Konya Closed River Basin), Black Sea (East Black Sea River Basin) river basins (Fig. 1).

RIVER BASINS. Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan *et al.* 1996; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen

et al. 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönüloğulları 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Kızılırmak (Gönüloğulları & Çomak 1990, 1992; Gönüloğulları 1993; Gönüloğulları & Obalı 1998; İşbakan *et al.* 2002), Konya Closed River Basin (Skuja 1937; Temel 1992, 1996; Yıldız *et al.* 1994; Mitamura *et al.* 1997; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Sakarya (Gönüloğulları 1985a, 1987), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, tychoplanktonic and mesosaprobous species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994). *Navicula rhynchocephala* is a circumneutral (Håkansson 1993) or an alkaliphilous diatom (Van Dam *et al.* 1994).

35. *Navicula tripunctata* (O. Müller) Bory

Figs 67, 68, 160 & 161

Navicula gracilis Ehrenberg

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).

DIMENSIONS. Valves 32–80 µm long and 6–11 µm wide, 9–12 striae in 10 µm.

DISTRIBUTION IN TÜRKMEN MT. Söğüt-Lütüfiye, Lütüfiye-Güllüdere, Güllüdere, Güllüdere-Türkmenbaba, İdris, Akındere.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya, Seyhan), Black Sea (East Black Sea River Basin, West Black Sea River Basin, Kızılırmak), Egean (Gediz, Küçük Menderes), Inner Anatolia (Konya Closed River Basin, Kızılırmak, Sakarya), Eastern Anatolia (Fırat, Aras, Çoruh) river basins (Fig. 1).

RIVER BASINS. Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997;

Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönüloğulları 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, 1991; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996, 1999), Kızılırmak (Kılınç & Dere 1988; Yıldız & Özkıran 1991; Gönüloğulları & Arslan 1992; Dere & Sıvacı 1994; Kılınç 1998; Kılınç & Sıvacı 2001), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1996; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönüloğulları & Aykulu 1984; Obalı 1984; Yıldız 1987a; Gönüloğulları 1985b; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994), Yeşilirmak (Yazıcı & Gönüloğulları 1994; Altuner & Pabuççu 1996; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, tychoplanktonic, mesosaprobous and eutraphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

36. *Navicula trivialis* Lange-Bertalot

Figs 69 & 70

Ref. Krammer & Lange-Bertalot 1986 (p. 110, Fig. 35: 1–4); Lange-Bertalot 2001 (p. 73, Fig. 29: 1–6); Hofmann *et al.* 2011 (p. 403, Fig. 33: 11–15).

DIMENSIONS. Valves 27.0–43.3 µm long and 7.0–10.7 µm wide, 10–14 striae in 10 µm.

DISTRIBUTION IN TÜRKMEN MT. Dümbüldek, Darıpınar, Seydi.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat River Basin) (Fig. 1).

RIVER BASINS. Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), Fırat (Şen & Çetin 1988; Şen *et al.* 1995; Çetin & Şen 1998, 2004).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, tycho planktonic, mesosaprobous and eutraphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Van Dam *et al.* 1994).

37. *Navicula veneta* Kützing Figs 71, 72 & 159

Navicula cryptocephala var. *veneta* (Kützing) Grunow 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).

DIMENSIONS. Valves 18.0–26.7 µm long and 4.0–6.7 µm wide, 13–17 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Darıpinar, İnlı.

DISTRIBUTION IN TURKEY. Lakes and rivers in Inner Anatolia (Akarçay, Konya Closed River Basin, Sakarya, Kızılırmak), Egean (Gediz, Sursuluk, Büyük Menderes, Küçük Menderes), Eastern Anatolia (Fırat, Aras, Çoruh), Black Sea (East Black Sea River Basin, West Black Sea River Basin) river basins (Fig. 1).

RIVER BASINS. Akarçay (Obalı 1982; Gönülol & Obalı 1986; Şen *et al.* 1994), Aras (Kıvrak & Gürbüz 2005), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987; Gürbüz *et al.* 2002a, b), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1990b, 1994, 1996; Altuner & Pabuccu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Güner 1970; Cirik 1994; Gezerler *et al.* 1999), Kızılırmak (Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sivacı 1994; Gönülol & Obalı 1998; İşbakan *et al.* 2002), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997;

Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Cirik & Cirik 1989), Sakarya (Gönülol & Aykulu 1984; Obalı 1984; Ünal 1984; Gönülol 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Atıcı 2002; Yardımcı & Temel 2000), Sursuluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, tycho planktonic, mesopoly- or polysaprobous and eutraphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Van Dam *et al.* 1994).

38. *Nitzschia acicularis* (Kützing) W. Smith Figs 73 & 74

Nitzschia acicularis W. Smith

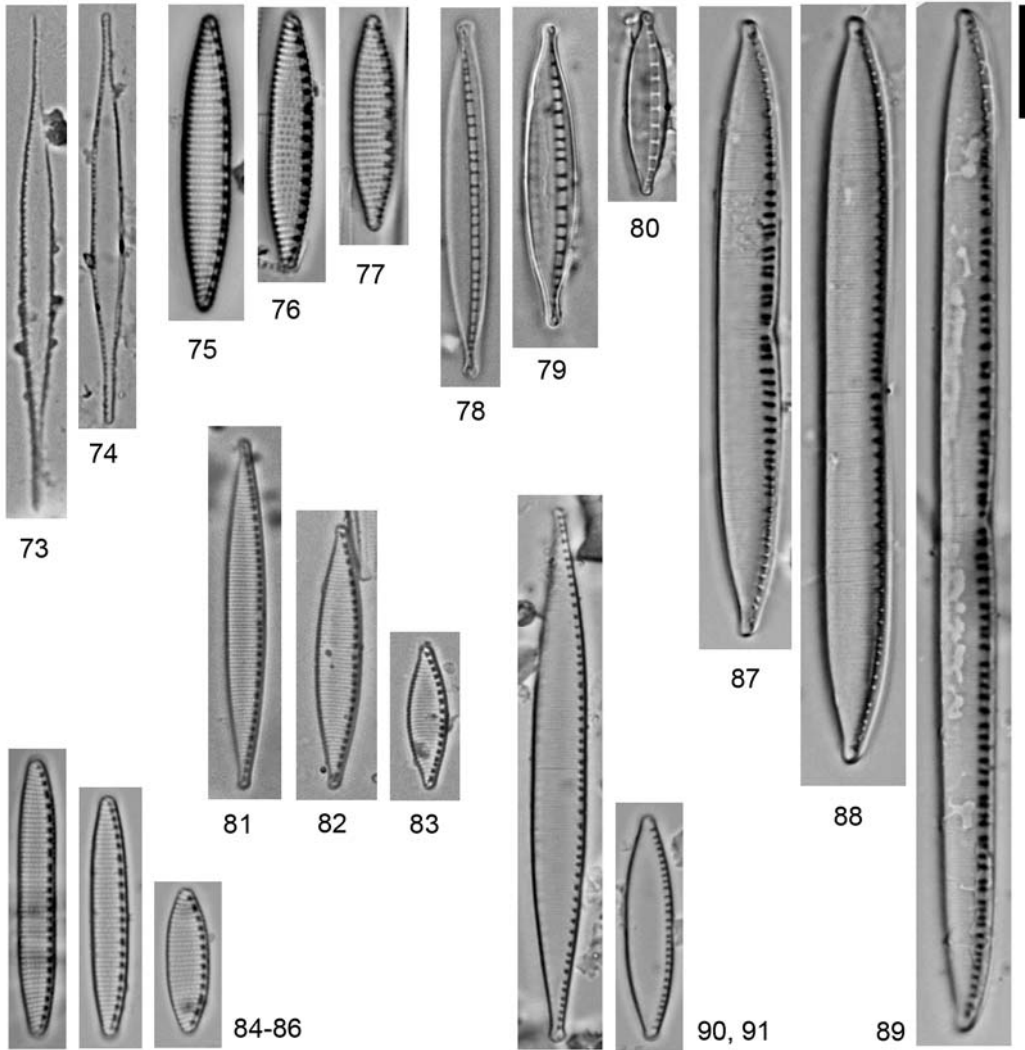
Ref. Hustedt 1930 (p. 423, Fig. 821); Krammer & Lange-Bertalot 1988 (p. 123, Fig. 85: 1–4).

DIMENSIONS. Valves 36–130 µm long and 2–5 µm wide, 17–19 fibulae in 10 µm.

DISTRIBUTION IN TURKMEN MT. İdris, Çobanlar, Seydi, Lütfiye-Güllüdere.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya), Eastern Anatolia (Fırat, Aras), Inner Anatolia (Konya Closed River Basin, Sakarya), Egean (Gediz, Küçük Menderes) river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Büyük Menderes (Cirik *et al.* 1989), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuccu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996, 1999), Kızılırmak (Kılınc & Dere 1988; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sivacı 1994;



Figs 73–91. 73 & 74 – *Nitzschia acicularis* (Kützing) W. Smith, 75–77 – *N. amphibia* Grunow, 78–80 – *N. dissipata* (Kützing) Grunow, 81–83 – *N. fonticola* Grunow, 84–86 – *N. frustulum* (Kützing) Grunow, 87–89 – *N. linearis* (Agardh) W. Smith, 90 & 91 – *N. palea* (Kützing) W. Smith. Scale bar = 10 μ m.

Gönüloğlu & Obalı 1998; Kılınç 1998; Kılınç & Sivacı 2001; İşbakan *et al.* 2002), Konya Closed River Basin (Skuja 1937; Yıldız 1985a, 1986a, b, 1987b; Temel 1992, 1996; Yıldız *et al.* 1994; Mitamura *et al.* 1997; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Obalı 1984; Ünal 1984; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996;

Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Güner *et al.* 1987; Gezerler 1992; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994; Cirik 1997), Yeşilırmak (Altuner & Pabuççu 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic, mesosaprobous and eutraphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.*

1994), classified as an alkaliphilous diatom (Van Dam *et al.* 1994).

39. *Nitzschia amphibia* Grunow Figs 75–77

Ref. Hustedt 1930 (p. 414, Fig. 793); Krammer & Lange-Bertalot 1988 (p. 108, Fig. 78: 13–21); Hofmann *et al.* 2011 (p. 433, Fig. 117: 9–15).

DIMENSIONS. Valves 18–40 μm long and 4–5 μm wide, 7–9 fibulae and 14–18 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Darıpinar, Güllüdere-Türkmenbaba, Çobanlar, İdris, İnli, Akındere.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat), Black Sea (Kızılırmak), East Black Sea River Basin) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Aras (Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuçcu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Kızılırmak (Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sıvacı 1994; Gönülol & Obalı 1998), Konya Closed River Basin (Cirik *et al.* 1991; Demirsoy 1996; Akköz & Obalı 1998), Sakarya (Obalı 1984; Obalı *et al.* 1989; Yıldız & Özkıran 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), Yeşilirmak (Yazıcı & Gönülol 1994; Altuner & Pabuçcu 1996; Kir & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tycho planktonic, mesosaprobous and eutraphentic species (Lange-Bertalot 1979; Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

40. *Nitzschia dissipata* (Kützing) Grunow Figs 78–80

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).

DIMENSIONS. Valves 16–45 μm long and 3.5–7.0 μm wide, 7–11 fibulae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Söğüt-Lütfiye, Çobanlar, İdris, Akındere.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat, Aras, Çoruh), Egean (Gediz, Küçük Menderes), Black Sea (Kızılırmak), Inner Anatolia (Sakarya) river basins (Fig. 1).

RIVER BASINS. Akarçay (Obalı 1982; Gönülol & Obalı 1986; Şen *et al.* 1994), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuçcu 1993, 1994; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996, 1999), Kızılırmak (Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sıvacı 1994; Gönülol & Obalı 1998), Konya Closed River Basin (Yıldız 1985a; 1986a; b; 1987b), Küçük Menderes (Cirik & Cirik 1989; Aysel *et al.* 1992, 1998a, b, 2001, 2002), Sakarya (Gönülol & Aykulu 1984; Gönülol 1985b; Yıldız 1987a, b; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), Yeşilirmak (Yazıcı & Gönülol 1994; Kir & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tycho planktonic, mesosaprobous and meso-eutraphentic or eutraphentic species (Lange-Bertalot 1979; Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994). *Nitzschia dissipata* is an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

41. *Nitzschia fonticola* Grunow Figs 81–83

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).

DIMENSIONS. Valves 11–49 μm long and 3–5 μm wide, 10–16 fibulae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Türkmenbaba, Dümbüldek, Darıpinar, Akındere.

DISTRIBUTION IN TURKEY. Lakes and rivers in Inner Anatolia (Sakarya, Konya Closed River Basin), Eastern Anatolia (Fırat), Black Sea (Kızılırmak) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönüloğlu & Obalı 1986; Şen *et al.* 1994), Antalya (Skuja 1937; Vardar & Güner 1972), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabucçu 1993, 1994; Gürbüz 2000; Gürbüz & Altuner 2000), Kızılırmak (Gönüloğlu & Çomak 1990, 1992; Elmacı & Obalı 1992; Gönüloğlu 1993; Gönüloğlu & Obalı 1998), Konya Closed River Basin (Skuja 1937; Temel 1992, 1996; Yıldız *et al.* 1994; Mitamura *et al.* 1997; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Sakarya (Gönüloğlu & Aykulu 1984; Obalı 1984; Gönüloğlu 1985b; Obalı *et al.* 1989; Yıldız & Özkıran 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), Van Closed River Basin (Öztiğ 1957; Gessner 1957).

GENERAL DISTRIBUTION AND ECOLOGY. Tycho planktonic, mesosaprobous and eutraphentic species (Lange-Bertalot 1979; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

42. *Nitzschia frustulum* (Kützinger) Grunow Figs 84–86 & 164

Ref. Hustedt 1930 (p. 414, Fig. 795); Krammer & Lange-Bertalot 1988 (p. 94, Fig. 68: 1–8); Hofmann *et al.* 2011 (p. 445, Fig. 112: 28–40).

DIMENSIONS. Valves 9.0–28.7 µm long and 3.0–4.3 µm wide, 9–12 fibulae and 20–26 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Darıpınar, Güllüdere-Türkmenbaba, İdris, İnlı.

DISTRIBUTION IN TURKEY. Lakes and rivers in Inner Anatolia (Konya Closed River Basin, Kızılırmak, Sakarya) river basins (Fig. 1).

RIVER BASINS. Akarçay (Obalı 1982), Aras (Altuner 1988; Akbulut & Yıldız 2002), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, 1991), Kızılırmak (Yıldız & Özkıran 1991; Elmacı & Obalı 1992; Dere & Sivacı

1994), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Temel 1992, 1996; Yıldız *et al.* 1994; Mitamura *et al.* 1997; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Sakarya (Aykulu *et al.* 1983; Gönüloğlu & Aykulu 1984; Gönüloğlu 1985b; Demirsoy 1996), Van Closed River Basin (Gessner 1957; Öztiğ 1957), Yeşilirmak (Yazıcı & Gönüloğlu 1994; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tycho planktonic, mesosaprobous and eutraphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

43. *Nitzschia linearis* (Agardh) W. Smith Figs 87–89

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).

DIMENSIONS. Valves 56–132 µm long and 3.0–6.7 µm wide, 9–15 fibulae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Darıpınar, Güllüdere-Türkmenbaba, Çobanlar, Akındere, Çifteler.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya), Inner Anatolia (Konya Closed River Basin, Kızılırmak, Sakarya), Eastern Anatolia (Fırat), Egean (Gediz, Küçük Menderes) river basins (Fig. 1).

RIVER BASINS. Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Asi (Şen *et al.* 1997), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), Fırat (Şen & Çetin 1988; Altuner & Gürbüz 1990b, 1994, 1996; Şen *et al.* 1995; Çetin & Şen 1998, 2004), Gediz (Gezerler *et al.* 1996), Kızılırmak (Kılınç & Dere 1988; Gönüloğlu & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönüloğlu 1993; Dere & Sivacı 1994; Gönüloğlu & Obalı 1998; Kılınç 1998; Kılınç & Sivacı 2001), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Mitamura *et al.* 1997; Demirsoy 1996;

Morkoyunlu *et al.* 1996; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Aykulu *et al.* 1983; Yıldız 1987a; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Demirsoy 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), Yeşilirmak (Yazıcı & Gönüloğlu 1994; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic, mesosaprobous and mesoeutraphentic or eutraphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Van Dam *et al.* 1994).

44. *Nitzschia palea* (Kützinger) W. Smith

Figs 90, 91, 162 & 163

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).

DIMENSIONS. Valves 20.0–55.7 µm long and 2.0–5.7 µm wide, 10–16 fibulae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dümbüldek, İnlü.

DISTRIBUTION IN TURKEY. Lakes and rivers in Inner Anatolia (Akarçay, Konya Closed River Basin, Kızılırmak, Sakarya), Eastern Anatolia (Fırat, Aras), Black Sea (East Black Sea River Basin, Kızılırmak), Egean (Küçük Menderes) river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Obalı 1982; Gönüloğlu & Obalı 1986; Şen *et al.* 1994), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönüloğlu 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen & Çetin 1988; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezlerler *et al.* 1996), Kızılırmak (Özesm 1987; Kılınç & Dere 1988; Gönüloğlu & Çomak 1990, 1992; Yıldız & Özkıran 1991;

Gönüloğlu & Arslan 1992; Gönüloğlu 1993; Dere & Sıvacı 1994; Gönüloğlu & Obalı 1998; Kılınç 1998; Kılınç & Sıvacı 2001; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezlerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Aykulu *et al.* 1983; Gönüloğlu & Aykulu 1984; Obalı 1984; Ünal 1984; Gönüloğlu 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Demirsoy 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), Yeşilirmak (Yazıcı & Gönüloğlu 1994; Altuner & Pabuççu 1996; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic, polysaprobous and eutraphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as a circumneutral diatom (Håkansson 1993; Van Dam *et al.* 1994).

45. *Pinnularia borealis* Ehrenberg Figs 92–94

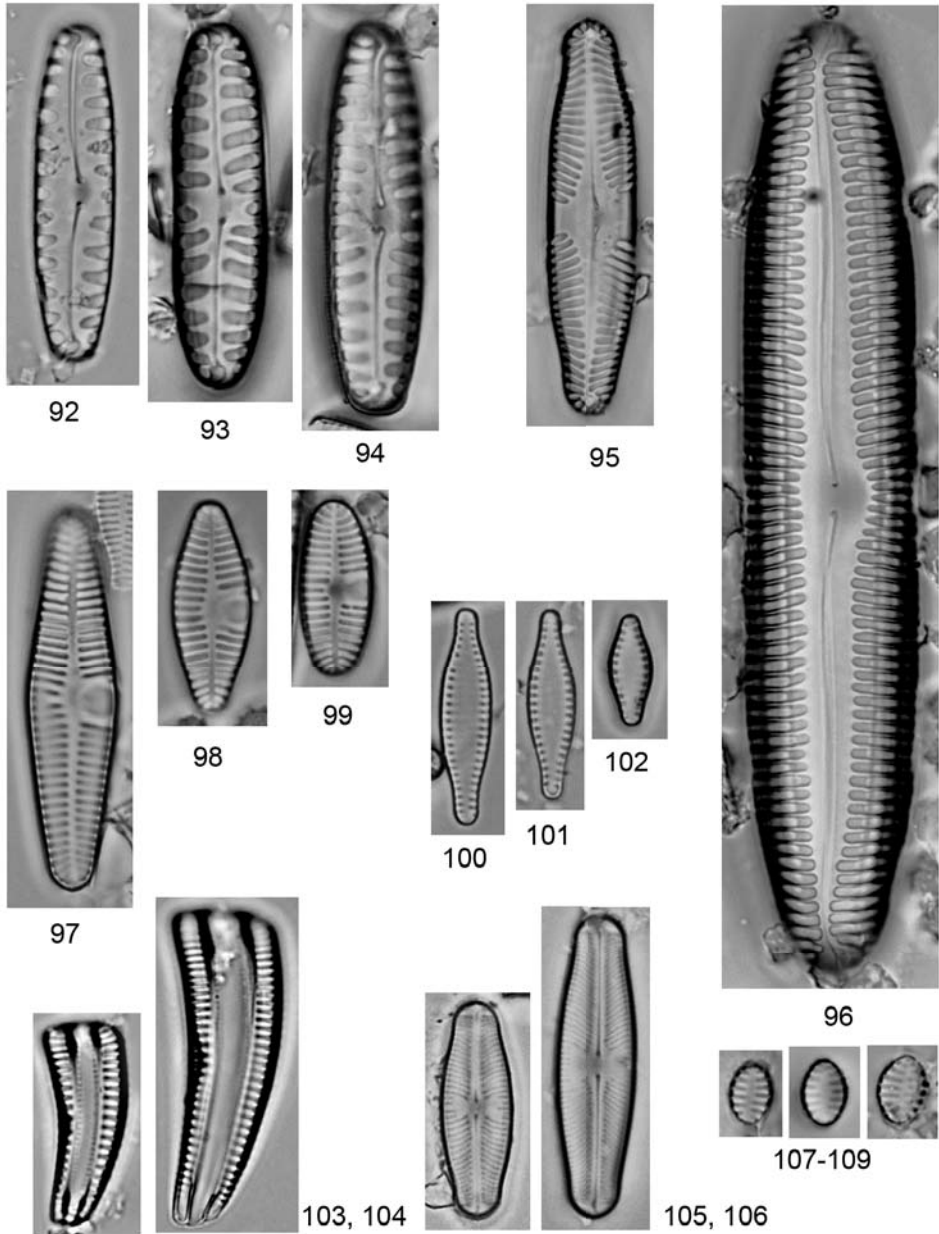
Ref. Hustedt 1930 (p. 326, Fig. 597); Patrick & Reimer 1966 (p. 618, Fig. 58: 13); Krammer & Lange-Bertalot 1986 (p. 405, Fig. 177: 1–12); Hofmann *et al.* 2011 (p. 481, Fig. 75: 27–33).

DIMENSIONS. Valves 29.0–40.7 µm long and 7–10 µm wide, 4–6 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Türkmenbaba, Çobanlar, İnlü, Uluköy.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat, Aras, Çoruh), Black Sea (East Black Sea River Basin) river basins (Fig. 1).

RIVER BASINS. Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönüloğlu 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, 1991; Altuner & Pabuççu 1993, 1994; Gürbüz 2000; Gürbüz & Altuner 2000), Kızılırmak (Özesm 1987; Yıldız & Özkıran 1991;



Figs 92–109. 92–94 – *Pinnularia borealis* Ehrenberg, 95 – *P. microstauron* (Ehrenberg) Cleve, 96 – *P. viridiformis* Krammer, 97–99 – *Planothidium lanceolatum* (Brébisson ex Kützing) Lange-Bertalot, 100–102 – *Pseudostaurosira brevistriata* Grunow, 103 & 104 – *Rhoicosphaenia abbreviata* (C. Agardh) Lange-Bertalot, 105 & 106 – *Sellaphora pupula* (Kützing) Mereschkowsky, 107–109 – *Staurosirella pinnata* (Ehrenberg) D. M. Williams & Round. Scale bar = 10 μm .

Dere & Sivacı 1994; Akbulut 2003), Sakarya (Yıldız & Özkıran 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004).

GENERAL DISTRIBUTION AND ECOLOGY. The species is an acidophilous diatom (Håkansson 1993).

46. *Pinnularia microstauron* (Ehrenberg) Cleve
Fig. 95

Ref. Hustedt 1930 (p. 320, Fig. 582); Patrick and Reimer 1966 (p.128, Fig. 14: 4); Krammer & Lange-Bertalot 1986 (p. 425, Fig. 191: 1–6; 192: 1–16); Hofmann *et al.* 2011 (p. 485, Fig. 71: 9–14).

DIMENSIONS. Valves 29–50 μm long and 8–11 μm wide, 11–13 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Türkmenbaba, Çobanlar, İnlı.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat, Aras, Çoruh), Egean (Gediz, Büyük Menderes, Küçük Menderes), Black Sea (Yeşilirmak, East Black Sea River Basin, West Black Sea River Basin) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Skuja 1937; Vardar & Güner 1972), Asi (Şen *et al.* 1997), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 2002), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen & Çetin 1988; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Güner 1970; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996), Kızılırmak (Özdemir 1987; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Dere & Sıvacı 1994; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Ciriç *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Aykulu *et al.* 1983; Gönülol & Aykulu 1984; Obalı 1984; Ünal 1984; Gönülol 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Demirsoy 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Güner *et al.* 1987; Gezerler 1992; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994), Yeşilirmak (Yazıcı & Gönülol 1994; Altuner & Pabuççu 1996; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic and mesosaprobous species (Krammer & Lange-Bertalot 1986; Denys 1991; Van Dam *et al.* 1994), classified as a circumneutral diatom (Van Dam *et al.* 1994).

47. *Pinnularia viridiformis* Krammer Fig. 96

Ref. Krammer 2000 (p. 167, Figs 160–162); Hofmann *et al.* 2011 (p. 493, Fig. 72: 3–4).

DIMENSIONS. Valves 58–82 μm long and 12.0–17.3 μm wide, 7–11 striae in 10 μm .

DISTRIBUTION IN TURKMEN MTS. Türkmenbaba, Çobanlar, İnlı.

DISTRIBUTION IN TURKEY. New for flora of Turkey.

GENERAL DISTRIBUTION AND ECOLOGY. Tychoplanktonic (Denys 1991) and mesosaprobic (Hofmann 1994), classified as a circumneutral diatom (Håkansson 1993).

48. *Planothidium lanceolatum* (Brébisson *ex* Kützing) Round & Bukhtiyarova Figs 97–99

Achnanthes lanceolata Brébisson, *A. lanceolata* Brébisson *ex* Kützing, *A. lanceolata* (Brébisson) Grunow
Ref. Hustedt 1930 (p. 207, Fig. 306a); Patrick & Reimer 1966 (p. 269, Fig. 18: 1–10); Krammer & Lange-Bertalot 1991b (p. 75, Fig. 41: 11–13); Hofmann *et al.* 2011 (p. 510, Fig. 24: 41–47).

DIMENSIONS. Valves 6.0–39.3 μm long and 4.0–9.3 μm wide, 9–18 striae in 10 μm .

DISTRIBUTION IN TURKMEN MT. Darıpınar, Türkmenbaba, Çobanlar, İdris, Uluköy.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya, Seyhan), Inner Anatolia (Akarçay, Kızırmak, Konya Closed River Basin, Sakarya), Eastern Anatolia (Fırat, Aras, Çoruh), Egean (Gediz, Susurluk, Büyük, Küçük Menderes), Black Sea (East Black Sea River Basin) river basins (Fig. 1).

RIVER BASINS. Akarçay (Obalı 1982), Antalya (Conk & Ciriç 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Ciriç 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras

(Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Kızılırmak (Kılınç & Dere 1988; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Dere & Sivacı 1994; Kılınç 1998; Kılınç & Sivacı 2001), Konya Closed River Basin (Cirik *et al.* 1991; Demirsoy 1996; Akköz & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Obalı 1984; Ünal 1984; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994; Cirik 1997), Yeşilirmak (Altuner & Pabuççu 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Tycho planktonic, mesosaprobous and eutraphentic species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

49. *Pseudostaurosira brevistriata* Grunow Figs 100–102

Ref. Hustedt 1930 (p. 145, Fig. 151); Patrick & Reimer 1966 (p. 128, Fig. 4: 15); Krammer & Lange-Bertalot 1991a (p. 162, Fig. 130: 9–16); Hofmann *et al.* 2011 (p. 258, Fig. 9: 25–29).

DIMENSIONS. Valves 9.0–22.3 µm long and 3–5 µm wide, 13–15 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Çobanlar, Darıpınar.

DISTRIBUTION IN TURKEY. Lakes and rivers in Inner Anatolia (Konya Closed River Basin) (Fig. 1).

RIVER BASINS. Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), Fırat (Şen *et al.* 1995; Çetin & Şen 1998, 2004), Konya Closed River Basin (Skuja 1937;

Temel 1992, 1996; Yıldız *et al.* 1994; Mitamura *et al.* 1997; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Sakarya (Gönülol 1985a, 1987).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tycho planktonic, mesosaprobous and mesotraphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

50. *Rhoicosphenia abbreviata* (C. Agardh) Lange-Bertalot Figs 103, 104 & 165

Rhoicosphenia curvata (Kützing) Grunow, *R. curvata* (Kützing) Grunow *ex* Rabenhorst

Ref. Hustedt 1930 (p. 207, Fig. 306a); Patrick & Reimer 1966 (p. 282, Fig. 20: 1–5); Krammer & Lange-Bertalot 1986 (p. 381, Fig. 91: 20–28); Hofmann *et al.* 2011 (p. 527, Fig. 18: 42–48).

DIMENSIONS. Valves 15.0–32.7 µm long and 7.0–10.7 µm wide, 11–18 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Çobanlar.

DISTRIBUTION IN TURKEY. Lakes and rivers in Inner Anatolia (Akarçay, Kızılırmak, Konya Closed River Basin, Sakarya), Mediterranean (Antalya, Asi, Seyhan), Eastern Anatolia (Fırat, Aras, Çoruh), Egean (Gediz, Büyük Menderes, Küçük Menderes), Black Sea (East Black Sea River Basin, Kızılırmak, Yeşilirmak) river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen & Aksakal 1988; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, 1991; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Güner 1969; Güner 1970; Cirik & Cirik 1989; Gezerler *et al.* 1996), Kızılırmak (Özdemir 1987; Gönülol

& Çomak 1990, 1992; Yıldız & Özkıran 1991; Elmacı & Obalı 1992; Gönüloğlu & Arslan 1992; Gönüloğlu 1993; Dere & Sivacı 1994; Gönüloğlu & Obalı 1998; İşbakan *et al.* 2002; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Mitamura *et al.* 1997; Demirsoy 1996; Akköz & Obalı 1998; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1996), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönüloğlu & Aykulu 1984; Obalı 1984; Gönüloğlu 1985a, b, 1987; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Gezerler 1992; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994), Yeşilirmak (Yazıcı & Gönüloğlu 1994; Altuner & Pabuççu 1996; Kır & Polat 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, tychoplanktonic, mesosaprobous and eutraphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

51. *Rhopalodia gibba* (Ehrenberg) Müller

Fig. 117

Ref. Hustedt 1930 (p. 390, Fig. 740); Patrick & Reimer 1975 (p. 189, Fig. 28: 1); Krammer & Lange-Bertalot 1988 (p. 159, Fig. 59: 1, 2, 4, 6, 7–13); Hofmann *et al.* 2011 (p. 529, Fig. 122: 4–8).

DIMENSIONS. Valves 48–100 µm long and 10.0–12.7 µm wide, 13–15 fibulae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Çobanlar, Darıpınar.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eaeon (Gediz), Eastern Anatolia (Fırat), Inner Anatolia (Konya Closed River Basin, Sakarya) river basins (Fig. 1).

RIVER BASINS. Akarçay (Gönüloğlu & Obalı 1986; Şen *et al.* 1994), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 2002), Fırat (Altuner

& Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996, 1999), Kızılırmak (Özdemir 1987; Gönüloğlu & Çomak 1990, 1992; Yıldız & Özkıran 1991; Elmacı & Obalı 1992; Gönüloğlu 1993; Dere & Sivacı 1994; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Yıldız 1985a, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Skuja 1937; Aysel *et al.* 1992, 1998a, b, 2001, 2002; Erener *et al.* 1995), Sakarya (Obalı 1984; Ünal 1984; Gönüloğlu 1985a, 1987; Yıldız 1987a; Obalı *et al.* 1988; Dere 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Gezerler 1992; Dere *et al.* 2002; Karacaoğlu *et al.* 2004), Yeşilirmak (Gönüloğlu & Obalı 1998).

GENERAL DISTRIBUTION AND ECOLOGY. Tychoplanktonic, mesosaprobous and eutraphentic species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous (Håkansson 1993) or alcalibiontic diatom (Van Dam *et al.* 1994).

52. *Sellaphora pupula* (Kützinger) Mereschkowsky Figs 105, 106, 166 & 167

Navicula pupula Kützinger

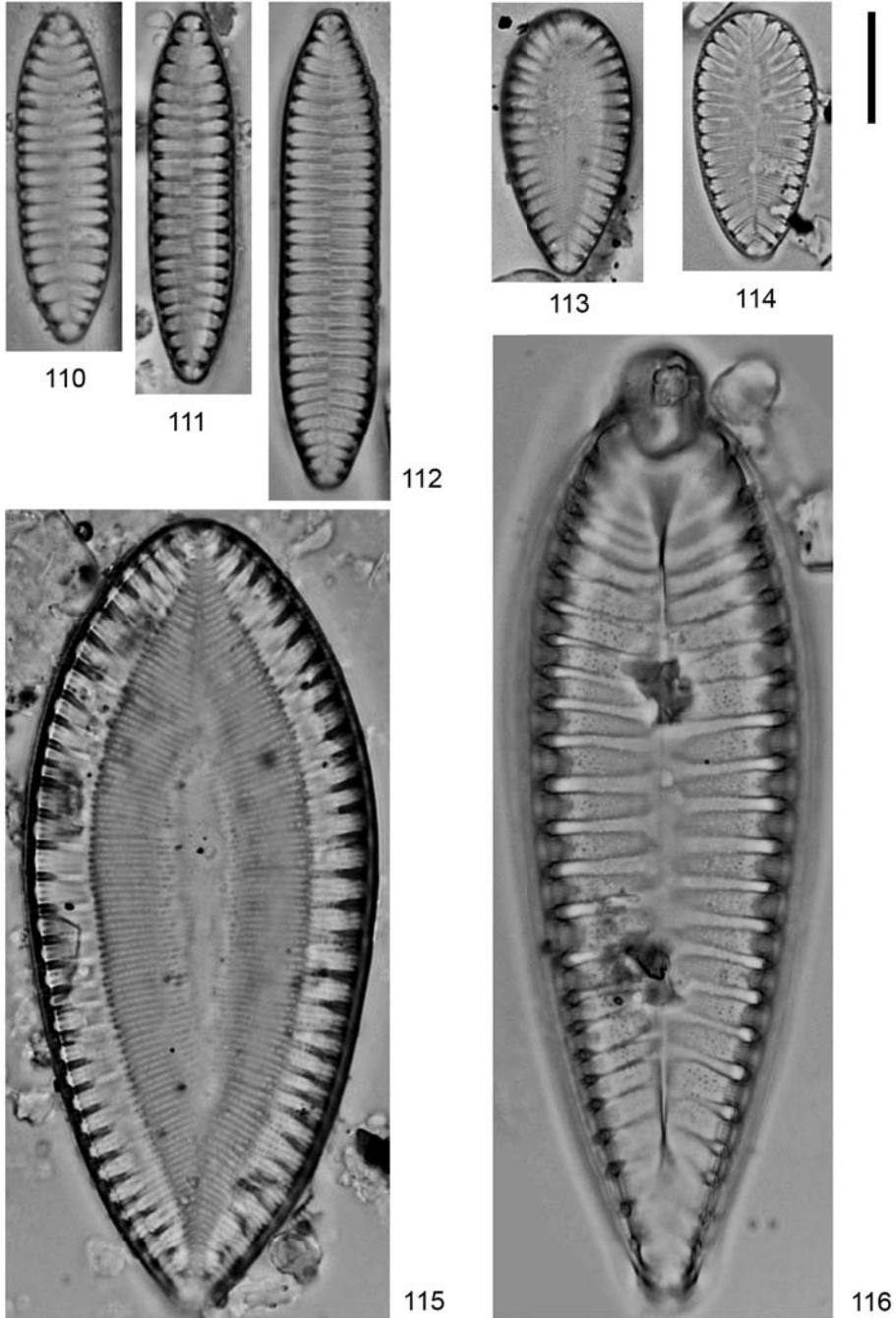
Ref. Hustedt 1930 (p. 281, Fig. 467a); Patrick & Reimer 1966 (p. 495, Fig. 47: 7); Krammer & Lange-Bertalot 1986 (p. 190, Fig. 68: 1–12); Hofmann *et al.* 2011 (p. 536, Fig. 41: 1–14).

DIMENSIONS. Valves 13–31 µm long and 4.0–8.7 µm wide, 18–24 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Darıpınar, Söğüt, Güllüdere-Türkmenbaba, Türkmenbaba, Çobanlar, İdris, Uluköy.

DISTRIBUTION IN TURKEY. Lakes and rivers in Eastern Anatolia (Fırat, Aras, Çoruh), Black Sea (East Black Sea River Basin, Kızılırmak), Egean (Gediz, Büyük Menderes, Küçük Menderes), Inner Anatolia (Konya Closed River Basin, Sakarya, Kızılırmak) river basins (Fig. 1).

RIVER BASINS. Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005),



Figs 110–116. 110–112 – *Surirella angusta* Kützing, 113 & 114 – *S. brebissonii* Krammer & Lange-Bertalot, 115 – *S. ovalis* Brébisson, 116 – *S. tenera* Gregory. Scale bar = 10 μ m.

Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen & Çetin 1988; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Cirik 1994; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996, 1999), Kızılırmak (Kılınç & Dere 1988; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sıvacı 1994; Gönülol & Obalı 1998; Kılınç 1998; Kılınç & Sıvacı 2001), Konya Closed River Basin (Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönülol & Aykulu 1984; Obalı 1984; Ünal 1984; Gönülol 1985a, b, 1987; Yıldız 1987a; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Cirik 1997), Yeşilirmak (Altuner & Pabuççu 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Tycho-planktonic, mesosaprobous and meso-eutraphentic species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as a circumneutral diatom (Håkansson 1993; Van Dam *et al.* 1994).

53. *Staurosirella pinnata* (Ehrenberg)

D. M. Williams & Round Figs 107–109

Ref. Hustedt 1930 (p. 142, Fig. 141); Patrick & Reimer 1966 (p. 127, Fig. 4: 10); Krammer & Lange-Bertalot 1991a (p. 156, Fig. 133: 1–18, 32, 32a); Hofmann *et al.* 2011 (p. 272, Fig. 10: 30–35).

DIMENSIONS. Valves 4.5–20.0 µm long and 3.5–6.0 µm wide, 9–14 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dümbüldek, Türkmenbaba, Çobanlar, İnli, Seydi.

DISTRIBUTION IN TURKEY. Lakes and rivers in Inner Anatolian (Konya Closed River Basin, Kızılırmak, Sakarya), Egean (Gediz, Susurluk, Küçük Menderes), Eastern Anatolia (Fırat, Aras, Çoruh) river basins (Fig. 1).

RIVER BASINS. Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1990b, 1994, 1996; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Kızılırmak (Özsem 1987; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Dere & Sıvacı 1994; Akbulut 2003), Konya Closed River Basin (Cirik *et al.* 1991; Demirsoy 1996; Akköz & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Sakarya (Obalı 1984; Yıldız 1987a; Obalı *et al.* 1989; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), West Black Sea River Basin (Öztürk 1994).

GENERAL DISTRIBUTION AND ECOLOGY. Tycho-planktonic and mesosaprobous species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

54. *Surirella angusta* Kützing Figs 110–112

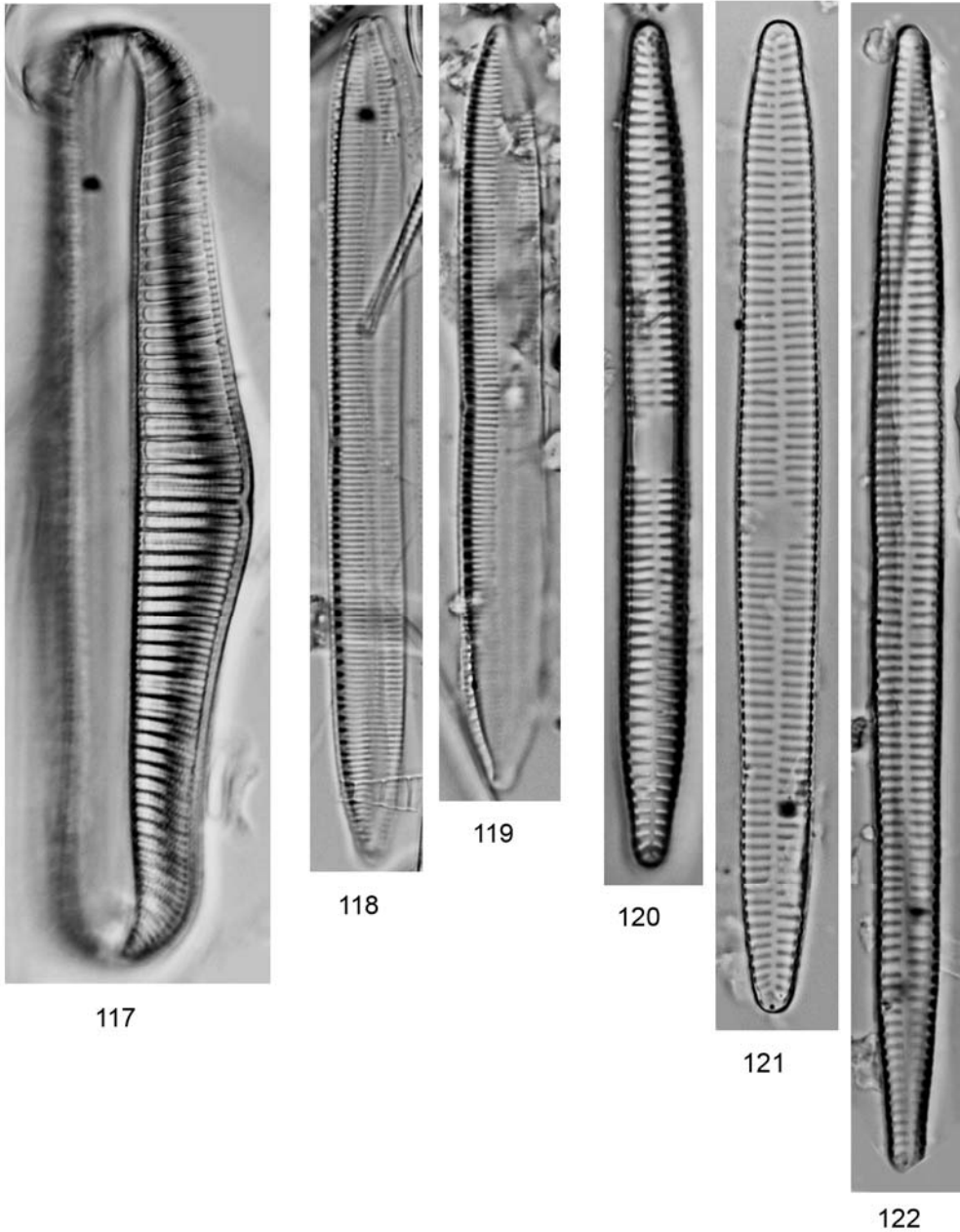
Ref. Hustedt 1930 (p. 435, Fig. 844–845); Krammer & Lange-Bertalot 1988 (p. 187, Figs 133: 6–13; 134: 1, 6–10); Hofmann *et al.* 2011 (p. 554, Fig. 131: 1–5).

DIMENSIONS. Valves 24.0–50.7 µm long and 7.0–10.7 µm wide, 6–7 fibulae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Türkmenbaba, Dümbüldek, Çobanlar.

DISTRIBUTION IN TURKEY. Lakes and rivers in Mediterranean (Antalya), Black Sea (East Black Sea River Basin), Eastern Anatolia (Fırat), Egean (Küçük Menderes), Inner Anatolian (Konya Closed River Basin, Sakarya) river basins (Fig. 1).

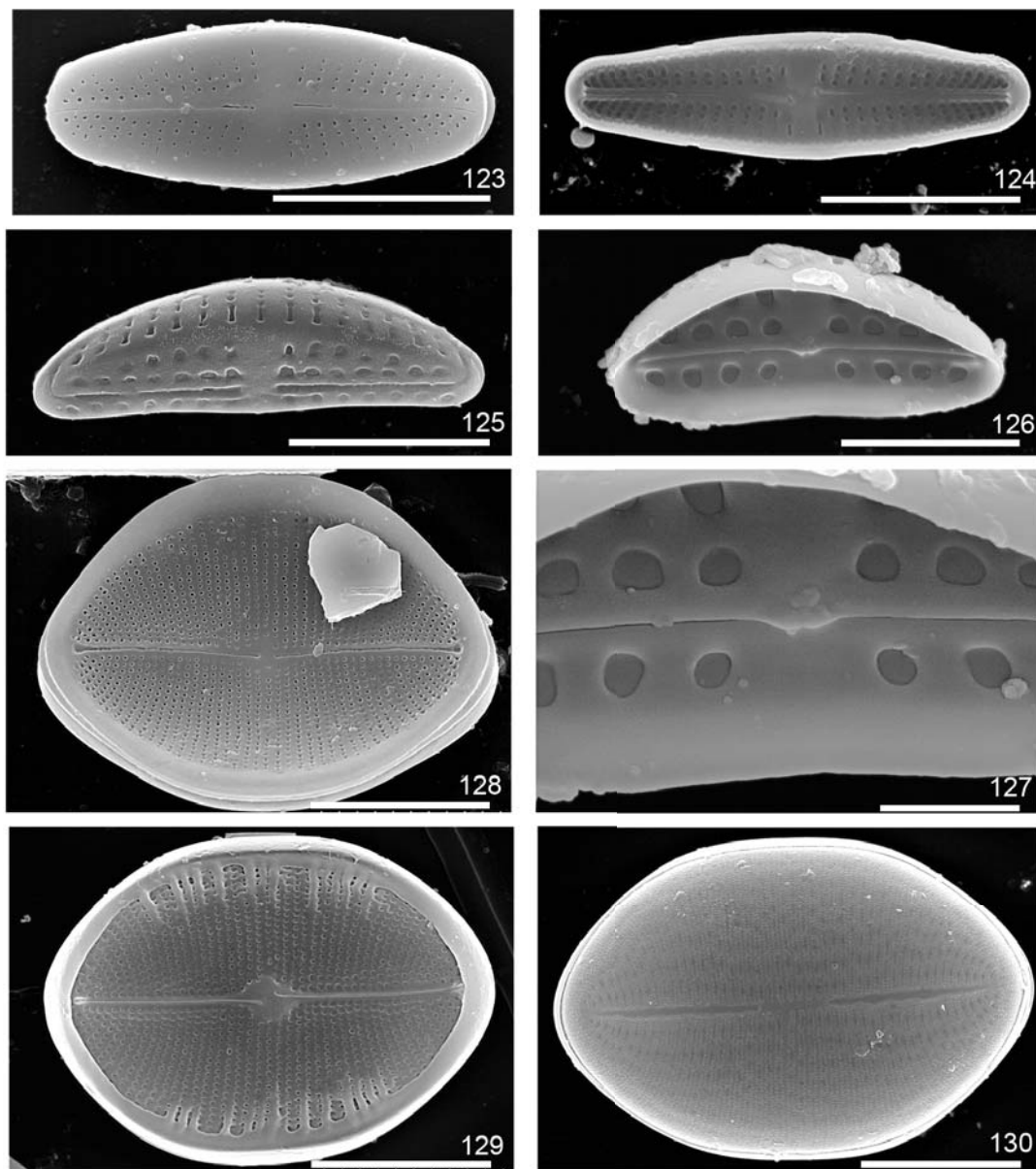
RIVER BASINS. Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Büyük Menderes (Skuja 1937; Güner 1966), Çoruh (Altuner 1984; Altuner & Aykulu 1987), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol



Figs 117–122. 117 – *Rhopalodia gibba* (Ehrenberg) Müller, 118 & 119 – *Tryblionella hungarica* (Grunow) Frenguelli, 120–122 – *Ulnaria ulna* (Nitzsch) P. Compère. Scale bar = 10 µm.

1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993, 1994; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996),

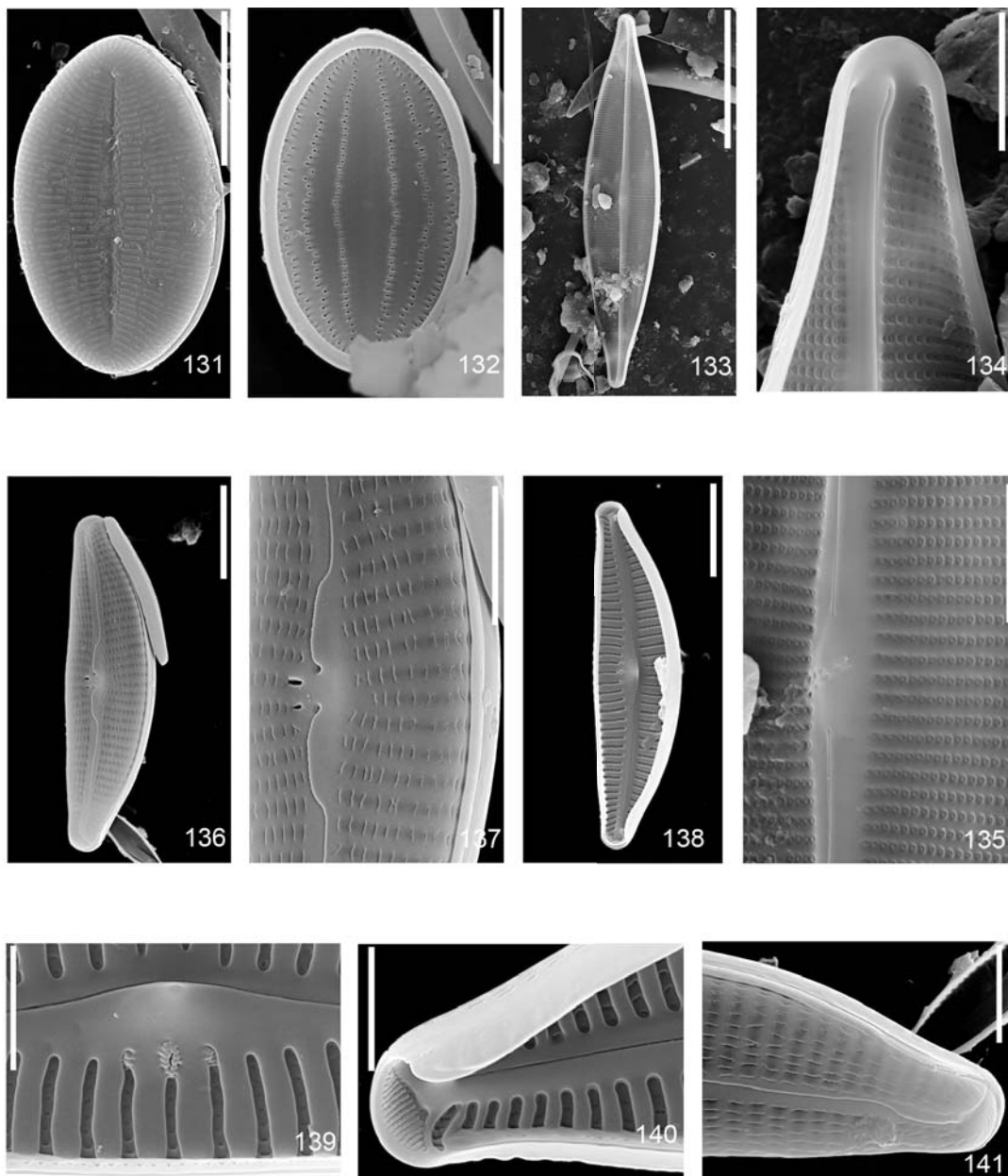
Kızılırmak (Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Dere & Sıvacı 1994), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız



Figs 123–130. 123 & 124 – *Achnanthydium minutissimum* (Kützing) Czarnecki, 125–127 – *Amphora pediculus* (Kützing) Grunow, 128–130 – *Cocconeis pediculus* Ehrenberg, external (123, 125, 128, 130) and internal (124, 126, 127, 129) view, all SEM. Scale bars: 123–125 = 5 μm , 126 = 3 μm , 127 = 1 μm , 128–130 = 10 μm .

et al. 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003),

Sakarya (Gönüloğlu & Aykulu 1984; Gönüloğlu 1985a, b; 1987; Yıldız 1987a; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004).



Figs 131–141. 131 & 132 – *Cocconeis placentula* var. *lineata* (Ehrenberg) Van Heurck, 133–135 – *Craticula cuspidata* (Kützing) D. G. Mann, 136–141 – *Cymbella cymbiformis* Agardh, external (131, 136, 137, 141) and internal (132–135, 138–140) view; all SEM. Scale bars: 131, 132, 136, 138 = 10 µm; 133 = 30 µm; 134, 135, 137, 141 = 5 µm; 139 & 140 = 3 µm.

GENERAL DISTRIBUTION AND ECOLOGY. Ty-
choplanktonic, mesosaprobous and eutrphentic
species (Denys 1991; Hofmann 1994; Van Dam

et al. 1994), classified as an alkaliphilous diatom
(Van Dam *et al.* 1994).

55. *Surirella brebissonii* Krammer
& Lange-Bertalot Figs 113 & 114

Ref. Krammer & Lange-Bertalot 1988 (p. 179, Figs 123: 4–5; 126: 2–6; 127: 1–13); Hofmann *et al.* 2011 (p. 556, Fig. 130: 11–21).

DIMENSIONS. Valves 21.5–43.0 µm long and 7.0–10.5 µm wide, 6 fibulae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Akındere, Çobanlar, Güllüdere, İdris.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Obalı 1982), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Asi (Şen *et al.* 1997), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Şen & Çetin 1988; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Güner 1970; Temel 1994, 1996, 1999, 2002, 2003; Gezerler *et al.* 1996), Kızılırmak (Kılınç & Dere 1988; Gönülol & Çomak 1990, 1992; Yıldız & Özkıran 1991; Elmacı & Obalı 1992; Gönülol & Arslan 1992; Gönülol 1993; Dere & Sivacı 1994; Gönülol & Obalı 1998; Kılınç 1998; Kılınç & Sivacı 2001; İşbakan *et al.* 2002), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Temel 1992, 1996; Yıldız *et al.* 1994; Mitamura *et al.* 1997; Morkoyunlu *et al.* 1999; Elmacı & Obalı 1998), Küçük Menderes (Cirik & Cirik 1989; Aysel *et al.* 1992, 1998a, b, 2001, 2002), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Aykulu *et al.* 1983; Gönülol & Aykulu 1984; Ünal 1984; Gönülol 1985a, b, 1987; Yıldız 1987a; Dere 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Demirsoy 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Seyhan (Kandemir-Çevik *et al.* 1994), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994), Yeşilirmak (Altuner & Pabuççu 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Ty-choplanktonic, mesosaprobous and eutrphentic

species (Denys 1991; Hofmann 1994), classified as an alkaliphilous diatom (Van Dam *et al.* 1994).

56. *Surirella ovalis* Brébisson Fig. 115

Ref. Hustedt 1930 (p. 441, Fig. 860–861); Krammer & Lange-Bertalot 1988 (p. 178, Fig. 125: 1–7); Hofmann *et al.* 2011 (p. 558, Fig. 129: 8–10).

DIMENSIONS. Valves 31.0–84.7 µm long and 19.0–37.3 µm wide, 3–5 fibulae and 14–16 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. İdris.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Akarçay (Obalı 1982; Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996; Yüce *et al.* 1997; Savaş & Cirik 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Gezerler *et al.* 1996), Kızılırmak (Kılınç & Dere 1988; Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Dere & Sivacı 1994; Kılınç 1998; Kılınç & Sivacı 2001), Konya Closed River Basin (Skuja 1937; Cirik *et al.* 1991; Temel 1992, 1996; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003), Sakarya (Gönülol & Aykulu 1984; Obalı 1984; Gönülol 1985a, b, 1987; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994), Yeşilirmak (Altuner & Pabuççu 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Wide-spread, ty-choplanktonic, mesosaprobous and eutrphentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Van Dam *et al.* 1994).

57. *Surirella tenera* Gregory Fig. 116

Ref. Hustedt 1930 (p. 401, Fig. 766); Krammer & Lange-Bertalot 1988 (p. 203, Figs 164: 1–4; 165: 1–3).

DIMENSIONS. Valves 31–100 µm long and 19.0–28.7 µm wide, 2–5 fibulae.

DISTRIBUTION IN TURKMEN MT. Çobanlar, Darıpinar.

DISTRIBUTION IN TURKEY. Lakes and rivers in Black Sea (East Black Sea River Basin), Eastern Anatolia (Fırat) river basins (Fig. 1).

RIVER BASINS. Aras (Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003; Şahin & Gönülol 1997; Kolaylı *et al.* 1998; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, 1991; Şen & Çetin 1988; Altuner & Pabuççu 1993, 1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Konya Closed River Basin (Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b), Yeşilirmak (Altuner & Pabuççu 1996).

GENERAL DISTRIBUTION AND ECOLOGY. Widespread, euplanktonic, mesosaprobous and eutra-phentic species (Krammer & Lange-Bertalot 1986; Denys 1991; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

58. *Tryblionella hungarica* (Grunow) Frenguelli Figs 118 & 119

Nitzschia hungarica Grunow

Ref. Hustedt 1930 (p. 401, Fig. 766); Krammer & Lange-Bertalot 1988 (p. 42, Fig. 34: 1–3).

DIMENSIONS. Valves 69.0–90.7 µm long and 6–8 µm wide, 9–11 fibulae, and 15–19 striae in 10 µm.

DISTRIBUTION IN TURKMEN MT. Dümbüldek.

DISTRIBUTION IN TURKEY. Lakes and rivers in Inner Anatolia (Konya Closed River Basin, Sakarya), Egean (Gediz) and Marmara (Marmara) river basins (Fig. 1).

RIVER BASINS. Aras (Altuner 1988; Akbulut & Yıldız 2002), Asi (Şen *et al.* 1997), Gediz (Cirik 1994; Gezerler

et al. 1999), Kızılırmak (Yıldız & Özkıran 1991; Gönülol & Arslan 1992; Dere & Sıvacı 1994), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Temel 1992, 1996; Yıldız *et al.* 1994; Mitamura *et al.* 1997; Elmacı & Obalı 1998; Morkoyunlu *et al.* 1999), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003; Yardımcı & Temel 2000), Sakarya (Obalı 1984; Yıldız 1987a; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Aykulu *et al.* 1999; Atıcı 2002; Yardımcı & Temel 2000), Susurluk (Skuja 1937; Dere *et al.* 2002; Karacaören *et al.* 2004), West Black Sea River Basin (Öztürk 1994).

GENERAL DISTRIBUTION & ECOLOGY. Widespread, euplanktonic, mesosaprobous and eutra-phentic (Krammer & Lange-Bertalot 1986; Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

59. *Ulnaria ulna* (Nitzsch) P. Compère

Figs 120–122

Synedra ulna (Nitzsch) Ehrenberg, *Fragilaria ulna* (Nitzsch) Lange-Bertalot

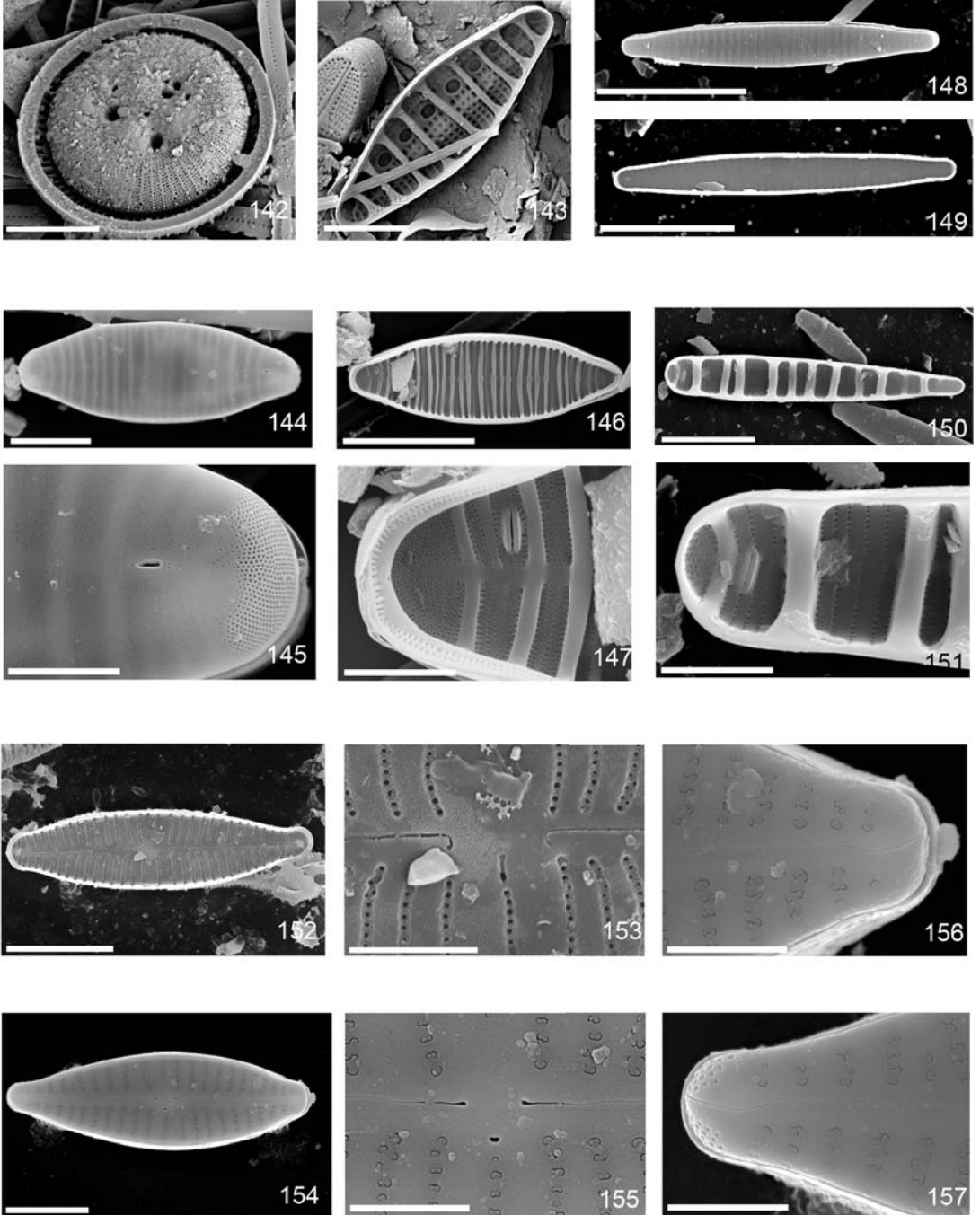
Ref. Hustedt 1930 (p. 151, Figs 158, 159); Patrick & Reimer 1966 (p. 148, Fig. 7: 1, 2); Krammer & Lange-Bertalot 1991a (p. 143, Fig. 122: 1–8); Hofmann *et al.* 2011 (p. 276, Fig. 5: 6–11).

DIMENSIONS. Valves 64–145 µm long and 2–9 µm wide, 9–15 striae in 10 µm.

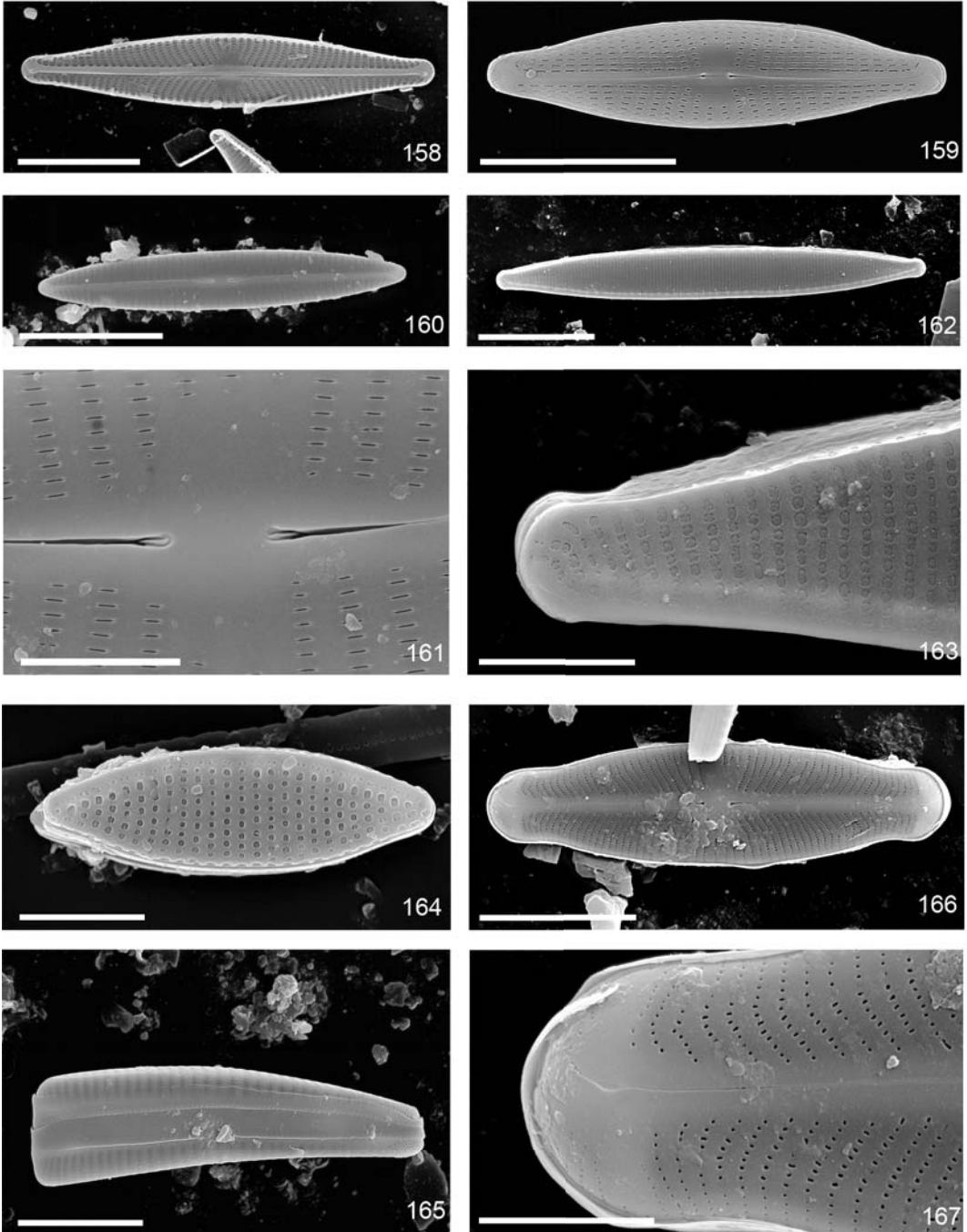
DISTRIBUTION IN TURKMEN MT. Darıpinar, İdrıs, Lütfiye-Güllüdere.

DISTRIBUTION IN TURKEY. Lakes and rivers in most of the river basins (Fig. 1).

RIVER BASINS. Akarçay (Aykulu & Obalı 1981; Obalı 1982; Gönülol & Obalı 1986; Şen *et al.* 1994), Antalya (Conk & Cirik 1991; Morkoyunlu & Ertan 1995a, b; Ertan *et al.* 1996; Morkoyunlu *et al.* 1996, Savaş & Cirik 1997; Yüce *et al.* 1997; Ertan & Morkoyunlu 1998), Aras (Altuner 1988; Şen *et al.* 1997; Akbulut & Yıldız 2002; Gürbüz *et al.* 2002a, b; Kıvrak & Gürbüz 2005), Büyük Menderes (Skuja 1937; Güner 1966; Cirik *et al.* 1989), Çoruh (Altuner 1984; Altuner & Aykulu 1987), Dicle (Şen 1988a; Şen *et al.* 1999; Baykal *et al.* 2004), East Black Sea River Basin (Şahin 1992, 1994, 1998a, b, 2000, 2001, 2002, 2003, Kolaylı *et al.* 1998; Şahin & Gönülol 1997; Kara & Şahin 2001), Fırat (Altuner & Gürbüz 1988, 1989, 1990a, b, 1991, 1994, 1996; Altuner & Pabuççu 1993,



Figs 142–157. 142 – *Cyclotella ocellata* Pantocsek, 143 – *Denticula tenuis* Kützing, 144–147 – *Diatoma vulgare* Bory, 148 & 149 – *Fragilaria capucina* Desmazieres s.l., 150 & 151 – *Meridion circulare* (Gréville) Agardh, 152–157 – *Gomphonema parvulum* (Kützing) Kützing, external (142, 144, 146, 147, 154–157) and internal (143, 145, 148–153) view; all SEM. Scale bars: 142 & 154 = 5 μ m; 143 = 4 μ m; 144–146, 150, 152 = 10 μ m; 147, 151, 153 = 5 μ m; 148, 149 = 15 μ m; 155–157 = 2 μ m.



Figs 158–167. 158 – *Navicula cryptocephala* Kützing, 159 – *N. veneta* Kützing, 160 & 161 – *N. tripunctata* (O. Müller) Bory, 162, 163 – *Nitzschia palea* (Kützing) W. Smith, 164 – *N. frustulum* (Kützing) Grunow, 165 – *Rhoicosphaenia abbreviata* (C. Agardh) Lange-Bertalot, 166 & 167 – *Sellaphora pupula* (Kützing) Mereschkowsky, internal (158) and external (159–167) view; all SEM. Scale bars: 158, 159, 162, 165, 166 = 10 µm; 160 = 20 µm; 161 & 167 = 3 µm; 163 = 2 µm; 164 = 5 µm.

1994; Şen *et al.* 1995; Çetin & Şen 1998, 2004; Gürbüz 2000; Gürbüz & Altuner 2000), Gediz (Güner 1969; Ciriç 1994; Ciriç & Ciriç 1989, 1990; Gezerler *et al.* 1999), Kızılırmak (Özesm 1987; Kılınc & Dere 1988; Kılınc 1998; Gönüloğlu & Çomak 1990, 1992; Yıldız & Özkıran 1991; Gönüloğlu & Arslan 1992; Gönüloğlu 1993; Dere & Sıvacı 1994; Kılınc & Sıvacı 2001; Akbulut 2003), Konya Closed River Basin (Skuja 1937; Yıldız 1984a, b, 1985a, b, 1986a, b, 1987b; Ciriç *et al.* 1991; Temel 1992, 1996, 1997a; Yıldız *et al.* 1994; Demirsoy 1996; Morkoyunlu *et al.* 1996; Mitamura *et al.* 1997; Akköz & Obalı 1998; Elmacı & Obalı 1998), Küçük Menderes (Skuja 1937; Kolaylı & Güner 1988; Ciriç & Ciriç 1989; Aysel *et al.* 1992, 1998a, b, 2001, 2002; Balık & Gezerler 1995; Erener *et al.* 1995; Gezerler 1992; Gezerler *et al.* 1996), Marmara (Albay & Aykulu 1994a, b; Temel 1994, 1996, 1999, 2002, 2003; Yardımcı & Temel 2000), Sakarya (Aykulu *et al.* 1983; Gönüloğlu & Aykulu 1984; Obalı 1984; Ünal 1984; Gönüloğlu 1985a, b, 1987; Yıldız 1987a, b; Dere 1989; Obalı *et al.* 1989; Yıldız & Özkıran 1994; Atıcı & Yıldız 1996; Demirsoy 1996; Aykulu *et al.* 1999; Yardımcı & Temel 2000; Atıcı 2002), Susurluk (Skuja 1937; Gezerler 1992; Gezerler *et al.* 1994; Dere *et al.* 2002; Karacaoğlu *et al.* 2004), West Black Sea River Basin (Öztürk 1994; Ciriç 1997), Yeşilirmak (Yazıcı & Gönüloğlu 1994; Altuner & Pabuççu 1996; Kır & Polat 1996; Gönüloğlu & Obalı 1998).

GENERAL DISTRIBUTION AND ECOLOGY. Tycho-planktonic and meso-polysaprobous species (Denys 1991; Hofmann 1994; Van Dam *et al.* 1994), classified as an alkaliphilous diatom (Håkansson 1993; Van Dam *et al.* 1994).

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