Mediterranean Marine Science

Vol 21, No 1 (2020)

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doi: 10.12681/mms.17293

Research Article

Mediterranean Marine Science
Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS
The journal is available on line at http://www.medit-mar-sc.net
DOI: http://dx.doi.org/10.12681/mms.17293

Taxonomy and distribution of diatoms on the Turkish Mediterranean Coast, Dalyan (Muğla)

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Handling Editor: Antonia GIANNAKOUROU

Received: 28 May 2018; Accepted: 18 December 2019; Published online: 30 April 2020

Abstract

Diatoms are one of the components in the littoral zone and the most productive in terms of O_2 production and primary production. Despite their importance in these coastal ecosystems, the diatoms of littoral zones of Turkish coastlines have been understudied. In this report, we document the littoral diatoms from Dalyan Iztuzu Beach at the southeast coasts of Aegean Sea. Samples were collected from 6 stations in Dalyan Beach between 2012 and 2016. We report here on the occurrence of 9 genera including, *Catenula* Mereschkowsky, *Cymatosira* Grunow, *Dimeregramma* Ralfs, *Diplomenora* Blazé, *Eunotogramma* Weisse, *Meloneis* Louvrou, Danielidis & Economou-Amilli, *Neohuttonia* Kuntze, *Plagiogramma* Greville and *Tetramphora* Mereschkowsky, as well as 40 taxa as newly-recorded from Turkey. The newly-recorded diatoms are characterized in terms of their morphology and illustrated with light micrographs. For each species, their habitat and geographic distribution along the coasts are discussed.

Keywords: Benthic; Diatom; Marine; New Records; The Mediterranean Sea; Turkish coast.

Introduction

The marine littoral zone is an important area in the oceans due to its high primary productivity, O_2 production and for the determination of the ecological status of the coasts (Desrosiers *et al.*, 2013). Diatoms are one of the components in the littoral zone and the most productive in terms of O_2 production and the primary production (Coelho *et al.*, 2007).

Previous studies in Turkey indicated that diatoms are generally the most abundant group amongst phytoplankton (Bat *et al.*, 2007; Taş, 2014). Taş (2014) indicated that in the Datça Peninsula, diatoms and dinoflagellates were found as dominants in the phytoplankton. The other records from the Sea of Marmara revealed that diatoms were one of the major groups in the phytoplankton (Deniz & Taş, 2009; Balkıs & Toklu-Alıçlı, 2014; Balkıs & Taş, 2016). Also, a few studies (e.g. Özman-Say & Balkıs, 2012) were carried out in the Mediterranean Sea, with similar results.

A pioneering study on Turkish marine benthic diatoms was performed in the first half of 19th Century by Ehrenberg (1844). His interest in Turkish marine diatoms concerned the Sea of Marmara and Bosporus (Istanbul) regions. Ehrenberg described three new species from the Sea of Marmara (*Achnanthes bacillaris*, *Cocconeis margaritifera,* and *Navicula decussata*) and one new species from Bosporus (*Gallionella asperula*). Then, in the early 20th Century, Hustedt (1930-1966) described *Achnanthes orientalis* (=*Karayevia amoena* (Hustedt) Bukhtiyarova), *Stauroneis decipiens* Hustedt and *Nitzschia capitellata* Hustedt from the Sea of Marmara. Hustedt also published some diatom records from Golden Horn, Bosporus, which included the presence of *Melosira dubia* Kützing, *M. nummuloides* Agardh, *Cocconeis notata* Petit and *Mastogloia pumila* Cleve (Hustedt, 1930-1966). Recently, research on the diatoms from Western Turkey was initiated and this activity resulted in the publication of several diatom checklists (Koray 2001; Balkıs, 2004; Aysel, 2005; Taş & Okuş, 2006). These checklists included some benthic diatoms but they were primarily dedicated to planktonic forms. Additionally, research on the benthic diatom composition from Homa Lagoon, İzmir province, resulted in some species being recorded for the first time for the Turkish marine flora, including species from *Cocconeis*, *Fogedia*, *Mastogloia*, *Seminavis*, *Synedra* and *Trachysphenia* (Çolak Sabancı, 2013; Çolak Sabancı *et al.*, 2010, 2014). More recently, 31 new records

of marine diatoms from the Black Sea coast at Sinop were published by Kaleli *et al.* (2017).

Turkey has coasts on several seas (Black Sea, Marmara, and the Mediterranean Sea), each differing from one another in terms of environmental conditions. The significant factors differing throughout the year between the marine coasts are salinity and water temperature (Tsimplis *et al.,* 2004; Coll *et al.*, 2010). The study area for the present report is part of the southeastern Aegean Sea coasts. This area has been shown to be a marine biodiversity hotspot, exposed to alien species via the Suez Canal (Coll *et al.*, 2010).

The aim of this study is to document the diatom species observed for the first time on the Turkish Mediterranean coasts of Dalyan, expand biogeographical knowledge of marine diatoms, and contribute to a fuller understanding of the Turkish marine diatom flora. For certain taxa treated here, we also indicate specific relationships between taxa and their habitats.

Material and Methods

Dalyan Iztuzu Beach (36. 4202° N, 28. 4131° E) is located on the southeastern coast of the Aegean Sea (Fig. 1). The Iztuzu Coast, which is 4.7 km long, is one of the protected areas of the Turkish coasts, due to the presence of nesting grounds of *Caretta caretta* (Linnaeus, 1758), the loggerhead sea turtle. In the southern part of the coast, Sülüklü Lake is present. This lake is shallow and has a mostly sandy bottom (Kaleli, 2019). In the northern part of the coast, the Dalyan River reaches the coast via the Delta of Dalyan.

Sampling was carried out between 2012-2016 from 6 different locations along the coast of Dalyan. Epilithic diatom samples were collected from stones and rocks from the southern coast by brushing, and epiphytic samples were collected from both the northern and southern parts of the beach by using plastic bags to collect host plants and dislodge the epiphytes. Sand samples were taken from the shoreline. Epipelic samples from Sülüklü Lake was collected with a spoon.

Samples were treated with 10 % HCl and washed several times with distilled water in order to remove carbonates. Then, the samples were prepared by boiling with H_2O_2 and washed with distilled water. Frustules were air-dried and mounted with Naphrax. Light microscopic (LM) observations were performed with Olympus BX-51 microscope in the Biology Department and Nikon Eclipse Ci-E microscope at Advanced Research Center (DPU-ILTEM) of Kütahya Dumlupınar University.

Diatom identification was aided with the following references: Peragallo & Peragallo (1897-1908), Hustedt (1930-1966), Hendey (1964), Simonsen (1987), Hartley *et al.* (1996), Loir & Novarino (2014), Witkowski *et al.* (2000), Witon & Witkowski (2006a), Wachnicka & Gaiser (2007), Riberio (2010), and Álvarez-Blanco & Blanco (2014).

Taxonomic classification and nomenclatural updates on genera and taxa names were checked with Fourtanier & Kociolek (2011), Guiry & Guiry (2019) and Kociolek *et al.* (2019). Previously published phytoplankton check-

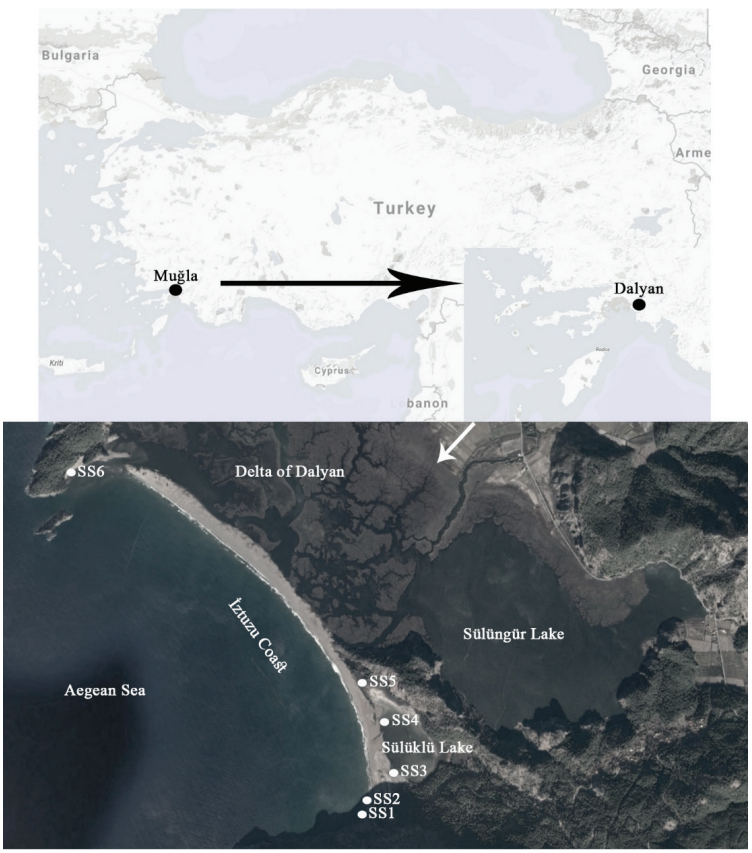

Fig. 1: Overall view of Sampling Location (SS = Sampling Sites).

Table 1. New recorded taxa list according to their presence in the substrates observed.

Taxa / Habitat	Epilithon	Epiphyton	Epipsammon
Achnanthes danica (Flögel) Grunow	+		
Amphora cymbamphora Cholnoky			+
Anorthoneis vortex Sterrenburg	+	+	
Ardissonea crystallina* var. *dalmatica (Kützing) Mills	+		
Brachysira estonarium Witkowski, Lange-Bertalot & Metzeltin	+		
Caloneis liber (Smith) Cleve	+		
Catenula adhaerens (Mereschkowsky) Mereschkowsky	+		
Cocconeis diaphana Smith	+		
Cocconeis dirupta Gregory	+		
Cocconeis pelta Schmidt	+		
Cocconeis peltoides Hustedt	+		+
Cymatosira belgica Grunow	+		
Cymatosira lorenziana Grunow	+		
Delphineis minutissima (Hustedt) Simonsen	+		
Dimeregramma minus* var. *nanum (Gregory) Van Heurck	+	+	
Diplomenora cocconeiformis (Schmidt) Blazé	+	+	
Eunotogramma marinum (Smith) H. Peragallo & M. Peragallo	+		+
Fallacia pseudony (Hustedt) Mann	+	+	
Fallacia schaeferae (Hustedt) Mann			+
Grammatophora angulosa* var. *mediterranea Grunow	+	+	
Licmophora ehrenbergii* f. *grunowii (Mereschkowsky) Witkowski		+	
Mastogloia crucicula (Grunow) Cleve		+	
Mastogloia emarginata Hustedt	+		
Mastogloia ovalis A. Schmidt	+	+	
Meloneis mimallis Louvrou, Danielidis & Economou-Amilli	+	+	
Navicula arenaria* var. *rostellata Lange-Bertalot	+		
Navicula lusoria Giffen	+		
Neohuttonia reichardtii (Grunow) Hustedt	+		+
Nitzschia aequorea Hustedt	+	+	
Nitzschia amabilis Suzuki	+		
Nitzschia nanodissipata Chunlian Li & Witkowski		+	
Nitzschia valdestriata Aleem & Hustedt	+	+	
Plagiogramma pulchellum* var. *pygmaeum (Greville) H. Peragallo & M. Peragallo	+		
Plagiogramma tenuissimum Hustedt	+		+
Planothidium lilljeborgei (Grunow) Witkowski, Lange-Bertalot & Metzeltin	+		
Proschkinia bulnheimii (Grunow) Karayeva	+		
Psammodictyon panduriforme* var. *continuum (Grunow) Snoeijs	+		
Tetramphora sulcata (Brébisson) Stepanek & Kociolek	+		
Trachysphenia acuminata Peragallo	+		
Tryblionella marginulata (Grunow) Mann	+		

lists by Koray (2001), Balkıs (2004), Taş & Okuş (2006) and Gönülol (2018) were compared for the new records.

Results

This is the first study on benthic diatoms carried out in the region. As a result, taxa belonging to 9 genera, including *Catenula* Mereschkowsky, *Cymatosira* Grunow, *Dimeregramma* Ralfs, *Diplomenora* Blazé, *Eunotogramma* Weisse, *Meloneis* Louvrou, Danielidis & Economou-Amilli, *Neohuttonia* Kuntze, *Plagiogramma* Greville, and *Tetramphora* Mereschkowsky and a total of 40 species were identified as new records for marine benthic flora of Turkish coasts. Descriptions and micrographs of the diatoms follow below with information, including habitat distributions (Table 1). For each taxon, valves were measured and individual (n) valves are given in the dimensions.

Description of the Taxa

Biddulphiaceae

Neohuttonia Kuntze, 1898

Neohuttonia reichardtii (Grunow) Hustedt (Fig. 2. A)

Basionym: *Cerataulus reichardtii* Grunow

References: Hustedt (1930-1966/I), p. 863, fig. 514; Hustedt (1955), p. 9, pl. 4:23, 24; Witkowski *et al.* (2000), p. 33, pl. 3: 12, 13; Al-Yamani & Saburova (2011), p. 55, pl. 19: a-d

Dimensions: Valve length 23.3-37.0 µm, breadth 9.0-11.9 µm and 9-10 pervalvar rows in 10 µm. (n=3).

Remarks: Found in rock scrape (epilithon) and sand (epipsammon) samples. The taxon was first described from the Adriatic Sea by Grunow (*Cerataulus reichardtii*), later observed at Milos Island, South Aegean Sea (Louvrou, 2007). The distribution of *N. reichardtii* from the Mediterranean was expanded to other oceans with reports from the Virgin Islands and the Caribbean Sea by Boyer (1927) and tropical and subtropical waters by Witkowski *et al.* (2000).

Eunotogramma Weisse, 1854

Eunotogramma marinum (Smith) H. Peragallo & M. Peragallo (Fig. 2. B)

Basionym: *Himantidium marinum* Smith

References: Peragallo & Peragallo (1897-1908), p. 343, pl. 82:36; Witkowski *et al.* (2000), p. 32, pl. 10: 1-3

Dimensions: Valve length 20.5-26.3 µm, breadth 3.8 µm, 4 septa in 10 µm. (n=2).

Remarks: A few valves observed in the materials. Valves semi-lanceolate and transapical ribs observed both in girdle and valve view. The species was described from the Atlantic coasts of France (Peragallo & Peragallo, 1897-1908) and also reported from western Baltic Sea by Witkowski *et al.* (2000). Hendey (1974) reported the species from the British coasts, and it was reported from Guadeloupe Island in the western Atlantic coast (Loir, 2011-2014).

Plagiogrammaceae

Dimeregramma Ralfs, 1861

Dimeregramma minus* var. *nanum (Gregory) Van Heurck (Fig. 2. C)

Basionym: *Denticula nana* Gregory

References: Hustedt (1930-1966/II), p. 119, fig. 641; Witkowski *et al.* (2000), p. 29, pl. 11:3-9; Li *et al.* (2015).

Dimensions: Valve length 6.2-12.8 µm, breadth 3.5-5.6 µm and 10-15 striae in 10 µm. (n=5).

Remarks: Observed in epilithon. Valves rhombic with sternum broader than in the nominate variety, also differ in size. Here, the number of transapical striae (10-15 in 10 µm) is lower than the values given by Hustedt (1930-1966) and Witkowski *et al.* (2000) (14 in 10 µm). Distributed widespread in the oceanic coasts and the Mediterranean; Japan (Sato *et al.*, 2008), South Africa (Giffen, 1975), Atlantic Ocean, Québec, (Poulin *et al.*, 1984), and the Mediterranean, (Hustedt 1930-1966; Louvrou, 2007).

Plagiogramma Greville, 1859

Plagiogramma pulchellum* var. *pygmaeum (Greville) H. Peragallo & M. Peragallo (Fig. 2 D)

Basionym: *Plagiogramma pygmaeum* Greville

References: Peragallo & Peragallo (1897-1908), p. 338, pl. 82:3; Hustedt (1930-1966/II), p. 104, fig. 634; p. 338, pl. 82:3; Witkowski *et al.* (2000), p. 38, pl. 10:13; 11:29, 30

Dimensions: Valve length 21 µm, breadth 6.4 µm 7 striae in 10 µm. (n=1).

Remarks: Rarely occurred in the epilithic samples. Differs from the nominate variety by the smaller size. The taxon was reported from the Persian Gulf (Hendey, 1970). observed by Peragallo & Peragallo (1897-1908) from the Balearic Sea in the Mediterranean and Hustedt (1930-1966/II), from Oman and New Caledonia by Witkowski *et al.* (2000).

Plagiogramma tenuissimum Hustedt (Fig. 2. E)

References: Hustedt (1956), p. 106, fig. 6-8

Dimensions: Valve length 7.3-14.7 µm, breadth 2.0-2.7 µm, which is in accordance with original description by Hustedt (1956). (n=11).

Remarks: A few valves occurred in epilithon and epipsammon. Valves elliptical, in girdle view rectangular. Two internal, transapical ribs (pseudosepta) visible in both valve and girdle view. Hustedt (1956) described this species from Lago Maracaibo in Venezuela. Witkowski *et al.* (2000), p. 23, pl. 10: 33-35, identified this diatom as *Anaulus minutus* Grunow. *Plagiogramma tenuissimum* is recorded from the type habitat, Lago Maracaibo, Venezuela, a coastal lagoon that connects with the Caribbean Sea (Hustedt, 1956; Rodríguez, 2001) but also as an epiphyte from Brazilian coastal lagoons (Da Rosa & Garcia, 2015). Recently recorded for the first time for Black Sea flora from Crimea (Nevrova, 2016)

Cymatosiraceae

Cymatosira Grunow, 1862

Cymatosira belgica Grunow (Fig. 2. F)

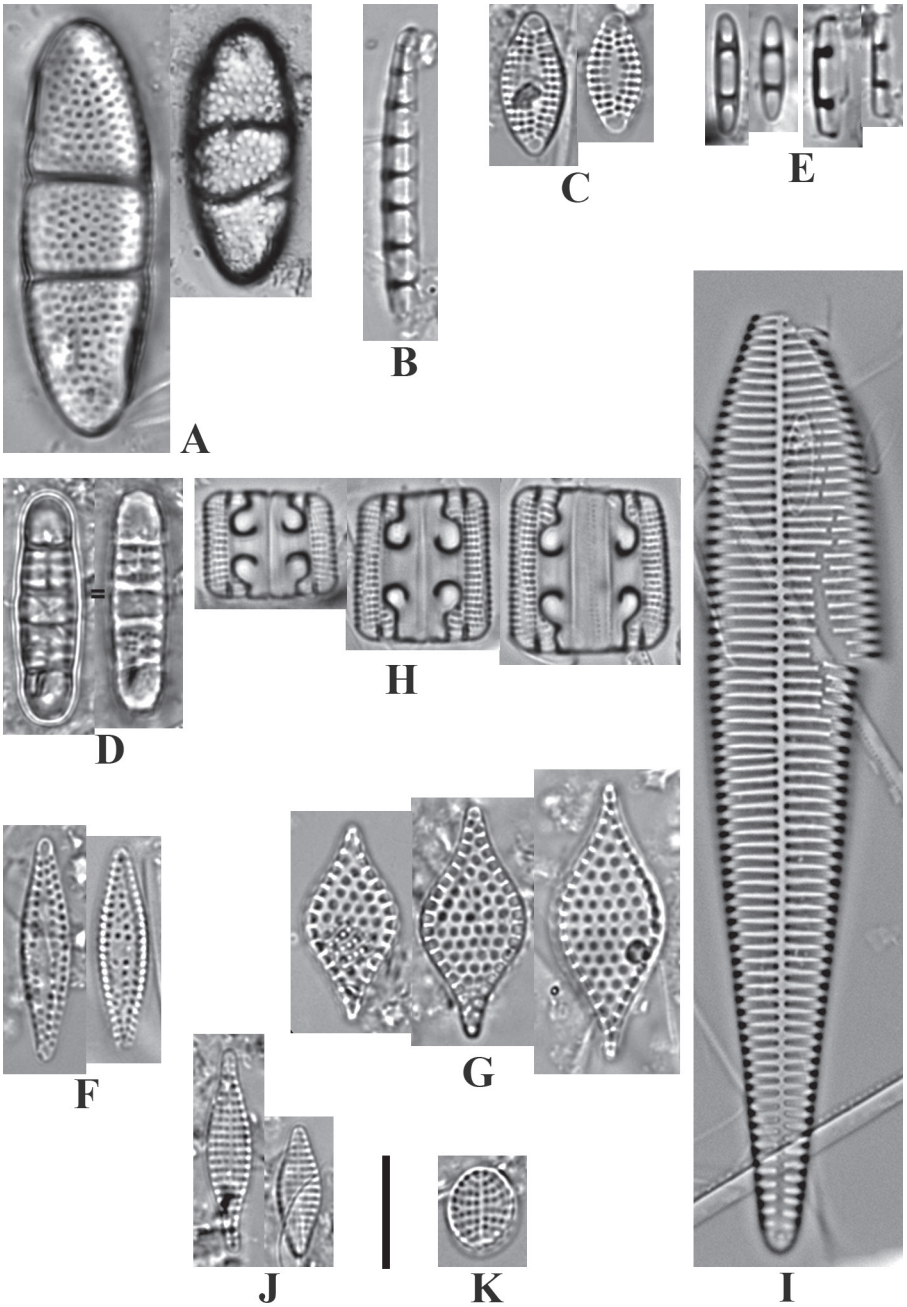

Fig. 2: A. *Neohuttonia reichardtii* (Grunow) Hustedt; B. *Eunotogramma marinum* (Smith) H. Peragallo & M. Peragallo; C. *Dimeregramma minus* var. *nanum* (Gregory) Van Heurck; D. *Plagiogramma pulchellum* var. *pygmaeum* (Greville) H. Peragallo & M. Peragallo; E. *Plagiogramma tenuissimum* Hustedt; F. *Cymatosira belgica* Grunow; G. *Cymatosira lorenziana* Grunow; H. *Grammatophora angulosa* var. *mediterranea* Grunow; I. *Licmophora ehrenbergii* f. *grunowii* (Mereschkowsky) Hustedt; J. *Trachysphenia acuminata* Peragallo; K. *Delphineis minutissima* (Hustedt) Simonsen. Scale bar =10 µm.

References: Peragallo & Peragallo (1897-1908), p. 337, pl. 82:25; Witkowski *et al.* (2000), p. 27, pl. 10:18-22; Dąbek *et al.* (2017) fig. S1.: b.

Dimensions: Valve length 10.1-19.9 µm, breadth 3.1-5.0 µm and 11-13 striae in 10 µm. (n=11).

Remarks: Observed in epilithon. Marine and brackish water species (Kociolek *et al.*, 2019). Possibly cosmopolitan species in marine coasts and brackish waters. It was reported from different coasts like Belgium, France (Peragallo & Peragallo, 1897-1908), Adriatic Sea (Vilicic *et al*. 2002), and the Atlantic coasts of Argentian and Brazil (Garibotti *et al*., 2011; Garcia, 2016).

Cymatosira lorenziana Grunow (Fig. 2.G)

References: Peragallo & Peragallo (1897-1908), p. 337, pl. 82:24; Foged (1984), p. 31, pl. 28:1-3; Witkowski *et al.* (2000), p. 27, pl. 11:12-15; Al-Yamani & Saburova (2011), p. 56, pl. 20: e-g; Dąbek *et al.* (2017), fig. S1: c.

Dimensions: Valve length 12.3-24.3 µm, breadth 7.6-9.6 µm and 8-11 striae in 10 µm. (n=9).

Remarks: Found in epilithic samples. Differs from *C. belgica* by size and rhombic valve outline with acute endings. Species was described from the Adriatic Sea by Grunow and reported by Hafner *et al*. (2018a) also in the

Mediterranean observed by Hustedt (1930-1999/II) and Peragallo & Peragallo (1897-1908) from Villefranche coasts and reported from Kuwait (Hendey, 1970; Al-Yamani & Saburova, (2011) and Aegean Sea (Economou-Amilli, 1980; Foged, 1986). Taxa also have distribution in river estuary found in the USA (Manoylov & Dominy, 2013).

Grammatophoraceae

Grammatophora Ehrenberg, 1840

Grammatophora angulosa* var. *mediterranea Grunow (Fig. 2: H)

References: Peragallo & Peragallo (1897-1908), p. 358, pl. 88:18

Dimensions: Valve length 9.3-14.4 µm, breadth 9.3-16.8 µm in girdle view and 15-17 striae in 10 µm. (n=14).

Remarks: Found in epiphytic samples. Differs from the nominate variety by the striae density. This taxon is similar to *G. hamulifera*. However, in the latter taxon undulating septa end with a ridge in the middle. In *G. angulosa* var. *mediterranea* septa undulation is continuous. Observed valves agree with the description given by Peragallo & Peragallo (1897-1908).

Licmophoraceae

Licmophora Agardh, 1827

Licmophora ehrenbergii* f. *grunowii (Mereschkowsky) Hustedt (Fig. 2 I)

Basionym: *Licmophora grunowii* Mereschkowsky

References: Hustedt (1930-1966 / II), p. 70, fig. 594;

Dimensions: Valve length 84.1 µm, breadth 15.1 µm and 9 striae in 10 µm. (n=1).

Remarks: This taxon occurred as an epiphyte on seaweeds. Differs from *L. ehrenbergii* f. *ehrenbergii* in terms of size and blunt wedge-shaped head pole. In the material studied, the nominate forma of *L. ehrenbergii* was found in epilithon samples and separated from *L. ehrenbergii* f. *grunowii* by wide wedge-shaped head-pole and larger size. Honeywill (1998) mentioned that the nominate forma of *L. ehrenbergii* has cuneate valve shape in girdle view and spathulate and robust valves. Taxa reported from the Black Sea, the Adriatic Sea and the Mediterranean Sea (Guiry & Guiry, 2019). Giffen (1971) found the species from the Atlantic Ocean coasts of South Africa (Gordon's Bay, Cape province).

Fragilariaceae

Trachysphenia Petit, 1877

Trachysphenia acuminata Peragallo (Fig. 2. J)

References: Hustedt (1955), p. 14, pl. 4:50-54; Witkowski *et al.* (2000), p. 84, pl. 24: 17-19

Dimensions: Valve length 11.5-17.8 µm, breadth 3.6-4.2 µm and 14-16 striae in 10 µm. (n=2).

Remarks: A few valves observed in epilithic samples. This taxon is distinguishable by produced rostrate apices and rhombic valves. According to Hustedt (1955), valve shape is characteristic and separates this species from *T. australis*. Reported from Mexican coasts (López-Fuerte & Siqueiros-Beltrones, 2016).

Rhaphoneidaceae

Delphineis Andrews, 1977

Delphineis minutissima (Hustedt) Simonsen (Fig. 2. K)

Basionym: *Rhaphoneis minutissima* Hustedt

References: Simonsen (1987), p. 252, pl. 374:10-16; Witkowski *et al.* (2000), p. 45, pl. 22: 11-14; Watanabe *et al.* (2013), fig: 1-15

Dimensions: Valve length 7.6 µm, breadth 6 µm, 12 transapical striae in 10 µm. (n=1).

Remarks: A few valves were observed. Valves are oblong with a very narrow sternum, transapical striae are punctate. It is easily overlooked due to the very small size. Taxa were described by Hustedt from North Sea (1939) and distributed to brackish waters of UK (Watanabe *et al*., 2013) to Atlantic coasts of Argentina (Sar *et al*., 2007)

Diplomenora Blazé, 1984

Diplomenora cocconeiformis (A. Schmidt) Blazé (Fig. 3. A)

Basionym: *Coscinodiscus cocconeiformis* Schmidt

References: Witkowski *et al.* (2000), p. 46, pl. 22:1, 2; 23:8-11; Al-Yamani & Saburova (2011), p. 62, Pl. 24: a-f

Dimensions: Valve diameter 18.2-23.3 µm and 13-15 striae in 10 µm. (n=6).

Remarks: Found in epilithic and epiphytic materials. Hendey (1970) observed the species from Kuwait and pointed out that the specimens he studied were almost circular. Reported from the same location by Al-Yamani & Saburova (2011), and from the oceanic coasts of South Africa, New Zealand and Australia (Giffen, 1966; Foged 1978, 1979). Needs further biogeographic investigation for the Mediterranean, can be confused with *Neodetonia superba* (C. Janisch) S. Blanco.

Meloneis Louvrou, Danielidis & Economou-Amilli, 2013 (Fig. 3. B)

Meloneis mimallis Louvrou, Danielidis & Economou-Amilli

References: Louvrou *et al.* (2012), p. 2, Figs. 1: A-E; 2: A-E

Dimensions: Valve length 19.6-30.4 µm, breadth 13.1-18 µm and 7-9 striae in 10 µm. (n=22).

Remarks: Observed on seaweeds but also in epilithon. This species has been described from the Greek coasts of the Aegean Sea (Louvrou *et al*., 2012). Valves observed have broader morphological distribution on the Turkish coast of the Aegean Sea. Reported from the Mallorca in the Mediterranean (Álvarez-Blanco & Blanco, 2014).

Ardissoneaceae

Ardissonea De Notaris, 1870

Ardissonea crystallina* var. *dalmatica (Kützing) Mills (Fig. 3. C)

Basionym: *Synedra dalmatica* Kützing

Heterotypic synonym: *Ardissonea fulgens* var. *dalmatica* 'Kützing' Mills 1933

References: Peragallo & Peragallo (1897-1908), p. 311, pl. 79:4

Dimensions: Valve length 129.1-129.8 µm, breadth 8.0-10.8 µm and 16-18 striae in 10 µm. (n=2).

Remarks: Found in epilithic samples. In the material studied *A. crystallina* var. *dalmatica* accompanied *A. crystallina*. *Ardissonea crystallina* was observed and illustrated on İzmir region coasts by Aktan (2001) and Sabanci (2008). *Ardissonea crystallina* var. *dalmatica* differs from the nominate variety by the stria density. In the Mediterranean coasts, reported from Naples (Peragallo & Peragallo, 1897-1908).

Achnantheceae

Achnanthes Bory, 1822

Achnanthes danica (Flögel) Grunow (Fig. 3. D)

Basionym: *Cocconeis danica* Flögel

References: Peragallo & Peragallo (1897-1908), p. 7, pl. 2:1, 2; Witkowski *et al.* (2000), p. 88, pl. 51:23-25

Dimensions: Valve length 29.0-35.8 μm, breadth

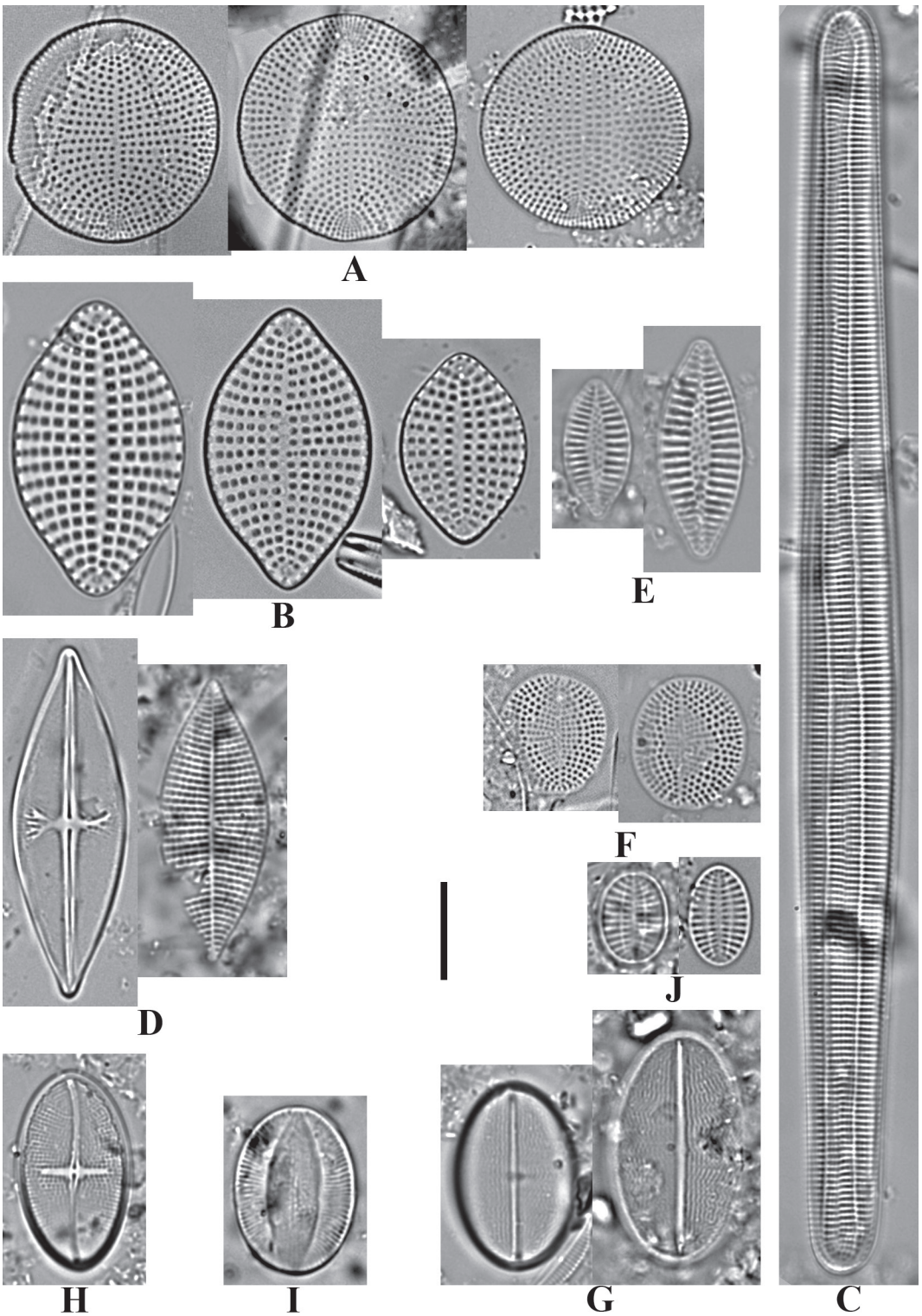

Fig. 3: A. *Diplomenora cocconeiformis* (Schmidt) Blazé; B. *Meloneis mimallis* Louvrou, Danielidis & Economou-Amilli; C. *Ardissonea crystallina* var. *dalmatica* (Kützing) Mills; D. *Achnanthes danica* (Flögel) Grunow; E. *Planothidium lilljeborgei* (Grunow) Witkowski, Lange-Bertalot & Metzeltin; F. *Anorthoneis vortex* Sterrenburg; G. *Cocconeis diaphana* W. Smith; H. *Cocconeis dirupta* Gregory; I. *Cocconeis pelta* Schmidt; J. *Cocconeis peltoides* Hustedt. Scale bar =10 μm.

11.0-11.5 µm and in SV (sternum view) 14 striae in 10 µm. (n=2).

Remarks: Found in the epilithic samples. The species is very similar to *Achnanthes fimbriata*. *A. fimbriata* has lanceolate valves with acutely rounded apices while *A. danica* has elliptic-lanceolate valves with slightly produced valve endings. In Witkowski *et al.* (2000) valve dimensions are given higher than *A. fimbriata* and *A. danica* has less stria in SV. Reported from the northern European coasts (Witkowski *et al*., 2000).

Planothidium Round & Bukhtiyarova, 1996

Planothidium lilljeborgei (Grunow) Witkowski, Lange-Bertalot & Metzeltin (Fig. 3. E)

Basionym: *Achnanthes lilljeborgei* Grunow

References: Schmidt (1874-1959), pl. 420:8, 9; Peragallo & Peragallo (1897-1908), p. 8, pl. 2:6; Witkowski *et al.* (2000), p. 121, pl. 49:1, 51:27-29; Witon & Witkowski (2006a), figs.156, 157

Dimensions: Valve length 13.7-22.7 µm, breadth 6.4-8.8 µm and 10-13 striae in 10 µm. (n=4).

Remarks: Found in the epilithon. Only SV was observed. Distinct with a wide sternum covered by puncta. Loir (2010-2014) reported this taxon from the Adriatic Sea coast of Greece. Found in the Faeroe Islands (Witon *et al*., 2006b), Northern European coasts (Hustedt & Aleem, 1951).

Cocconeidaceae

Anorthoneis Grunow, 1868

Anorthoneis vortex Sterrenburg (Fig. 3. F)

References: Witkowski *et al.* (2000), p. 98, pl. 42: 23-25; Lobban *et al.* (2012), p. 286, pl. 39:5

Dimensions: Valve length 12.4-13.8 µm, breadth 11.6-11.8 µm and 16-18 striae in 10 µm. (n=3).

Remarks: Observed both in epilithic and epiphytic samples. This species is similar to *Anorthoneis excentrica* in valve outline and hyaline central area, however, *A. vortex* is smaller. A marine, euryhaline species, it has been reported from Guam (Lobban *et al.*, 2012), Baltic Sea (Snoeijs & Vilbaste, 1994) and British Islands by Hendey (1964) and as *A. excentrica* as mentioned in Witkowski *et al.* (2000).

Cocconeis Ehrenberg, 1836

Cocconeis diaphana Smith (Fig. 3. G)

References: Smith (1853), p. 22; fig. 254; Álvarez-Blanco & Blanco (2014), p. 18, pl. 22:9; 23: 21-25

Dimensions: Valve length 19.5-24.0 µm, breadth 12.1-13.4 µm. (n=2).

Remarks: Marine species. Striae barely visible in LM. In the material studied, only SV was observed. Reported from the Atlantic coasts of France (Smith, 1853) and Murcia in Spain by Álvarez-Blanco & Blanco (2014). This taxon resembles *Cocconeis molesta* Kützing. However, *C. molesta* has narrower valves (7-8 µm broad, Witkowski *et al.*, 2000; Riaux-Gobin & Compère, 2008) as compared to *C. diaphana*. Type material illustrations of *C. molesta* in Riaux-Gobin & Compère (2008) reveals distinctly bent raphe endings whereas *C. diaphana* the raphe endings are straight in SV.

Cocconeis dirupta Gregory (Fig. 3. H)

References: Schmidt A. (1874-1959), pl. 191, fig. 55; Hustedt (1930-1966 / II), p.354, fig. 809; Witkowski *et al.* (2000), p. 105, pl. 39: 1-5; 51: 5-8

Dimensions: Valve length 20.2 µm, breadth 11.4 µm and 23 striae in 10 µm. (n=3).

Remarks: A few valves were observed in the material studied. This species resembles *C. diaphana*, but its RV (raphe view) is characterized by the presence of a sigmoid raphe, and transverse fascia. Widespread in the Faeroe Islands (Witon *et al.*, 2006b) and more broadly, in the Atlantic Ocean (Stidolph, 2012). In the Adriatic reported by Hafner *et al*. (2018b).

Cocconeis pelta Schmidt (Fig. 3. I)

References: Schmidt A. (1874-1959), pl. 191, fig. 6; Giffen (1970), p. 271, fig. 27, 28; Witkowski *et al.* (2000), p. 111, pl. 41: 7-10

Dimensions: Valve length 17.3 µm, breadth 12.3 µm and 22 striae in 10 µm. (n=1).

Remarks: Only one SV valve was observed. It has a wide sternum. This taxon is spread across warmer waters (Giffen 1970; fig. 27) and also from the Baltic Sea (Witkowski *et al.*, 2000). This taxon also resembles *Cocconeis germainii* Riaux-Gobin, Witkowski & Romero. *C. germainii* valves are small, narrower and elliptic (length: 9.7-13.2 µm, breadth: 5-7.4 µm; length: 11-15.2 µm, breadth: 5.8-8.5 µm) (Riaux-Gobin *et al.*, 2007, 2011, respectively), material observed in this study has broader valves but striae counts are similar to *C. germainii* (SV: 22.5-27 in 10 µm and 19.6-23.5 in 10 µm) Riaux-Gobin *et al.*, 2007, 2011, respectively). Sar *et al.* (2003) observed the species with lower striae count (14-18 in 10 µm).

Cocconeis peltoides Hustedt (Fig. 3. J)

References: Snoeijs & Vilbaste (1994), p. 31, fig. 119; Hartley *et al.* (1996), p.122, pl. 53:1; Witkowski *et al.* (2000), p. 112, pl. 38:1-9; Al-Yamani & Saburova (2011), p. 83, pl. 53:g, h

Dimensions: Valve length 9.0-10.4 µm, breadth 6.1-7.3 µm and 12-14 striae in 10 µm. (n=13).

Remarks: This is a cosmopolitan marine species. In SV valves the transapical striae are crossed by longitudinal lines between the valve middle and the margin. In the material studied here, the striae count was 12-14 in 10 µm, which is slightly lower than given in Witkowski *et al.* (2000). Hendey (1964, 1970) observed this species in mud, on dead seaweeds or attached to sand grains. In Dalyan, this taxon was observed in the epilithon and epipsammon. In the Mediterranean observed in Neum Bay, Bosnia & Herzegovina (Hafner *et al*., 2018b).

Sellaphoraceae

Fallacia Stickle & Mann, 1990

Fallacia pseudony (Hustedt) Mann **(**Fig. 4. A)

Basionym: *Navicula pseudony* Hustedt

References: Hustedt (1955), p. 22, pl. 8:6,7; Simonsen (1987), p. 408, pl. 611:20-24; Round *et al.* (1990) p. 669, Witkowski *et al.* (2000), p. 210, pl. 71:23-30

Dimensions: Valve length 8.9-12.0 µm, breadth 6.2-6.7 µm and 29 striae in 10 µm. (n=2).

Remarks: Observed in samples from the epilithon and epiphyton. Simonsen (1987) and Witkowski *et al.* (2000) agree *F. pseudony* is conspecific with *F. oculiformis* (Hustedt) Mann. Giffen (1975, 1976) reported the species on the coasts of South Africa found the taxon with lower stria density (21 in 10 µm.). Hustedt's type habitat was Beaufort Bay, East Coast of the United States (1955). This species has a very broad distribution in the Atlantic Ocean and elsewhere (e.g., Riberio, 2010).

Fallacia schaeferae (Hustedt) D.G. Mann (Fig. 4. B)

Basionym: *Navicula schaeferae* Hustedt

References: Hustedt (1930-1966/II), p. 545, fig. 1583; Simonsen (1987), p. 491, pl.751:20-22; Witkowski *et al.* (2000), p. 212, pl. 70:29

Dimensions: Valve length 30.5-36.8 µm, breadth 7.3-9.1 µm and 26 striae in 10 µm. (n=5).

Remarks: Valves were found in the epipsammon. Transapical striae of this species are difficult to resolve in LM. In valves illustrated here, the stria density is slightly lower than indicated in the description of Hustedt (1930-1966) (28-32 in 10 µm). It was previously recorded in the North Sea (Hustedt 1930-1966) and from the Mediterranean Sea (Witkowski *et al*., 2000).

Mastogloiaceae

Mastogloia Thwaites in Smith, 1856

Mastogloia crucicula (Grunow) Cleve (Fig. 4. C)

Basionym: *Orthoneis crucicula* Grunow

References: Cleve (1895), p.148; Hustedt (1955), p. 19, pl. 6:12; Hendey (1970); p. 145, pl.1:8; Witkowski *et al.* (2000), p. 242, pl. 75:3; Lobban *et al.* (2012), p. 270, pl. 26:6-7; 27:1; Loir & Novarino (2014), p. 25 pl. 6: b

Dimensions: Valve length 9.9-18.6 µm, breadth 6.1-8.4 µm and 18-21 striae in 10 µm. (n=7).

Remarks: Commonly occurred in epiphytic samples from the Dalyan beach and Sülüklü Lake. This taxon possesses a distinct transverse fascia in the middle which reaches the valve margins. Partecta interrupted in the middle, 4 partecta in 10 µm observed. Reported by Loir (2010-2014) from the Greek Islands and Louvrou (2007) from Milos Island. Foged (1986) observed reported taxa from the Aegean coasts of Greece. In the Adriatic Coasts found by Hafner *et al*. (2018a) and in the Mediterranean by Loir (2011-2014).

Mastogloia emarginata Hustedt (Fig. 4. D)

References: Hustedt (1930-1966 / II), p. 476, fig. 896; Simonsen (1987), p. 94, pl. 134:5-7

Witkowski *et al.* (2000), p. 245, pl. 77: 9-12

Dimensions: Valve length 19.8 µm, breadth 9.5 µm and 23 striae in 10 µm. (n=1).

Remarks: This taxon was observed in the epilithon. Partecta is weakly silicified. The raphe is slightly undulating. Witkowski *et al.* (2000) indicated in Hustedt's drawings and Simonsen's micrographs there are two different taxa present. Here, our specimens agree with the micrographs in Witkowski *et al.* (2000). The species was previously reported from the Aegean Sea by Loir (2010-2014) and Foged (1986).

Mastogloia ovalis Schmidt **(**Fig. 4. E)

References: Witkowski *et al.* (2000), p. 255, pl. 75:11-13; Lobban *et al.* (2012), p. 279, pl. 33:4-6; Loir & Novarino (2014), p. 39, pl. 17: a

Dimensions: Valve length 14.5-17.1 µm, breadth 8.2-9.8 µm and 16-19 striae in 10 µm. (n=9).

Remarks: Observed both in the epilithic and epiphytic samples. Valves elliptic, partecta in the middle, 3 in 10 µm. Reported from the Mediterranean by Hustedt (1930-1966) and Aegean Sea (Foged, 1986; Loir, 2010-2014).

Brachysiraceae

Brachysira Kützing, 1836

Brachysira estonarium Witkowski, Lange-Bertalot & Metzeltin (Fig. 4. F)

References: Witkowski *et al.* (2000), p. 160, pl. 134:1-4

Dimensions: Valve length 19.6-26.4 µm, breadth 3.6-4.0 µm. (n=4).

Remarks: This taxon was observed in epilithic samples. This is a marine to brackish water species. This taxon resembles *B. aponina*; however, *B. estonarium* valves are smaller and narrower (Witkowski *et al*. 2000 indicated *B. aponina* 14-35 µm long and 4-5.5 µm wide and *B. estonarium* 11.5-29 µm long and 3-3.5 µm wide). Striae of both species are not resolvable in LM. This species was observed from Estonia and Mississippi Delta by Witkowski *et al.* (2000), Karstic wetlands of Central America (La Hee, 2010) and in samples from the Adriatic Sea surrounding the Dubrovnik area (Witkowski & Car, unpublished observations).

Naviculaceae

Caloneis Cleve, 1894

Caloneis liber (Smith) Cleve (Fig. 4. G)

Basionym: *Navicula liber* Smith

Heterotypic Synonyms: *Navicula maxima* Gregory 1855, *Navicula liber* var. *maxima* (Gregory) Grunow 1867, *Caloneis liber* var. *maxima* (Gregory) Jørgensen 1905, *Caloneis liber* var. *maxima* (Gregory) Frenguelli 1939

References: Cleve (1894-1895), p. 54; Peragallo & Peragallo (1897-1908), p. 71, pl. 9:5, 6; Hendey (1964), p.229, pl. 29:2; Hartley *et al.* (1996), p. 102, pl. 43:1; Witkowski *et al.* (2000), p.166, pl.152:9

Dimensions: Valve length 49.7-51.4 µm, breadth 8.5-8.9 µm and 18 striae in 10 µm. (n=2).

Remarks: This taxon was found in the material studied. The species is considered cosmopolitan, an inhabitant of the marine littoral zone. This species has been reported from the Aegean Sea by Economou-Amilli (1980). In the Adriatic Sea reported by Hafner *et al.* (2018b). *Caloneis liber* var. *linearis* was observed in the brackish Homa Lagoon in central Aegean coasts of Turkey (Çolak Sabancı, 2008).

Navicula Bory, 1822

Navicula arenaria* var. *rostellata Lange-Bertalot (Fig. 4. H)

References: Witkowski *et al.* (2000), p. 267, pl. 116: 18-20; 129: 29

Dimensions: Valve length 32.1 µm, breadth 7.5 µm and 9 striae in 10 µm. (n=1).

Remarks: This taxon is differentiated by having a large central area where transapical striae are interrupted at the margins. *Navicula arenaria* var. *rostellata* differs from the nominate variety by the linear-lanceolate valves. It occurred in epilithon samples in the present study and was previously reported from Crete by Loir (2010-2014).

Navicula lusoria Giffen (Fig. 4. I)

References: Giffen (1975), p. 84, figs. 75-77; Witkowski *et al.* (2000), p. 289, pl. 129: 11-14

Dimensions: Valve length 24.3 µm, breadth 7.8 µm and 13 striae in 10 µm. (n=1).

Remarks: Valves are elliptical, with transapical striae in the middle strongly radiate. This taxon was described from South Africa Giffen (1975) and has also been reported from Mexico (López-Fuerte & Siqueiros-Beltrones, 2016), from Crete (Loir, 2010-2014) and the Aegean Sea (Louvrou, 2007).

Proschkiniaceae

Proschkinia Karayeva, 1978

Proschkinia bulnheimii (Grunow) Karayeva (Fig. 4. J)

Basionym: *Navicula bulnheimii* Grunow

References: Witkowski *et al.* (2000), p. 340, pl. 147: 14-17

Dimensions: Valve length 28.9 µm, breadth 4 µm. (n=1).

Remarks: This taxon was found in the epilithic material, but scarce. In the central area, a fistula is resolvable in LM. *Proschkinia bulnheimii* can be differentiated from the similar taxon *P. complanata* by size dimensions (*P. bulnheimii*, 15-31 µm long, 5-8 µm broad; *P. complanata*, 25-75 µm long and 4.0-7.5 µm broad) (Witkowski *et al.*, 2000). This is a widespread marine species (Kociolek *et al.*, 2019).

Catenulaceae

Amphora Ehrenberg ex Kützing, 1844

Amphora cymbamphora Cholnoky (Fig. 4. K)

References: Witkowski *et al.* (2000), p. 136, pl. 164: 26-28

Dimensions: Valve length 33.5-36.5 µm, breadth 5.9-7.0 µm and 12-13 dorsal striae in 10 µm. (n=6).

Remarks: This species was observed in epipsammic samples, inhabiting brackish to marine waters. Distinct with the narrow axial area and straight ventral margin. Valves observed here are slightly longer than reported by Witkowski *et al.* (2000). Also, it was observed in the brackish Sülüklü Lake near the coast of Dalyan. Louvrou (2007) reported the species from the Aegean Sea.

Catenula Mereschkowsky, 1903

Catenula adhaerens (Mereschkowsky) Mereschkowsky (Fig. 4. L)

Basionym: *Navicula adhaerens* Mereschkowsky

References: Witkowski *et al.* (2000), p. 168, pl. 170: 1-12

Dimensions: Valve length 16.0-18.3 µm, breadth 2.0-2.5 µm. (n=4).

Remarks: This taxon was observed in epilithon samples. Valves are semi-elliptic in shape. Striae discernible in LM. Sabbe & Vyverman (1995) and Tremarin & Ludwig (2008), reported on the occurrence of *C. adhaerens* in estuarine sites. Widespread taxa (Guiry & Guiry, 2019).

Tetramphora Mereschkowsky, 1903

Tetramphora sulcata (Brébisson) Stepanek & Kociolek (Fig. 4. M)

Basionym: *Amphora sulcata* Brébisson

References: Peragallo & Peragallo (1897-1908), p. 213, pl. 47:7; Wachnicka & Gaiser (2007), p. 418, figs. 113-115; Stepanek & Kociolek (2016), p. 128, figs. 22-30

Dimensions: Valve length 27.7 µm, breadth 5.3 µm and 20 dorsal striae in 10 µm. (n=1).

Remarks: This taxon was observed in samples from the epilithon. Specimens observed in this study are slightly smaller than given by Stepanek & Kociolek (2016, 35-58 µm long). However, other characters, including arched dorsal margin and bi-arcuate raphe, agree well with the description of Stepanek & Kociolek (2016) and illustration in Peragallo & Peragallo (1897-1908).

Bacillariaceae

Nitzschia Hassall, 1845

Nitzschia aequorea Hustedt (Fig. 4. N)

References: Simonsen (1987), p. 262, pl. 382:15-20; Witkowski *et al.* (2000), p. 367, pl. 210: 14, 15

Dimensions: Valve length 18.1-22.9 µm, breadth 3.1-3.8 µm and 15-16 fibulae in 10 µm. (n=4).

Remarks: This taxon was observed widely, but was somewhat more abundant in epilithon samples. Valves are lanceolate with weakly capitate endings, while the transapical striae are discernible in LM. Reported from South African coasts by Cholnoky (1961) and Giffen (1975).

Nitzschia amabilis Suzuki (Fig. 4. O)

Heterotypic Synonym: *Nitzschia laevis* Hustedt 1939, non *Nitzschia levis* (*laevis*) Frenguelli 1923

References: Witkowski *et al.* (2000), p. 387, pl. 190:1-6; Suzuki *et al.* (2010), p. 223; Rivera & Cruces (2011), p. 95, fig. 1

Dimensions: Valve length 14.4-15.6 µm, breadth 4.5-5.8 µm and 9-10 fibulae in 10 µm. (n=2).

Remarks: This taxon was found in epilithon samples. This species resembles *Psammodictyon rudum* in terms of valve outline. However, *N. amabilis* is less constricted in the middle, and the valve endings are short, rostrate, while in *P. rudum* the apices are roundly produced. A new name was proposed by Hid. Suzuki in Suzuki *et al.* (2010) for this taxon. Reported from Chile coasts (Rivera & Cruces, 2011). Widespread marine species (Witkowski *et al*., 2000).

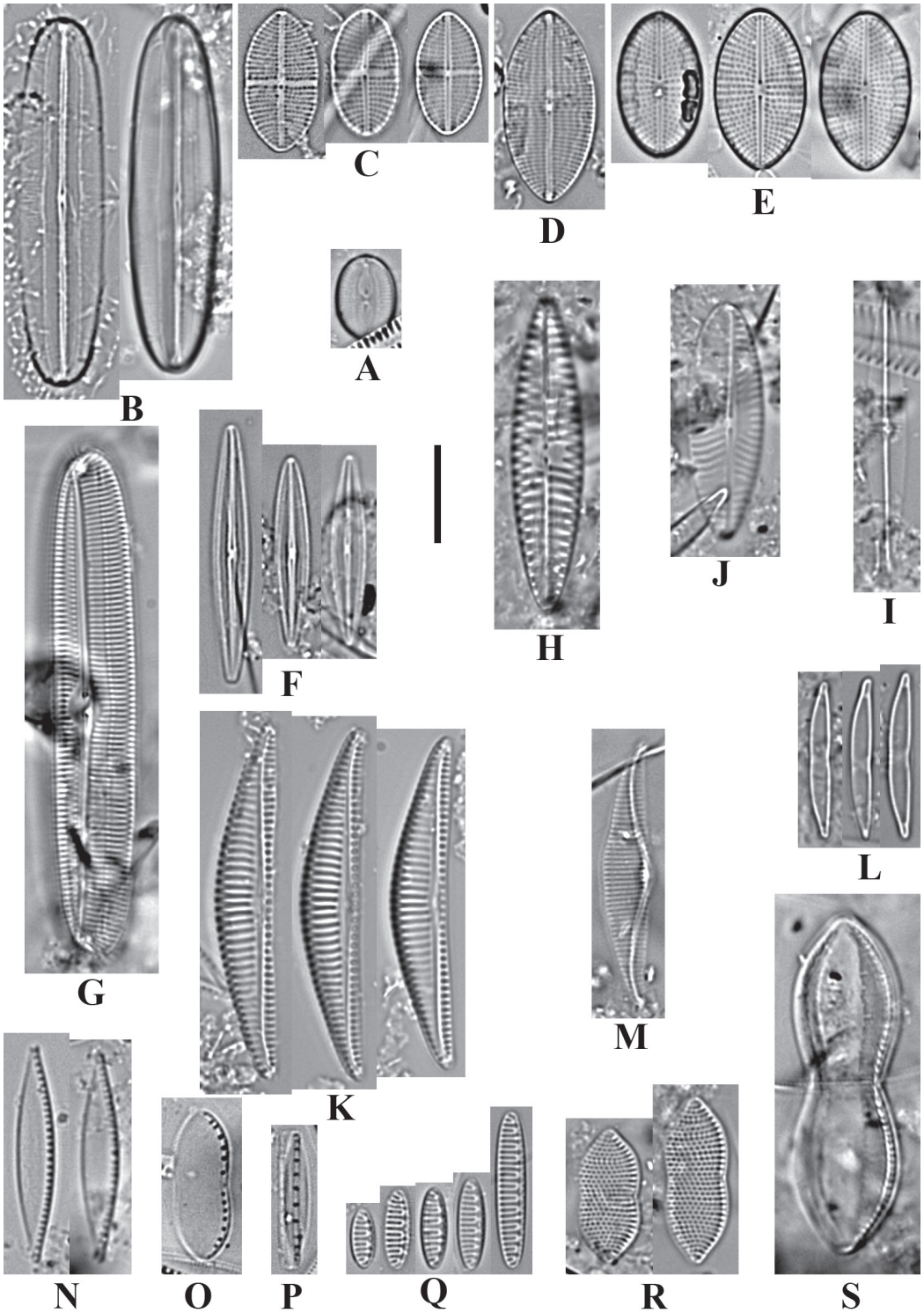

Fig. 4: A. *Fallacia pseudony* (Hustedt) Mann; B. *Fallacia schaeferae* (Hustedt) Mann; C. *Mastogloia crucicula* (Grunow) Cleve; D. *Mastogloia emarginata* Hustedt; E. *Mastogloia ovalis* Schmidt; F. *Brachysira estonarium* Witkowski, Lange-Bertalot & Metzeltin; G. *Caloneis liber* (Smith) Cleve; H. *Navicula arenaria* var. *rostellata* Lange-Bertalot; J. *Navicula lusoria* Giffen; I. *Proschkinia bulnheimii* (Grunow) Karayeva; K. *Amphora cymbamphora* Cholnoky; L. *Catenula adhaerens* (Mereschkowsky) Mereschkowsky; M. *Tetramphora sulcata* (Brébisson) Stepanek & Kociolek; N. *Nitzschia aequorea* Hustedt; O. *Nitzschia amabilis* Suzuki; P. *Nitzschia nanodissipata* Chunlian Li & Witkowski; Q. *Nitzschia valdestriata* Aleem & Hustedt; R. *Psammodictyon panduriforme* var. *continuum* (Grunow) Snoeijs; S. *Tryblionella marginulata* (Grunow) Mann. Scale bar =10 µm.

Nitzschia nanodissipata Chunlian Li & Witkowski (Fig. 4. P)

References: Witkowski *et al.* (2016), p. 188, fig. 3-d

Dimensions: Valve length 13.7 µm, breadth 2.7 µm and 8 fibulae in 10 µm. (n=1).

Remarks: This taxon occurred in the epiphytic material. It may be confused with *Nitzschia dissipata*; however, *N. nanodissipata* is much smaller. Dimensions of specimens studied here conform to those of *N. nanodissipata* (Witkowski *et al.*, 2016).

Nitzschia valdestriata Aleem & Hustedt (Fig. 4. Q)

References: Aleem & Hustedt (1951), p. 19, fig. 5; Simonsen (1987), pl. 551:9-13; Snoeijs & Vilbaste (1994), p. 86, fig. 174; Hartley *et al.* (1996), p. 402, pl. 193:3; Witkowski *et al.* (2000), p. 407, pl. 203:19-21; 207:14-16

Dimensions: Valve length 4.3-16.8 µm, breadth 2.1-2.8 µm and 16-19 striae in 10 µm. (n=120).

Remarks: This taxon was observed in epilithon and epiphyton samples, but dominant in the epiphytic samples. This taxon is characterized as a cosmopolitan marine to freshwater species (Guiry & Guiry, 2019).

Psammodictyon D.G.Mann, 1990

Psammodictyon panduriforme **var.** ***continuum*** (Grunow) Snoeijs (Fig. 4. R)

Basionym: *Nitzschia panduriformis* var. *continua* Grunow

Heterotypic synonym: *Nitzschia panduriformis* var. *continua* Grunow 1880

References: Krammer & Lange-Bertalot (1988), fig. 38:6, 7; Snoeijs & Balashova (1998), p. 88; Witkowski *et al.* (2000), p. 398, pl. 183:6

Dimensions: Valve length 12.2-17.1 µm, breadth 4.9-6.3 µm and 20-21 striae in 10 µm. (n=3).

Remarks: This taxon was observed in epilithon samples. It differs from the nominate variety by its smaller size and panduriform valve shape (Witkowski *et al.*, 2000). Snoeijs & Balashova (1998) reported taxa from the Baltic Sea, also found in the Adriatic (Hafner, 2018b) and the Black Sea (Nevrova, 2016)

Tryblionella Wm.Smith, 1853

Tryblionella marginulata (Grunow) D.G.Mann (Fig. 4. S)

Basionym: *Nitzschia marginulata* Grunow

References: Round *et al.* (1990), p. 678; Witkowski *et al.* (2000), p. 392, pl. 183: 4, 5

Dimensions: Valve length 35 µm, breadth 10.7 µm and 16 striae in 10 µm. (n=1).

Remarks: This taxon was observed in epilithic samples. It is a marine to brackish-water species. It was reported previously from Aegean coasts (Loir, 2010-2014) and Black Sea (Nevrova, 2016).

Discussion

Marine benthic diatom taxonomy of Turkish coastal waters is a relatively new area of research. Some previous studies and checklists regarding marine diatoms have been prepared; however, the number of taxa reported so far is relatively low. Checklists (Koray 2001; Balkıs, 2004; Aysel, 2005; Taş & Okuş, 2006) and some other taxonomical research (Ehrenberg, 1844; Hustedt, 1930-1966; Çolak Sabancı, 2013; Çolak *et al.*, 2010, 2014; Kaleli *et al.*, 2017) revealed that 65 centric diatoms and 249 pennate diatoms (for a total of 304 taxa) have been documented for the Turkish coasts so far. In these surveys, the Black Sea and Sea of Marmara were the areas where most taxa have been reported. *Navicula* (46 taxa), *Nitzschia* (30 taxa) and *Mastogloia* (22 taxa) are the genera with the highest numbers of taxa represented. This study contributes additional taxa to the checklist of marine diatoms of Turkey for these genera: 2 for *Navicula*, 4 for *Nitzschia* and 3 for *Mastogloia*. Additionally, this study adds nine additional genera to the list of Turkish marine benthic diatoms. However, insufficient data from the region has been a difficulty for comparisons of species distributions in the Aegean Sea. The present report is the first study of marine diatoms from the Dalyan region. On the other hand, there have been a few previous studies on marine diatoms (Çolak, 2008) from Turkey, and from the other side of the Aegean Sea (Economou-Amilli, 1980; Foged, 1986; Louvrou *et al*., 2012; Loir, 2010-2014). In these studies, some taxa were discussed biogeographically and taxonomically. Although there were not many records of diatoms from the region, some species habitat information was mentioned as additional data in these studies.

From a biogeographic point of view, *Neohuttonia reichardtii* was reported from the tropics and subtropics (in Kuwait by Al-Yamani & Saburova (2011) and in Tanzania by Foged (1975). *Cymatosira belgica* and *C. lorenziana* were found in the epilithon in Dalyan coasts. These taxa were previously reported from the Mediterranean (Álvarez-Blanco & Blanco, 2014) and Greece (Loir, 2010-2014), being more abundant from warm waters (Witkowski *et al.* 2000). *Meloneis mimallis* was described from Aegean coasts of Greece (Louvrou *et al.* 2012); this is the second record of that species from the Aegean Sea. *Planothidium lilljeborgei* has been reported from Faeroe Islands Fjords (Witon & Witkowski, 2006a) extending its biogeography to cold waters. Other species also reported by Witon & Witkowski (2006a,) such as *Cocconeis dirupta,* were also observed at Dalyan.

A number of the recorded taxa and their distributions, in general, reveal that this coastline integrates species from both warm water environments as well as cold water environments. That might indicate that the flora could be quite extensive; unique not in new species, but unique in community composition, supporting species from very different temperature regimes.

Acknowledgements

Authors thank anonymous reviewers for their helpful comments on this manuscript. The authors also thank Prof. Dr. hab Andrzej Witkowski for the opportunity to work at the Institute of Marine and Environmental Sciences (University of Szczecin, Poland) and to Genowefa Daniszewska-Kowalczyk and Agnieszka Kierzek for their assistance with the literature. This study is supported by Kütahya Dumlupınar University Foundation (Grant no 2017-38).

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