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# Flora and factors affecting species diversity in protected "Natura 2000" sites of the Ionian area: the Echinades islet group (Greece)

**Abstract**

Iliadou E., Panitsa M., Raus Th. & Dimopoulos P.: Flora and factors affecting species diversity in protected "Natura 2000" sites of the Ionian area: the Echinades islet group (Greece). – Willdenowia 44: 121–136. 20 March 2014. – Version of record published online ahead of inclusion in April 2014 issue; ISSN 1868-6397; © 2014 BGBM Berlin-Dahlem.

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The vascular plant species diversity of the Echinades islet group, quite unexplored so far, is documented by an inventory of flowering plants and ferns, filling a gap in the floristic information available for the National Park to which these islets belong, as well as for the Ionian land-bridge island system, for which detailed studies concerning floristic and phytogeographical relationships were available before. Field investigations on 19 of the 20 Echinades islets generated an inventory of plant species composition for the first time for 18 of them and added 56 taxa as new to the islet of Oxeia as compared to previous literature. The total vascular flora of the Echinades islets comprises 386 plant taxa. Spectra of life-form and chorological categories are presented and discussed. Floristic cross-correlations (beta-diversity) showed that the individual islet floras differ from each other from 25 % to 85 %. Concerning the role of geographical variables as influencing plant species diversity in the area, regression analyses indicated island surface area and elevation as the major predictor variables of species richness, while distance to the mainland plays a subordinate predictive role.

Additional key words: island biogeography, land-bridge islands, phytogeography, Mediterranean region

## Introduction

Islands are highly significant in providing natural experimental designs for research on the ecology and evolution of species (Denslow 2001). They represent rather simplified real-world systems (Kueffer & Fernández-Palacios 2010), and the Mediterranean islands in particular are considered conservative systems considerably unaffected by climatic and evolutionary changes (Troia & al. 2012). Greece is characterized by a large number of islands and islets, making up almost one-quarter of its geographical area distributed in two major archipelagos, the Aegean to the east and the Ionian to the west of the mainland. This fragmentation of the Greek land surface area is one of the main technical obstacles for the inventory of its floristic richness, but simultaneously it serves as an excellent case study of plant diversity responses to ecological and historical factors such as isolation and random dispersal events (see Runemark 1969).

The geotectonic evolution of the Greek Islands has largely shaped the presently observed biogeographic patterns of their plant taxa. The rather recent geological evolution of the Ionian Islands, with most islands becoming isolated from the mainland during the Pleistocene or even thereafter (Triantis & Mylonas 2009; Perissoratis & Conispoliatis 2003), is considered the main reason for the low rate of endemism in the area (Tzanoudakis & Panitsa 1995).

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Tan & Iatrou (2001) mentioned a total number of 1886 plant taxa for the floristic (phytogeographical) region of the Ionian Islands. Georgiou & Delipetrou (2010) showed that regarding the 90 Greek endemic taxa recorded in the Ionian area, the phytogeographical region of the Ionian Islands proper (IoI) is closest to South Pindos (SPi) and the other two phytogeographical regions with west-facing coastal parts, Peloponnisos (Pe) and Sterea Ellas (StE). Dimopoulos & al. (2013) recorded 2027 taxa (1932 species) and 92 Greek endemic taxa from IoI. The Red Data Book of Rare and Threatened Plants of Greece (Phitos & al. 1995, 2009) also includes taxa of the Ionian Island flora, where, according to the IUCN criteria (IUCN 2013), there are two critically endangered, four endangered and seven vulnerable plant taxa.

From a nature conservation point of view, the ecological importance of the Ionian area is more pronounced if we consider the designation of a large number of areas as protected and included in the European Natura 2000 ecological network (21 Sites of Community Importance, of which two are also designated as Ramsar sites of International Importance for birds, and National Parks of National Importance). According to Krigas & al. (2010), c. 7 % of 1853 Important Plant Species (IPS) recorded within the Natura 2000 sites of Greece are found in the Ionian Islands.

Plant species diversity of many larger Ionian islands and islets has been studied, (Ronniger 1941; Hofmann 1968; Hansen 1982; Georgiadis 1983, 1985; Phitos & Damboldt 1985; Georgiadis & al. 1986; Christodoulakis & al. 1988; Georgiou 1988; Borkowsky 1994; Gutermann 1995; Yannitsaros & al. 1995; Raus 1999; Strasser 2001; Markantonatou & al. 2002; Baliousis & Yannitsaros 2010), but there is still a large number of small islands and islets that have not been investigated at all. Among them the Echinades islet group, situated on the border of W mainland Greece and the Ionian Islands area (Fig. 1), remained completely unexplored except for the islet of Oxeia (Christodoulakis & al. 1988) together with some records reported by Gutermann (1995).

The Echinades islet group is part of two overlapping Natura 2000 sites, a Special Protection Area (GR2310015) and a Site of European Community Importance (GR2310001), that compose the "National Park of Mesolongi – Aitoliko lagoons, estuaries of Acheloos and Evinos River and Echinades islet group". This national park, one of the most diverse and complex sites of the Natura 2000 ecological network in Greece, is also one of the 11 Ramsar wetlands of Greece of international importance for the conservation of its avifauna (Dimopoulos & al. 2005).

Table 1. Geographical and ecological information for the Echinades islet group. – Abbreviations: S = number of taxa. A = surface area [ha]; E = highest elevation [m]; Dm = minimum distance to nearest mainland [km].

| Islet name | Islet number | Latitude [N] | Longitude [E] | S | A | E | Dm |
|---|---|---|---|---|---|---|---|
| Oxeia | 1 | 38°18'07" | 21°06'26" | 251 | 426.0 | 421 | 1.2 |
| Makropoula | 2 | 38°21'02" | 21°03'17" | 81 | 9.2 | 20 | 3.4 |
| Makri | 3 | 38°21'31" | 21°02'12" | 134 | 98.5 | 126 | 4.0 |
| Modi | 4 | 38°25'25" | 21°01'20" | 84 | 26.1 | 66 | 7.2 |
| Apasa | 5 | 38°25'53" | 21°01'29" | 65 | 2.3 | 17 | 6.7 |
| Soros | 6 | 38°26'05" | 21°01'30" | 80 | 3.9 | 31 | 6.8 |
| Gravaris | 7 | 38°26'23" | 21°01'35" | 51 | 1.4 | 24 | 6.2 |
| Kalogeros | 8 | 38°29'27" | 21°01'48" | 94 | 25.1 | 34 | 0.7 |
| Tsakalonisi | 9 | 38°27'43" | 21°02'10" | 55 | 10.0 | 25 | 3.7 |
| Filippos | 10 | 38°28'16" | 21°00'55" | 77 | 4.5 | 30 | 3.3 |
| Bistros | 11 | 38°27'52" | 21°00'58" | 81 | 11.4 | 41 | 4.0 |
| Pontikus | 12 | 38°27'18" | 21°03'57" | 118 | 73.2 | 62 | 1.8 |
| Labrino | 13 | 38°28'21" | 21°00'17" | 131 | 35.3 | 61 | 3.5 |
| Sofia | 14 | 38°28'50" | 21°00'05" | 103 | 17.1 | 43 | 3.2 |
| Provati | 15 | 38°27'47" | 21°02'51" | 142 | 120.3 | 75 | 2.5 |
| Prasso | 16 | 38°28'57" | 20°58'10" | 34 | 1.4 | 12 | 5.4 |
| Karlonisi | 17 | 38°28'31" | 21°02'35" | 146 | 72.1 | 77 | 2.2 |
| Petalas | 18 | 38°24'48" | 21°05'38" | 159 | 549.5 | 250 | 1.3 |
| Dragonera | 19 | 38°28'51" | 21°01'14" | 142 | 243.6 | 128 | 1.5 |
| Vromonas | 20 | 38°22'07" | 20°59'43" | ? | 104.7 | 141 | 7.8 |

The main objectives of the present study are: (1) to provide a floristic inventory of the Echinades islet group; (2) to investigate the floristic similarities among the islets of the Echinades group; and (3) to explore the main factors affecting plant species richness in the Echinades islet group. Since there are no previous detailed studies concerning floristic relationships in the Ionian land-bridge island system, the role of ecogeographical variables in shaping its flora is particularly highlighted.

## Material and methods

### 1. Study area

The floristic survey of the Echinades involves 19 of the small offshore islets with surface areas ranging from 1.4 ha to 426 ha, elevations ranging from 12 m to 421 m, and distance from the nearest mainland coastline ranging from 0.7 km to 7.2 km (Table 1). The hilly and coastal slopes are generally gentle except for the NE coasts of the islets, which are characterized mostly by vertical cliffs, and the almost inaccessible steep and weather-beaten coasts of the most isolated islet of the group, Vromonas. The names of the islets and their geographical data are provided in Table 1 and Fig. 1. The map of the Echinades

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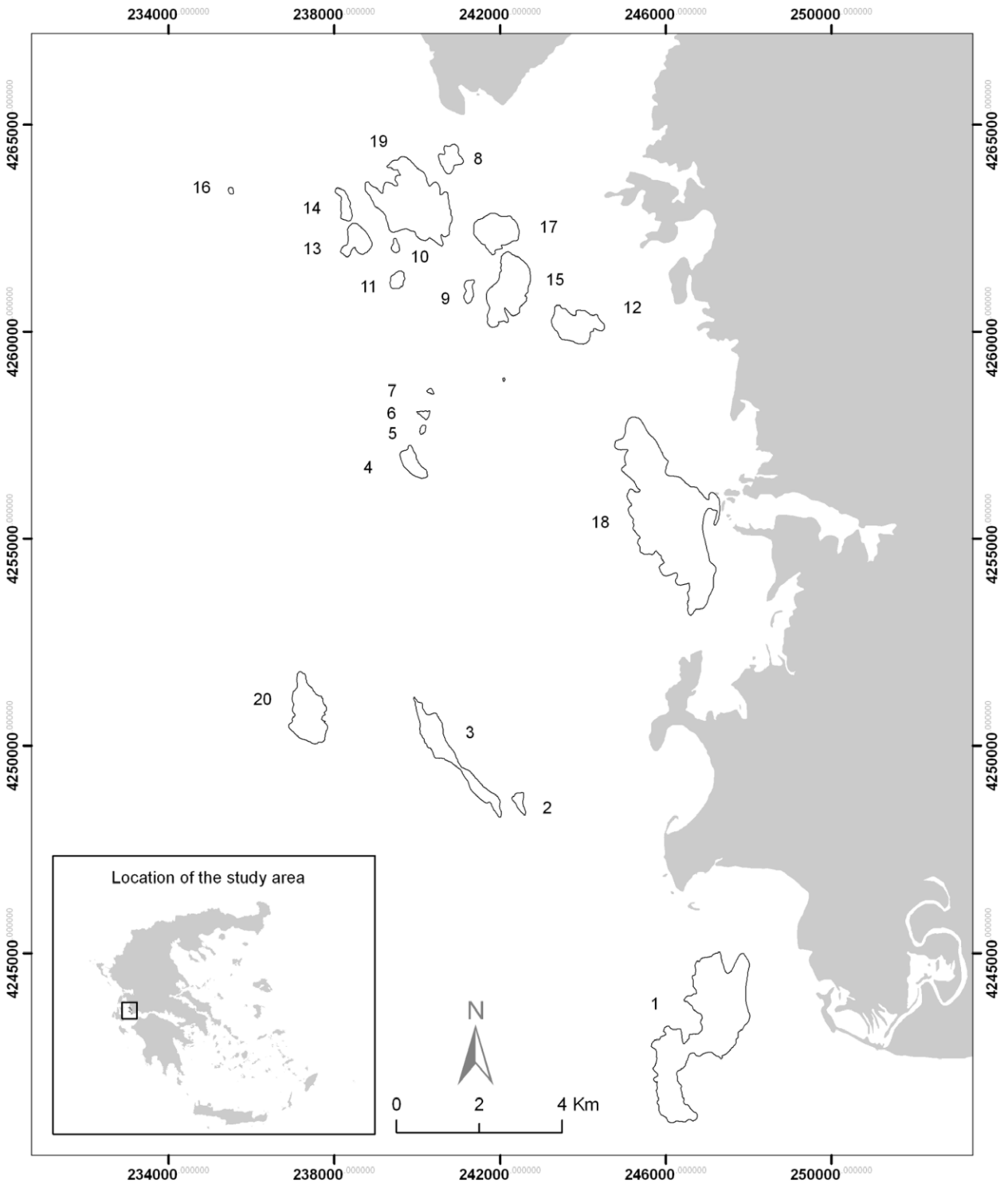



Fig. 1. Map of the Echinades islets. The islet numbers refer to Table 1.

islets has been digitized and the islets' size values were estimated using GIS. All Echinades islets are uninhabited, but some ruins and fenced areas have been observed mainly on the islets of Petalas and Dragonera, where cow and sheep grazing takes place constantly, and also on the islets of Kalogeros, Karlonisi, Oxeia and Tsakalonisi, where seasonal grazing of young sheep and goats was observed. None of the islets is cultivated and no relicts of cultivation were observed. The main human activity in the sea around the studied islets is fishing. The islets belong to the prefecture of Kefallinia and are owned by the Greek state except the islets of Petalas and Oxeia, which are both privately owned. Although it was attempted to visit the islet of Vromonas when weather permitted, access was not possible and the islet remains floristically unexplored.

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The Echinades islets are composed of upper Triassic, slightly dolomitized Pantocrator limestones (IGME 1989). The soil is mainly shallow clay. From a geomorphologic and tectonic point of view, the Echinades islets are a projection of the nearby mountainous continental area. The Ionian Islands were separated from continental W Greece probably during the Upper Pliocene and Pleistocene (Phitos & al. 1995; Perissoratis & Conispoliatis 2003).

Based on the climatological data of the Hellenic National Meteorological Service from the weather station of Mesolongi during 1982–1997, the mean annual precipitation is about 590 mm and the mean number of rainfall days is 46.5. The average annual minimum and maximum temperatures are 3.3 ºC for January and 33.7 ºC for August. The climatic diagram of Emberger (1952) and Sauvage (1961) places the study area into the subhumid bioclimatic zone characterized by mild winters. The xerothermic index (Bagnouls & Gausssen 1953) and the ombrothermic diagram (UNESCO-FAO 1963) characterize the study area as thermomediterranean with a dry period from early May to mid-October.

Six habitat types of Annex I of the Directive 92/43/EU have been recognized in the study area: vegetated sea cliffs of the Mediterranean coasts (habitat type code 1240), thermomediterranean and pre-desert scrub of *Euphorbia dendroides* (5330), garrigues of the E Mediterranean (5340), *Sarcopoterium spinosum* phrygana (5420), *Olea europaea* and *Pistacia lentiscus* scrub (9320) and, only on the islet of Oxeia, Mediterranean pine forests (9540).

The vegetation of the Echinades islets is mainly composed of evergreen sclerophyllous and phryganic plant communities assigned to the classes *Quercetea ilicis* Braun-Blanq. ex A. Bolòs 1950 and *Cisto-Micromerietea julianae* Oberd. 1954, respectively. Plant communities with *Pinus halepensis* were recorded only on the islet of Oxeia, belonging to the class *Quercetea ilicis*. The halophytic communities that have been observed on the rocky coasts of most of the islets are assigned to the class *Crithmo-Staticetea* Braun-Blanq. in Braun-Blanq. & al. 1952.

### 2. Annotated floristic inventory

The plant list presented here (see Appendix) includes species and subspecies, with their life-form and chorological categories, of the flora of the individual islets of the Echinades group. Repeated field trips were carried out between 2007 and 2012 in different seasons of the year in order to acquire an integrated knowledge of the flora of the Echinades islets.

Taxa mentioned for the islet of Oxeia by Christodoulakis & al. (1998), and for the Echinades islet group by Gutermann (1995), are also included in the plant list after nomenclatural adaptations, where necessary. Families, genera, species and subspecies are given in alphabetical order within the higher groups pteridophytes, gymnosperms and angiosperms. For simplicity, the term ''taxa'' is used hereafter for both species and subspecies (when a species has more than one subspecies) as in Dimopoulos & al. (2013). The plant collections are deposited in Agrinio (W Greece) at the herbarium of the Department of Environmental and Natural Resources Management, Laboratory of Ecology and Nature Conservation.

Nomenclature and life-form and chorological categories follow Dimopoulos & al. (2013). For the determination of the plant material, Tutin & al. (1968–1980, 1993), Pignatti (1982) and Strid & Tan (1997, 2002) were used. The status of the recorded endemic taxa is based on Georghiou & Delipetrou (2010).

### 3. Floristic similarity analysis

Floristic similarity of the islets per pair (beta-diversity) was calculated using the Sørensen similarity coefficient (Sørensen 1948): $Cs = 2j / (a + b)$, where, j = the number of taxa common to both islets, a = the number of taxa recorded from islet 1, b = the number of taxa recorded from islet 2. In addition, the proportion of islets on which a taxon occurs was calculated. The dendrogram presenting floristic relations between the Echinades islets is based on the hierarchical cluster analysis using Statistica 6 (StatSoft, Inc. 2001).

### 4. Statistical analysis of the factors affecting plant species richness

Geographical data concerning surface area (A), highest elevation (E) and minimum distance to the nearest mainland (Dm) were determined by open-access digital topographic maps (1: 50000 scale) of the Hellenic Military Geographical Service.

The relationships between plant species richness and the geographical variables affecting it were tested using simple and multiple linear regression analyses and the Spearman correlation coefficient. All regressions and the estimations of parameters were carried out with Statistica 6 (StatSoft, Inc. 2001).

## Results

### 1. Floristic inventory and analysis

Previous literature information revealed 195 vascular plant taxa so far reported for only one of the Echinades islets, the islet of Oxeia (Christodoulakis & al. 1988) and seven more taxa reported by Gutermann (1995) for the Echinades islet group. Our own field investigations on the 19 of the 20 Echinades islets, for the first time for 18 of them, added 184 plant taxa for the whole area, and a further 56 taxa as new to the islet of Oxeia. *Astragalus epiglottis* L., found only on the islet of Labrino, is also a new record for the Ionian Islands (IoI) phytogeographical region.

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Table 2. Numbers of vascular plant taxa in the flora of the Echinades islet group.

| | Families | Genera | Species | Subspecies | Taxa | % |
|---|---|---|---|---|---|---|
| Pteridophytes | 6 | 8 | 8 | 0 | 8 | 2.1 |
| Gymnosperms | 3 | 3 | 3 | 1 | 4 | 1.0 |
| Angiosperms | 62 | 237 | 345 | 29 | 374 | 96.9 |
| Total | 71 | 248 | 356 | 30 | 386 | 100.0 |

Table 3. Life forms in the flora of the Echinades islet group.

| Life-form category | Number of taxa | % |
|---|---|---|
| Phanerophytes | 37 | 9.7 |
| Chamaephytes | 29 | 7.6 |
| Hemicryptophytes | 68 | 17.9 |
| Geophytes | 36 | 9.4 |
| Therophytes | 211 | 55.4 |

Table 4. Chorological spectrum of the flora of the Echinades islet group.

| Chorological category | Number of taxa | % |
|---|---|---|
| **1. Widespread taxa** | **88** | **23.2** |
| Cosmopolitan | 16 | 4.2 |
| Subtropical-tropical | 8 | 2.1 |
| European | 1 | 0.3 |
| Euro-Siberian | 6 | 1.6 |
| European-SW Asian | 37 | 9.7 |
| Paleotemperate | 19 | 5.0 |
| Circumtemperate | 1 | 1.3 |
| **2. Mediterranean taxa** | **268** | **70.5** |
| East Mediterranean | 24 | 6.3 |
| Mediterranean | 168 | 44.2 |
| Mediterranean-Atlantic | 10 | 2.6 |
| Mediterranean-European | 28 | 7.4 |
| Mediterranean-SW Asian | 38 | 10.0 |
| **3. Balkan taxa** | **16** | **4.2** |
| Balkan | 6 | 1.6 |
| Balkan-Italian | 5 | 1.3 |
| Balkan-Anatolian | 5 | 1.3 |
| **4. Endemic Taxa** | **3** | **0.8** |
| Greek endemic | 1 | 0.3 |
| Ionian endemic | 2 | 0.5 |
| **5. Alien taxa** | **5** | **1.3** |

Table 5. Results of simple regressions for the dependent variable S with A, E, and Dm as independent variables. – Abbreviations are as in Table 1.

| Simple regressions | R | $R^2$ | P | z |
|---|---|---|---|---|
| logS – logA | 6 | 8 | <0.0001 | 0.236 |
| logS – logE | 3 | 3 | <0.0001 | 0.472 |
| lohS –logDm | 62 | 237 | <0.0005 | |

The vascular plant diversity of the 19 Echinades islets comprises 386 taxa, belonging to 71 families, 248 genera, 356 species and 30 subspecies (Table 2). Eight of the taxa are pteridophytes, four are gymnosperms and 374 are angiosperms.

More than one-third (37.6 %) of the taxa found on the Echinades islets belong to three families: *Poaceae* (52 taxa), *Fabaceae* (49 taxa) and *Asteraceae* (44 taxa). Also well represented are the families *Apiaceae* (20 taxa), *Lamiaceae* (16 taxa), *Caryophyllaceae* (15 taxa) and *Brassicaceae* (14 taxa), representing 16.9 % of the total flora. For the life-form spectrum see Table 3, for the chorological spectrum see Table 4.

Four neophytes and one archaeophyte, according to Arianoutsou & al. (2010), are present in the flora of the Echinades islets, viz. *Lepidium didymum* L., *Oxalis pes-caprae* L., *Phalaris canariensis* L., *Veronica persica* Poir. and *Brassica napus* L., respectively.

The endemic element comprises three taxa, viz. *Teucrium halacsyanum* Heldr. as a Greek endemic and *Limonium* cf. *saracinatum* R. Artelari and *Stachys ionica* Halácsy as Ionian endemics (although the latter was referred to as an ambiguous taxon by Gutermann 1995).

## 2. Floristic similarity among the studied islets

Floristic cross-correlations (beta-diversity) between the studied islets by means of the Sørensen similarity coefficient revealed values (0.15–0.75) showing that the floras of the studied islets differ from each other from 25 % to 85 % (Fig. 2). The hierarchical cluster analysis showed that the island of Oxeia (islet 1), highest and second largest of the group, has a very different floristic composition compared to the other Echinades islets (Fig. 2). The other 18 islets are divided into two groups: the first group comprises most of the very small islets, viz. the southern Echinades islets (islets 2–7) together with the two smaller northern Echinades islets (islets 9 and 16); the second group includes the larger of the northern islets (islets 8, 11–15, 17 and 19) and the islet of Petalas (islet 18, the largest of all).

Concerning the number of islets on which each taxon occurs, 26 % of the taxa occur on only one of the 19 studied islets, 12.2 % of the taxa occur on only two of the islets and 9.4 % of the taxa occur on only three of the islets. Only 0.8 % of the taxa were found on all 19 studied islets, while 3.1 % of the taxa were found on 17 or 18 of the islets. The most common plant taxa recorded on the Echinades islets are: *Asparagus acutifolius* L., *Lotus cytisoides* L. and *Parapholis incurva* (L.) C. E. Hubb. (on all 19 studied islets) and *Allium subhirsutum* L., *Brachypodium retusum* (Pers.) P. Beauv., *Dactylis glomerata* L., *Euphorbia dendroides* L. and *Pistacia lentiscus* L. (on 18 of the islets).

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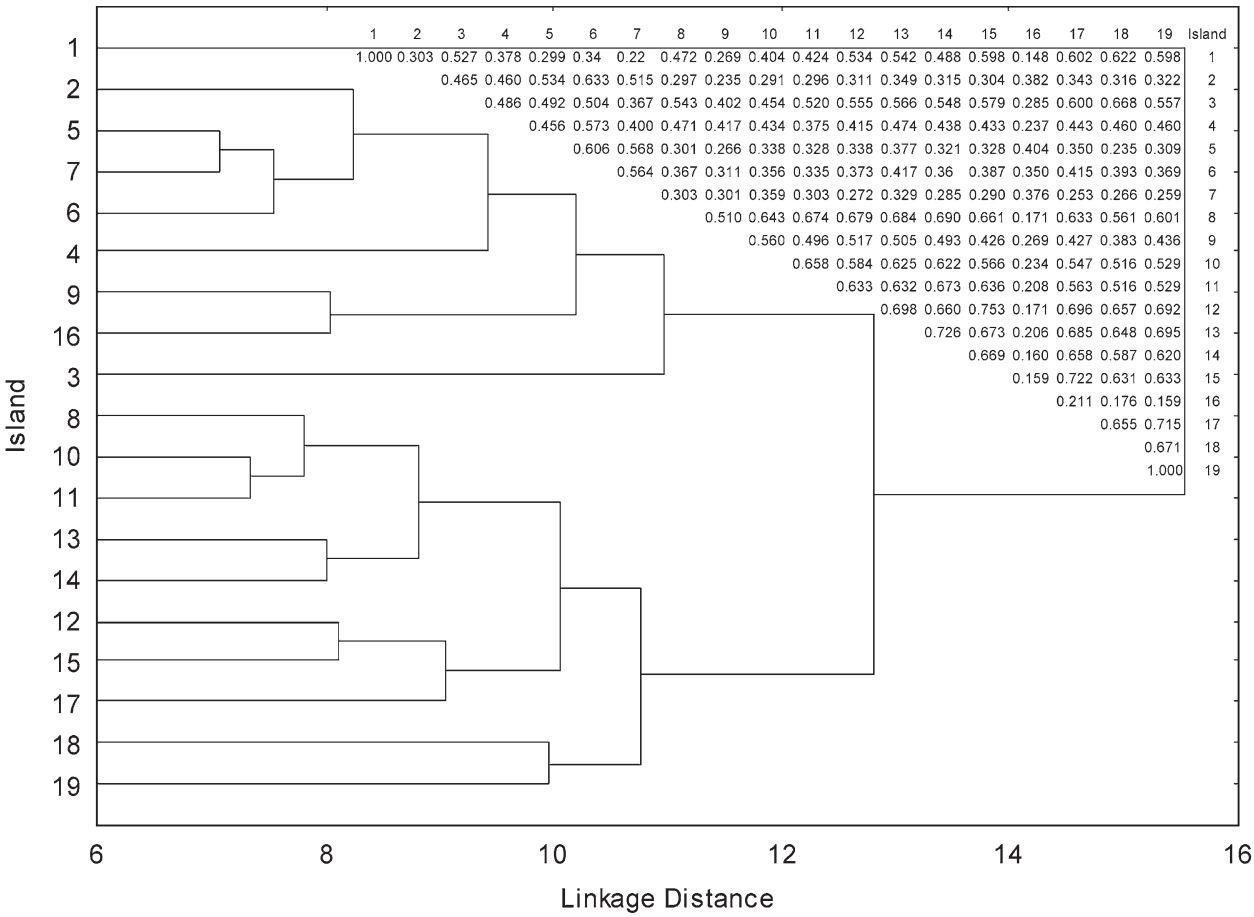



Fig. 2. Hierarchical cluster analysis showing floristic relations between the Echinades islets (linkage method: complete linkage. Euclidean distances). The table on the upper right side of the dendrogram presents floristic cross-correlations (beta-diversity) between the studied islets by means of the Sørensen similarity coefficient. – Abbreviations are as in Table 1.

### 3. Statistical analysis of the factors affecting plant species richness

The Spearman correlation coefficient was calculated among biogeographical factors to evaluate multi-colinearity of these predictor variables. Surface area (A) and elevation (E) are strongly correlated (R = 0.954), while minimum distance to nearest mainland (Dm) is negatively correlated to A (R = –0.732) and E (R = 0.651).

The results of simple regression analyses (log-log) of plant species richness with the predictor variables are shown in Table 5. Simple regression analyses indicated the combined effect of the island surface area ($R^2$ = 0.837) and elevation ($R^2$ = 0.828) as predictor variables of species richness. Distance to the mainland explains a lower amount of the variation ($R^2$ = 0.367). Fig. 3 presents the logarithmic species-area relationship (SAR) for the Echinades islet group with the equation logS = log1.659 + 0.236 logA. The SAR model explains 83.7 % of the variability of species richness, with a Spearman correlation coefficient R = 0.916. Stepwise multiple regression analyses were conducted among the number of plant taxa and the set of the studied biogeographical factors.

## Discussion

The flora of the Echinades islet group comprises 386 plant taxa belonging to 71 families and 248 genera. Of the taxa recorded, 37.6 % belong to the families *Asteraceae*, *Fabaceae* and *Poaceae*, which are among the best-adapted families to the ecological conditions of the Mediterranean area, as is confirmed by many floristic studies of Greek insular areas (Panitsa & Tzanoudakis 2001, 2010; Kougioumoutzis & al. 2012; etc.).

The high percentage of Mediterranean taxa (70.5 %; Table 4) in conjunction with the high percentage of therophytes (55.4 %; Table 3) reflect the Mediterranean character of the flora of the Echinades islet group. At present, the local natural ecosystems are not endangered by the invasion of alien taxa, the percentage of which (1.3 %; Table 4) ranges well below the one recorded for the Greek flora as a whole (5 % according to Arianoutsou & al. 2010; 3.8 % according to Dimopoulos & al. 2013).

Panitsa & Tzanoudakis (2010) stated that the number of species per surface unit (alpha-diversity) is an important parameter that highlights the role of small islands in the conservation of the diversity of the East Aegean area. The Echinades islet group hosts a high number of

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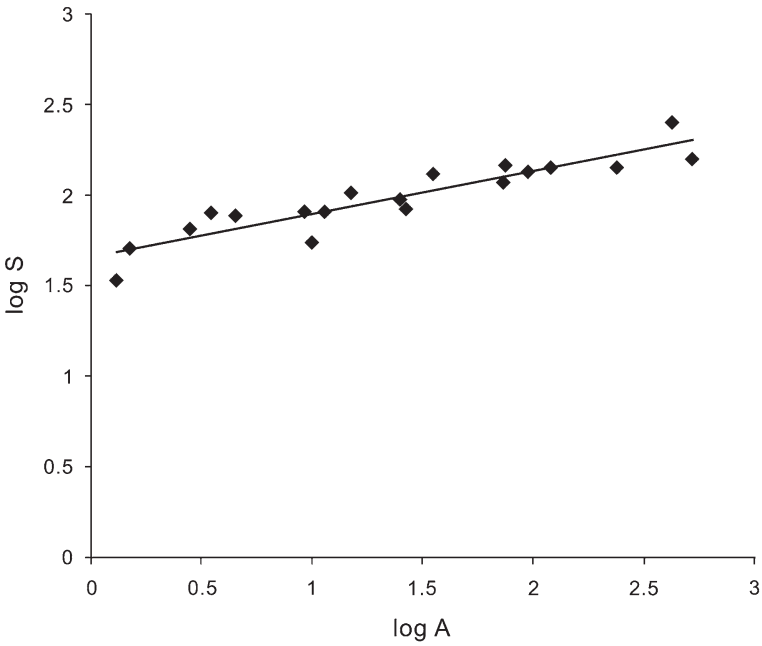



Fig. 3: Plant species-area relationship (SAR) of the Echinades islets (logS = 1.659 + 0.236 logA, $R^2$ = 0.837).

taxa per surface unit (22.2 taxa/km$^2$), as is also the case in the East Aegean islet groups of Arki and Lipsi (21.2 taxa/km$^2$) (Panitsa & Tzanoudakis 2001). Within island biogeography, species richness on different islands is likely to be particularly affected by species richness on the mainland and by the degree of inter-island dispersal (Bunnefeld & Phillimore 2012).

Floristic cross-correlations of the studied islets (beta-diversity) according to the Sørensen similarity coefficient revealed values from 0.15, indicating high floristic heterogeneity, to 0.75, showing significant floristic similarity. Overall heterogeneity, expressed by Sørensen similarity coefficient values, was slightly higher for East Aegean islet groups (Panitsa & Tzanoudakis 1998, 2001). Hierarchical cluster analysis divided the Echinades islets into two subgroups plus the island of Oxeia mainly based on surface area, elevation and the geographical position of the islets within the whole islet group. Furthermore, when the number of islets on which each taxon occurs is considered, 23 % of the taxa occur on more than half of the studied islets, while 26 % of the taxa occur on only one of the islets. The flora – as well as the fauna – of the Ionian Islands are far more "harmonic", i.e. without profound gaps in their taxonomic composition, since the biota of the Ionian Islands are very similar to those of the adjacent mainland, although few endemic taxa can be found, most of which live on the larger and more heterogeneous islands (Triantis & Mylonas 2009).

The very low proportion (0.5 %) of the Ionian endemic plant taxa of the Echinades and the absence of local endemics could be attributed to the relatively recent isolation of the islets from the mainland. According to Perissoratis and Conispoliatis (2003), the coastline was up to 10 km offshore during latest Pleistocene at 21 500 cal yr BP (sea level at −120 m). Many shelf islands in the Ionian area were connected with each other and/or with the mainland. At 11 800 cal yr BP (sea level at −60 m) the significant sea-level rise had greatly modified the previous coastal configuration in all sectors of the Ionian area, and in the area studied the coastline had retreated to a distance of less than 2 km from today's position. Coastal plains existed at that period in the same areas as before, but most of the islands had obtained their present shape. Finally, at 8000 cal yr BP the coastal configuration was much like that of today. The eustatic sea-level fluctuations driven by glacial/interglacial cycles of the Pleistocene have repeatedly increased and decreased the surface areas of the islands and coastal areas, temporarily shortening the distances between islands and between islands and mainland areas, favouring colonization events (Blondel & al. 2010).

The investigation of other factors such as surface area, highest elevation and minimum distance to the nearest mainland showed that for the Echinades islet group the total species richness is strongly correlated to island surface area and to the interaction between surface area and highest elevation. There is a strong species-area relationship ($R^2$ = 0.837, z = 0.236) as was also found for the islands of the South Aegean ($R^2$ = 0.73, z = 0.39) by Kagiampaki & al. (2011). Panitsa & al. (2006, 2010) and Panitsa & Tzanoudakis (2010) found a strong species-area relationship ($R^2$ = 0.893) for the large islands of the East Aegean area, a striking species-area relationship for the East Aegean Leros islet group consisting of a central large and 16 offshore islets ($R^2$ = 0.435), and a significant species-area relationship ($R^2$ = 0.323, z = 0.40) for Aegean islets of a surface area less than 0.05 km$^2$. In general, surface area is the most influential variable contributing to species richness (Whittaker & Fernández-Palacios 2007; Triantis & al. 2008a, 2008b).

The logarithmic approach of the power function (S = cAz) of Arrhenius's model (1921) shows higher slopes for "island"-like species-area relationships than "mainland" relationships according to Rosenzweig (1995). This logarithmic model best explains the variation in species richness (Willerslev & al. 2002). The z-value of the species-area relationship for the Echinades islet group is 0.236, very close to the "canonical" value of 0.263 set up by Preston (1962) and MacArthur & Wilson (1967) and also within the range of 0.2–0.5 proposed by Rosenzweig (1995) for island groups. The slope (z-value) shows the increase rate of species richness with surface area, and it can vary according to the examined geographical unit and the taxonomic group analysed (Duarte & al. 2008; MacArthur & Wilson 1967).

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The distance to the nearest mainland explains c. 37 % of the plant species richness and this is in accordance with the paleogeography of the area studied. These results are similar to those of Kallimanis & al. (2010), who found that distance from the mainland exhibited limited predictive value also in the Aegean area.

As a conclusion, the present study showed that the Echinades islet group hosts a significant plant species richness and a high overall heterogeneity. The role of geological history, paleogeography, and of variables such as surface area, elevation and distance from the mainland determines the individual islet floras. Knowledge of the biodiversity of protected areas is necessary in order to propose and implement proper measures for the conservation management of species and habitats. From this point of view, the inventory of the plant species diversity of the Echinades islet group, the exploration of plant species-richness patterns and of the effects of factors affecting them, fills a gap in the floristic information available for the "National Park of Mesolongi – Aitoliko lagoons, estuaries of Acheloos and Evinos River and Echinades islet group" and the Ionian landbridge islands system.

From a nature conservation related point of view, the determining factor of human interference should also be underlined, since previous studies (Panitsa & Tzanoudakis 1998, 2001; Bergmeier & Dimopoulos 2003; Snogerup & Snogerup 2004; Panitsa & al. 2006, 2008) indicated that even traditional, low-intensity human practice affects significantly the processes shaping plant communities on single, isolated islets by increasing total species richness but decreasing overall heterogeneity.

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## Appendix. – Vascular plant catalogue

Symbols and abbreviations:

Life-form categories (following Dimopoulos & al. 2013): **C** = chamaephyte; **H** = hemicryptophyte; **G** = geophyte; **P** = phanerophyte; **T** = therophyte.

Chorological categories (following Dimopoulos & al. 2013): **BA** = Balkan-Anatolian; **BI** = Balkan-Italian; **Bk** = Balkan; **Co** = Cosmopolitan; **Ct** = Circumtemperate; **EA** = European-SW Asian; **EM** = East Mediterranean; **Eu** = European; **ES** = Euro-Siberian; **MA** = Mediterranean-Atlantic; **Me** = Mediterranean; **ME** = Mediterranean-European; **MS** = Mediterranean-SW Asian; **Pt** = Paleotemperate; **ST** = Subtropical-tropical.

**1**–**19** = islet numbers; see Table 1.

**E** = Taxon reported by Gutermann (1995) for the Echinades islet group without specifying individual islet(s).

**[ ]** = Alien taxa according to Arianoutsou & al. (2010).

### Pteridophytes

***Aspleniaceae***

*Asplenium ceterach* L. – H, EA; 1, 9, 10, 12, 13, 17, 18, 19.

***Dennstaedtiaceae***

*Pteridium aquilinum* (L.) Kuhn – G, Co; 1.

***Dryopteridaceae***

*Dryopteris pallida* (Bory) Maire & Petitm. – G, Me; 1.

***Polypodiaceae***

*Polypodium cambricum* L. – H, Me; 1, 12, 15, 18.

***Pteridaceae***

*Adiantum capillus-veneris* L. – G, ST; 1.

*Allosorus acrosticus* (Balb.) Christenh. – H, Me; 19.

*Anogramma leptophylla* (L.) Link – T, Co; 1.

***Selaginellaceae***

*Selaginella denticulata* (L.) Spring – C, Me; 1.

### Gymnosperms

***Cupressaceae***

*Juniperus oxycedrus* subsp. *deltoides* (R. P. Adams) N. G. Passal. – P, EM; 1.

*Juniperus phoenicea* L. – P, Me; 1, 3, 5, 6, 13, 14, 16, 18.

***Ephedraceae***

*Ephedra foeminea* Forssk. – P, Me; 1, 2, 6, 7, 18.

***Pinaceae***

*Pinus halepensis* Mill. – P, Me; 1.

### Angiosperms

***Alliaceae***

*Allium ampeloprasum* L. – G, Me; 2, 3, 5, 6, 7, 11, 12, 13, 14, 16, 17.

*Allium subhirsutum* L. – G, Me; 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19.

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***Amaryllidaceae***
*Narcissus tazetta* L. – G, MS; 5, 7, 10.
*Pancratium maritimum* L. – G, Me; 3.
*Sternbergia lutea* Spreng. – G, MS; 2.

***Anacardiaceae***
*Pistacia lentiscus* L. – P, Me; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Pistacia terebinthus* L. – P, Me; 1, 5, 10, 16, 17, 18.

***Apiaceae***
*Bubon macedonicum* L. – H, BI; 11.
*Bunium ferulaceum* Sm. – G, EM; 4, 10, 13, 14, 15, 17, 18.
*Bupleurum glumaceum* Sm. – T, Bk; 1, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Crithmum maritimum* L. – C, ME; 1, 2, 3, 5, 7, 8, 11, 13, 14, 15.
*Daucus carota* L. – H, Pt; 1, 5, 7, 13, 18.
*Daucus guttatus* Sm. – T, Me; 1, 6, 8, 10, 11, 12, 13, 14, 15, 17, 19.
*Daucus involucratus* Sm. – T, EM; 14.
*Eryngium maritimum* L. – G, ME; E.
*Ferula communis* subsp. *glauca* (L.) Rouy & Camus – H, Me; 2, 3, 5, 6, 7, 16.
*Lagoecia cuminoides* L. – T, Me; 1, 8, 11, 12, 13, 15, 17, 18, 19.
*Opopanax chironium* (L.) W. D. J. Koch – H, ME; 1, 2.
*Opopanax hispidus* (Friv.) Griseb. – H, MS; 8.
*Orlaya daucoides* (L.) Greuter – T, MS; 1, 14, 18.
*Pseudorlaya pumila* (L.) Grande – T, Me; 2.
*Scaligeria napiformis* (Spreng.) Grande – H, EM; 1, 3, 4, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Scandix pecten-veneris* L. – T, EA; 1.
*Tordylium apulum* L. – T, Me; 1, 3, 15, 18.
*Tordylium officinale* L. – T, Me; 1, 13, 14, 15, 17, 19.
*Torilis arvensis* (Huds.) Link – T, ME; 1, 4, 13, 18.
*Torilis nodosa* (L.) Gaertn. – T, EA; 1, 2, 3, 4, 6, 12, 13, 17, 18, 19.

***Araceae***
*Arisarum vulgare* O. Targ. Tozz. – G, Me; 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19.
*Arum italicum* Mill. – G, ME; 1, 4, 5, 6, 9, 12, 15, 17, 19.

***Aristolochiaceae***
*Aristolochia* sp. – 19.

***Asparagaceae***
*Asparagus acutifolius* L. – P, Me; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19.

***Asphodelaceae***
*Asphodelus ramosus* L. – G, Me; 1, 10, 11, 12, 15, 18.

***Asteraceae***
*Aetheorhiza bulbosa* (L.) Cass. – G, Me; 15, 17, 19.
*Anthemis arvensis* subsp. *incrassata* (Loisel.) Nyman – T, Me; 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 14, 15, 17, 18, 19.
*Anthemis chia* L. – T, Me; 1, 17, 19.
*Atractylis cancellata* L. – T, Me; 13, 17.
*Calendula arvensis* L. – T, ME; 1, 2, 6, 13, 17, 18, 19.
*Carduus pycnocephalus* L. – H, ME; 1, 3, 4, 5, 6, 11, 15, 16, 17.
*Carlina corymbosa* subsp. *graeca* (Heldr. & Sart.) Nyman – H, BA; 9, 13.
*Carlina gummifera* (L.) Less. – H, Me; 3, 8.
*Carthamus lanatus* L. – T, Me; 3, 4.
*Centaurea cyanus* L. – T, Me; 1, 18.
*Crepis dioscoridis* L. – T, BA; 1.
*Crepis foetida* L. – T, ME; 1.
*Crepis neglecta* subsp. *corymbosa* (Ten.) Nyman – T, BI; 1, 2, 3, 4, 8, 17, 18, 19.
*Crepis neglecta* L. subsp. *neglecta* – T, BI; 1.
*Crepis zacintha* (L.) Loisel. – T, EA; 8, 12, 13, 14, 15, 19.
*Crupina crupinastrum* (Moris) Vis. – T, EA; 11, 12, 14, 15, 17, 18.
*Dittrichia viscosa* (L.) Greuter – H, Me; 1.
*Filago gallica* L. – T, MA; 8, 12, 13, 14, 15, 17, 19.
*Filago germanica* (L.) Huds. – T, Pt; 1, 4, 8, 9, 10, 13, 15, 17, 18, 19.
*Filago pygmaea* L. – T, Me; 1, 8, 12, 13, 17, 19.
*Filago pyramidata* L. – T, Me; 1, 8, 11, 14, 15, 19.
*Galactites tomentosus* Moench – H, Me; 1, 2, 4, 5, 6, 18.
*Geropogon hybridus* (L.) Sch. Bip. – H, Me; 1, 3, 18.
*Hedypnois rhagadioloides* (L.) F. W. Schmidt – T, Me; 1, 3, 4, 8, 12, 13, 14, 15, 17, 18, 19.
*Helichrysum stoechas* subsp. *barrelieri* (Ten.) Nyman – C, Me; 1.
*Hyoseris scabra* L. – T, Me; 4, 19.
*Hypochaeris achyrophorus* L. – T, Me.; 1, 3, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Inula verbascifolia* subsp. *aschersoniana* (Janka) Tutin – C, BA.; 1.
*Jacobaea maritima* subsp. *bicolor* (Willd.) B. Nord. & Greuter – C, Me; 1.
*Lactuca tuberosa* Jacq. – H, EA; 1.
*Leontodon tuberosus* L. – H, Me; 1.
*Limbarda crithmoides* (L.) Dumort. – C, MA; 1, 3, 5, 15, 16.
*Pallenis spinosa* (L.) Cass. – T, Me; 1, 14, 18.
*Phagnalon rupestre* subsp. *graecum* (Boiss. & Heldr.) Batt. – C, Me; 1, 3, 10, 11, 12, 13, 14, 15, 18, 19.
*Ptilostemon chamaepeuce* (L.) Less. – C, EM; 1, 7.
*Pulicaria odora* (L.) Rchb. – H, Me; 1, 12, 13, 14, 18, 19.
*Reichardia picroides* (L.) Roth – H, Me; 1, 3, 8, 9, 11, 13, 15, 16, 17, 18.
*Rhagadiolus stellatus* (L.) Gaertn. – T, Me; 1, 15, 17.
*Scolymus hispanicus* L. – H, ME; 8, 10, 11, 13, 15.
*Senecio vulgaris* L. – T, Pt; 2, 6.
*Silybum marianum* (L.) Gaertn. – H, Me; 1, 2, 4, 6, 8.
*Sonchus asper* subsp. *glaucescens* (Jord.) Ball – T, Pt; 2, 3, 4, 5, 6, 13.

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*Sonchus oleraceus* L. – T, ME; 2, 3, 4, 5, 6, 7, 16.
*Urospermum picroides* (L.) F. W. Schmidt – T, Me; 1, 3, 4, 5, 6, 8, 10, 11, 12, 13, 15, 17, 18, 19.

***Boraginaceae***
*Anchusella cretica* (Mill.) Bigazzi, Nardi & Selvi – T, Me; 9, 10, 13, 14, 18, 19.
*Cerinthe retorta* Sm. – T, BA; 1, 18.
*Cynoglossum columnae* Ten. – T, Me; 1.
*Echium parviflorum* Moench – T, Me; 3, 4, 5, 6, 7, 17, 19.
*Echium plantagineum* L. – T, ME; 1, 2, 4, 5.
*Heliotropium europaeum* L. – T, ME; 2, 6, 16.
*Neatostema apulum* (L.) I. M. Johnst. – T, Me; 1, 4, 8, 9, 11, 12, 13, 14, 15, 18.

***Brassicaceae***
*Arabis* sp. no. 1 – 2.
*Arabis* sp. no. 2 – 15.
*Biscutella didyma* L. – T, Me; 1, 3, 8, 12, 13, 14, 15, 17, 18.
[*Brassica napus* L]. – T; 5, 6, 7.
*Cakile maritima* Scop. – T, ME; 1, 16.
*Calepina irregularis* (Asso) Thell. – T, MS; 2.
*Capsella bursa-pastoris* (L.) Medik. – H, Co; 1, 2, 4, 6.
*Hirschfeldia incana* (L.) Lagr.-Foss. – H, EA; 4, 5, 6.
[*Lepidium didymum* L.] – T, [South American]; 2.
*Lunaria annua* L. – H, BI; 1, 6.
*Malcolmia flexuosa* (Sm.) Sm. – T, EM; 1.
*Malcolmia maritima* (L.) R. Br. – T, Me; 1, 3, 6, 7, 8, 12, 13, 15, 17, 18.
*Rapistrum rugosum* (L.) All. – T, EA; 2.
*Sisymbrium officinale* (L.) Scop. – T, ES; 2, 6, 18.

***Campanulaceae***
*Campanula erinus* L. – T, ME; 1, 12, 15, 19.
*Campanula spatulata* Sm. – T, Bk; 1.
*Legousia hybrida* (L.) Delarbre – T, EA; 1, 18.
*Legousia speculum-veneris* (L.) Chaix – T, ME; 1, 4.

***Capparaceae***
*Capparis orientalis* Veill. – P, Me; 2, 5, 6, 7, 11, 15, 16.

***Caprifoliaceae***
*Lonicera etrusca* Santi – P, Me; 1.
*Lonicera implexa* Aiton – P, Me; 1, 14, 15, 17.

***Caryophyllaceae***
*Arenaria leptoclados* (Rchb.) Guss. – T, EA; 1, 3, 8, 10, 11, 12, 13, 14, 17, 18, 19.
*Arenaria serpyllifolia* L. – T, EA; 1.
*Cerastium glomeratum* Thuill. – T, Co; 5.
*Cerastium glutinosum* Fr. – T, EA; 13, 17, 19.
*Cerastium semidecandrum* L. – T, EA; 3.
*Minuartia hybrida* (Vill.) Schischk. – T, EA; 1.
*Petrorhagia dubia* (Raf.) G. López & Romo – T, Me; 1.
*Petrorhagia saxifraga* (L.) Link – H, EA; 1.
*Polycarpon tetraphyllum* (L.) L. – T, MS; 4, 6, 9, 13, 14, 18, 19.
*Sagina maritima* G. Don – T, MA; 13.
*Silene nocturna* L. – T, Me; 1, 17, 19.
*Silene sedoides* Poir. – T, Me; 1, 2, 3, 6, 7, 8, 9, 11, 13, 14, 15, 17, 18, 19.
*Silene vulgaris* subsp. *macrocarpa* Turrill – H, Me; 3, 15.
*Silene* sp. – 12.
*Spergularia salina* J. Presl & C. Presl – T, Pt; 2.

***Chenopodiaceae***
*Arthrocnemum macrostachyum* (Moric.) K. Koch – C, Me; 7, 10.
*Atriplex prostrata* DC. – T, ES.; 1, 2, 3, 5, 11, 12, 13, 15, 16, 17, 19.
*Beta vulgaris* subsp. *maritima* (L.) Arcang. – H, EA; 1, 2, 3, 5, 6, 7, 9, 10, 15, 17.
*Chenopodiastrum murale* (L.) S. Fuentes & al. – T, EA.; 2, 3, 6, 16.
*Halimione portulacoides* (L.) Aellen – C, ME; 2, 3, 5, 7.
*Oxybasis chenopodioides* (L.) S. Fuentes & al. – T, ES; 2, 3, 4, 18.
*Salsola soda* L. – T, Pt; 1, 3.
*Sarcocornia perennis* (Mill.) A. J. Scott – C, MA; 3, 9, 15.
*Suaeda maritima* (L.) Dumort. – T, EA; 3.

***Cistaceae***
*Cistus creticus* L. – P, Me; 1, 10, 11, 12, 13, 14, 15, 17, 18.
*Cistus salviifolius* L. – P, Me; 1, 4, 8, 9, 10, 11, 12, 13, 14, 15, 17, 19.
*Fumana arabica* (L.) Spach – C, Me; 1, 2, 8, 10, 11, 12, 13, 14, 15, 17, 19.
*Fumana thymifolia* (L.) Webb – C, Me; 1, 4, 13, 14, 15, 17, 19.
*Tuberaria guttata* (L.) Fourr. – T, MA; 1.

***Convolvulaceae***
*Calystegia silvatica* (Kit.) Griseb. – H, MS; E.
*Convolvulus arvensis* L. – G, Co; 2, 3.
*Convolvulus cantabrica* L. – H, MS; 14.
*Convolvulus elegantissimus* Mill. – H, Me; 1, 3, 8, 9, 10, 11, 12, 13, 14, 15, 18, 19.
*Cressa cretica* L. – C, ST; 9.
*Cuscuta palaestina* Boiss. – T, Me; 13.

***Crassulaceae***
*Phedimus stellatus* (L.) Raf. – T, Me; 12, 15, 17, 18.
*Sedum hispanicum* L. – T, EA; 1, 3, 4, 8, 15, 18.
*Sedum litoreum* Guss. – T, Me; 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Umbilicus chloranthus* Boiss. – G, Me; 1, 15, 17.
*Umbilicus horizontalis* (Guss.) DC. – G, Me; 1, 2, 4, 6, 7.

***Cyperaceae***
*Carex distachya* Desf. – H, Me; 17, 18.
*Carex divisa* Huds. – G, EA; 1, 8, 15, 17.

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*Carex flacca* subsp. *serrulata* (Biv.) Greuter – G, MS; 9, 10, 12, 15, 17.

***Dipsacaceae***
*Knautia integrifolia* (L.) Bertol. – T, Me; 1, 3, 5, 12, 18.

***Ericaceae***
*Arbutus unedo* L. – P, Me; 1, 14, 17.

***Euphorbiaceae***
*Euphorbia acanthothamnos* Boiss. – C, EM; 14.
*Euphorbia dendroides* L. – P, Me; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Euphorbia exigua* L. – T, ME; 1, 2, 8, 11, 12, 13, 14, 15, 17, 18, 19.
*Euphorbia helioscopia* L. – T, Co; 1, 17.
*Euphorbia paralias* L. – C, Me; 1.
*Euphorbia peplus* L. – T, Co; 1, 3.
*Euphorbia taurinensis* All. – T, EA; 1.
*Mercurialis annua* L. – T, Pt; 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 16, 17, 18, 19.

***Fabaceae***
*Anagyris foetida* L. – P, Me; 15.
*Anthyllis hermanniae* L. – C, Me; 1.
*Anthyllis vulneraria* subsp. *rubriflora* (DC.) Arcang. – H, Me; 1, 11, 12, 13, 14, 15, 17.
*Astragalus hamosus* L. – T, MS; 6, 12, 15.
*Astragalus pelecinus* (L.) Barneby – T, Me; 1, 19.
*Astragalus epiglottis* L. – T, Me; 13.
*Bituminaria bituminosa* (L.) C. H. Stirt. – H, Me; 1, 5, 18, 19.
*Calicotome villosa* (Poir.) Link – P, Me; 1, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Coronilla valentina* subsp. *glauca* (L.) Batt. – P, Me; 1.
*Hippocrepis emerus* subsp. *emeroides* (Boiss. & Spruner) Lassen – P, EM; 1, 10, 11, 14, 15, 17.
*Hippocrepis unisiliquosa* L. – T, Me; 1.
*Hymenocarpos circinnatus* (L.) Savi – H, Me; 1, 12, 13, 15, 18, 19.
*Lathyrus aphaca* L. – T, MS; 1, 3, 18, 19.
*Lens ervoides* (Brign.) Grande – T, Me; 19.
*Lotus cytisoides* L. – C, Me; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19.
*Lotus edulis* L. – T, Me; 1, 3, 12, 17, 18, 19.
*Lotus ornithopodioides* L. – T, Me; 1, 17, 18, 19.
*Lupinus angustifolius* L. – T, Me; 3.
*Medicago coronata* (L.) Bartal. – T, MS; 1.
*Medicago disciformis* DC. – T, Me; 3, 18.
*Medicago minima* (L.) Bartal. – T, Pt; 1, 14, 15, 19.
*Medicago orbicularis* (L.) Bartal. – T, MS; 1, 12, 18, 19.
*Medicago polymorpha* L. – T, Pt; 12, 18.
*Medicago rigidula* (L.) All. – T, MS; 3.
*Medicago rugosa* Desr. – T, Me; 1.
*Medicago truncatula* Gaertn. – T, MS; 1, 3, 14, 17, 18, 19.
*Medicago tuberculata* (Retz.) Willd. – T, Me; 18.
*Melilotus indicus* (L.) All. – T, EA; 2, 6.
*Melilotus sulcatus* Desf. – T, Me; 7.
*Ononis reclinata* L. – T, ME; 1, 12, 13, 15, 18, 19.
*Ononis viscosa* subsp. *breviflora* (DC.) Nyman – T, Me; 12.
*Scorpiurus muricatus* L. – T, Me; 1, 3, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Securigera securidaca* (L.) Degen & Dörfl. – T, Me; 1, 15.
*Spartium junceum* L. – P, Me; 2.
*Tetragonolobus purpureus* Moench – T, Me; 1, 3, 18, 19.
*Trifolium angustifolium* L. – T, EA; 1, 3, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Trifolium arvense* L. – T, Pt; 8, 10, 11, 12, 13, 14, 15, 17, 19.
*Trifolium boissieri* Guss. – T, EM; 1.
*Trifolium campestre* Schreb. – T, EA; 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Trifolium lappaceum* L. – T, MS; 1, 13, 15, 18.
*Trifolium nigrescens* Viv. – T, Me; 1, 19.
*Trifolium scabrum* L. – T, EA; 1, 3, 5, 8, 11, 12, 13, 14, 15, 17, 18, 19.
*Trifolium stellatum* L. – T, Me; 1, 3, 8, 9, 12, 13, 15, 17, 19.
*Trigonella corniculata* subsp. *balansae* (Boiss. & Reut.) Lassen – T, EM; 3, 5, 6, 8, 17.
*Trigonella corniculata* (L.) L. subsp. *corniculata* – T, Me; 1, 10.
*Tripodion tetraphyllum* (L.) Fourr. – T, Me; 1, 3, 9, 11, 12, 13, 14, 15, 17, 18, 19.
*Vicia angustifolia* L. – T, Pt; 1, 3, 8, 11, 12, 15, 18, 19.
*Vicia pubescens* (DC.) Link – T, Me; 1, 12, 15.
*Vicia villosa* subsp. *microphylla* (d'Urv.) P. W. Ball – T, EM; 1, 2, 3, 5, 12, 13, 14, 15, 17, 18, 19.

***Fagaceae***
*Quercus coccifera* L. – P, Me; 1, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Quercus ilex* L. – P, Me; 1.

***Fumariaceae***
*Fumaria capreolata* L. – T, Me; 5, 16.
*Fumaria judaica* Boiss. – T, EM; 1, 2, 3, 4, 5, 6, 7.
*Fumaria macrocarpa* Parl. – T, Me; E.

***Gentianaceae***
*Blackstonia perfoliata* (L.) Huds. subsp. *perfoliata* – T, ME; 1, 3, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Centaurium erythraea* Rafn – H, EA; 1, 3, 9, 10, 13, 14, 17, 19.
*Centaurium pulchellum* (Sw.) Druce – T, EA; 1.
*Centaurium tenuiflorum* (Hoffmanns. & Link) Fritsch – T, ME; 1, 3, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.

***Geraniaceae***
*Erodium cicutarium* (L.) L'Hér. – T, Ct; 3, 4, 9, 16, 17, 19.
*Erodium malacoides* (L.) L'Hér. – T, MS; 1, 2, 3, 5, 6, 10, 16, 18.

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*Geranium purpureum* Vill. – T, Me; 1, 3, 4, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Geranium rotundifolium* L. – T, Pt; 1, 3, 4, 5, 6, 7, 10, 12, 13, 15, 18, 19.

***Hyacinthaceae***
*Bellevalia hyacinthoides* (Bertol.) K. Perss. & Wendelbo – G, Bk; 1.
*Drimia numidica* (Jord. & Fourr.) J. C. Manning & Goldblatt – G, Me; 1, 3, 4, 5, 8, 9, 11, 12, 13, 14, 15, 17, 18, 19.
*Muscari comosum* (L.) Mill. – G, ME; 1, 2, 3, 4, 5, 6, 11, 12, 13, 14, 15, 17, 18, 19.
*Ornithogalum collinum* Guss. – G, Me; E.
*Ornithogalum narbonense* L. – G, Me; 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19.

***Hypericaceae***
*Hypericum olympicum* L. – H, BA; E.
*Hypericum perfoliatum* L. – H, Me; 1.

***Iridaceae***
*Gladiolus italicus* Mill. – G, MS; 3, 15, 17, 18.
*Romulea bulbocodium* (L.) Sebast. & Mauri – G, Me; 1, 3, 5, 17, 18.

***Juncaceae***
*Juncus acutus* L. – H, EA; 3.

***Lamiaceae***
*Micromeria graeca* (L.) Rchb. – C, Me; 1, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Micromeria juliana* (L.) Rchb. – C, Me; 1, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Micromeria nervosa* (Desf.) Benth. – C, Me; 8, 9, 10, 11, 13, 14, 15, 17, 18.
*Phlomis fruticosa* L. – P, Me; 1, 2, 3, 4, 5, 6, 7, 8, 10, 13, 14, 15, 18.
*Prasium majus* L. – C, Me; 1, 2, 3, 5, 6, 7, 12, 14, 15, 17, 18, 19.
*Salvia fruticosa* Mill. – P, EM; 1, 8, 11, 18.
*Salvia verbenaca* L. – H, MA; 1, 8.
*Salvia viridis* L. – T, Me; 13, 17, 18, 19.
*Sideritis purpurea* Benth. – T, Bk; 1, 3, 4, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Stachys ionica* Halácsy – H, *(Ionian endemic); 1.
*Teucrium capitatum* L. – C, Me; 3, 8, 9, 11, 12, 13, 14, 18, 19.
*Teucrium divaricatum* Heldr. – C, EM; 1.
*Teucrium flavum* subsp. *hellenicum* Rech. f. – C, EM; 1, 18, E.
*Teucrium halacsyanum* Heldr. – C, *(Greek endemic); 1.
*Teucrium* sp. – H; 1, 3, 8, 13, 14, 17.
*Thymbra capitata* (L.) Cav. – C, Me; 1, 10, 17.

***Lauraceae***
*Laurus nobilis* L. – P, Me; 7, 16.

***Liliaceae***
*Lilium candidum* L. – G, EM; 2, 4, 14, 18.

***Linaceae***
*Linum bienne* Mill. – H, Me; 1.
*Linum corymbulosum* Rchb. – T, EA; 1, 3, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Linum pubescens* Banks & Sol. – T, Bk; 1, 12, 15, 17, 18, 19.
*Linum strictum* L. – T, Me; 1, 3, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19.

***Malvaceae***
*Malva cretica* Cav. – T, Me; 1, 4, 10, 13, 15, 18, 19.
*Malva multiflora* (Cav.) Soldano & al. – T, Me; 1, 2, 3, 16.
*Malva parviflora* L. – T, MS; 2, 3, 5, 6, 17, 18, 19.
*Malva setigera* Schimp. & Spenn. – T, EA; 6, 13, 18.

***Oleaceae***
*Olea europaea* L. subsp. *europaea* – P, Me; 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19.
*Phillyrea latifolia* L. – P, Me; 1, 3, 11, 12, 14, 15, 17, 18, 19.

***Orchidaceae***
*Anacamptis pyramidalis* (L.) Rich. – G, Eu; 8, 12, 17, 18, 19.
*Ophrys scolopax* subsp. *cornuta* (Steven) E. G. Camus – G, ME; 1, 4, 18, 19.
*Serapias vomeracea* (Burm. f.) Briq. – G, ME; 12, 15.

***Orobanchaceae***
*Orobanche minor* Sm. – T, EA; 1, 3, 4, 11, 17, 18, 19.

***Oxalidaceae***
[*Oxalis pes-caprae* L.] – G, [S African].; 15.

***Papaveraceae***
*Papaver apulum* Ten. – T, BI; 1, 12, 19.
*Papaver rhoeas* L. – T, Pt; 1.

***Plantaginaceae***
*Plantago afra* L. – T, Me; 1, 12, 13, 15, 17, 18, 19.
*Plantago bellardii* All. – T, Me; 8, 12, 13, 14, 15, 17, 18, 19.
*Plantago coronopus* L. – T, MA; 1, 3, 6, 13, 14, 15, 17, 18.
*Plantago lagopus* L. – T, ME; 6, 17, 18, 19.
*Plantago lanceolata* L. – H, Co; 1, 3, 18.
*Plantago weldenii* Rchb. – T, Me; 3, 6, 17.

***Plumbaginaceae***
*Limonium narbonense* Mill. – H, MS; 2, 3, 5, 6.
*Limonium* cf. *saracinatum* R. Artelari – H, *(Ionian endemic); E.
*Limonium virgatum* (Willd.) Fourr. – H, Me; 1, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.

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***Poaceae***
*Aegilops biuncialis* Vis. – T, MS; 1, 18.
*Aira elegantissima* Schur – T, MS; 1, 4, 12, 15, 17.
*Alopecurus myosuroides* Huds. – T, Co; 1, 2, 17.
*Andropogon distachyos* L. – H, ST; 4, 10, 11, 13, 18.
*Anthoxanthum odoratum* L. – H, Co; 4, 18.
*Avena barbata* Link – T, Me; 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Avena sterilis* L. – T, MS; 4, 6, 18.
*Brachypodium distachyon* (L.) P. Beauv. – T, MS; 1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Brachypodium pinnatum* (Pers.) P. Beauv. – H, ES; 7, 9, 13, 16.
*Brachypodium retusum* P. Beauv. – H, Me; 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19.
*Brachypodium sylvaticum* (Huds.) P. Beauv. – H, Pt; 1.
*Briza maxima* L. – T, ST; 1, 3, 12, 13, 14, 15, 17, 18, 19.
*Bromus alopecuros* subsp. *caroli-henrici* (Greuter) P. M. Sm. – T, EM; 1, 2, 3, 5, 6, 12, 13, 15, 17.
*Bromus diandrus* Roth – T, Me; 1, 2, 3, 5, 6.
*Bromus fasciculatus* C. Presl – T, Me; 1, 8, 10, 11, 12, 13, 14, 15, 19.
*Bromus hordeaceus* L. – T, Co; 3.
*Bromus intermedius* Guss. – T, Me; 1, 4, 17, 18, 19.
*Bromus lanceolatus* Roth – T, Pt; 1.
*Bromus madritensis* L. – T, MS; 1, 2, 3, 4, 6, 13, 14, 15, 17, 19.
*Bromus rigidus* Roth – T, ST; 3, 4, 6, 7, 11, 15.
*Bromus rubens* L. – T, MS; 1, 3, 8, 10, 11, 12, 13, 14, 15, 17, 19.
*Bromus squarrosus* L. – T, Pt; 8, 12, 15, 17.
*Bromus sterilis* L. – T, MS; 12, 16, 18.
*Bromus tectorum* L. – T, Pt; 10, 14.
*Catapodium marinum* (L.) C. E. Hubb. – T, MA; 1, 3, 8, 9, 10, 11, 13, 14, 16, 17, 18, 19.
*Catapodium rigidum* (L.) C. E. Hubb. – T, Me; 1, 3, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Cynosurus echinatus* L. – T, Me; 1, 3, 8, 12, 15, 17, 18, 19.
*Dactylis glomerata* L. – H, Pt; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Dasypyrum villosum* (L.) P. Candargy – T, MS; 18.
*Elytrigia juncea* (L.) Nevski – G, Me; 3.
*Gastridium ventricosum* (Gouan) Schinz & Thell. – T, Me; 1, 3, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18.
*Gaudinia fragilis* (L.) P. Beauv. – T, Me; 12, 15, 17, 18.
*Hordeum geniculatum* All. – T, MS; 4.
*Hordeum murinum* subsp. *leporinum* (Link) Arcang. – T, Me; 1, 2, 3, 4, 5, 6, 7, 12, 13, 16, 17, 18, 19.
*Hyparrhenia hirta* (L.) Stapf – H, ST; 1, 3, 4, 5, 8, 11, 12, 13, 14, 15, 17, 18.
*Lagurus ovatus* L. – T, Me; 1, 2, 3, 6, 11, 12, 13, 15, 17, 18, 19.
*Lolium perenne* L. – H, ES; 1, 6, 7, 15, 18.
*Lolium rigidum* Gaudin – T, ST; 5, 7, 13.
*Melica ciliata* L. – H, MS; 1, 5, 11, 13.
*Parapholis incurva* (L.) C. E. Hubb. – T, MA; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19.
[*Phalaris canariensis* L.] – T, [Macaronesian]; 2, 16, 17.
*Phragmites australis* (Cav.) Steud. – G, Co; 11, 17.
*Piptatherum coerulescens* (Desf.) P. Beauv. – H, Me; 1, 3, 11, 15, 18.
*Piptatherum miliaceum* (L.) Coss. – H, Me; 1, 3.
*Poa bulbosa* L. – H, Pt; 1, 19.
*Poa infirma* Kunth – T, Me; 2, 7, 16.
*Polypogon monspeliensis* (L.) Desf. – T, ST; 2, 3, 4.
*Psilurus incurvus* (Gouan) Schinz & Tell. – T, Me; 1, 17, 18.
*Rostraria cristata* (L.) Tzvelev – T, Co; 1, 3, 4, 6, 8, 12, 13, 14, 15, 17, 18, 19.
*Stipa capensis* Thunb. – T, Me; 1, 4, 6, 8, 12, 13, 14, 17.
*Vulpia ciliata* Dumort. – T, MS; 1, 17, 19.
*Vulpia myuros* (L.) C. C. Gmel. – T, Me; 8, 10, 12, 13, 18.

***Polygonaceae***
*Polygonum* sp. – 2.
*Rumex conglomeratus* Murray – H, EA; 1.
*Rumex pulcher* L. – H, MS; 1.

***Primulaceae***
*Anagallis arvensis* L. – T, Co; 1, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.
*Asterolinon linum-stellatum* (L.) Duby – T, Me; 4.
*Cyclamen hederifolium* Aiton – G, Me; 1, 3, 4, 8, 12, 14, 15, 17, 18, 19.

***Rafflesiaceae***
*Cytinus hypocistis* (L.) L. – G, Me; 1, 19.

***Ranunculaceae***
*Anemone pavonina* Lam. – G, Me; 1.
*Nigella damascena* L. – T, Me; 1, 8, 13, 14, 15, 17, 18, 19.
*Ranunculus chius* DC. – T, MS; 9, 13, 19.
*Ranunculus muricatus* L. – T, MS; 19.
*Ranunculus neapolitanus* Ten. – H, Me; 1, 18, 19.
*Ranunculus sprunerianus* Boiss. – H, EM; 1.

***Rhamnaceae***
*Rhamnus alaternus* L. – P, Me; 1, 3, 4, 8, 9, 10, 12, 13, 14, 15, 17, 18, 19.

***Rosaceae***
*Prunus spinosa* L. – P, EA; 1.
*Pyrus spinosa* Forssk. – P, Me; 15, 18.
*Sanguisorba minor* subsp. *balearica* (Nyman) Muñoz Garm. & C. Navarro – H, EA; 1, 3, 15, 17, 18, 19.
*Sarcopoterium spinosum* (L.) Spach – P, EM; 9, 12, 14, 15, 17, 18.

***Rubiaceae***
*Crucianella latifolia* L. – T, ME; 1, 8, 10, 12, 13, 15, 17, 18, 19.
*Galium aparine* L. – T, EA; 1, 2, 3, 4, 5, 6, 7, 10, 12, 13, 15, 16, 17, 18, 19.

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*Galium divaricatum* Lam. – T, Me; 1, 8, 10, 12, 15, 17, 18, 19.
*Galium intricatum* Margot & Reut. – H, Bk; 1, 13, 15, 17.
*Plocama calabrica* (L. f.) M. Backlund & Thulin – P, Me; 1.
*Rubia peregrina* L. – P, MA; 1, 2, 3, 12, 15, 19.
*Rubia tenuifolia* d'Urv. – P, EM; 3.
*Sherardia arvensis* L. – T, EA; 1, 17, 18, 19.
*Theligonum cynocrambe* L. – T, Me; 13, 18, 19.
*Valantia hispida* L. – T, Me; 1, 4, 6, 8, 15.
*Valantia muralis* L. – T, Me; 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19.

***Ruscaceae***
*Ruscus aculeatus* L. – C, ME; 1, 6.

***Scrophulariaceae***
*Scrophularia canina* subsp. *bicolor* (Sm.) Greuter – H, EM; 1, E.
*Scrophularia heterophylla* Willd. – H, EM; 1.
*Verbascum sinuatum* L. – H, MS; E.

***Smilacaceae***
*Smilax aspera* L. – P, Me; 1, 2, 3, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19.

***Solanaceae***
*Solanum nigrum* L. – T, Co; 2, 7.

***Tamaricaceae***
*Tamarix hampeana* Boiss. & Heldr. – P, EM; 5, 7.

***Urticaceae***
*Parietaria cretica* L. – T, EM; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19.
*Parietaria judaica* L. – H, EA; 1.
*Parietaria lusitanica* L. – T, ME; 9.
*Urtica membranacea* Poir. – T, MS; 2, 4.
*Urtica pilulifera* L. – T, MS; 18, 19.
*Urtica urens* L. – T, Co; 2, 4, 5, 6, 7, 9, 13, 19.

***Valerianaceae***
*Centranthus ruber* (L.) DC. – C, Me; 1.
*Valerianella eriocarpa* Desv. – T, Me; 1.

***Verbenaceae***
*Vitex agnus-castus* L. – P, MS; 3, 13.

***Veronicaceae***
*Kickxia elatine* subsp. *crinita* (Mabille) Greuter – T, Me; 19.
*Veronica arvensis* L. – T, EA; 1, 13, 19.
[*Veronica persica* Poir.] – T, [W Asian]; 4.

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