Evaluation of the flora and vegetation of Trizonia island – floristic affinities with small Ionian Islands

KONSTANTINOS KOUGIOUMOUTZIS, ARGYRO TINIAKOU, GEORGIOS DIMITRELLOS & THEODOROS GEORGIADIS

Abstract

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The flora of Trizonia island (Corinthian Gulf, Greece) comprises 217 taxa, eight of which are under a protection status, while two are Greek endemics. Most of them belong to the therophytes and to the Eurymediterranean chorological group. The floristic affinities between Trizonia and the small Ionian Islands Paxoi, Othonoi, Ereikoussa, and Oxeia were examined by application of the Sørensen's and Jaccard's indices, in order to investigate the relationships between them and the islets of the W Corinthian Gulf. The vegetation survey revealed nine natural and three human induced habitat types, illustrated in the vegetation map of the island, given in the present study.

K. Kougioumoutzis, A. Tiniakou, G. Dimitrellos & Th. Georgiadis, Division of Plant Biology, Department of Biology, University of Patras, GR-26500 Patras, Greece. E-mail: konkougioumou@upatras.gr; tiniakou@upatras.gr; georgiad@upatras.gr

Key words: Phytogeography, Corinthian Gulf, vegetation mapping, Trizonia island.

Introduction

The study area represents the largest of the islands and islets of the Corinthian gulf and constitutes a continental type of island. Its distance from the mainland is 500 m, and has an areal extent of 2.56 km^2 and a coastline length of 11 km. Trizonia island belongs to the prefecture of Fokida and lays ca. 30 km east of the city of Nafpaktos.

The landscape is hilly without any deep ravines; there are 4 catchment areas, the largest of which lies at the central part of the island, near the port. In the northwestern part of the island lies the highest peak, Palaiokastro, with an altitude of 106 m. The coastline is mostly steep, with the exception of 4 small, sandy beaches.

Geotectonically, the study area belongs to the Pindhos zone (KATSIKATSOS 1992), comprising mainly early Cretaceous limestone. Finally, it is noteworthy that the island of Trizonia, by being in the Corinthian gulf, lies in a very earthquake-active area with many active faults around the island (MORETTI & al. 2003).

Climatic data for the island of Trizonia originate from the Aigion meteorological station, as there is no station on the island. According to the climatic diagram of EMBERGER (1955, 1959), modified by SAUVAGE (1961), the study area

belongs to the sub humid bioclimatic zone with a mild winter and according to the xerothermic index (x) (BAGNOULS & GAUSSEN 1953), it belongs to the weak Thermo-mediterranean type with a small dry period, which lasts from early May to mid September.

Trizonia island was included in a study of the flora and vegetation and the correlation trends of the islets of the Corinthian gulf (THEOCHAROPOULOS & al. 2005).

The present study focuses only on the island of Trizonia, with a thorough investigation of its flora and vegetation and with the mapping of its main habitat types. The floristic affinities between Trizonia and the small Ionian Islands Paxoi (GEORGIADIS & al. 1986), Othonoi (GEORGIADIS 1983), Ereikoussa (GEORGIADIS 1985) and Oxeia (CHRISTODOULAKIS & al. 1988) are also examined, in order to investigate the relationships between them and the islets of the W Corinthian gulf.

Material and methods

Several collections and field observations between the spring of 2005 and the spring of 2007 have been conducted in the study area, in order to acquire an integrated knowledge of its flora and vegetation. The identification and nomenclature of the taxa are based on: Flora Hellenica (STRID & TAN, 1997, 2002) Flora Europaea (TUTIN & al. 1968, 1972, 1976, 1980 & 1993), Flora d' Italia (PIGNATTI 1982) and Med-Checklist (GREUTER & al. 1984, 1986, 1989). For the determination of the habitat types the Technical Guide for Mapping (DAFIS & al. 2001) was used. For the examination of the floristic affinities of Trizonia, we used bibliographical data for the small Ionian Islands Paxoi (GEORGIADIS & al. 1986), Othonoi (GEORGIADIS 1983), Ereikoussa (GEORGIADIS 1985), and Oxeia (CHRISTODOULAKIS & al. 1988). Sørensen's and Jaccard's indices, as well as the statistical packet SPSS 13, were used for the cross-correlation between the islands. Satellite images (Google Earth 2006), the orthophotomap of the island (1971, 1:20,000), as well as our own field observations and photos were used for construction of the vegetation map of the study area, with the help of ArcGis 9.2.

Results

Flora

The flora of Trizonia consists of 217 Spermatophyte taxa (Table 1- Appendix 1), out of which 199 are new records, two (2) Greek endemics and eight (8) under a protection status (Table 2).

The 7 richest in species families found on the island of Trizonia are Fabaceae, Asteraceae, Liliaceae, Poaceae, Cruciferae, Labiatae and Apiaceae (Fig. 1).

Table 1. Floristic elements of Trizonia island.

Taxonomical unit	Families	Genera	Species	Subspecies	Taxa	%
Gymnospermae	4	5	6	1	7	3.17
Dicotyledones	42	125	156	11	167	76.47
Monocotyledones	6	33	43	0	43	20.36
Total	**52**	**163**	**205**	**12**	**217**	**100.00**

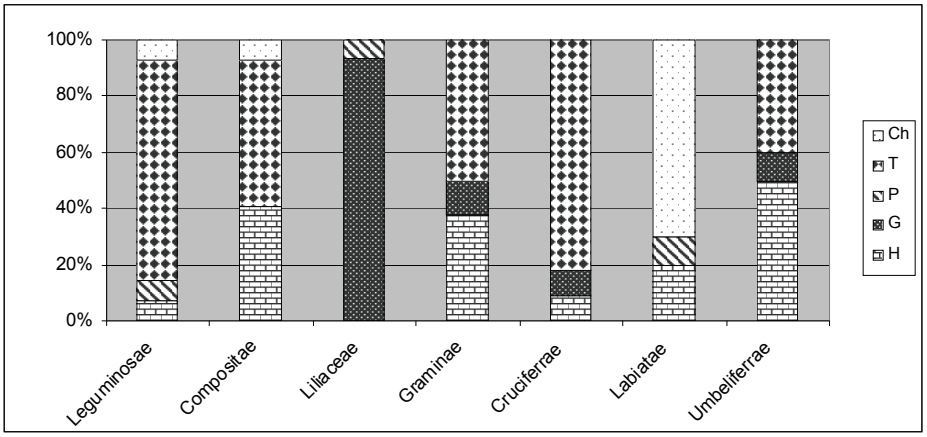

Fig. 1. Biological spectra of the 7 richest in species families found on the island of Trizonia.

Table 2. Taxa under protection status. P.D.: Presidential degree 67/1981, about the protection of the native flora and wild fauna of Greece; W.C.M.C.: the directive for the Threatened (Endangered, Vulnerable, Rare or Data Deficient) taxa according to the World Conservation Monitoring Center; Natura 2000: the database created after the Directive 92/43/EEC, where the plants are evaluated as Greek endemics (B), belonging to CITES (C) or Balkan endemics and other rare species (D) (DAFIS & al. 1996).

Family	**Taxon**	**Protection status**	**Natura 2000**
Boraginaceae	*Anchusella variegata*	-	B
Compositae	*Anthemis chia*	-	D
Compositae	*Inula ensifolia*	W.C.M.C., P.D.	D
Primulaceae	*Cyclamen repandum* subsp. *peloponessiacum*	-	B
Orchidaceae	*Anacamptis pyramidalis*	-	C
Orchidaceae	*Barlia robertiana*	-	C
Orchidaceae	*Ophrys lutea*	-	C
Orchidaceae	*Orchis pappilionacea*	-	C

In the biological spectrum (Fig. 2) of the flora of Trizonia, the therophytes (39%) dominate, followed by hemicryptophytes (21%), geophytes (16%), phanerophytes (16%) and chamaephytes (8%). It should be noted that the predominant subcategory among the geophytes is that of the G bulbs (11.52%). According to BERGMEIER & al. (2001), areas dominated by this type of biological form were formerly cultivated.

As indicated in Fig. 1, Fabaceae comprise one fourth of the therophyte species occurring on the island, while half of the therophytes belong to five families: Fabaceae, Asteraceae, Poaceae, Cruciferrae and Apiaceae.

It is well known from the literature (NAVEH 1974, BARBERO & al. 1990, PANITSA & al. 1994, PANITSA & TZANOUDAKIS 1998) that high percentages of therophytes and leguminous species are indicators of disturbance in Mediterranean ecosystems. This is true also for Trizonia, where the percentage of leguminous

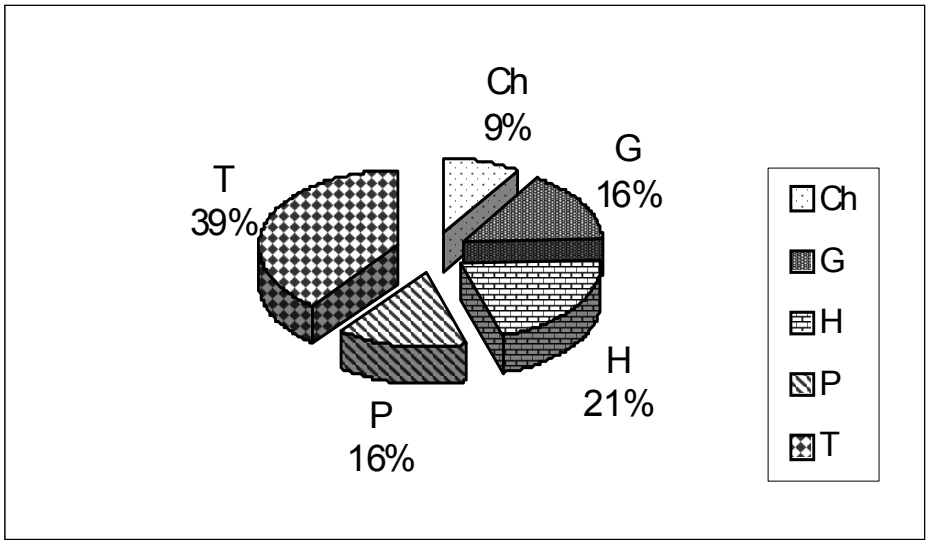

Fig. 2. Biological spectrum of the flora of Trizonia.

species is 12.66% (28 taxa).

In the chorological spectrum of the study area (Table 3) the Mediterranean elements predominate (71.44%), with the Eurymediterranean unit showing the highest percentage (30.87%). The dominance of the Eurymediterranean elements reflects the weak thermomediterranean character of the island. There are only two endemic taxa (*Anchusella variegata* & *Cyclamen repandum* subsp. *peloponnesiacum*), showing a very low representation of endemics (0.92%), but taking into consideration the small size of the island and its short distance from the nearest continental shore, we can account the contribution of this chorological category as significant. A final remark on the chorological analysis of the study area has to do with the relatively small contribution to the island's flora of cosmopolitan and subcosmopolitan elements, as well as adventive elements, which could indicate a mild human induced pressure to the study area.

From the eight (8) taxa which are under Protection status (Table 2), two are Greek endemics, four (5) belong to the Orchidaceae family, and two (2) are treated as Balkan endemics.

From the cross-correlation between Trizonia and the islands Oxeia, Paxoi, Ereikoussa and Othonoi, by the application of the Sørensen's and Jaccard's indices (Tables 4 and 5, respectively), we can conclude that Trizonia is more closely related to Othonoi and then to Paxoi; furthermore, among the islands in comparison, more closely related are Paxoi and Othonoi, followed by Oxeia and Othonoi.

Vegetation

The vegetation of Trizonia is represented by three human induced and nine natural habitat types (Table 6), four of which are coastal, while the rest of them lie in the mainland and four of them are bioclimatically defined. Maquis (934A, 5210)

Table 3. Chorological spectrum of Trizonia island.

Chorological unit	**Number of taxa**	**%**
Endemics (Greece)	2	0.92
Balkan	3	1.38
Mediterranean taxa		
Stenomediterranean (StenoMedit.)	50	23.05
Eurymediterranean (EuryMedit.)	67	30.87
E Mediterranean (E-Medit.)	20	9.22
Mediterranean - wider Meditteranean (Stenomedit.-Atl., Eurymedit.-Atl., Stenomedit.-Turan., Eurymedit.-Turan, Medit.-Atl., Medit.-Turan.)	18	8.30
Palaeotemperate (Palaeotemp.)	11	5.07
Eurasiatic (Eurasiat., Europ.-Caucas., SE-Europ-Pontico)	10	4.61
Circumboreal (Circumbor.)	5	2.30
European (Europ., SE-Europ., N-Europ.)	5	2.30
Paleo-Subtropical (Paleosubtrop.)	3	1.38
Sub- and Cosmopolitan (Subcosmop., Cosmop.)	18	8.30
Adventive (Adv.) & Naturalised	5	2.30
Total	**217**	**100.00**

Table 4. Sørensen's indicator values for each of the islands in comparison.

Sørensen	Trizonia	Oxeia	Paxoi	Ereikoussa
Trizonia				
Oxeia	0.224			
Paxoi	0.267	0.327		
Ereikoussa	0.132	0.150	0.191	
Othonoi	0.276	0.334	0.367	0.264

Table 5. Jaccard's indicator values for each of the islands in comparison.

Jaccard	Trizonia	Oxeia	Paxoi	Ereikoussa
Trizonia				
Oxeia	0.176			
Paxoi	0.216	0.279		
Ereikoussa	0.105	0.098	0.137	
Othonoi	0.221	0.318	0.363	0.239

predominate in the northern part of Trizonia, phrygana (5420) dominate mostly in the northwestern and central part of the study area, while pine trees (9540) are scattered throughout the island, mainly in stands (but also sporadic individuals); most probably, this vegetation type covered in the past larger parts of the island.

Table 6. Habitat types found on Trizonia island.

Natura 2000 code	Habitat type	Characteristic taxa
1020	Cultivated fields	
1060	Settlements, fallow land	
1070	Abandoned fields	
1210	Annual vegetation of drift lines	*Cakile maritime*
1240	Vegetated sea cliffs of the Mediterranean coasts (with endemic *Limonium* spp.)	*Limonium narbonense*, *Limonium virgatum*, *Capparis spinosa*
1420	Mediterranean and thermo-Atlantic halophilous scrubs (Arhtrocnemetalia fruticosae)	*Arthrocnemum macrostachyum*, *Hordeum marinum*, *Atriplex portulacoides*
2110	Embryonic shifting dunes	*Elymus farctus*, *Eryngium maritimum*
934A	Greek *Quercus coccifera* forests	*Quercus coccifera*, *Prasium majus*, *Arbutus unedo*
5210	Juniper formations	*Juniperus phoenicea*
9540	Mediterranean pine forests	*Pinus halepensis*
5420	*Sarcopoterium spinosum* phrygana	*Sarcopoterium spinosum*, *Coridothymus capitatus*, *Phagnalon graecum*, *Erica manipuliflora*
92DO	Thermo-Mediterranean riparian galleries (Nerio-Tamaricetea)	*Vitex agnus-castus*

The small wetland with *Vitex agnus-castus* in the central part of the island is in good condition. The only danger it currently faces is a possible climatic change with less annual precipitation. Trizonia island is covered mainly by well-fitted, mixed vegetation bundles, consisting of phrygana and maquis. Coastal habitat types (1210, 1420, 2110) are found in small, limited patches at the eastern part of the island, while habitat type 1240 is not threatened, as it is found all along the coastline. Small, interspersed, cultivated fields, which formerly covered a much larger proportion of the study area, are found only in the central part of Trizonia island. Finally, an increase of real estate and housing and the subsequent increasing number of tourists are the main threats to Trizonia island, as the area that human induced habitat types (1020, 1060 & 1070) occupy is quite large, considering the size of the study area.

All abovementioned habitat types are illustrated in the vegetation map of the island, given in Fig. 3.

Evaluation

In spite of its relatively small size, the island of Trizonia, displays an interesting and rich floristic composition, since among the 217 taxa of the study area, eight are of

particular importance, due to the fact that they are under a protection status. The number of these protected taxa is quite large, taking into consideration the island's size and its distance from the shore.

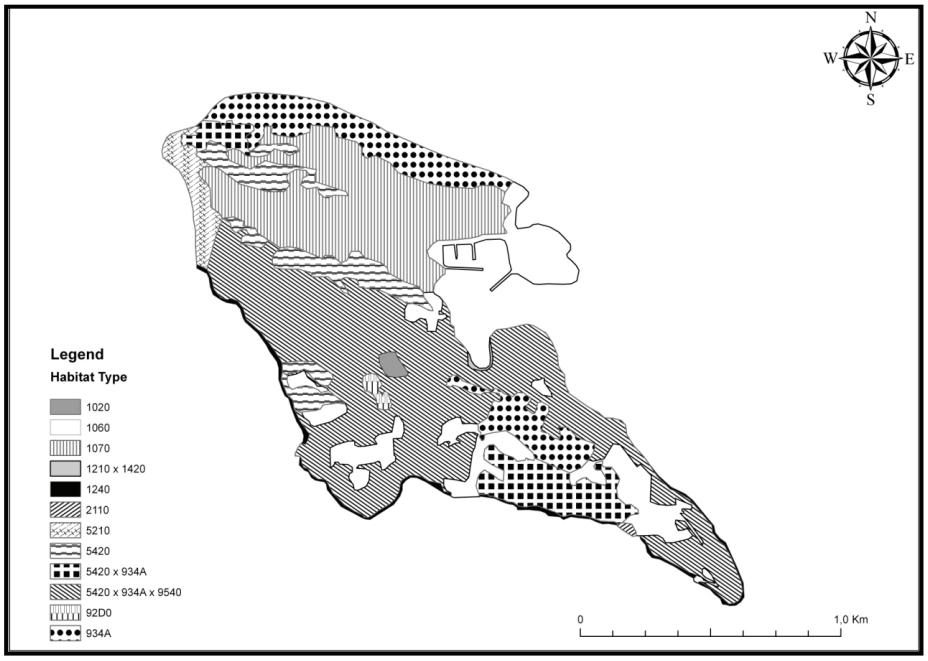

Fig. 3. Vegetation map of Trizonia island.

A careful evaluation of the vegetation units and the habitat types of the island leads to the following assessments: the arboreous vegetation is represented by the habitat type 9540 with *Pinus halepensis* and *Pinus halepensis* subsp. *brutia* stands, as well as sporadic individuals, scattered in the north and central part of the study area. This vegetation type most possibly covered in the past a much larger area; due to human activities and local ecological conditions, it retrieved to its current extent or simply replaces the typical *Quercion ilicis* vegetation.

The condition of the maquis vegetation, represented by the habitat types 934A and 5210, is considered to be better than that of the arboreous vegetation, since it is the prevailing vegetation type on the island. Habitat type 934A is represented by the taxa *Quercus coccifera*, *Arbutus unedo* and *Pistacia lentiscus* that replace the climax - association. Habitat type 5210 is represented by *Juniperus phoenicea* stands and scattered trees and predominating in the western coasts of the island; the area covered by this habitat type is nowadays noticeably smaller, compared to the orthophotomap (1971, 1:20,000).

Phrygana vegetation represented by the habitat type 5420 is characterized by the taxa *Sarcopoterium spinosum*, *Erica manipuliflora*, *Cistus salvifolius*, *Cistus parviflorus*, *Phlomis fruticosa*, *as well as Calicotome villosa*. This type of vegetation dominates the northwestern part of the island and is well developed.

In the central part of Trizonia mainly mixed vegetation (good formations of phrygana and maquis) dominates, with the phytoassociations' composition being territorially modified.

Coastal vegetation, represented by the habitat types 1210 and 1240 faces the greatest threats, since it is extremely vulnerable and subjected to human induced impacts (coastal roads, housing). *Cakile maritima* and *Salsola soda* represent the habitat type 1210, *Limonium narbonense*, *Limonium virgatum* and *Capparis spinosa* represent the habitat type 1240. Habitat type 1210 is found on the eastern beaches and habitat type 2110 is found in a single locality in the southeastern part of the study area, while habitat type 1240 predominates across the coastline.

Finally, cultivating fields do not cover a large extent of the study area, since they are mainly located in the central part of the island; nevertheless, in the past they covered a larger area, but nowadays most cultivated fields have been abandoned.

Discussion – Management proposals

On the study area, field crops of high intensity were not detected, although meadows do occur, in which annuals, such as *Convolvulus althaeoides*, *Gladiolus italicus* and *Papaver rhoeas* predominate, and are indicating formerly cultivated fields. Regarding the rest of the human induced influences, there are no signs of intensive grazing or fire, but large areas were cleared in the frame of real estate activities, thus changing the land use.

In the biological spectrum of Trizonia, the prevalence of the therophytes is not just a presumable result, taking into account the climate of the study area, which is classified as weak Thermo-mediterranean with a small dry period. The geophytes' contribution to the biological spectrum of the flora and especially the contribution of its predominant subcategory of the bulbous ones, is quite significant, since areas dominated by this biological form were formerly cultivated (BERGMEIER & al. 2001). Moreover, it is noteworthy that Trizonia shows the highest percentage of geophytes among the islands we compared, although it lies in a different bioclimatic zone than that of Paxoi, Othonoi and Ereikoussa, which encumber the development and occurrence of the geophytes (subhumid bioclimatic zone, less precipitation). Geophytes are also more abundant in Trizonia than in Oxeia, even though the latter demonstrates greater geomorphological heterogeneity (larger, higher altitude). On the other hand, the therophytes' contribution to the flora of the study area is the lowest (together with that of Ereikoussa) among the five assessed islands, remarkably lower than that of Oxeia, which lies in the same bioclimatic zone with Trizonia, and lower than that of Paxoi and Othonoi, which are found far north from Trizonia and belonging to the humid bioclimatic zone. This phenomenon could be ascribed to the very location of the Trizonia Island, as it is found in a relatively open and deep part of the Corinthian gulf, where the influence of the sea currents is profound, with high mountains and a river just at the nearest coast. These conditions can partly explain the relatively low percentage of the therophytes and the high percentage of geophytes.

Regarding the ecological status of the study area, the grazing intensity is rather mild and the rural development low; however, as mentioned before, large areas were cleared, in the process of land use changes, which disrupt the vegetation's continuity,

while the number of tourists gradually rises, hence the increase in the amounts of waste that end up in the small landfill area of the island.

Some of the areas that were reclamated, are found at the island's coasts, which means, that beyond the extinction of the occurring plant taxa populations in those areas, new taxa immigrate to the island. Those new taxa will be, in their vast majority, generalists, consequently cosmopolitan and most probably, therophytes. The number of species may rise, for as much as the conditions will be favorable (lack of competition, small distance from the shore), but the flora's physiognomy will alter greatly and dramatically, deteriorating the present state of disturbance. This trend may be averted, either by apprising and sensitizing the locals of the importance of the present vegetation, or by exhorting them to develop ecotourism in the island, combined with a program of environmental education not only for the local population, but also for the visitors. Another way to prevent alteration is the establishment of some protected zones, in which new buildings, constructions and easy accessibility should be avoided or forbidden.

Finally, due to Trizonia's location, sedulous research of many biogeographical hypotheses can be conducted, as numerous islets of equal or nearly equal size lie nearby, thus enabling the examination of the species-area relationship, the small island effect and the stepping stones effect.

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Appendix 1: Floristic list (*: new records)

Gymnospermae

Cupressaceae
Cupressus sempervirens L.: Pscap, E-Medit.
Juniperus phoenicea L.: Pscap, Eurymedit.

Ephedraceae
Ephedra foeminea Förskal (***E. campylopoda*** C. A. Meyer): NPcaesp, E-Medit.

Pinaceae
Pinus halepensis Miller subsp. ***brutia*** (Ten) Holmoe: Pscap, Stenomedit.
P. pinaster Aiton (***P. maritima*** Lam.): Pscap, Stenomedit.

Angiospermae

Dicotyledones

Amaranthaceae
Amaranthus hybridus L.: Tscap, Nordamer/Naturalized.

Anacardiaceae
Pistacia lentiscus L.: Pcaesp, Stenomedit.

Apocynaceae
Nerium oleander L.: Pcaesp, Stenomedit.

Boraginaceae
Anchusa cretica Miller: Tscap, Stenomedit.
Anchusella variegata (L.) Bigazzi, Nardi & Selvi: Tscap, Endemic.
Cynoglossum creticum Miller: Hscap Eurymedit.
Echium plantagineum L.: Tscap, Eurymedit.
Neatostema apulum (L.) I.M.Johnson: Tscap, Stenomedit.

Cactaceae
Opuntia ficus barbarica A. Berger (***O. ficus indica*** (L.) Miller): Psucc, Neotropic/Naturalized.

Capparaceae
Capparis spinosa L.: NP, Eurymedit.

Caprifoliaceae
Lonicera etrusca G.Santi: Plian, Eurymedit.

Caryophyllaceae
Cerastium glomeratum Thuill: Hscap, Europ.
Petrorhagia dubia (Rafin) G.Lopez & Romo (***P. velutina*** (Guss.) P.W.Ball & Heywood): Tscap, Eurymedit.
Sagina maritima G.Donn: Tscap, Med (Eurymedit)-Atl.
Silene vulgaris (Moench) Garke: Hscap, Stenomedit.
S. vulgaris (Moench) Garke subsp. ***macrocarpa*** Turill: Hscap, Stenomedit.

Chenopodiaceae
Arthrocnemum macrostachyum (Moric) K. Koch: Chsucc, Stenomedit.
Atriplex halimus L.: Pcaesp, Atl.-Stenomedit.
A. portulacoides L.: Chfrut, Circumbor.
Salsola soda L.: Tscap, Palaeotemp.

Cistaceae
Cistus creticus L.: NP, Stenomedit.
C. parviflorus Lam.: NP, Stenomedit.
C. salvifolius L.: Chfrut, Eurymedit.
Fumana arabica (L.) Spach: Chsuffr, Europ-Caucas.
F. thymifolia (L.) Webb: Chsuffr, Eurymedit.

Compositae
Andryala integrifolia L.: Tscap, Stenomedit.
Anthemis chia L.: Tscap, NE-Medit.
Calendula arvensis L.: Tscap, Eurymedit.
Carlina corymbosa L. subsp. ***graeca*** (Boiss.) Nyman: Hscap E-Medit.
Chrysanthemum coronarium L.: Tscap, Eurymedit.
C. segetum L.: Tscap, Eurymedit.
Cirsium vulgare (Savi) Ten. (***C. lanceolatum*** (L.) Scop.): Hscap, Palaeotemp.
Crepis foetida L. subsp. ***rhoeadifolia*** (Bieb.) Celak: Tscap, Eurymedit.
C. setosa Haller: Tscap, E-Medit.
Crupina crupinastrum (Moris) Vis.: Tscap, Eurymedit.
Cynara scolymus L. (***C. cardunculus*** L. subsp. ***scolymus***): Hscap, Stenomedit.
Hedypnois cretica (L.) Dum.-Cours: Tscap, Stenomedit.
Hypochoeris glabra L.: Tscap, Eurymedit.
Inula crithmoides L.: Chsuffr, Europ.
I. ensifolia L.: Hscap, SE-Europ-Pontico.
I. oculus-christi L.: Hscap, SE-Europ-Pontico.
Pallenis spinosa (L.) Cass.: Tscap, Eurymedit-Atl.
Phagnalon graecum Boiss.: Chsuffr, NE-Medit.
Picnomon acarna (L.) Cass.: Hscap, Stenomedit.
Reichardia picroides (L.) Roth: Hscap, Stenomedit.
Scolymus hispanicus L.: Hbienn, Eurymedit.
Senecio vulgaris L.: Tscap, Cosmop.
Sonchus asper (L.) Hill subsp. ***asper***: Tscap/Hbienn, Subcosmop.
S. tenerimus L.: Tscap, Stenomedit.
Taraxacum officinale Weber: Hros, Circumbor.
Tragopogon crocifolius L. subsp. ***samaritanii*** (Heldr. & Sart. ex Boiss.) I.B.K Richardson: Hros, Orof-SE-Europ.
T. porrifolius L.: Hscap, Eurymedit.

Convolvulaceae
Convolvulus althaeoides L.: Hscand, Stenomedit.

Crassulaceae
Sedum album L.: Chsucc, Eurymedit.
S. rubens L.: Tscap, Eurymedit.

Cruciferae
Biscutella didyma L.: Tscap, S-Medit-Turan.
Bunias erucago L.: Tscap, Eurymedit.
Cakile maritima Scop.: Tscap, Medit-Atl.
Capsella bursa-pastoris (L.) Medicus: Hbienn, Cosmop.
Cardaria draba (L.) Desv.: Grhiz/Hscap, Medit-Turan.
Eruca vesicaria (L.) Cav. subsp. ***sativa*** (Miller) Thell. (***E***. ***sativa*** Miller): Tscap, Medit-Turan.
Raphanus raphanistrum L.: Tscap, Circumbor.
R. ***raphanistrum*** L. subsp. ***landra*** (DC.) Bonnier & Layens: Tscap, Eurymedit.
Sinapis alba L.: Tscap, Palaeotemp.
S. ***arvensis*** L.: Tscap, Stenomedit.
Sisymbrium orientale L.: Tscap, Eurymedit.

Dipsacaceae
Knautia integrifolia (L.) Bertol.: Tscap, Eurymedit.

Ericaceae
Arbutus unedo L.: Pcaesp, Stenomedit.
Erica arborea L.: Pcaesp, Eurymedit.
E. ***manipuliflora*** Salisb. (***E***. ***verticillata*** Forsskal): Chfrut, E-Medit.

Euphorbiaceae
Mercurialis annua L.: Tscap, Palaeotemp.

Fagaceae
Quercus coccifera L.: Pcaesp, Stenomedit.

Fumariaceae
Fumaria petteri Reichb. (***F***. ***thureti*** Boiss.): Tscap, E-Medit.
F. ***carpeolata*** L.: Tscap, Eurymedit.
F. ***officinalis*** L. subsp. ***officinalis***: Tscap, Subcosmop.

Geraniaceae
Erodium cicutarium (L.) L'Her: Tscap, Subcosmop.
Geranium molle L.: Tscap, Subcosmop.
G. ***purpureum*** Vill.: Tscap, Eurymedit.
G. ***rotundifolium*** L.: Tscap, Palaeotemp.

Hypericaceae
Hypericum empetrifolium Willd.: Chsuffr, E-Medit.
H. ***perforatum*** L.: Hscap, Subcosmop.
H. ***triquetrifolium*** Turra: Hscap, Eurymedit.

Labiatae
Clinopodium vulgare (L.) Fritsch (***Calamintha clinopodium*** Spenner***, Satureja vulgaris*** (L.) Fritsch): Hscap, Circumbor.
Coridothymus capitatus (L.) Reichenb. fil.: Chfrut, Stenomedit.
Micromeria juliana (L.) Reichenb. (***Satureja juliana*** L.): Chsuffr, Stenomedit.
Phlomis fruticosa L.: Pcaesp, N-Stenomedit.
Prasium majus L.: Chfrut, Stenomedit.
Salvia verbenaca L.: Hscap, Medit-Atl.
Satureja thymbra L.: Chfrut, E-Medit.

Teucrium chamaedrys L.: Chsuffr, Eurymedit.
T. divaricatum Heldr.: Chsuffr, Eurymedit.
T. polium L.: Chsuffr, Stenomedit.

Leguminosae
Anthyllis hermanniae L.: Chfrut, Stenomedit.
A. tetraphylla L.: Tscap, Stenomedit.
A. vulneraria L.: Hscap, N-Europ.
Calicotome villosa (Poiret) Link: Pcaesp, Stenomedit.
Colutea arborescens L.: Pcaesp, Eurymedit (Subpontico).
Dorycnium hirsutum (L.) Ser.: Chsuffr, Eurymedit.
D. pentaphyllum Scop.: Hscap/Chsuffr, SE-Europ.-Steppico.
Hippocrepis unisiliquosa L.: Tscap, Eurymedit.
Hymenocarpos circinatus (L.) Savi: Tscap, Eurymedit.
Lathyrus cicera L.: Tscap, Eurymedit.
L. nissolia L.: Tscand, Eurymedit.
L. sphaericus Retz.: Tscap, Eurymedit.
Lotus edulis L.: Tscap, Stenomedit.
L. ornithopodioides L.: Tscap, Eurymedit.
L. tetragonolobus L. (***Tetragonolobus purpureus*** Moench): Tscap, Stenomedit.
Lupinus varius L.: Tscap, Stenomedit.
Medicago orbicularis (L.) Bart.: Tscap, Eurymedit.
Melilotus indicus (L.) All.: Tscap, Subcosmop.
Scorpiurus muricatus L.: Tscap, Eurymedit.
Trifolium campestre Schreber: Tscap, Europ-Caucas.
T. stellatum L.: Tscap, Eurymedit.
Vicia bengalensis L.: Tscap, Stenomedit.
V. cretica Boiss. & Heldr.: Tscap, NE-Medit.
V. hybrida L.: Tscap, Eurymedit.
V. lutea L. subsp. ***lutea***: Tscap, Eurymedit.
V. sativa L. subsp. ***cordata*** (Hoppe) Asch. & Graebn.: Tscap, Eurymedit.
V. sativa L. subsp. ***sativa***: Tscap, Eurasiat.
V. villosa Roth: Tscap, Eurymedit.

Malvaceae
Malva sylvestris L. (***M. ambiqua*** Guss.): Hscap, Subcosmop.

Oleaceae
Olea europea L.: Pcaesp, Eurymedit.
Phillyrea latifolia L. (***P. media*** L.): Pcaesp, Stenomedit.

Orobanchaceae
Orobanche pubescens D'Urv (***O. versicolor*** F.W.Schultz. ***O. vitalbae*** Bertol.): Tpar, E-Medit.

Oxalidaceae
Oxalis corniculata L.: Hrept, Cosmop.
O. pes-carpae L.: Gbulb, Cosmop.

Papaveraceae
Papaver argemone L.: Tscap, Medit-Turan.
P. rhoeas L.: Tscap, Palaeotemp.

Plantaginaceae
Plantago lanceolata L.: Hros, Subcosmop.

Plumbaginacee
Limonium narbonense Miller: Hros, Eurymedit.
L. virgatum (Willd.) Fourr. (***Statice virgata*** Willd.: Chsuffr, Eurymedit.
L. oleifolium Pign. in Fl. Europ. non Miller): Hros (Chsuffr), Eurymedit.

Polygonaceae
Rumex crispus L.: Hscap, Cosmop.

Primulaceae
Anagallis arvensis L.: Trept, Subcosmop.
Cyclamen hederifolium Aiton (***C. neapolitanum*** Ten): Gbulb, Eurymedit.
C. repandum Sibth. & Sm.: Gbulb, Stenomedit.
C.repandum Sibth. & Smith subsp. ***peloponessiacum*** Grey-Wilson: Gbulb, Endemic.

Ranunculaceae
Anemone pavonina Lam.: Gbulb, Stenomedit.
Clematis flammula L.: Plian, Eurymedit.
Nigella damascena L.: Tscap, Eurymedit.
Ranunculus muricatus L.: Tscap, Eurymedit.

Resedaceae
Reseda lutea L.: Hscap, Palaeotemp.

Rhamnacee
Rhamnus alaternus L.: NP, Stenomedit.

Rosaceae
Prunus webbii (Spach.) Vierh.: NP, E-Medit.
Pyrus amygdaliformis Vill.: MPscap, Stenomedit.
Rubus sanctus Schreber: Pscap, Palaeotemp.
Sanguisorba minor (L.) Scop. (***Poterium sanguisorba*** L.): Hscap, Subcosmop.
Sarcopoterium spinosum (L.) Spach: NP, E-Medit/ Stenomedit.

Rubiaceae
Galium apanine L.: Tscap, Eurasiat.
Rubia tenuifolia D'Urv. (***R. olivieri*** A.Richard): Pcaesp, E-Medit.
Sherardia arvensis L.: Tscap, Subcosmop.

Santalaceae
Osyris alba L.: Pcaesp, Eurymedit.

Scrophulariaceae
Linaria vulgaris Miller: Hscap, Eurasiat.
Scrophularia peregrina L.: Tscap, Stenomedit.
Verbascum blattaria L.: Hbienn (Tscap), Palaeotemp.
V. undulatum Lam.: Hscap, Balkan.
Veronica cymbalaria Bodard: Trept, Eurymedit.

Tamaricaceae
Tamarix parviflora DC.: Pcaesp/Pscap, E-Medit.

Umbelliferae
Bupleurum glumaceum Sibth. & Smith: Tscap, Stenomedit-Turan.
B. semicompositum L. (***B. glaucum*** Robill. & Cast.): Tscap, Stenomedit-Turan.
Daucus carota L.: Hbienn, Subcosmop.
Eryngium campestre L.: Hscap, Eurymedit.
E. maritimum L.: Grhiz, Medit-Atl.
Malabaila aurea (Sibth. & Smith) Boiss.: Hbienn, Balkan.
Pimpinella major (L.) Hudson (***P. magna*** L.): Hscap, Europ-Caucas.
Scandix pecten-veneris L.: Tscap, Palaeotemp.
Tordyllium apulum L.: Tscap, Stenomedit.
Scaligeria napiformis (Spraengel) Grade: Hbienn, E-Medit.

Verbenaceae
Vitex agnus-castus L.: Pcaesp, Eurymedit/Medit-Turan.

Monocotyledones

Agavaceae
Agave americana: Adv.

Dioscoraceae
Tamus communis L.: Grad, Eurymedit.

Gramineae
Aegilops geniculata Roth (***Ae. ovata*** auct.non L.): Tscap, Stenomedit-Turan.
Aira elegandissima Schur: Tscap, Eurymedit.
Arundo donax L.: Grhiz, Subcosmop.
Avena barbata Pott: Tscap, Medit-Turan.
Brachypodium distachyon (L.) Beauv.: Hcaesp, Stenomedit-Turan.
B. pinnatum (L.) Beauv.: Hcaesp, Eurasiat.
Briza maxima L.: Tcaesp, Palaeosubtrop.
Bromus rigidus Roth (***B. villosus***): Tcaesp, Palaeosubtrop.
Dactylis glomerata L.: Hcaesp, Palaeotemp.
Elymus farctus (Viv.) Runemark: Grhiz, Stenomedit.
Hordeum maritimum With. (***H. marinum*** L.): Tscap, Eurymedit-Occid.
H. murinum L.: Tscap, Circumbor.
Lagurus ovatus L.: Tscap, Eurymedit.
Melica ciliata L.: Hcaesp, Eurymedit-Turan.
Piptatherum miliaceum (L) Cosson (***Oryzopsis miliacea*** (L.) Bengham & Hooker): Hcaesp, Stenomedit.
Stipa bromoides (L.) Doerlfer: Hcaesp, Stenomedit.

Iridaceae
Freesia refracta (Jacq) Ecklon: Gbulb, Naturalized.
Gladiolus imbricatus L.: Gbulb, SE-Europ.
G. italicus Miller (***G. segetum*** Ker-Gawler): Gbulb, Eurymedit.
Hermodactylus tuberosus (L.) Miller: Grhiz, E-Stenomedit.
Iris florentina L.: Grhiz, Naturalized.

Liliaceae

***Allium subhirsutum** L.: Gbulb, Stenomedit.
***A**. **ampeloprasum** L.: Gbulb, Eurymedit.
***A**. **roseum** L.: Gbulb, Stenomedit.
***Asparagus acutifolius** L.: Grhiz,/NP, Eurymedit.
***Asphodelus aestivus** Brot. (**A**. **microcarpus** Viv): Grhiz, Stenomedit.
***Colchicum cupanii** Guss. (**C**. **bertolonii** Steven): Gbulb, Stenomedit.
***Gagea graeca** (L.) Teracc. (**Lloydia graeca** (L.) Endl. ex Kunth): Gbulb, E-Medit.
***Muscari commutatum** Guss.: Gbulb, C-E-Medit.
***M**. **comosum** (L.) Miller (**Leopoldia sartoriana** Heldr.): Gbulb, Eurymedit.
***M**. **neglectum** Guss. ex Ten (**M**. **racemosum** (L.) Lam & DC): Gbulb, Eurymedit.
***M**. **parviflorum** Desf: Gbulb, Stenomedit.
***Ornithogallum narbonense** L.: Gbulb, Eurymedit.
***O**. **umbellatum** L.: Gbulb, Eurymedit.
***Smilax aspera** L.: Plian, Palaeosubtrop.
***Urginea maritima** (L.) Baker: Gbulb, Stenomedit.

Orchidaceae

***Anacamptis pyramidalis** (L.) L.C.M Richard: Gbulb, Eurymedit.
***Barlia robertiana** (Loisel) Greuter (**Loroglossum longibracteatum** Moris ex Ardoino): Gbulb, Stenomedit.
***Ophrys ferrum-equinum** Desf.: Gbulb, Balkan.
***O**. **lutea** Cavanilles: Gbulb, Medit-Atl.
***Orchis papillionacea** L.: Gbulb, Eurymedit.