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CONTRIBUTION TO THE FLORA AND BIOGEOGRAPHY OF THE KIKLADES: FOLEGANDROS ISLAND (KIKLADES, GREECE)

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The island of Folegandros, located between the Milos and Santorini archipelagos in the southern Kiklades (Greece), constitutes together with Ios and Sikinos the south-central part of the phytogeographical region of the Kiklades. Its flora consists of 474 taxa, 47 of which are under statutory protection, 40 are Greek endemics and 145 are reported here for the first time. We show that Folegandros has the highest percentage of Greek endemics in the phytogeographical area of the Kiklades. The known distribution of the endemic *Muscari cycladicum* subsp. *cycladicum* is expanded, being reported for the first time outside the South Aegean Volcanic Arc. The floristic cross-correlation between Folegandros and other parts of the phytogeographical region of the Kiklades by means of Sørensen's index revealed that its phytogeographical affinities are stronger to Anafi Island than to any other part of the Kiklades.

Keywords. Aegean flora, biodiversity, endemism, phytogeography.

Introduction

The Aegean Sea has long attracted the attention of biogeographers (Turrill, 1929; Strid, 1996), since it is characterised by high environmental and topographical heterogeneity (Blondel *et al.*, 2010), diversity and endemism (Strid, 1996). The Aegean archipelago consists of more than 7000 islands and islets (Triantis & Mylonas, 2009), most of which are located in the phytogeographical region of the Kiklades. Intensive field work has taken place in this region, which is characterised as one of the most floristically explored phytogeographical regions of Greece (Dimopoulos *et al.*, 2013; Bergmeier & Strid, 2014). However, certain islands have been the main focal areas of floristic research, leaving our knowledge of the Kiklades' flora still incomplete.

Twenty-two large islands and numerous islets comprise the phytogeographical region of the Kiklades, which has long been considered floristically impoverished, compared to the other phytogeographical regions of Greece (Phitos *et al.*, 1995). The Kiklades host 1768 taxa (Dimopoulos *et al.*, 2013), 161 of which are Greek endemics (9.10%), and demonstrate lower than normal endemism, as expected by their size (Georghiou & Delipetrou, 2010). However, their degree of endemism is above average for Mediterranean islands (c.8%, Médail & Quézel, 1997) and in a recent analysis

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(Kougioumoutzis & Tiniakou, 2014), some members of the Kiklades emerged as plant diversity hotspots. The Kiklades seem predestined to biogeographical and floristic studies, due to their variability in size, palaeogeographical history and geological composition, as well as in topographical and climatic characteristics. Less than half the large islands comprising the phytogeographical region of the Kiklades are floristically well known (Hansen, 1971; Tzanoudakis, 1981; Raus, 1986, 1988, 2012; Böhling, 1994; Browicz, 1997; Livaniou-Tiniakou *et al.*, 2003; Snogerup *et al.*, 2006; Kougioumoutzis *et al.*, 2012, 2014a). Thus, we decided to investigate the flora of Folegandros Island thoroughly.

The island of Folegandros (Fig. 1) has a special geographical, biogeographical and ecological position in the Aegean area. It is located in the southern part of the phytogeographical area of the Kiklades, between the volcanic archipelagos of Milos and Santorini, and, despite its small size (c.32 km^2), it is characterised by a variety of substrates and is built up of five major tectono-stratigraphic units (Photiades & Keay, 2003), viz. schists with serpentinite bodies, gneiss, marbles, Quaternary and Neogene deposits. Folegandros forms a part of the median tectono-metamorphic Attic-Cycladic Complex, which is composed of an Alpine and pre-Alpine tectonic pile (Papanikolaou, 1984, 1987).

The study area is mainly hilly with an intense relief, the highest peak being Aghios Eleftherios hill (415 m). Several gravelly and sandy beaches can be found by the coast. The hydrographical network is rather limited, with no obvious runoff.

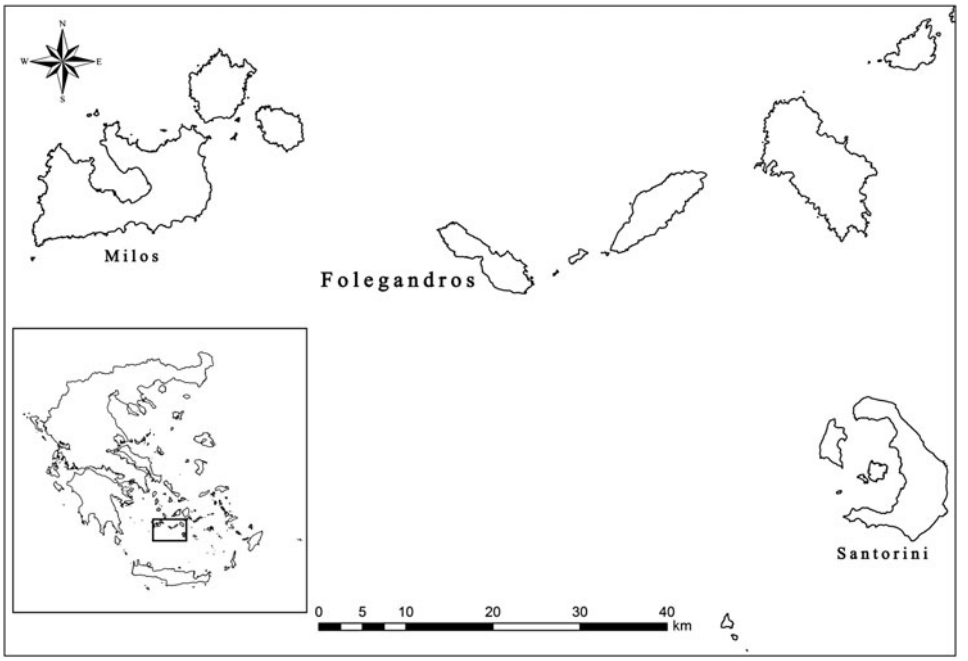

FIG. 1. Folegandros Island.

The nearest meteorological station to Folegandros lies in Antiparos island; according to Gouvas & Sakellariou (2011), this station and therefore the study area belongs to the arid bioclimatic zone with a mild winter and also to the Thermo-mediterranean zone, with a long dry period.

Rechinger (1944) was the first botanist to report on plants from Folegandros. Most records, however, were reported within the framework of the Natura 2000 research programme. Snogerup (1994), Runemark (1996, 2000, 2006), Strid & Tan (1997, 2002), Thanopoulos (2007) and Biel & Tan (2008) have also reported on plants from Folegandros. Information on some endemic taxa occurring in the area is given by Tan & Iatrou (2001). From a phytogeographical point of view, however, the interesting flora of the island of Folegandros has not yet received the attention it deserves.

The present study therefore aimed to thoroughly investigate the flora of Folegandros, by examining the floristic affinities of the study area to the other, floristically better explored islands of the phytogeographical region of the Kiklades, namely Anafi (Kougioumoutzis *et al.*, 2012), Andros (Snogerup *et al.*, 2006), Antiparos and Paros (Raus, 1986), Giaros (Tzanoudakis, 1981), Kimolos (Kougioumoutzis *et al.*, 2014a), Milos (Browicz, 1997; Raus, 2012), Naxos (Böhling, 1994), Santorini (Hansen, 1971; Raus, 1988; Tan & Iatrou, 2001) and Serifos (Livaniou-Tiniakou *et al.*, 2003).

Materials and Methods

Several collection and field observation trips to the study area were carried out in the spring and autumn of 2013 in order to acquire an integrated knowledge of the flora and vegetation of Folegandros. Herbarium specimens are deposited at the Botanical Museum of the University of Patras (UPA). Species identification and nomenclature are according to Tutin *et al.* (1964–1980, 1993), Davis (1965–1985), Pignatti (1982), Tan & Iatrou (2001), Greuter *et al.* (1984–1989), Strid & Tan (1997, 2002), Greuter & Raab-Straube (2008) and Dimopoulos *et al.* (2013). Species identification and nomenclature of the genera *Anthemis* L., *Astragalus* L., *Anchusa* L., *Crepis* L., *Dittrichia* Greuter, *Reichardia* Roth, *Tordylium* L. and *Trifolium* L. are according to Georgiou (1990), Podlech (2008), Selvi & Bigazzi (2003), Kamari (1976), Brullo & de Marco (2000), Gallego *et al.* (1980), Al-Eisawi & Jury (1988) and Zohary & Heller (1984) respectively. For family delimitation we follow APG III (2009). The nomenclature and status of the endemic taxa recorded from Folegandros are based on Tan & Iatrou (2001), Georghiou & Delipetrou (2010) and Dimopoulos *et al.* (2013). The status of the alien taxa occurring in the study area is according to Arianoutsou *et al.* (2010) and Dimopoulos *et al.* (2013). The life-form and chorological categories follow Dimopoulos *et al.* (2013 – see Appendix for abbreviations used). Sørensen's index (Sørensen, 1948) as well as the statistical software SPSS 20 are used for the cross-correlation between the islands. We used the same databases as in Kougioumoutzis & Tiniakou (2014) and Kougioumoutzis *et al.* (2014b) regarding the endemism levels in the phytogeographical region of the Kiklades.

Results

Flora

The vascular flora of Folegandros comprises 474 taxa, belonging to 263 genera and 68 families (Table 1). Six alien taxa are included in the plant list, but have not been considered in the floristic analysis.

The literature survey revealed 329 bibliographical reports for the study area (Rechinger, 1944; Snogerup, 1994; Runemark, 1996, 2000, 2006; Strid & Tan, 1997, 2002; Tan & Iatrou, 2001; Thanopoulos, 2007; Biel & Tan, 2008). We report 145 taxa as new to Folegandros (see Appendix). Forty taxa are Greek endemics, seven of which are new records for the study area. Fourteen of the new records and 47 taxa overall are under statutory protection.

The most species-rich families in the flora of Folegandros are the Asteraceae (64 taxa), followed by the Fabaceae (63 taxa) and Poaceae (48 taxa). These three families account for more than one third of the total flora (37.31%). Apiaceae (24 taxa), Caryophyllaceae (24 taxa), Brassicaceae (22 taxa) and Lamiaceae (14 taxa) are also well represented.

In life forms (Table 2) therophytes dominate, followed by hemicryptophytes, geophytes, chamaephytes and phanerophytes.

According to their general distribution, the local vascular flora can be classified into 15 main chorological groups (Table 3). The endemic group represents 8.55% of the total flora with 40 taxa. Phytogeographically, the endemic element is the most important group and is discussed separately. The Mediterranean chorological group predominates, highlighting the geographical position and climatic characteristics of the study area. The other chorological elements are represented in lower percentages, with a relatively high proportion of Asian elements, and also of invasive elements, indicating intense human impact in the study area.

The alien flora of Folegandros comprises six taxa (1.27%), belonging to six genera and six families. The neophytes amount to 60.00% of Folegandros alien flora and the most prominent among the invasive species is *Aeonium arboreum* (L.) Webb & Berthel., which occupies large areas, especially in the endemic species-rich calcareous cliffs of Folegandros.

Table 1. Number of vascular plant taxa in the flora of Folegandros Island

Systematic unit	Families	Genera	Taxa	%
Pteridophytes	3	5	5	1.06
Gymnospermae	2	2	2	0.42
Dicotyledones	49	200	374	78.90
Monocotyledones	14	56	93	19.62
Total	68	263	474	100.00

TABLE 2. Life forms in the flora of Folegandros Island

Life form	Total no. of taxa	%
Phanerophytes	24	5.13
Chamaephytes	37	7.91
Hemicryptophytes	86	18.38
Therophytes	269	57.48
Geophytes	51	10.90
Hydrophytes	1	0.20
Total	468	100.00

Endemism

According to Dimopoulos *et al.* (2013), 1768 taxa are found in the phytogeographical region of the Kiklades, 161 of which are considered endemics (9.10%). In Folegandros, 40 endemic taxa were found, making up 8.55% of its flora (Table 4). The level of endemism in Folegandros is rather low compared to that in the whole of Greece (22.2%, Dimopoulos *et al.*, 2013) but, taking into consideration the small size of the study area (c.32 km^2), its geographic position not close to known areas of

TABLE 3. Chorological groups in the flora of Folegandros Island

			Total	
Chorological group	No. of taxa	%	No. of taxa	%
1. *Widely distributed taxa*			82	17.52
European-SW Asian	40	8.55		
Euro-Siberian	7	1.50		
Paleotemperate	15	3.20		
Circumtemperate	2	0.43		
Subtropical-Tropical	6	1.28		
Cosmopolitan	12	2.56		
2. *Mediterranean taxa*			339	72.43
E Mediterranean	53	11.32		
Mediterranean	197	42.09		
Mediterranean-Atlantic	8	1.71		
Mediterranean-European	35	7.48		
Mediterranean-SW Asian	46	9.83		
3. *Balkan taxa*				
Balkan	1	0.21	7	1.50
Balkan-Italian	2	0.43		
Balkan-Anatolian	4	0.86		
4. *Endemic taxa*			40	8.55
Endemic	40	8.55		
Total	468	100.00	468	100.00

TABLE 4. Endemism in Folegandros and the phytogeographical region of the Kiklades, as well as in the other large Kikladic islands

Region	% endemics
Kiklades	9.10
Amorgos	7.99
Anafi	5.99
Andros	4.04
Antiparos	3.85
Astypalaea	6.35
Folegandros	8.55
Giaros	2.52
Ios	3.67
Kea	3.36
Kimolos	6.88
Kythnos	5.44
Milos	5.54
Mykonos	3.48
Naxos	5.00
Paros	3.90
Polyaegos	3.70
Santorini	3.57
Serifos	4.26
Sifnos	5.48
Sikinos	6.71
Syros	2.44
Tinos	3.38

high endemism, the unfavourable arid climate, as well as the intense human pressure present on the island (i.e. high intensity grazing, highly cultivated areas – abandoned or not), this percentage is rather significant. Furthermore, compared to endemism levels in other parts of the phytogeographical region of the Kiklades, yet with larger size than that of the study area (Table 4), that of Folegandros is rather high, even appearing to be the highest in the phytogeographical region of the Kiklades.

The endemic species belong to 19 families and 31 genera. Families rich in endemic species in absolute numbers are Asteraceae, Campanulaceae and Caryophyllaceae (Table 5), their degree of endemism (9.38%, 80.00% and 16.67%, respectively) being higher than that of the general flora (8.55%). These results agree with the trend observed in the whole Greek endemic flora (Georghiou & Delipetrou, 2010).

Nearly half (19) of the endemic taxa found on Folegandros correspond to one or two phytogeographical areas (Table 6), thus providing valuable information regarding the phytogeographical position of the study area, as the existence of biregional endemics is a good indication of phytogeographical connections between regions (Georghiou & Delipetrou, 2010). It would be expected that Folegandros shows higher affinities with the phytogeographical area of the East Aegean Islands (EAe) since, according to Georghiou & Delipetrou (2010), the phytogeographical area of the

TABLE 5. Families with endemic taxa and their degree of endemism

Family	No. of endemic taxa	%
Asteraceae	6	9.38
Campanulaceae	4	80.00
Caryophyllaceae	4	16.67
Apiaceae	3	12.50
Brassicaceae	3	13.64
Iridaceae	3	60.00
Asparagaceae	2	25.00
Fabaceae	2	3.17
Plumbaginaceae	2	33.33
Ranunculaceae	2	25.00
Amaryllidaceae	1	10.00
Boraginaceae	1	7.14
Chenopodiaceae	1	10.00
Liliaceae	1	33.33
Orchidaceae	1	9.09
Poaceae	1	2.08
Primulaceae	1	25.00
Rubiaceae	1	7.69
Scrophulariaceae	1	10.00

Kiklades (Kik) is chorologically more closely connected to EAe than to that of Kriti and Karpathos (KK). While this may be true for the majority of the Kikladic islands, our results demonstrate that Folegandros is phytogeographically closer to KK, as we recorded eight endemic taxa (*Anthyllis splendens* Willd., *Campanula laciniata* L., *Dianthus fruticosus* L. subsp. *amorginus* Runemark, *Eryngium amorginum* Rech.f., *Erysimum candicum* Snogerup subsp. *candicum*, *Galium amorginum* Halácsy, *Pimpinella pretenderis* (Heldr.) Orph. ex Halácsy and *Sternbergia greuteriana* Kamari & Artelari) occurring exclusively in Kik and KK and only two taxa (*Silene cythnia* (Halácsy) Walters and *Campanula calaminthifolia* Lam.) that occur exclusively in Kik and EAe. Therefore we argue that Folegandros seems to be more closely connected to KK, concurring with previous studies in the southern part of the phytogeographical area of the Kiklades (Kougioumoutzis *et al.*, 2012, 2014a). It could be argued that the southern Kiklades as a whole have higher phytogeographical affinities with Kriti and this could possibly be attributed to the close palaeogeographical distance between southern Kiklades and Kriti during the Messinian salinity crisis (Hsü, 1972). Our results concur with Kougioumoutzis *et al.* (2014b), according to whom most of the biregional endemics present in the phytogeographical region of the Kiklades originate from the phytogeographical region of Kriti and Karpathos.

The conservation status of the Greek endemic taxa of Folegandros, as well as their evaluation status within the Natura 2000 Network, is shown in Table 6. Twenty-four out of 40 endemic taxa are under statutory protection.

TABLE 6. Greek endemic taxa in Folegandros, their geographical distribution and their protection and evaluation status according to European and national legislation and lists

Family	Taxon	Pe	StE	WAe	IoI	SPi	NPi	EC	NC	NE	NAe	Kik	KK	EAe	Protection status	Natura 2000
Apiaceae	*Eryngium amorginum* Rech.f.											*	*		RDB (R), PD 67/81	—
Apiaceae	*Pimpinella pretenderis* (Heldr.) Halácsy											*	*		RDB (R), PD 67/81	—
Apiaceae	*Seseli gummiferum* Sm. subsp. *crithmifolium* (DC.) P.H.Davis											*	*	*	PD 67/81	—
Asteraceae	*Anthemis scopulorum* Rech.f.	*		*								*	*	*	—	—
Asteraceae	*Centaurea laconica* Boiss. subsp. *lineariloba* (Halácsy) Wagenitz & E.Gamal-Eldin											*			IUCN (R)	—
Asteraceae	*Centaurea raphanina* Sm. subsp. *mixta* (DC.) Runemark	*	*	*								*			—	B
Asteraceae	*Crepis hellenica* Kamari subsp. *hellenica*	*	*	*		*		*		?		*		*	—	B
Asteraceae	*Filago cretensis* Gand. subsp. *cretensis*	*	*	*								*	*	*	—	B
Asteraceae	*Scorzonera cretica* Willd.	*										*	*	*	—	—
Boraginaceae	*Anchusella variegata* (L.) Bigazzi, Nardi & Selvi	*	*	*	*			*	?		*	*	*	*	—	—
Brassicaceae	*Erysimum candicum* Snogerup subsp. *candicum*		*	*											PD 67/81	—
Brassicaceae	*Erysimum senoneri* (Heldr. & Sartori) Wettst. subsp. *senoneri*			*								*			—	B
Brassicaceae	*Fibigia lunarioides* (Willd.) Sm.											*	*	*	PD 67/81	B
Campanulaceae	*Campanula anchusiflora* Sm.	*										*			—	—
Campanulaceae	*Campanula calaminthifolia* Lam.											*		*	—	—
Campanulaceae	*Campanula heterophylla* L.											*			PD 67/81	—

TABLE 6. (*Cont'd*)

Campanulaceae	*Campanula laciniata* L.											*	*		RDB (R), PD 67/81	B
Caryophyllaceae	*Arenaria aegaea* Rech.f.	*										*	*	*	—	B
Caryophyllaceae	*Dianthus fruticosus* L. subsp. *amorginus* Runemark											*	*		PD 67/81	—
Caryophyllaceae	*Silene adelphiae* Runemark											*			—	—
Caryophyllaceae	*Silene cythnia* (Halácsy) Walters											*		*	PD 67/81	—
Chenopodiaceae	*Atriplex recurva* d'Urv.		*	*					*	*		*	*		—	—
Fabaceae	*Anthyllis splendens* Willd.											*	*		RDB (R), PD 67/81	B
Fabaceae	*Vicia cretica* Boiss. & Heldr. subsp. *aegaea* (Halácsy) P.W.Ball		*									*			PD 67/81	—
Plumbaginaceae	*Limonium doerfleri* (Halácsy) Rech.f.											*	*	*	—	—
Plumbaginaceae	*Limonium ocymifolium* (Poir.) Kuntze	*	*									*	*	*	—	B
Primulaceae	*Cyclamen graecum* Link subsp. *graecum*	*	*	*		*		*	*	*	*	*			CITES	—
Ranunculaceae	*Nigella degenii* Vierh. subsp. *degenii*											*			—	—
Ranunculaceae	*Nigella doerfleri* Vierh.	*										*	*		—	B
Rubiaceae	*Galium amorginum* Halácsy											*	*		PD 67/81	—
Scrophulariaceae	*Scrophularia heterophylla* Willd. var. *heterophylla*	*	*	*	*			*		*	*	*	*	*	—	—
Amaryllidaceae	*Sternbergia greuteriana* Kamari & Artelari											*	*		—	—
Asparagaceae	*Bellevalia hyacinthoides* (Bertol.) K.M.Perss. & Wendelbo	*	*		*	*		*	*	?		*			—	—

TABLE 6. (*Cont'd*)

Family	Taxon	Pe	StE	WAe	IoI	SPi	NPi	EC	NC	NE	NAe	Kik	KK	EAe	Protection status	Natura 2000
Asparagaceae	*Muscari cycladicum* P.H.Davis & D.C.Stuart subsp. *cycladicum*											*			—	—
Iridaceae	*Crocus cartwrightianus* Herb.	*	*		?							*	*		—	—
Iridaceae	*Crocus laevigatus* Bory & Chaub.	*	*	*						?		*	*		—	—
Iridaceae	*Crocus tournefortii* J.Gay	*										*	*	*	—	B
Liliaceae	*Fritillaria ehrhartii* Boiss. & Orph.			*								*			—	—
Orchidaceae	*Ophrys spruneri* Nyman subsp. *spruneri*	*	*	*	*	*	*					*	*	*	CITES	—
Poaceae	*Phleum exaratum* Griseb. subsp. *aegaeum* (Vierh.) Doğan	*										*	*	*	—	—

Abbreviations:

Pe, Peloponnisos; StE, Sterea Hellas; WAe, West Aegean Islands; IoI, Ionian Islands; SPi, South Pindhos; NPi, North Pindhos; EC, East Central; NC, North Central; NE, North East; NAe, North Aegean Islands; Kik, Kiklades; KK, Kriti and Karpathos; EAe, East Aegean Islands.

CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora.

IUCN: *Red List of Threatened Plants* (IUCN, 2010), with the following classification system: R: the species population is rare.

Natura 2000 (Dafis *et al*., 1996): The database created after the Directive 43/1992, where the plants are evaluated as: B: Greek endemics.

PD: Greek Presidential Decree 67/1981 (1981), on the protection of the native flora and wild fauna of Greece.

RDB: *Red Data Book of Rare and Threatened Plants of Greece*.

Phytogeographical relationships within the Kiklades

The phytogeographical region of the Kiklades consists of 22 large islands; detailed and available floristic data exist, however, only for the following islands: Anafi, Andros, Antiparos and Paros, Giaros, Kimolos, Milos, Naxos, Santorini and Serifos. Therefore, we focus on these 10 islands in order to examine the floristic affinities of Folegandros Island within the phytogeographical region of the Kiklades.

All the islands in the comparison are in the same bioclimatic zone and phytogeographical region (Kik) as the study area, except for Naxos, which has a more humid climate, although being part of the same phytogeographical region (Kik).

In Table 7 Sørensen's index values for each island pair show that Folegandros has the strongest phytogeographical affinity with Anafi.

Discussion

The high percentages of therophytes (57.48%) and of leguminous taxa (13.43%) indicate disturbance in Mediterranean ecosystems (Naveh, 1974; Arianoutsou & Margaris, 1981; Barbero *et al.*, 1990; Panitsa *et al.*, 1994, 2003; Panitsa & Tzanoudakis, 1998). Intense stock farming and other agricultural activities have not yet ceased in Folegandros and have clearly altered the island's floristic character, as the relatively high local amount of Asian elements (8.55%) suggests.

According to Arianoutsou *et al.* (2010), the total number of alien taxa accounts for c.5% of the native flora of Greece, which is significantly higher than that of Folegandros (1.27%). Nevertheless, in Folegandros where abandoned grazing grounds and farm lands occupy large areas, *Aeonium arboreum* has heavily contaminated and altered these habitats which would otherwise be colonised by native pioneer herbs and shrubs. This phenomenon is also observed in other Aegean islands (Arianoutsou *et al.*, 2010; Kougioumoutzis *et al.*, 2012, 2014a).

Table 7. Sørensen's index values for each large island of the phytogeographical region of the Kiklades compared to Folegandros Island

Pair with Folegandros	Sørensen's index
Anafi	63.4
Kimolos	55.4
Santorini	54.7
Antiparos	54.4
Paros	53.1
Serifos	53.0
Milos	52.4
Naxos	47.3
Andros	43.9
Giaros	43.1

The high percentages of chamaephytes and hemicryptophytes depend on the frequency of limestone cliffs which very often harbour endemic taxa (Kypriotakis, 1998; Kypriotakis & Tzanoudakis, 2001; Tzanoudakis *et al.*, 2006). In Folegandros, nearly half (45%) of the endemic flora are chamaephytes or hemicryptophytes, which are scattered in the numerous steep calcareous cliffs present on the island.

The number of species per surface unit is an important parameter of Aegean vascular plant diversity, in relation to the conservation of the diversity of the Aegean area (Panitsa & Tzanoudakis, 2010). In this context Folegandros seems to be a biodiversity hotspot at least for the phytogeographical region of the Kiklades, in spite of the intense human presence and the relatively low number of plant taxa present on the island, as it hosts more than five times (14.7 species/km^2) the taxa per surface unit than Andros or Naxos (2.7 and 2.4 species/km^2, respectively), 37 times the taxa compared to the whole East Aegean area (0.4 species/km^2, Panitsa & Tzanoudakis, 2010) and 27 times the taxa compared to the Kiklades (c.0.54 species/km^2, Phitos *et al.*, 1995). Moreover, Folegandros hosts 10 times (1.25 endemic species/km^2) the endemic taxa per surface unit compared to Andros and Naxos (0.11 and 0.12 endemic species/km^2, respectively) and 21 times the endemic taxa compared to the Kiklades (0.06 endemic species/km^2). Our results concur with Kougioumoutzis & Tiniakou (2014), who characterised Folegandros as an endemic plant diversity hotspot in the phytogeographical region of the Kiklades.

The existence of biregional endemics is a good indication of phytogeographical connections between regions (Georghiou & Delipetrou, 2010). Eight endemic taxa found in the study area – *Anthyllis splendens*, *Campanula laciniata*, *Dianthus fruticosus* subsp. *amorginus*, *Eryngium amorginum*, *Erysimum candicum* subsp. *candicum*, *Galium amorginum*, *Pimpinella pretenderis* and *Sternbergia greuteriana* – provide useful information regarding the biogeographical position of Folegandros, as they are found exclusively in the phytogeographical regions of Kiklades and Kriti-Karpathos. Folegandros seems to have very close phytogeographical affinities with Amorgos, Anafi and Astypalaea. More specifically, *Erysimum candicum* subsp. *candicum* and *Sternbergia greuteriana* can only be found outside the phytogeographical region of Kriti-Karpathos, in Anafi and Folegandros. The rest of the aforementioned taxa have a wider southern Kikladic distribution; most of them, however, are also found in (or were described from) Amorgos. In particular, *Anthyllis splendens* is found outside Kriti only in Amorgos, Anafi, Folegandros and Kythnos, *Campanula laciniata* is reported from Kriti, Karpathos, Amorgos, Anafi, Astypalaea, Folegandros, Kythnos, Sikinos and Sifnos, *Dianthus fruticosus* subsp. *amorginus* is distributed in Kriti and Amorgos, Astypalaea, Folegandros, Kimolos, Milos and Sikinos, *Eryngium amorginum* is found in Kriti, Amorgos, Astypalaea and Folegandros, *Galium amorginum* in Kriti, Amorgos, Folegandros and Naxos, while *Pimpinella pretenderis* is distributed in Kriti, Astypalaea, Folegandros, Ios, Santorini and Sikinos. The evidence presented here suggests a close phytogeographical relationship between Folegandros and Kriti, as well as between southern Kiklades and Kriti since, according to Strid & Tan (1997),

the phytogeographical region of Kriti and Karpathos has strong connections to that of the Kiklades, especially as far as the dry southeastern islands are concerned.

The flora of Folegandros is more similar to that of Anafi, and then to Kimolos and Santorini (Kik), than to that of Andros and Giaros. The stronger floristic affinities between Folegandros and Anafi can be attributed to the fact that in both these islands there are numerous calcareous cliffs hosting several rare and endemic taxa, as well as to their quite similar climatic conditions. On the other hand, the rather low floristic similarity between Folegandros and Andros can be attributed to the more humid climate of the latter; after all, the phytogeographical region of the Kiklades is climatically compartmentalised (Theocharatos, 1978). Our results are in accordance with the phytogeographical compartmentalisation of the Kiklades (Kougioumoutzis *et al.*, 2014b), as well as with the fact that Folegandros acts as an endemic species pool in the phytogeographical region of the Kiklades (Kougioumoutzis *et al.*, 2014b).

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APPENDIX

Notes

- Only taxa new to the investigated area appear in the catalogue below.
- Names of taxa not native to the area are in square brackets.

Abbreviations used

KK: K. Kougioumoutzis observations and/or vouchers
Obs.: Field observation
Phot.: Photograph

Collection dates

a: 24/03/2013–27/03/2013
b: 20/04/2013–22/04/2013
c: 18/05/2013–19/05/2013
d: 24/11/2013–25/11/2013

Collection sites

1. 109 m. N36°35′46.5″ E24°56′4.5″
2. 84 m. N36°35′41.4″ E24°56′44.4″
3. 5 m. N36°36′25.6″ E24°57′8.4″
4. 388 m. N36°37′15.3″ E24°54′40.6″
5. 108 m. N36°37′49.1″ E24°54′52.3″
6. 76 m. N36°38′3.2″ E24°54′18.0″
7. 152 m. N36°39′10.2″ E24°52′27.8″
8. 2 m. N36°37′49.9″ E24°51′20.9″
9. 309 m. N36°37′47.8″ E24°55′28.8″
10. 226 m. N36°37′24.5″ E24°56′4.6″
11. 178 m. N36°37′34.1″ E24°54′6.9″
12. 141 m. N36°37′32.7″ E24°53′58.8″
13. 106 m. N36°35′44.8″ E24°56′12.5″
14. 82 m. N36°35′39.1″ E24°56′46.7″
15. 5 m. N36°36′25.6″ E24°57′8.4″
16. 136 m. N36°37′24.1″ E24°56′12.0″
17. 15 m. N36°37′1.8″ E24°50′47.7″
18. 175 m. N36°37′24.8″ E24°55′44.4″
19. 159 m. N36°37′41.2″ E24°54′58.5″
20. 92 m. N36°35′49.0″ E24°56′19.8″
21. 109 m. N36°35′35.9″ E24°56′44.5″
22. 379 m. N36°37′15.7″ E24°54′39.9″
23. 149 m. N36°37′30.9″ E24°54′2.9″
24. 241 m. N36°37′36.4″ E24°55′23.3″
25. 274 m. N36°37′48.4″ E24°55′29.3″

Life forms

Chamaephyte (Ch)
Hemicryptophyte (H)
Hydrophyte (A)
Geophyte (G)
Phanerophyte (P)
Therophyte (T)

Chorological groups

Widely distributed taxa
European-SW Asian (EA)
Euro-Siberian (ES)
Paleotemperate (Pt)
Circumtemperate (Ct)
Subtropical-Tropical (ST)
Cosmopolitan (Co)

Mediterranean taxa
Eastern Mediterranean (EM)
Mediterranean (Me)
Mediterranean-Atlantic (MA)
Mediterranean-European (ME)
Mediterranean-SW Asian (MS)

Balkan taxa
Balkan (Bk)
Balkan-Italian (BI)
Balkan-Anatolian (BA)

Endemic taxa (Endemic)

Adventive taxa (Adv.)

Catalogue of plants

FERNS

Pteridaceae
Adiantum capillus-veneris L. – G, ST; L; 17, b, KK 3204

ANGIOSPERMAE

Acanthaceae
Acanthus spinosus L. – H, Me; KK Phot.

Amaryllidaceae
Allium neapolitanum Cirillo – G, Me; 9, a, KK 2899
Sternbergia greuteriana Kamari & Artelari – G, Endemic; 25, d, KK 3209

Apiaceae
Daucus guttatus Sm. subsp. *guttatus* – T, Me; 13, b, KK 3282; 16, b, KK 3298
Foeniculum vulgare Mill. – H, Me; L; KK Obs.
Prangos ferulacea (L.) Lindl. – H, EA; L; KK Obs.
Scandix pecten-veneris L. – T, EA; L; 1, a, KK 2980; 10, a, KK 3222

Asparagaceae
Muscari commutatum Guss. – G, BI; 4, a, KK 3210
Muscari cycladicum P.H.Davis & D.C.Stuart subsp. *cycladicum* – G, Endemic; 1, a, KK 2896; 5, a, KK 3115
Ornithogalum narbonense L. – G, Me; L; 13, b, KK 3254

Asteraceae
Anthemis rigida (Sm.) Heldr. – T, EM; 7, a, KK 3368
Calendula arvensis (Vaill.) L. – T, ME; L; 2, a, KK 3058; 4, a, KK 2862
Carduus pycnocephalus L. subsp. *pycnocephalus* – T, Me; 1, a, KK 3001
Crepis foetida L. subsp. *rhoeadifolia* (M.Bieb.) Čelak. – T, EA; L; 1, a, KK 2951
Crepis sancta (L.) Bornm. – T, EA; 1, a, KK 2969
Hedypnois rhagadioloides (L.) F.W.Schmidt subsp. *tubaeformis* (Ten.) Hayek – T, Me; L; 1, a, KK 2946; 13, b, KK 3253; 15, b, KK 3330
Hyoseris scabra L. – T, Me; 9, a, KK 2885; 11, a, KK 2850
Hypochaeris cretensis (L.) Bory & Chaub. – T, Me; 13, b, KK 3287; 16, b, KK 3294
Lactuca acanthifolia (Willd.) Boiss. – H, EM; F; KK Obs.
Notobasis syriaca (L.) Cass. – T, Me; 16, b, KK 3299
Ptilostemon chamaepeuce (L.) Less. – H, EM; L; KK Obs.
Rhagadiolus stellatus (L.) Gaertn. – T, Me; 1, a, KK 2978; 13, b, KK 3250
Scorzonera mollis M.Bieb. – H, EA; L; 1, a, KK 2934; 2, a, KK 3063; 11, a, KK 2828; 12, b, KK 3341; 13, b, KK 3255
Sonchus tenerrimus L. – T, Me; L; 3, a, KK 3078; 7, a, KK 2825; 9, a, KK 2912
Tragopogon dubius Scop. – H, EA; 10, a, KK 3219
Tragopogon porrifolius L. – H, Me; 1, a, KK 2922; 11, a, KK 2844; 12, b, KK 3342

Boraginaceae
Anchusa aegyptiaca (L.) DC. – H, EM; L; 1, a, KK 2924
Anchusa italica Retz. – H, Me; KK Obs.
Buglossoides arvensis (L.) I.M.Johnst. – T, Me; 4, a, KK 2871
Cynoglossum columnae Ten. – T, Me; 1, a, KK 2944
Echium diffusum Sm. – T, Me; L; 4, a, KK 2870

Echium parviflorum Moench – T, Me; L; 16, b, KK 3293
Echium plantagineum L. – T, ME; 12, a, KK 2858
Neatostema apulum (L.) I.M.Johnst. – T, Me; L; 13, b, KK 3277
Onosma graecum Boiss. – T, EM; 1, a, KK 2971

Brassicaceae
Erysimum candicum Snogerup subsp. *candicum* – Ch, Endemic; F; 5, a, KK 3103; 6, a, KK 3112; 7, a, KK 2827; 9, a, KK 2883
Matthiola incana (L.) R.Br. – Ch, ME; 17, b, KK 3338

Campanulaceae
Campanula erinus L. – T, ME; L; 13, b, KK 3263

Caryophyllaceae
Spergularia diandra (Guss.) Boiss. – T, EA; L; 7, a, KK 2853; 9, a, KK 2873
Spergularia media (L.) C.Presl – Ch, Me; 15, b, KK 3321

Chenopodiaceae
Salsola tragus L. – T, Pt/[Co]; KK Obs.

Convolvulaceae
Cuscuta palaestina L. – T, Me; L; 14, b, KK 3317

Crassulaceae
[*Aeonium arboreum* (L.) Webb & Berthel.] – H/C, [NW-Afr.]; KK Obs.

Cucurbitaceae
Bryonia cretica L. – G, EM; L; 9, a, KK 2909

Euphorbiaceae
Euphorbia exigua L. – T, ME; L; 2, a, KK 3048
Euphorbia helioscopia L. – T, Co; 1, a, KK 2964
Euphorbia peplus L. – T, Co; 1, a, KK 3009

Fabaceae
Astragalus echinatus Murray – T, Me; L; 15, b, KK 3307
Astragalus hamosus L. – T, MS; L; 6, a, KK 3116
Astragalus spruneri Boiss. – T, Bk; L; 6, a, KK 3193
Coronilla scorpioides (L.) W.D.J.Koch – T, ME; L; 2, a, KK 3036
Hedysarum spinosissimum L. – G, Me; 1, a, KK 3000; 13, b, KK 3258; 15, b, KK 3319
Hippocrepis unisiliquosa L. – T, Me; 11, a, KK 2838
Lathyrus aphaca L. – T, MS; L; 6, a, KK 3199
Lathyrus cicera L. – T, MS; L; 11, a, KK 2837; 13, b, KK 3333
Lathyrus clymenum L. – T, Me; L; 2, a, KK 3064
Lathyrus setifolius L. – T, Me; L; 12, b, KK 3367
Lotus ornithopodioides L. – T, Me; L; 1, a, KK 3011; 2, a, KK 3060; 6, a, KK 3117; 9, a, KK 2906; 12, b, KK 3370
Medicago disciformis DC. – T, Me; 10, a, KK 3224
Medicago polymorpha L. – T, Pt; 1, a, KK 2953; 6, a, KK 3112
Medicago truncatula Gaertn. – T, MS; L; 2, a, KK 3044; 9, a, KK 2874
Onobrychis aequidentata (Sm.) d'Urv. – T, Me; L; 1, a, KK 2963; 10, a, KK 3218; 15, a, KK 3328
Onobrychis caput-galli Lam. – T, Me; 12, b, KK 3353; 14, b, KK 3301
Ononis ornithopodioides L. – T, Me; 13, b, KK 3267
Ononis viscosa L. subsp. *sieberi* (DC.) Širj. – T, Me; 12, b, KK 3385; 15, b, KK 3308

Trifolium nigrescens Viv. – T, Me; L; 1, a, KK 2935; 9, a, KK 2881
Trifolium spumosum L. – T, Me; L; 7, a, KK 2803
Trifolium tomentosum L. var. *tomentosum* – T, Me; L; 6, a, KK 3105; 7, a, KK 2814; 11, a, KK 2834
Vicia cretica subsp. *aegaea* (Halácsy) P.W.Ball – T, Endemic; 10, a, KK 3225
Vicia hybrida L. – T, Eurymed.; 7, a, KK 2807
Vicia sativa subsp. *cordata* (Hoppe) Batt. – T, ME; 11, a, KK 2863
[*Vicia sativa* L. subsp. *sativa*] – T, Pt; 1, a, KK 2956; 6, a, KK 3123; 11, a, KK 2842; 12, b, KK 3388

Gentianaceae
Centaurium tenuiflorum (Hoffmanns. & Link) Fritsch subsp. *tenuiflorum* – T, ME; 2, a, KK 3205; 12, b, KK 3346; 15, b, KK 3309

Geraniaceae
Erodium gruinum (L.) L'Hér. – T, EM; L; 2, a, KK 3046; 9, a, KK 2908
Geranium molle L. – T, Pt; L; 1, a, KK 2937; 4, a, KK 2864; 16, b, KK 3296
Geranium purpureum Vill. – T, Me; L; KK Obs.

Hypericaceae
Hypericum triquetrifolium Turra – H, EM; L; 1, a, KK 3017

Iridaceae
Crocus cartwrightianus Herb. – G, Endemic; 21, d, KK Phot.; 22, d, KK Phot.
Crocus laevigatus Bory & Chaub. – G, Endemic; 21, d, KK Phot.; 22, d, KK Phot.; 24, d, KK Phot.

Lamiaceae
Lamium moschatum Mill. – T, EM; L; 5, a, KK 3097
Salvia verbenaca L. – H, MA; L; 1, a, KK 2923
Salvia viridis L. – T, Me; L; 1, a, KK 3002; 10, a, KK 3212
Sideritis romana L. subsp. *curvidens* (Stapf) Holmboe – T, EM; L; 11, a, KK 2833

Liliaceae
Gagea graeca (L.) Irmsch. – G, BA; 4, a, KK 2984
Gagea peduncularis (J.Presl & C.Presl) Pascher – G, Me; 4, a, KK 2859

Linaceae
Linum bienne Mill. – H, Me; 2, a, KK 3030
Linum strictum L. subsp. *strictum* – T, Me; 1, a, KK 2995; 12, b, KK 3381; 13, b, KK 3276; 15, b, KK 3315

Malvaceae
Malva parviflora L. – T, MS; L; 7, a, KK 2818
Malva pusilla Sm. – T, ES; 1, a, KK 3013

Myrtaceae
[*Eucalyptus camaldulensis* Dehnh.] – P, [Austr.]; KK Obs.

Oleaceae
Olea europaea L. – P, Me; L; KK Obs.

Orchidaceae
Anacamptis collina (Russell) R.M.Bateman, Pridgeon & M.W.Chase – G, MS; KK Phot.
Anacamptis papilionacea (L.) R.M.Bateman, Pridgeon & M.W.Chase – G, MS; KK Phot.
Ophrys ferrum-equinum Desf. – G, BA; KK Phot.
Ophrys fusca Link subsp. *fusca* – G, Me; KK Phot.

Ophrys fusca Link subsp. *iricolor* (Desf.) K.Richt. – G, Me; KK Phot.
Ophrys lutea subsp. *galilaea* (H.Fleischm. & Bornm.) Soó – G, Me; KK Phot.
Ophrys lutea Cav. subsp. *lutea* – G, Me; KK Phot.
Ophrys omegaifera H.Fleischm. – G, Me; KK Phot.
Ophrys spruneri Nyman subsp. *spruneri* – G, Endemic; KK Phot.
Ophrys tenthredinifera Willd. – G, Me; KK Phot.
Serapias orientalis (Greuter) H.Baumann & Künkele subsp. *orientalis* – G, Me; KK Phot.

Orobanchaceae
Orobanche minor Sm. – T, EA; L; KK Phot.
Orobanche pubescens d'Urv. – T, Me; L; KK Phot.
Phelipanche nana (Reut.) Soják – T, Pt; L; KK Phot.

Papaveraceae
Fumaria capreolata L. – T, Me; 19, c, KK 3237
Glaucium corniculatum (L.) Rudolph – T, Me; 14, b, KK 3304
Glaucium flavum – H, ME; KK Phot.
Papaver rhoeas L. var. *rhoeas* – T, EM; 1, a, KK 2919; 2, a, KK 3032; 9, a, KK 2890; 11, a, KK 2845; 12, b, KK 3259; 19, c, KK 3234
Papaver rhoeas L. var. *strigosum* Boenn. – T, Pt; 2, a, KK 3019; 13, b, KK 3251

Plantaginaceae
Plantago afra L. – T, Me; 2, a, KK 3026; 9, a, KK 2904

Poaceae
Anisantha diandra (Roth) Tutin – T, Me; 12, b, KK 3368
Anisantha fasciculata (C.Presl) Nevski – T, Me; 1, a, KK 2993; 13, b, KK 3262
Anisantha sterilis (L.) Nevski – T, MS; L; 13, b, KK 3249
Avena sterilis L. – T, MS; L; 9, a, KK 2877
Briza maxima L. – T, ST; 1, a, KK 2985; 12, b, KK 3248
Hainardia cylindrica (Willd.) Greuter – T, Me; 12, b, KK 3365
Hordeum murinum L. subsp. *leporinum* (Link) Arcang. – T, Me; 2, a, KK 3054; 6, a, KK 3108; 9, a, KK 2914; 12, b, KK 3367; 15, b, KK 3312
Melica minuta L. – H, Me; L; 12, b, KK 3247
Phleum arenarium L. – T, MS; 7, a, KK 2820; 15, b, KK 3326
Phragmites australis (Cav.) Steud. – G, Co; KK Obs.
Piptatherum miliaceum (L) Coss. – H, MS; 7, a, KK 2810
Poa timoleontis Boiss. – H, EM; 1, a, KK 2926
Polypogon maritimus Willd. subsp. *maritimus* – T, Me; 1, a, KK 2984
Polypogon monspeliensis (L.) Desf. – T, ST; 2, a, KK 3027; 15, b, KK 3313
Stipa capensis Thunb. – T, Me; L; 14, b, KK 3302
Stipa pennata L. – H, ES; 2, a, KK 3047; 13, b, KK 3284

Posidoniaceae
Posidonia oceanica (L.) Delile – A, Me; KK Obs.

Primulaceae
Samolus valerandi L. – H, Co; 17, b, KK 3200

Rubiaceae
Galium murale (L.) All. – T, Me; L; 12, b, KK 3378; 13, b, KK 3260
Galium setaceum Lam. – T, MS; L; 16, b, KK 3290
Galium spurium L. – T, Ct; 1, a, KK 2918; 2, a, KK 3056; 5, a, KK 3095; 7, a, KK 2806; 15, b, KK 3318

Galium verrucosum Huds. – T, Me; 9, a, KK 2895
Sherardia arvensis L. – T, EA; 7, a, KK 2804

Scrophulariaceae
Linaria triphylla (L.) Mill. – T, Me; L; 2, a, KK 3022; 9, a, KK 2891
Scrophularia lucida L. – H (Ch), Me; L; 5, a, KK 3096
Veronica agrestis L. – T, EA; 4, a, KK 2861
Veronica cymbalaria Bodard – T, Me; 9, a, KK 2884
Veronica polita Fr. – T, EA; L; 1, a, KK 2927

Tamaricaceae
Tamarix hampeana Boiss. & Heldr. – NP, EM; 2, a, KK 3023; 7, a, KK 2824

Urticaceae
Parietaria judaica L. – H, EA; 17, b, KK 3336

Valerianaceae
Centranthus calcitrapae (L.) Dufr. – T, Me; L; 2, a, KK 3039; 10, a, KK 3216; 13, b, KK 3283
Valerianella discoidea Loisel. – T, Me; L; 1, a, KK 2929; 2, a, KK 3041
Valerianella vesicaria (L.) Moench – T, MS; 12, b, KK 3390; 13, b, KK 3274