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Research article/Araştırma makalesi

Vascular Plants of Mudanya Cost (Bursa, South Marmara/Turkey)

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Abstract

This study, carried out between 2002 and 2011, presents the vascular plant flora of the cost of Mudanya District (Bursa province, South Marmara). A total of 252 taxa belonging to 55 families and 181 genera were determined. The distribution of phytogeographic elements is as follows: 58 (23 %) Mediterranean, 17 (6.8 %) Euro-Siberian, 2 (0.8 %) Irano-Turanian and 175 (69.4 %) pluriregional or unknown. According to the number of taxa, the richest families are Asteraceae (43), Poaceae (33), Chenopodiaceae (12), Caryophyllaceae (12), Brassicaceae (11), Apiaceae (11) and the richest genera are *Atriplex* L. (6), *Euphorbia* L. (5), *Crepis* L. , *Plantago* L., *Veronica* L., *Cyperus* L. (4), *Rumex* L., *Papaver* L., *Geranium* L., *Hypericum* L., *Inula* L. and *Echium* L. (3). Four endemic taxa (*Campanula lyrata* Lam. subsp. *lyrata, Verbascum bombyciferum* Boiss., *Ballota nigra* L. subsp. *anatolica* P. H. Davis, *Lavandula stoechas* L. subsp. *cariensis* (Boiss.) Rozeira), and one rare taxa (*Pancratium maritimum* L.) were determined in the study area. Furthermore, factors affecting vascular plant diversity of the study area were given.

Key words: Seashore vascular plants, Coastal dunes, Mudanya district, Bursa, South Marmara

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Mudanya (Bursa, Güney Marmara) Sahilinin Vasküler Bitkileri

Özet

2002 ve 2011 yılları arasında yapılmış bu çalışma Mudanya ilçesi (Bursa, Güney Marmara) sahilinde yetişen vasküler bitkileri içermektedir. Alandan 55 familya, 181 cinse ait toplam 252 takson teşhis edilmiştir. Taksonların fitocoğrafik elementlere göre dağılımı 55 (% 22) Akdeniz, 17 (% 6.8) Avrupa-Sibirya, 3 (% 1.2) İran-Turan ve 175 (% 70) çok bölgeli ya da bölgesi bilinmeyenler şeklindedir. Takson sayısına göre en zengin familyalar; Asteraceae (42), Poaceae (33), Chenopodiaceae (12), Caryophyllaceae (12), Brassicaceae (11), Apiaceae (11) olup en zengin cinsler ise *Atriplex* L. (6), *Euphorbia* L. (5), *Crepis* L. , *Plantago* L., *Veronica* L., *Cyperus* L. (4), *Rumex* L., *Papaver* L., *Geranium* L., *Hypericum* L. ve *Echium* L. (3)'dur. Alanda 4 endemik (*Campanula lyrata* Lam. subsp. *lyrata, Verbascum bombyciferum* Boiss., *Ballota nigra* L. subsp. *anatolica* P. H. Davis, *Lavandula stoechas* L. subsp. *cariensis* (Boiss.) Rozeira) ve bir nadir takson (*Pancratium maritimum* L.) belirlenmiştir. Ayrıca, çalışma alanının vasküler bitki çeşitliliğini etkileyen faktörler verilmiştir.

Anahtar kelimeler: Sahil vasküler bitkileri, Kıyı kumulları, Mudanya, Bursa, Güney Marmara

1. Introduction

Coastal regions are very special areas due to having unusual ecological conditions (i. e. excessive salinity, drought) and the vascular plants which were adaptated to these conditions are grown in these areas. Bursa province has a long beach which continues to Yalova province at south of Marmara Sea. A part of 55 km long and 10 km wide of the coast included in Mudanya District. This part of the coast is less rugged and its elevation varied from 80 to 125 metres.

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1.1.Geography of the Study Area

Mudanya is situated between 28°-29°E longitude and 40°-41° N latitude in Marmara Region and it is limited with Gemlik District at east, Karacabey District at west, Gemlik Gulf at north and Bursa at south (Figure 1). The Mudanya Mts, lied from Gemlik to Esence (Eşkel) Gulf, occurs a barrier between Bursa Plateau and Marmara Sea. The highest point of study area is Üsküp Hill (600 m) and its important water supply is Nilüfer Stream (Enginalp, 1983). It is located in Mediterranean phytogeographical region and A2 (A) square according to the grid system used in the Flora of Turkey (Davis, 1965-1985).

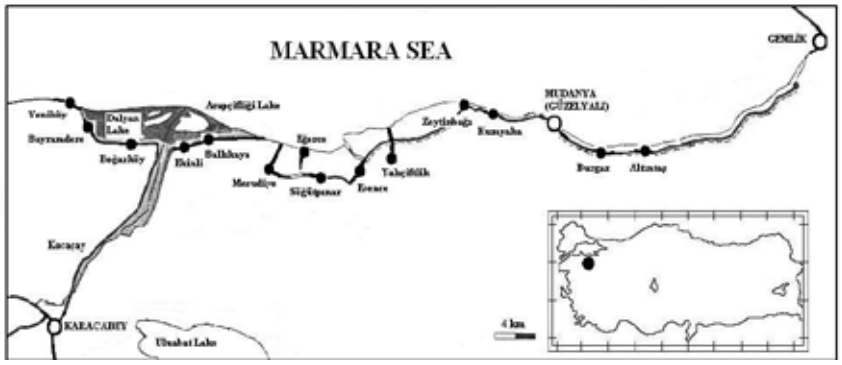

Figure 1. Map of the study area and its surroundings

1.2.Geology, Climate and Vegetation of the Study Area

The main substrate of the study area is constituted of neogenic sedimentary masses i.e. sandstones, marls, limestones (Anonym, 1995). Since a meteorological station is not present in the study area, the climatic data obtained from the meteorological station of Gemlik District, the closest station to Mudanya, were used (Anonym, 1974). According to these data, annual mean temperature is 14.9°C, annual rainfall is 691 mm. The study area is included in Mediterranean climate on the basis of Emberger's drought index (S=2.1) and the area belongs to the less-rainy subtype of Mediterranean bioclimatic zone in term of pluviothermic coefficient (Q=90.2) (Akman, 1990). The ombrothermic climate diyagram of Gemlik was drawn according to Walter et al. (1975) and given in Figure 2.

There are mainly two vegetation types in the study area. The cost between Altıntaş and Yalıçiftlik is very narrow and it occurs stones or rocks. On the other hand, the cost between Esence Gulf and Mesudiye lies as rather broad dunes. The coastal region is characterized by halophytic vegetation consists of *Atriplex* spp., *Beta maritima* L., *Salsola tragus* L., *Suaeda altissima* (L.) Pall., *Polygonum maritimum* L., *Erygium maritimum* L., *Otanthus maritimus* (L.) Hoffmanns., *Inula viscosa* (L.) Aiton, *Cakile maritima* Scop., *Polycarpon tetraphyllum* L., *Euphorbia peplis* L. and *E. terracina* L.

Dry forest vegetation, from behind of the cost to 100 m, is characterized by *Pinus nigra* Arn. subsp. *nigra* var. *caramanica* (Loudon) Rehder, *P. brutia* Ten., *Quercus infectoria* Oliv. subsp. *infectoria*, *Q. pubescens* Willd. and *Juniperus foetidissima* Willd. Some maquis elements, such as *Laurus nobilis* L., *Arbutus andrachne* L., *Phillyrea latifolia* L., *Quercus coccifera* L., *Pistacia terebinthus* L. subsp. *palaestina* (Boiss.) Engl., *Cistus salvifolius* L., *Rhus coriaria* L., and *Sarcopoterium spinosum* L. are dominant under these forests. Moreover, olive fields occupies large areas in where damaged maquis and dry forests because olive industry is one of the important livelihoods for the local puplic.

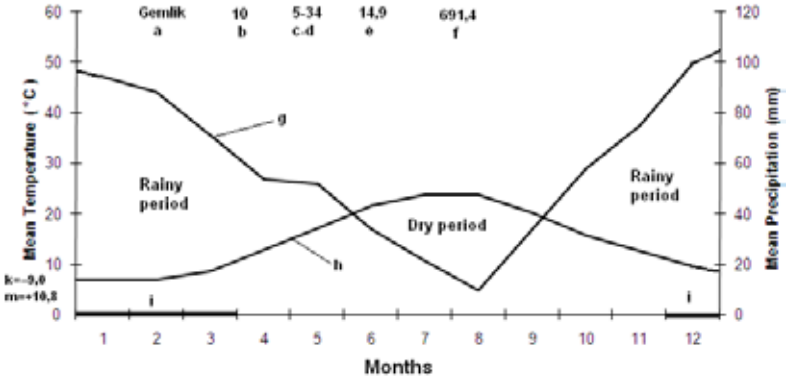

Figure 2. Ombrothermic diagram of Gemlik (Bursa) meteorological station.

a: Station name, **b**: Station altitude (m), **c:** The measuring period for temperature (year), **d:** The measuring period for precipitation (year), **e**: Annual mean temperature (°C), **f**: Annual mean precipitation (mm), **i:** Months with an absolute minimum below 0 °C, **g**: Precipitation curve, **h**: Temperature curve, **k:** Mean minumum temperature of the coldest month (°C), **m**: Absolute minimum temperature (°C).

1.4. Importance of the Study Area

Many parts of Bursa province have been studied floristically by various researchers (Kaynak and Tuyji, 1991, Günay Daşkın and Kaynak, 2006, Kaynak et al., 2008, Daşkın and Kaynak, 2010 a, b, Özen 2010, Erdoğan et al., 2011). However there is only one studies, conducted in Yeniköy (Karacabey district), about vascular plants grown at the seashores of Bursa (Uslu and Gehu, 1991). Therefore, I belive that this study is contributed to the costal flora of Bursa province. Furthermore, the study area is adjacent to Kocaçay Delta which is one of the 122 Important Plant Areas (IPA No: 17) in Turkey defined by Özhatay et al. (2003) and has "Emergency" status for conservation priorities (Figure 1). Since both areas are similar in terms of ecological conditions and floristic elements, determining of vascular plants in Mudanya cost is important for conservation actions in the future.

2. Materials and methods

This study based on 800 herbarium speciemens collected from the study area between April 2002 and September 2011. These speciemens were identified with the help of the following literature; Davis (1965-1985), Davis et al. (1988), Güner et al. (2000), Tutin et al. (1964-1980), Seçmen and Leblebici (1997), Kaynak et al. (1996), Kaynak et al. (2008). All the plant specimens were stored at the Herbarium of Uludağ University, the Faculty of Arts and Sciences, Biology Department (BULU).

In the floristic list, families, genera and species were arranged in alphabetic order. The author's abbreviations were checked by The International Plant Name Index (2005) (http://www. ipni. org). After the species name and authors' abbreviations, the floristic list gives the number of localities, habitats, herbarium accession numbers, phytogeographical regions, threatened categories of endemic and rare taxa (Ekim et al., 2000), and life forms. An asterik preceding a plant name indicates a new record for the A2 square (Yıldırımlı, 1999; Özen, 2010). Life form categories were determined according to Raunkiaer (1934).

The abbreviations used in the article are listed as follows: Ch.: Chamaephytes; Crp.: Cryptophytes; E. Medit.: East Mediterranean Element; End.: Endemic to Turkey; Euro-Sib.: Euro-Siberian Element; Hcrp: Hemicryptophytes; Ir.-Tur.: Irano-Turanian Element; LC: Least Concern; Medit.: Mediterranean Element; NT: Near Threatened; Ph.: Phanerophytes; R. Daşkın: Ruziye Daşkın; Th.: Therophytes; VU.: Vulnerable.

List of locations in the study area

1. Bursa: Mudanya; Söğütpınar-Esence Village, 31.07.2002, R. Daşkın
2. Mudanya; Eğerce-Söğütpınar Village, Daşkın, 11.08.2002, R. Daşkın
3. Mudanya; cost of Eğerce, Daşkın, 11.08.2002, R. Daşkın
4. Mudanya; cost of Mesudiye Village, 11.08.2002, R. Daşkın
5. Mudanya; cost of Söğütpınar Village, 26.05.2003, R. Daşkın
6. Mudanya; Söğütpınar-Eğerce Village, 26.05.2003, R. Daşkın
7. Mudanya; Esence-Yalıçiftlik Village, 26.05.2003, R. Daşkın
8. Mudanya; cost of Yalıçiftlik, 01.10.2011, R. Daşkın
9. Mudanya; cost of Esence, 23.05.2004, R. Daşkın
10. Mudanya; Esence-Yalıçiftlik Village, 10.08.2004, R. Daşkın
11. Mudanya; cost of Zeytibağı, 01.10.2011, R. Daşkın
12. Mudanya; Zeytinbağı-Mudanya, 01.10.2011, R. Daşkın
13. Mudanya; cost of Altıntaş, 13.06.2011, R. Daşkın
14. Mudanya; cost of Güzelyalı, 13.06.2011, R. Daşkın
15. Mudanya; Kumyaka-Zeytinbağı, 13.06.2011, R. Daşkın
16. Mudanya; Eğerce- Söğütpınar Village, 05.09.2011, R. Daşkın
17. Mudanya; Eğerce-Mesudiye Village, 07.09.2011, R. Daşkın
18. Mudanya; Eğerce-Esence Village, 07.09.2011, R. Daşkın
19. Mudanya; Mudanya-Kumyaka, 08.10. 2011, R. Daşkın
20. Mudanya; Burgaz-Altıntaş, 13.06.2011, R. Daşkın

3. Results and discussion

800 plant specimens were collected from area between 2002 and 2011. As a result of the identification of these specimens, 252 taxa belonging to 55 families and 181 genera were determined. Two taxa were from the Pteridophyta division, 250 taxa were from Spermatophyta division. Of these, 208 taxa were Dicotyledonae and 42 taxa were Monocotyledonae. Only four taxa were endemic and endemism rate of the area was low (1.6 %).

The floristic results obtaneid from this study were compared with those of studies carried out in nearby regions (Armutlu, Uluabat Lake, Şile and Çatalca). Medit. elements with 58 taxa (23 %) were found as the most common phytogeographical elements followed by the Euro.-Sib. with 17 taxa (6.8 %) and Ir.-Tur. elements with 2 taxa (0.8 %). 175 taxa (69.4 %) were pluriregional or phytogeographically unknown. In all studies, the number of the Medit. elements is higher than other elements. This can be explained by these areas are located in the Medit. region and Medit. climate

prevails in the areas. When the areas were compared in terms of endemism, the rate of endemic plants in Uluabat Lake and Armutlu is higher than those of the other areas. This can be explained with the influence of excession urbanization in Mudanya, Şile and Çatalca (Table 1).

According to number of taxa, the largest families in the area are Asteraceae (43), Poaceae (33), Chenopodiaceae (12), Caryophyllaceae (12), Brassicaceae (11) and Apiaceae (11). The comparison of the richest families and genera with neighbouring areas is given in Table 2. Asteraceae, Fabaceae, Lamiaceae and Poaceae that are largest families in Flora of Turkey, are placed in first fifth rank in all areas except for Mudanya District. In the study area, Caryophyllaceae and Chenopodiaceae are placed among first fifth rank families. Although *Trifolium, Vicia, Lathyrus, Medicago, Veronica* and *Ranunculus* are the richest genera in the areas, *Atriplex*, *Euphorbia, Crepis, Plantago* and *Cyperus* are the richest genera in Mudanya District. This situation can be as a result of the study area has different microclimatical and edafical conditions.

Table 1. A comparison between the present study and other studies according to the total number of taxa, phytogeographical distribution (%) and endemism (%)

Research area	Total taxa	Medit.	Euro-Sib.	Ir.-Tur.	Pluriregional	Endemism
Mudanya/Bursa (This study)	252	23	6.8	0.8	69.4	1.6
Uluabat Lake/Bursa (pers. com.)	675	21.3	14.0	1.4	63.3	3.55
Armutlu/Yalova (Kaynak, 1997)	906	23.1	15.1	1.3	60.5	3.6
Şile/İstanbul (cited from Akaydın et al., 2011)	440	19.0	17.2	1.5	62.3	--
Çatalca /İstanbul (Genç and Özen, 2007)	444	20.9	19.4	0.5	59.2	1.57

The distribution of taxa in the study area according to life forms are as follows: therophytes (44.4%), hemicryptophytes (31.3 %), cryptophytes (13.4 %), phanerophytes (7.9 %), and chamaephytes (3.0 %). As stated by Akman et al. (2000), therophytes and hemicryptophytes are the most common life forms in areas where a Mediterranean climate is dominant. Life form spectrum of the study area supports this opinion.

Table 2. A comparison between the present study and other studies in terms of the richest families and genera.

Research area	Families	Genera
Mudanya/Bursa (This study)	Asteraceae (43), Poaceae (33), Chenopodiaceae (12), Caryophyllaceae (12), Brassicaceae (11), Apiaceae (11)	*Atriplex* (6), *Euphorbia* (5), *Crepis* (4), *Plantago* (4), *Veronica* (4), *Cyperus* (4)
Uluabat Lake/Bursa (pers. com.)	Asteraceae (74), Fabaceae (67), Lamiaceae (47), Poaceae (41), Brassicaceae (28), Apiaceae (27)	*Trifolium* (19), *Ranunculus* (12), *Medicago* (11), *Vicia* (10), *Rumex* (9)
Armutlu/Yalova (Kaynak, 1997)	Asteraceae (123), Fabaceae (91), Brassicaceae (49), Poaceae (45), Lamiaceae (44)	*Trifolium* (22), *Vicia* (14), *Ranunculus* (13), *Verbascum* (11), *Geranium* (10)
Şile/İstanbul (cited from Akaydın et al., 2011)	Fabaceae (59), Poaceae (46), Asteraceae (45), Lamiaceae (33), Brassicaceae (13)	*Trifolium* (21), *Ranunculus* (10), *Lathyrus* (7), *Vicia*, *Centaurea* (4)
Çatalca /İstanbul (Genç and Özen, 2007)	Asteraceae (60), Fabaceae (49), Lamiaceae (25), Rosaceae (23), Poaceae (20)	*Trifolium* (11), *Geranium* (8), *Veronica, Vicia, Salvia* (7)

3.1. Factors Affecting Vascular Plant Diversity of the Study Area

Urbanization, excessive construction, and partially grazing are the main factors for damages to plant diversity in the area. Mudanya (Güzelyalı), Burgaz, Kumyaka, Altıntaş, Zeytinbağı (Trilye) have completely urbanized and the cost of these areas have conspiciously narrowed (Figure 3). On the other hand, Yalıçiftlik, Esence, Söğütpınar, Eğerce and Mesudiye are under excessive construction pressure. The construction of summer resorts, pensions and sheds for summer tourism on both coastal region and slopes behide of the cost is the most important problem in these areas. Grazing is a less important factor than the others and only effective in the cost of Söğütpınar and Mesudiye.

These factors have been limited habitats of the plants and their populations have decreased. Especially *Pancratium maritimum* L., known as Sand lily, is very important. The species is not endemic, but included in VU category (Ekim et al., 2000). Although, it is distributed on dunes of the costs of Marmara, Black Sea and Mediterrnean in Turkey, the habitats of the species have been damaged because of tourism and its relative activities (Figure 4).

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Figure 3. Excessive construction in Mudanya cost (photo. R. Daşkın)

Figure 4. Habit of *Pancratium maritimum* L. (photo. R. Daşkın)

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Appendix
Floristic List
PTERIDOPYHTA
1. Equisetaceae
Equisetum telmateia Ehrh., 2, on dunes, BULU 14674, Crp.
2. Hypolepidaceae
Pteridium aquilinum (L.) Kuhn, 5, on dunes, BULU 18070, Crp.

SPERMATOPHYTA
ANGIOSPERMAE
DICOTYLEDONEAE
3. Amaranthaceae
Amaranthus albus L., 2, on dunes, BULU 14665; 8, in stony places, BULU 33564, Hcrp.
A. retroflexus L., 2, on dunes, BULU 14664, Th.
4. Anacardiaceae
Pistacia terebinthus L. subsp. *palaestina* (Boiss.) Engl., 2, on rocks, BULU 14680; 6, on rocks, BULU 23151, E. Medit., Ph.
Rhus coriaria L., 1, on rocks, BULU 14631; 11, on slopes, BULU 33603, Ph.
5. Apiaceae (Umbelliferae)
Crithmum maritimum L., 1, on rocks, BULU 14639, Hcrp.
Daucus guttatus Sm., 1, on dunes, BULU 14638; 6, on dunes, BULU 23156, Th.
Eryngium campestre L. var. *virens* Link, 17, on dunes, BULU 33499, Hcrp.
E. maritimum L., 6, on dunes, BULU 23154; 8, in stony places, BULU 33570, Hcrp.
Foeniculum vulgare L., 11, on slopes, BULU 33590; 12, in stony places, BULU 33614, Hcrp.
Oenanthe pimpinelloides L., 11, on slopes, BULU 33594, Hcrp.
Pastinaca sativa L. subsp. *urens* (Req. ex Godron) Čelak., 15, on rocks, BULU 33463, Hcrp.
Pseudorlaya pumila Grande, 5, on dunes, BULU 18079, Medit., Th.
Smyrnium olusatrum L., 13, on rocks, BULU 33432, Medit., Hcrp.
Tordylium apulum L., 4, on dunes, BULU 18064; 13, on dunes, BULU 33429, Medit., Th.
Torilis arvensis (Huds.) Link subsp. *neglecta* (Spreng.) Thell., 13, on rocks, BULU 33430, Th.
6. Araliaceae
Hedera helix L., 11, on slopes, BULU 33609, Ph.
7. Asclepiadaceae
Cionura erecta Griseb., 5, on dunes, BULU 18091; 13, on rocks, BULU 33415, Hcrp.
Cynachum acutum L. subsp. *acutum*, 1, on dunes, BULU 14607, Hcrp.
8. Asteraceae (Compositae)
**Andryala integrifolia* L., 6, on dunes, BULU 23160, Medit., Hcrp.
Anthemis altissima L., 15, in stony places, BULU 33450, Th.
A. tinctoria L. var. *euxina* (Boiss.) Grierson, 1, on dunes, BULU 14634; 6, on dunes, BULU 23167; 11, on slopes, BULU 33596, Hcrp.
A. tomentosa L. subsp. *tomentosa*, 1, on dunes, BULU 14636; 6, on dunes, BULU 23168, E. Medit., Hcrp.
Bellis sylvestris Cirillo, 19, on dunes, BULU 33624, Medit., Hcrp.
Cardopatium corymbosum (L.) Pers., 6, on rocks, BULU 23157, Medit., Hcrp.
Carlina lanata L., 16, on dunes, BULU 33475A, Medit., Th.
Carthamus dentatus Vahl., 6, on dunes, BULU 23163, Th.
C. lanatus L., 11, on slopes, BULU 33610, Th.
Centaurea solstitialis L. subsp. *solstitialis*, 11, on slopes, BULU 33611B, Th.
C. spinosa L. var. *spinosa*, 6, on dunes, BULU 23158; 17, on dunes, BULU 33493, Ch.
Cichorium inthybus L., 6, on dunes, BULU 23162, Hcrp.
Cirsium vulgare (Savi.) Ten., 16, on dunes, BULU 33471, Hcrp.
Chondrilla juncea L. var. *juncea*, 16, on dunes, BULU 33481A, Hcrp.
Conyza bonariensis (L.) Cronquist, 16, on dunes, BULU 33480; 15, in wet places, BULU 33469, Th.
C. canadensis (L.) Cronquist, 16, on dunes, BULU 33478; 14, in stony places, BULU 33622, Th.
Crepis sancta Babc., 3, on dunes, BULU 18039; 5, on dunes, BULU 18087, Th.
C. setosa Hall., 2, on dunes, BULU 14661, Euro.-Sib., Th.
C. vesicaria L., 1, on dunes, BULU 14616; 7, on dunes, BULU 23169, Medit., Th.
C. zacintha (L.) Babc., 19, in stony places, BULU 33626, Th.
Echinops viscosus DC. subsp. *bithynicus* (Boiss.) Rech. fil., 15, on dunes, BULU 33472, Hcrp.
Helichrysum stoechas Moench subsp. *barrelieri* (Ten.) Nyman, 1, on rocks, BULU 14646; 11, on slopes, BULU 33583, Hcrp.
Helminthoteca echioides (L.) Holub, 11, on slopes, BULU 33592, Th.
Hedypnois cretica (L.) Dum.-Cours., 13, in stony places, BULU 33428, Medit., Hcrp.
Inula graveolens Desf., 11, on slopes, BULU 33598, Th.
I. viscosa (L.) Aiton, 6, on dunes, BULU 23164; 8, in stony places, BULU 33559; 12, on slopes, BULU 33613, Medit., Hcrp.
I. vulgaris Trevis., 11, on slopes, BULU 33611A, Hcrp.
Lactuca serriola L., 11, stony slopes, BULU 33602, Euro.-Sib., Hcrp.
Matricaria chamomilla L. var. *recutica* (L.) Grierson, 13, on dunes, BULU 33419; 15, in wet places, BULU 33451, Th.
Otanthus maritimus (L.) Hoffmanns. & Link, 1, on dunes, BULU 14635, Medit., Crp.
Pallenis spinosa Cass., 17, on dunes, BULU 33489, Medit., Th.
Picris altissima Delile, 7, on dunes, BULU 23165, Medit., Th.
Pulicaria dysenterica Bernh., 17, on dunes, BULU 33483, Hcrp.
Ptilostemon chamaepeuce (L.) Less., 15, on rocks, BULU 33453; 11, on slopes, BULU 33612B, E. Medit., Ph.
Reichardia picroides (L.) Roth, 11, on slopes, BULU 33578, Hcrp.
Senecio vulgaris L., 15, on dunes, BULU 33465, Th.
Sonchus asper (L.) Hill subsp. *glaucescens*, 2, on dunes, BULU 14648; 13, on dunes, BULU 33425, Hcrp.
**S. tenerrimus* L., 14, in stony places, BULU 33621, Medit., Hcrp.
Taraxacum serotinum Soest, 19, in stony places, BULU 33627, Hcrp.
Tussilago farfara L., 8, on slopes, BULU 33565, Euro.-Sib., Crp.
Urospermum picroides F. W. Schmidt, 6, on dunes, BULU 23166, Medit., Th.
Xanthium spinosum L., 17, on dunes, BULU 33491, Th.
X. strumarium L. subsp. *cavanillesii* (Schouw) D. Löve & P. Dans., 20, on dunes, BULU 33444; 16, on dunes, BULU 33481B, Th.

9. Boraginaceae

Anchusa undulata L. subsp. *hybrida* (Ten.) Cout., 1, on dunes, BULU 14617; 2, on dunes, BULU 14677; 4, on dunes, BULU 18065, Medit., Hcrp.

Echium angustifolium Mill., 6, on dunes, BULU 23169, E. Medit., Hcrp.

E. italicum L., 6, on dunes, BULU 23172, Medit., Hcrp.

E. plantagineum L., 5, on dunes, BULU 18089, Medit., Hcrp.

Heliotropium dolosum De Not., 15, in stony places, BULU 33466, Th.

H. europaeum L., 1, on dunes, BULU 14626; 11, in stony places, BULU 33604, Medit., Th.

H. hirsutissimum Grauer, 2, on dunes, BULU 14650; 19, in stony places, BULU 33623, E. Medit., Th.

Myosotis arvensis (L.) Hill subsp. *arvensis*, 3, on dunes, BULU 18041; 5, on dunes, BULU 18090, Euro-Sib., Hcrp.

10. Brassicaceae (Cruciferae)

Alyssum minus (L.) Rothm. var. *minus*, 3, on dunes, BULU 18032; 5, on dunes, BULU 18074, Th.

Cakile maritima Scop., 1, on dunes, BULU 14605; 8, in stony places, BULU 33558, Th.

Capsella bursa-pastoris (L.) Medik., 6, on dunes, BULU 23170, Th.

Cardaria draba (L.) Desv. subsp. *draba*, 13, on dunes, BULU 33417; 15, in stony places, BULU 33460, Hcrp.

Lepidium graminifolium L., 11, on slopes, BULU 33601, Hcrp.

Matthiola fruticulosa (L.) Maire, 15, on slopes, BULU 33448, Hcrp.

M. incana (L.) R. Br., 15, on slopes, BULU 33446, Hcrp.

Maresia nana Batt., 3, on dunes, BULU 18033, Th.

Raphanus raphanistrum L., 1, on dunes, BULU 14160; 6, on dunes, BULU 23145, Th.

Rapistrum rugosum (L.) All., 13, on dunes, BULU 33412, Th.

Sisymbrium polyceratum L., 15, in stony places, BULU 33445, Th.

11. Campanulaceae

Campanula lyrata Lam. subsp. *lyrata*, 12, on slopes, BULU 33617, **End.**, **LC.,** Hcrp.

12. Caryophyllaceae

Arenaria leptoclados (Rchb.) Guss., 4, in wet places, BULU 18050, Th.

A. rotundifolia M. Bieb. subsp. *rotundifolia*, 3, on rocks, BULU 18034, Hcrp.

Cerastium diffusum Pers., 13, on dunes, BULU 33420, Th.

C. glomeratum Thuill., 4, on dunes, BULU 18052, Th.

C. gracile Duf., 4, on dunes, BULU 18053, Th.

Moenchia mantica (L.) Bartl. subsp. *mantica*, 5, on dunes, BULU 18076, Th.

Polycarpon tetraphyllum L., 5, in wet places, BULU 18075; 15, in wet places, BULU 33467, Th.

Sagina maritima Don, 2, in wet places, BULU 14678, Th.

Silene dichotoma Ehrh. subsp. *dichotoma*, 5, on dunes, BULU 18078, Th.

S. dichotoma Ehrh. subsp. *euxina* (Rupr.) Coode & Cullen, 3, on dunes, BULU 18036; 4, on dunes, BULU 18054, Euro.-Sib., Th.

S. vulgaris (Moench) Garcke var. *vulgaris*, 13, on rocks, BULU 33403, Hcrp.

Spergularia bocconii (Scheele) Asch. & Graebn., 4, in wet places, BULU 18051, Medit., Th.

13.Chenopodiaceae

Atriplex halimus L., 8, in stony places, BULU 33561B, Ph.

A. hastata L., 1, on dunes, BULU 14612; 6, on dunes, BULU 23150; 14, in stony places, BULU 33620; 20, in stony places, BULU 33438, Th.

A. hortensis L., 11, on stony slopes, BULU 33563, Th.

A. patula L., 11, in stony places, BULU 33588, Th.

A. rosea L., 11, in stony places, BULU 33574; 14, in stony places, BULU 33619, Th.

A. tatarica L. var. *tatarica*, 2, on dunes, BULU 14667; 20, in stony places, BULU 33439, Th.

Beta maritima L. var. *pilosa* Del., 2, on dunes, BULU 14668; 20, on dunes, BULU 33442, Th.

B. trigyna Waldst. & Kit., 8, in stony places, BULU 33561A, Hcrp.

Chenopodium album L. subsp. *album* var. *album*, 2, on dunes, BULU 14666; 13, on dunes, BULU 33401; 11, in stony places, BULU 33600, Th.

Halimione verrucifera (M. Bieb.) Aellen, 3, on dunes, BULU 18040, Ph.

Salsola tragus L., 1, on dunes, BULU 14618; 8, in stony places, BULU 33560, Th.

Suaeda altissima (L.) Pall., 1, on dunes, BULU 14619, Th.

14.Convolvulaceae

Calystegia soldanella (L.) R. Br., 1, on dunes, BULU 14615, Hcrp.

C. sylvatica (Kit.) Griseb., 11, on slopes, BULU 33585, Hcrp.

Convolvulus arvensis L., 17, on dunes, BULU 33490; 11, on slopes, BULU 33582, Hcrp.

15.Crassulaceae

Sedum pallidum M. Bieb. var. *pallidum*, 13, on rocks, BULU 33431, Th.

16.Cucurbitaceae

Ecballium elaterium L., 13, on dunes, BULU 33421; 12, in stony places, BULU 33615, Medit., Hcrp.

17. Dipsacaceae

Scabiosa atropurpurea L. subsp. *maritima* (L.) Arcang., 17, on dunes, BULU 33492, Hcrp.

18. Elaeagnaceae

Elaeagnus angustifolia L., 17, on dunes, BULU 33496, Ph.

19. Euphorbiaceae

Chrozophora tinctoria (L.) Rafin., 17, on dunes, BULU 33487, Th.

Euphorbia chamaesyce L., 7, on dunes, BULU 23181, Th.

E. helioscopia L., 4, on dunes, BULU 18069, Th.

E. peplis L., 1, on dunes, BULU 14609; 2, on dunes, 14663, Medit., Th.

E. peplus L. var. *peplus*, 13, on dunes, BULU 33418; 14, on dunes, BULU 33440; 15, in stony places, BULU 33470, Th.

E. terracina L., 1, on dunes, BULU 14621, 5, on dunes, BULU 18096, Medit., Hcrp.

Mercurialis annua L., 13, in stony places, BULU 33407, Th.

M. perrennis L., 15, in stony places, BULU 33461, Euro.-Sib., Hcrp.

20. Fabaceae (Leguminosae)

Dorycnium hirsutum (L.) Ser., 1, on slopes, BULU 14637; 5, on dunes, BULU 18098, Medit., Ch.

Glycyrrhiza echinata L., 17, in wet places, BULU 33482, E. Medit., Ph.

Hymenocarpus circinnatus (L.) Savi, 3, on dunes, BULU 18038, Medit., Th.

Lotus corniculatus L. subsp. *tenuifolius* L., 17, on dunes, BULU 33494, Hcrp.

Medicago littoralis Rohde ex Loisel. var. *littoralis*, 5, on dunes, BULU 18084; 15, in stony places, BULU 33459, Th.

M. marina L., 1, on dunes, BULU 14627; 4, on dunes, BULU 18063, Hcrp.

Spartium junceum L., 12, on slopes, BULU 33615B, Medit., Ph.
Vicia lathyroides L., 5, on dunes, BULU 18085, Th.
V. villosa Roth subsp. *microphylla* (d'Urv.) P. W. Ball, 6, on dunes, BULU 23152, E. Medit., Th.

21. Fagaceae
Quercus coccifera L., 11, on slopes, BULU 33607, Medit., Ph.
Q. infectoria Oliv. subsp. *infectoria*, 1, on rocks, BULU 14620, Ph.

22. Fumariaceae
Fumaria officinalis L., 13, on dunes, BULU 33411, Th.

23. Gentianaceae
Blackstonia perfoliata (L.) Huds. subsp. *perfoliata*, 11, on slopes, BULU 33580, Th.

24. Geraniaceae
Geranium molle L. subsp. *molle*, 5, on dunes, BULU 18079, Th.
G. dissectum L., 4, on dunes, BULU 18058, Th.
G. asphodeloides Burm. f. subsp. *asphodeloides*, 4, on dunes, BULU 18056, Euro.-Sib., Crp.
Erodium cicutarium (L.) L'Her. subsp. *bipinnatum* (Desf.) Tourlet, 5, on dunes, BULU 18080; 15, in stony places, BULU 33448, Th.

25. Hypericaceae (Guttiferae)
Hypericum calycinum L., 11, on slopes, BULU 33581, Ch.
H. perforatum L., 13, on rocks, BULU 33402, Hcrp.
H. triquetrifolium Turra, 8, in stony places, BULU 33569, Hcrp.

26. Lamiaceae (Labiatae)
Ballota nigra L. subsp. *anatolica* P. H. Davis, 1, on dunes, BULU 14606, Ir.-Tur., **End.,**
LC., Hcrp.
Lavandula stoechas L. subsp. *cariensis* (Boiss.) Rozeira, 4, on dunes, BULU 18094, E. Medit, **End., NT.,** Ch.
Lamium amplexicaule L., 3, on dunes, BULU 18043, Euro-Sib., Th.
L. purpureum L. var. *purpureum*, 3, on dunes, BULU 18044, Th.
Marrubium peregrinum L., 2, on dunes, BULU 14673, Hcrp.
Mentha spicata L. subsp. *tomentosa* (Briq.) Harley, 2, in wet places, BULU 14681; 6, in wet places, 23176, Crp.
Micromeria myrtifolia Boiss. & Hohen., 13, on rocks, BULU 33405, E. Medit., Hcrp.
Salvia aethiopsis L., 6, on dunes, BULU 23178, Hcrp.
S. virgata Jacq., 17, on dunes, BULU 33488, Ir.-Tur., Hcrp.
Teucrium chamaedrys L. subsp. *chamaedrys*, 11, on slopes, BULU 33575, Euro.-Sib., Ch.

27. Lythraceae
Lythrum hyssopifolia L., 2, in wet places, BULU 14653, Hcrp.
L. salicaria L., 1, in wet places, BULU 14632, Euro-Sib., Hcrp.

28. Malvaceae
Malva nicaensis All., 13, in stony places, BULU 33427, Th.
Alcea pallida Waldst. & Kit., 12, on slopes, BULU 33616, Hcrp.

29. Moraceae
Ficus carica L. subsp. *carica*, 1, on rocks, BULU 14613; 11, on slopes, BULU 33609, Ph.

30.Oleaceae
Phillyrea latifolia L., 11, on slopes, BULU 33586, Medit., Ph.

31. Onagraceae
Epilobium hirsutum L., 2, in wet places, BULU 14662, Hcrp.
E. tetragonum L. subsp. *tetragonum*, 15, in wet places, BULU 33458, Th.

32. Orobanchaeceae
Orobanche caryophyllacea Smith, 13, on rocks, BULU 33406

33. Papaveraceae
Glaucium flavum Crantz, 1, on dunes, BULU 14630; 2, on dunes, BULU 14675, Hcrp.
Papaver argemone L., 4, on dunes, BULU 18047; 5, on dunes, BULU 18072, Th.
P. dubium L., 5, on dunes, BULU 18073, Th.
P. rhoeas L., 13, on dunes, BULU 33395, Th.
Hypecoum procumbens L., 4, on dunes, BULU 18045; 5, on dunes, BULU 18071, Medit., Th.

34. Plantaginaceae
Plantago coronopus L. subsp. *commutata* (Guss.) Pilg., 2, on dunes, BULU 14655; 13, on dunes, BULU 33426; 20, on dunes, BULU 33437, E. Medit., Th.
P. lagopus L., 2, on dunes, BULU 14671; 7, on dunes, BULU 23179, Hcrp.
P. major L. subsp. *intermedia* (Gilib.) Lange, 2, in wet places, BULU 14669; 8, in stony places, BULU 33566, Hcrp.
P. scabra Moench, 1, on dunes, BULU 14611, Th.

35. Plumbaginaceae
Limonium graecum (Poir.) Rech. f. var. *graecum*, 3, on rocks, BULU 23180; 13, on rocks, BULU 33404, E. Medit., Ch.

36. Polygonaceae
Polygonum arenastrum Bor., 11, in stony places, BULU 33605, Th.
P. maritimum L., 1, on dunes, BULU 14629; 6, on dunes, BULU 23148, Hcrp.
P. pulchellum Lois., 15, in wet places, BULU 33462, Th.
Rumex bucephalophorus L., 4, on dunes, BULU 18059, Medit., Th.
R. crispus L., 2, on dunes, BULU 14647, Hcrp.
R. conglomeratus Murray, 15, in stony places, BULU 33454, Hcrp.
R. pulcher L., 2, on dunes, BULU 14656, Hcrp.

37. Portulacaceae
Portulaca oleraceae L., 2, on dunes, BULU 14659, Th.

38. Primulaceae
Anagallis arvensis L. var. *arvensis*, 5, in wet places, BULU 18093, Th.
A. arvensis var. *caerulea* (L.) Gouan, 5, in wet places, BULU 18092; 8, in stony places, BULU 33562, Medit., Th.

39. Ranunculaceae
Ranunculus sceleratus L., 15, in wet places, BULU 33447, Th.
Clematis vitalba L., 5, on rocks, BULU 18097, Ph.

40. Resedaceae
Reseda lutea L. var. *lutea*, 11, on slopes, BULU 33593, Th.

41. Rhamnaceae
Paliurus spina-christii Mill., 11, on slopes, BULU 33612, Ph.
Rhamnus alaternus L., 11, on slopes, BULU 33587, Medit, Ph.

42. Rosaceae
Potentilla reptans L., 8, in stony places, BULU 33568, Hcrp.
Rubus canescens DC. subsp. *glabratus* (Godron) P. H. Davis & Meikle, 1, on dunes, BULU 14650; 11, on slopes, BULU 33599, Ph.
Sarcopoterium spinosum (L.) Spach, 6, on rocks, BULU 23153, E. Medit., Ch.

43. Rubiaceae
Galium album Mill. subsp. *prusense* (C. Koch) Ehrend. & Krendl, 13, on slopes, BULU 33394, Hcrp.
G. verum L. subsp. *verum*, 5, on dunes, BULU 18102, Euro-Sib., Hcrp.

Rubia peregrina L., 11, on slopes, BULU 33584, Medit., Hcrp.

44. Santalaceae

Osyris alba L., 11, on slopes, BULU 33597, Medit., Ph.

45. Scrophulariaceae

Kickxia elatine (L.) Dumort. subsp. *crinita* (Mabille) Greuter, 2, on dunes, BULU 14660; 8, in stony places, BULU 33567, Medit., Th.

Misopates orontium (L.) Raf., 15, in stony places, BULU 33455, Th.

Parentucellia latifolia (L.) Caruel subsp. *latifolia*, 4, on dunes, BULU 18066, Medit., Th.

Verbascum sinuatum L. var. *sinuatum*, 7, on dunes, BULU 23172, Medit., Hcrp.

V. pinnatifidum Vahl, 1, on dunes, BULU 14633; 6, on dunes, BULU 23174, E. Medit., Hcrp.

V. bombyciferum Boiss., 11, on slopes, BULU 33591, Euro.-Sib., **End., NT.**, Hcrp.

Veronica anagallis-aquatica L., 2, in wet places, BULU 14676; 13, in wet places, BULU 33422, Th.

V. cymbalaria Bodard, 3, on dunes, BULU 18042; 4, on dunes, BULU 18068, Th.

V. persica Poir., 13, in wet places, BULU 33410, Th.

V. polita Fr., 4, in wet places, BULU 18067, Th.

46. Solanaceae

Solanum nigrum L. subsp. *nigrum*, 1, on dunes, BULU 14625; 11, on slopes, BULU 33571, Th.

47. Tamaricaceae

Tamarix smyrnensis Bunge, 5, in wet places, BULU 18099, Ph.

48. Urticaceae

Parietaria judaica L., 1, on rocks, BULU 14628; 13, on rocks, BULU 33408; 20, on rocks, BULU 33441, Hcrp.

49. Verbanaceae

Phyla canescens (Kunth) Greene, 6, in wet places, BULU 23175, Hcrp.

Verbana officinalis L., 2, in wet places, BULU 14658; 6, BULU 23173, Hcrp.

Vitex agnus-castus L., 17, on dunes, BULU 33497, Medit., Ph.

50. Zygophyllaceae

Tribulus terrestris L., 2, on dunes, BULU 14679, Th.

MONOCOTYLEDONAE

51. Amaryllidaceae

Pancratium maritimum L., 3, on dunes, BULU 23183; 16, on dunes, BULU 33475B, Medit., **Rare, VU.,** Crp.

52. Cyperaceae

Cyperus capitatus Vand., 1, on dunes, BULU 14624; 5, on dunes, BULU 18103, Crp.

C. fuscus L., 2, on dunes, BULU 14684, Euro-Sib., Crp.

C. rotundus L., 2, on dunes, BULU 14685, Crp.

Scirpoides holoschoenus (L.) Soják, 1, on dunes, BULU 14622; 7, on dunes, BULU 23186, Crp.

53. Juncaceae

Juncus compressus Jacq., 1, on dunes, BULU 14623, Crp.

54. Liliaceae

Asparagus acutifolius L., 2, on rocks, BULU 14657; 17, on dunes, BULU 33498, Crp.

Allium neapolitanum Cirillo, 13, on rocks, BULU 33416, Medit., Crp.

Ruscus aculeatus L., 11, on slopes, BULU33598, Crp.

55. Poaceae (Gramineae)

Aeluropus littoralis (Gouan) Parl., 15, in wet places, BULU 33455, Crp.

Agropogon x littoralis (Sm.) C. E. Hubb., 13, in wet places, BULU 33423, Medit., Crp.

Ammophila arenaria (L.) Link subsp. *arundinacea* H. Lindb. f., 1, on dunes, BULU 14645, Medit., Crp.

Avena sterilis L. subsp. *sterilis*, 13, on rocks, BULU 33424, Th.

Bromus rigidus Roth, 13, on rocks, BULU 33433, Th.

B. tectorum L., 5, on dunes, BULU 18104, Th.

Calamagrostis pseudophragmites Link ex Rchb., 11, on slopes, BULU33595, Euro-Sib., Crp.

Catabrosa aquatica (L.) P. Beauv., 15, in wet places, BULU 33456, Crp.

Crypsis alopecuroides Schrad., 17, on dunes, BULU 33503, Th.

Cynodon dactylon (L.) Pers. var. *dactylon*, 1, on dunes, BULU 14644; 7, on dunes, BULU 23190, Crp.

Cynosurus echinatus L., 1, on dunes, BULU 14640, Medit., Th.

Dactylis glomerata L. subsp. *hispanica* (Roth) Nyman, 13, in wet places, BULU 33414; 11, on slopes, BULU 33576, Crp.

Echinochloa colonium (L.) Link, 2, on dunes, BULU 14686, Th.

E. crus-galli P. Beauv., 2, on dunes, BULU 14654, Th.

Elymus elongatus (Host) Runemark subsp. *turcicus* (P. E. MacGuire) Melderis, 1, on dunes, BULU 14642, 5, on dunes, BULU 18105; 7, on dunes, BULU 23185, Crp.

E. farctus (Viv.) Runemark ex Melderis subsp. *farctus* var. *farctus*, 1, on dunes, BULU 14641, Crp.

E. repens (L.) Gould subsp. *repens*, 11, on slopes, BULU 33577, Crp.

Hordeum bulbosum L., 20, on dunes, BULU 33443, Crp.

Lagurus ovatus L., 1, on dunes, BULU 14643; 7, on dunes, BULU 23188, Medit., Th.

Lolium perenne L., 15, in wet places, BULU 33468, Crp.

Melica ciliata L. subsp. *ciliata*, 13, on rocks, BULU 33435, Crp.

Parapholis incurva (L.) C. E. Hubb., 15, on dunes, BULU 33449, Th.

Phleum pratense L., 7, on dunes, BULU 23187, Euro-Sib., Th.

Phragmites australis (Cav.) Trin. ex Steud., 18, on dunes, BULU 33501; 9, in wet places, BULU 33507, Euro.-Sib., Crp.

Piptatherum miliaceum (L.) Coss. subsp. *thomasii* (Duby) Freitag, 11, on slopes, BULU 33595, Crp.

Polypogon monspeliensis (L.) Desf., 15, in wet places, BULU 33457, Th.

P. viridis (Gouan) Breistr., 2, on dunes, BULU 14683, Euro-Sib., Crp.

Rostraria cristata (L.) Tzvelev var. *cristata*, 15, in wet places, BULU 33457, Th.

Setaria viridis (L.) P. Beauv., 2, on dunes, BULU 14682, Th.

Sporobolus virginicus (L.) Kunth, 17, on dunes, BULU 33501, Crp.

Sorghum halepense (L.) Pers. var. *halepense*, 13, on rocks, BULU 33436; 11, on slopes, BULU 33606, Crp.

Trachynia distachya (L.) Link, 13, on rocks, BULU 33434, Medit., Th.

Tragus racemosus (L.) All., 7, on dunes, BULU 23189, Th.

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