Article

Fl. Medit. 34: 95-111
https://doi.org/10.7320/FlMedit34.095
Version of Record published online on 2 May 2024

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Checklist updating and analysis of the flora of Sifnos Island and Kitriani Islet (Kiklades, Greece) with new noteworthy floristic records

Abstract

Cattaneo, C. & Grano, M.: Checklist updating and analysis of the flora of Sifnos Island and Kitriani Islet (Kiklades, Greece) with new noteworthy floristic records. — Fl. Medit. 34: 95-111. 2024. — ISSN: 1120-4052 printed, 2240-4538 online.

The aim of this work is to provide a contribution to the flora of Sifnos Island and Kitriani Islet by analyzing the distribution patterns and endemism of their vascular flora. The total flora of Sifnos Island consists of 95 families, 381 genera and 776 taxa including alien species. A comparison, albeit partial, with the first florula of the island compiled by Malakates in 1933 was also made, highlighting the landscape changes that have occurred over the years due to the dessication of the island following human exploitation of its resources. Also in the present paper, 26 additional species for both islands are added as new records. In particular for the island of Sifnos, *Gagea pseudopeduncularis*, *Limonium oligotrichum* and *L. sitiacum* new for the phytogeographic region of the Kiklades, *Campanula heterophylla* and *Galanthus ikariae*, endemic species with a rather restricted distribution in the Aegean area.

Key words: floristics, endemism, aliens, Mediterranean.

Article history: Received 11 December 2023; received in revised form 7 February 2024; accepted 21 February 2024; published 2 May 2024.

Introduction

Sifnos lies in the western Kiklades. It belongs to the administrative region of South Aegean and to the regional unit of Milos. It is located between Serifos, Kimolos and Antiparos (36° 58’ N 24° 45’ E) and is 80 nm from Piraeus. The island covers an area of 74 km² and the coastline is approximately 70 km. The main bays are Kamares, Faros, Vathy, and Herronisos (Fig. 1). Sifnos shows the typical Cycladic landscape characterized by land terraces cultivated with cereal crops, vineyards and olive trees interspersed with bushy vegetation. The western side of the island and precisely the area between Kamares and Vathy is a Special Protection Area and a Site of Community Importance according to European directives (GR 4220008) mostly occupied by Profitis Ilias, the highest peak of the island (682 m a.s.l.) with the springs of Agia Marina, Agios Ioannis and Panagia. The most relevant element of this site is the *Juniperus turbinata* Guss. maquis interspersed with

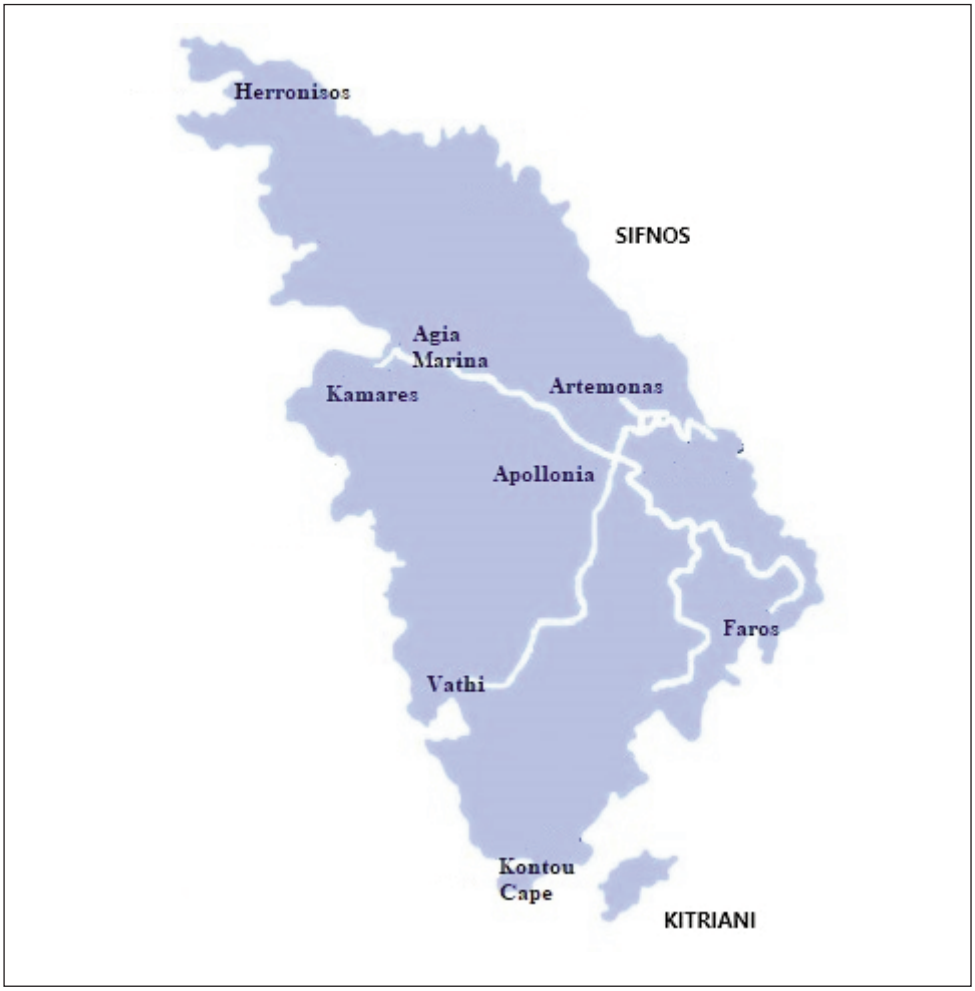

Fig. 1. Sifnos Island and Kitriani Islet.

phrygana whose most representative elements are: *Sarcopoterium spinosum* (L.) Spach, *Thymbra capitata* (L.) Cav., *Salvia fruticosa* Mill., *Origanum onites* L., and *Genista acanthoclada* DC. The northern section of the island is one of Greece's most important areas for birds, breeding raptors and passage migrants (https://old.ornithologiki.gr/; http://datazone.birdlife.org/site/factsheet/northern-sifnos-iba-greece). Not too far from the southernmost Kontou Cape lies the uninhabited islet of Kitriani, which administratively belongs to Sifnos. It is under one kilometre long with a maximum elevation of 136.8 m a.s.l. From a floristic point of view, it is mainly characterized by dense low scrub of *Juniperus turbinata* and *Pistacia lentiscus* L. The islet can only be reached by private boats from Plati Yalos located on the opposite cost of Sifnos.

The botanical explorations of Sifnos

John Sibthorp and Ferdinand Bauer passed Sifnos when sailing north from Crete to the Greek mainland in the summer of 1786, but do not appear to have set foot on the island. Instead, Sibthorp's associate John Hawkins visited Sifnos in 1787, but probably did not collect plants since there are no records in Florae Graecae Prodromus (1806-1816). The first published records from Sifnos appear in Chaubard & Bory: Nouvelle flore du Péloponnèse et des Cyclades (1838), based on their own collections around 1830. At least three species were mentioned, viz. *Colchicum variegatum* L., *Euphorbia dendroides* L. and "*Salsola brevifolia*" (now *Caroxylon aegaeum* (Rech. f.) Akhani & Roalson). Josef Sartori, a plant collector in Athens at the time of King Otto, collected at least one interesting species on Sifnos, the Aegean endemic *Hymenonema graecum* (L.) DC. (Halácsy 1901-1904).

Theodor von Heldreich collected on some Kikladian islands in the late summer of 1881. In spite of the advanced season, he gathered some interesting species on Sifnos, including at least *Carthamus leucocaulos* Sm., *Centaurea spinosa* L., *Heliotropium dolosum* De Not. and *Limonium ocymifolium* (Poir.) Kuntze.

During the twentieth century, there was an increase in the floristic exploration of the Kiklades and the Aegean area on the whole. An extensive floristic catalogue for Sifnos was published by Malakates (1933). A Swedish group (Hans Runemark, Sven Snogerup, Bengt Bentzer, Mats Gustafsson and Arne Strid) collected on Sifnos 13–16 May 1958, 12–13 April 1967, 20 June 1967 and 9–10 April 1969, gathering a total of 457 species. Specimens are mostly at LD. Heiselmeyer & Pilsl (1983) published Vegetationskundliche Studien an Brandflächen unterschiedlichen Alters auf Siphnos. Several coastal and wetland species were reported from Sifnos by Koumpli-Sovantzi & Yannitsaros (1993).

Heinz Kalheber collected on Sifnos in 1997 and 1998, gathering around 390 species. No details are available, but the species have been registered for the Flora Hellenica Database from a list supplied in 2011. A new species, *Allium apolloniensis* Biel, Tan & Tzanoudakis, was recently described (Biel & al. 2006). So far it is known only from the island of Sifnos. Burkhard Biel published additions to the orchid flora of the Kiklades, including Sifnos (2008). Finally, Biel & Tan (2016) published several additions to the flora of Serifos and Sifnos. Material regarding the flora of Kitriani derive from the collections of Runemark, Bentzer and Hansen (LD). Literature data were retrieved from all these published sources and from Runemark (1969, 1970, 1971a, 1971b), Runemark & al. (1960), Strid (1965, 2016). Rechinger (1950, 1955) and Rechinger & Rechinger-Moser (1951) were also consulted.

Study area

Sifnos is a semi-mountainous island. The northern part is rocky and less productive than the southern and western parts, which are characterized by vast cultivated plains around Vathy, Platys Yalos (south) and Kamares (west). Sifnos lacks permanent water courses, there are only small streams, the most important of which is Leivadas River (almost completely waterless at certain times of the year) which runs through the valley of Kamares. Wells are used to access the aquifer to fulfill the island's water needs. Sifnos was once much richer in water sources as documented by Malakates (1933) who stated that the eastern part of the island was once intensively cultivated with wheat, vines, oil, cotton,

legumes and figs. At present, agriculture has significantly declined due to limited water availability, however extensive areas are still cultivated, mainly with olive groves. Cropland suffered the highest area loss through conversions to semi-natural vegetation or settlements and at the same time the *Juniperus turbinata* maquis vegetation expanded over time, mainly away from settlements (Tzanopoulos & Vogiatzakis 2011). The abandonment of cultivation and subsequent grazing has led to vegetation degradation. Between 1987 to 1999, grazing involved 11,000 animals, including goats and sheep, and this gives us information on how much grazing affected the island (Tzanopoulos & Vogiatzakis 2011). In the past, agriculture and sheep and goat breeding were not enough for the livelihood of the citizens, who also relied on pottery production and mining. Nowadays, there are nineteen pottery workshops all over the island, which produce useful utensils. Unfortunately, the realization of this pottery since ancient times has had its destructive role as the woods were destroyed as fuel for the furnaces (Malakates 1933). The bare slopes and the toponymy itself bear witness to this fact. The occurrence of toponyms such as Kapsalos, whose name means burnt in Greek, on Sifnos and other islands such as Kasos Island (Cattaneo & Grano 2021), is extremely indicative of how much the Aegean islands have suffered a real impoverishment of their original flora for historical and economic reasons, such as the use of wood as fuel not only for the production of pottery but also for the transformation of limestone into lime or for the construction of vessels (Cattaneo & Grano 2016). Another element which has greatly influenced the landscape of Sifnos is mining. Sifnos is rich in minerals and its metal wealth has been known since ancient times. The mining activity of Sifnos is mentioned in the writings of Herodotus and Pausanias, which indicate the existence of productive gold mines on the island until approximately 400 B.C. (Ashton 1991), silver (the richest were in Aghios Sostis), manganese, iron, copper, lead and galanite (Malakates 1933). Iron and lead mines operated on the island from the 16th century until the beginning of the 20th century (Davis 1966). The exploitation of mines has contributed greatly to the degradation of the natural ecosystem and a similar situation also occurred on Serifos Island (Livaniou-Tiniakou & al. 2023). The abandoned mines that have left an indelible mark on the island's landscape are currently clearly visible.

Geology and Paleogeography

During the Pliocene, many of the Cycladic islands were welded together to form a single large unit, which were segregated from the mainland tectonically in the Middle Pleistocene (Foufopoulos & Ives 1999). During the Late Glacial Maximum (ca 20,000 BP) at the end of the last glacial period, when the sea level dropped 120 m, a large number of the eastern Kikladic islands, (Andros, Tinos, Mykonos, Siros, Paros, Antiparos, Naxos, Ios, Folegandros, Sikinos and some smaller islands) formed one large island "Mega-Kiklades palaeo-island", with an area of 6,978 km². To the west of this "mega island", the islands of Kithnos, Serifos and Sifnos, along with the group of Milos, Kimolos and Polyaigos remained distinct from each other as well from the Greek mainland (Gaki-Papanastassiou & al. 2005; Kapsimalis & al. 2009). This palaeo-island fragmented into an archipelago of islands during the subsequent sea level rise at the end of the LGM (Kapsimalis & al. 2009). Hence 18,000 years ago Sifnos was already isolated (Gaki-Papanastassiou & al. 2005). During the LGM, the global sea level was ~135 m lower than present and this led to a major reduction (approximately 70%) of total island area in the

Aegean basin and a rapid increase in the number of islands due to fragmentation (Simaiakis & al. 2017).

Rising sea levels led to island-area reductions and distance increases, causing increased species extinction rates and reduced migration rates. Based on recent studies, it seems that among the Kiklades, the palaeo-islands suffered highest area-reduction rates and distance increase and consequently higher species extinction rates, while islands with smaller area reductions are expected to have suffered lower species extinction rates (Simaiakis & al. 2017). This is the case of Sifnos which seems to have experienced minimal area loss and, in fact, shows good floristic richness, including notable levels of endemism.

With regards to the geology of Sifnos, two main tectonic units can be identified: Chersonissos and Faros. The Chersonissos Unit is further divided into three lithologic subunits which are the Upper Marble Complex, exposed in the north-western part of the island following the Eclogite and Blueschist Unit and the Main Marble Unit that covers almost all of the central southern part of the island. The Faros Unit mainly concerns the southeastern part of the island and is composed of metabasites and metasediments strongly retrograded in the greenschist-facies (Trotet & al. 2001; Roche & al. 2016).

Malakates flora

The first inventory of the vascular flora of Sifnos was drawn up by Malakates (1933) and this paper provides an updated checklist of the flora of Sifnos 90 years later. The authors drew up a checklist grouping all the published floristic data from 1933 to 2023 (also including those of Kitriani) adding their own data on the flora of both islands. The Malakates' checklist amounts to 345 taxa including cultivated species (19 taxa). Thirty of these taxa are no longer confirmed. It is not possible to make a detailed study of the Malakates checklist, as the number of species recorded by the author is too low. Although it was not possible to perform a chorological and biological comparison between the two checklists, it was possible to guess the distinctive features of the flora of Sifnos at the beginning of the 1900s by noticing the changes that occurred in the island landscape over the years. As previously stated, Sifnos was once much richer in vegetation cover and water sources and the flora compiled by Malakates is proof of this. The island was isolated from the other islands and the mainland only in the late Pleistocene. Isolation with the resulting climate change and human impact over time have led to changes in the island's vegetation.

Many of the taxa from Malakates' checklist that are no longer found on Sifnos show a western and northwestern distribution mainly involving the Peloponnese, Sterea Ellas and Western Aegean Islands, which is the case for *Asphodelus tenuifolius* (Cav.) (Sterea Ellas), *Scorzonera crocifolia* Sm. (Sterea Ellas, W. Aegean Islands), *Cerastium illyricum* Ard. (Peloponnese, Sterea Ellas), *Silene corinthiaca* Boiss. & Heldr. (Peloponnese, Sterea Ellas), *Bryonia dioica* Jacq. (Peloponnese, Sterea Ellas), *Hyoseris radiata* L. (Ionian Islands and Peloponnese). This type of distribution has also been observed for some endemic taxa of Sifnos, which is evidence of the connection between Sifnos and mainland in ancient times when it most likely had a different climate and greater water availability that enabled other plant species to grow. The separation of Sifnos from the mainland and the centuries-long impact of human exploitation on the island's resources likely led to its dessication, a fate common to almost all the Aegean islands. This would have led to a loss of some species which were unable to survive in a modified environment. Indeed, most of the taxa no longer confirmed on the island are species linked in vary-

ing degrees to water availability and a landscape featuring greater vegetation cover. Species mentioned by Malakates but no longer encountered on Sifnos, such as *Ammi visnaga* (L.) Lam., *Helminthotheca echioides* (L.) Holub, *Hyoseris radiata*, *Pulicaria dysenterica* L., *Rumex crispus* L., *Cyperus rotundus* L., *Melissa officinalis* L., *Portulaca oleracea* aggr. and *Salix alba* L. are linked to wet environments, riverbanks, grassy pastures, and for some of these, their abundance on the island or their presence along the rivers was emphasized. Malakates also mentions the punctiform presence of *Cotinus coggygria* Scop. and *Erica arborea* L. The former species is mostly linked to thermophilous deciduous woodlands in sub-Mediterranean environments from the coast to hilly and mountainous areas and *E. arborea* grows in evergreen woodlands and scrubs (Pignatti 2017-2019). The presence of *Cotinus coggygria* is exclusively reported along the river Leivadas of the Kamares valley where here was once greater moisture; it is therefore not surprising that the species is no longer found. Malakates indicated *Erica arborea* exclusively at a site on the south-west side of Profitis Ilias Mt. and on Kitriani Islet, but this taxon was also not found by the authors, even on their recent visit to Kitriani.

Materials and Methods

Sifnos was investigated by the authors on two occasions: from 31 July to 17 August 2022 and from 6 to 11 April 2023. Kitriani was visited only once on 13 August. Plant material is deposited in the first author's personal herbarium (Herbarium Cristina Cattaneo). The authors provide an updated checklist of the flora of Sifnos Island and Kitriani Islet, which includes all taxa registered to date Electronic Supplementary File 1 (ESF1). Plant identification mainly relied on Rechinger (1944, 1949), Rechinger & Rechinger-Moser (1951), Tutin & al. (1964-1980, 1993), Greuter & al. (1984-1989), Strid & Tan (1997, 2002), Biel & al. (2006), Greuter & Raab-Straube von (2008), Tison & al. (2013), Brullo & Erben (2016) and Strid (2016). With regard to the status of alien taxa, Arianoutsou & al. (2010) and Dimopoulos & al. (2018) were followed. The distribution of the genus *Limonium* complies with Brullo & Erben (2016). Species nomenclature and the status of endemic taxa recorded for Sifnos is based on Dimopoulos & al. (2018). The life-form and chorological categories follow Raunkiaer (1934) and Dimopoulos & al. (2018). The term "endemic" is used to denote taxa with a distribution area confined to Greece. Place names mentioned in the text follow the map of Sifnos produced by Terrain Cartography Group (2018).

Abbreviations used in the text: IOI = Ionian Islands; NPi = Northern Pindos; SPi = Southern Pindos; StE = Sterea Ellas; EC = East Central; NC = North Central; NE = North East; NAe = North Aegean Islands; WAe = West Aegean Islands; Kik = Kiklades; KK = Kriti and Karpathos; EAe = East Aegean Islands.

Results

Floristic analysis

The total flora of Sifnos Island consists of 776 specific and subspecific taxa, including alien species, referred to95 families and 381 genera. *Erigeron karvinskianus* DC. was not included in the floristic analysis as not well established in Greece. The families with the

largest number of genera are represented by *Asteraceae* (51), *Poaceae* (42), *Fabaceae* (27) and *Brassicaceae* (25). The richest families are *Fabaceae* (101 taxa), *Asteraceae* (92 taxa) and *Poaceae* (76 taxa). The alien taxa are represented by 20 species belonging to 10 families and 14 genera. None seem to have an invasive character (except for *Oxalis pes-caprae* L.) and all are restricted to near settlements. This is the case of species such as *Amaranthus albus* L., *A. blitodes* S. Watson, *A. deflexus* L., *A. retroflexus* L., *Erigeron bonariensis* L., *E. sumatrensis* Retz., *Euphorbia chamaesyce* L., *E. serpens* Kunth, *Nicotiana glauca* R.C. Graham, *Solanum elaeagnifolium* Cav., *Malephora purpureocrocea* (Haw.) Schwantes, *Carpobrotus edulis* (L.) N.E. Br. and *Opuntia ficus-indica* (L.) Mill. Among the alien taxa occurring on Sifnos, three taxa (*O. pes-caprae*, *N. glauca* and *Solanum nigrum* L.) were already present on Sifnos in the early 1900s as mentioned by Malakates. Malakates did not provide information regarding the spread of *N. glauca* and *E. chamaesyce* on the island, but he underlines the diffusion of *O. pes-caprae*, defining it as a weed in vineyards and cultivated fields that is dangerous for domestic animals. Currently this species has an invasive character especially in the central and southern part of the island. *Nicotiana glauca* is fairly common especially along the roadsides and *E. chamaesyce* has been observed by the authors only in Aghia Marina and Kamari.

The island flora is mostly constituted by therophytes (55.67%), followed by hemicryptophytes (19.07%) and geophytes (11.72%) (Table 1). The high proportion of therophytes highlights the strong Mediterranean character, which is further emphasized by the chorological spectrum of the island flora. The Mediterranean group predominates constituting 69.84% of Sifnos' flora. More specifically, species with a circum-Mediterranean distribution constitute about 38.55% of the flora (298 taxa), followed by species restricted to E Mediterranean with 11.46% (89 taxa) and by species confined to Mediterranean SW-Asian 9.57% (74 taxa) (Table 2). Among the widely distributed taxa, a good percentage is represented by species with a European SW-Asian distribution with 8.92% (69 taxa). The latter value is quite high, especially considering Sifnos' position, which is closer to the Greek mainland than to the southwestern Mediterranean area. From a phytogeographical point of view, Sifnos falls in the phytogeographic region of the Kiklades (Kik) sharing the highest number of taxa with the phytogeographic region of the East Aegean Islands (EAe) with 739 taxa, followed by the phytogeographic region of the Peloponnisos (Pe) with 737 taxa, and by the phytogeographic region of Kriti and Karpathos (KK) with 728 taxa (Table 3).

Table 1. Life-form spectrum of Sifnos' flora (life-forms are as defined by Dimopoulos & al. 2018).

Life-forms	**Number of taxa**	**%**
Therophytes	432	55.67
Phanerophytes	50	6.44
Hemicryptophytes	148	19.07
Geophytes	91	11.72
Chamaephytes	51	6.57
Aquatic (Hydrophyte)	4	0.51
Total	776	100.00

Table 2. Chorological spectrum of the native flora of Sifnos Island (chorological groups are as defined by Dimopoulos & al. 2018).

Chorological group	**Number of taxa**	**%**	**Total number of taxa**	**%**
Widely distributed taxa			163	21.00
European	4	0.51		
European-SW Asian	69	8.92		
Euro-Siberian	6	0.77		
South West European	1	0.12		
Paleotemperate	31	4.01		
Circumtemperate	4	0.51		
Subtropical	11	1.42		
Cosmopolitan	37	4.78		
Mediterranean Taxa			542	69.84
E Mediterranean	89	11.46		
Mediterranean	298	38.55		
Mediterranean-Atlantic	20	2.58		
Mediterranean-European	60	7.76		
Mediterranean-SW Asian	74	9.57		
W-Mediterranean	1	0.12		
Balkan Taxa			11	1.41
Balkan-Italian	3	0.38		
Balkan-Anatolian	8	1.03		
Endemic Taxa			40	5.15
Endemic	40	5.15		
Alien taxa			20	2.57
Am.	1	0.12		
N-Am.	5	0.64		
S-Am.	4	0.51		
S-Afr.	4	0.51		
Neotrop.	4	0.51		
SW-Asian	2	0.25		
Total	776	100.00	776	100.00

Endemism on Sifnos

Sifnos hosts 40 endemics (5.15%), 9 Kikladic endemics (including one single-island endemic), 10 Aegean endemics and 21 Greek endemics (Table 4). Sifnos endemics belong to 14 families and 24 genera. *Asteraceae* is the richest family (12 taxa) followed

Table. 3. Number of taxa belonging to the flora of Sifnos that also occur in each of the 13 floristic regions of Greece.

Ionian Islands	637
Northern Pindos	438
Southern Pindos	576
Peloponnisos	737
Sterea Ellas	709
East Central	583
North Central	520
North East	622
North Aegean Islands	645
West Aegean Islands	706
Kiklades	776
Kriti and Karpathos	728
East Aegean Islands	739

by *Plumbaginaceae*, *Amaryllidaceae* and *Campanulaceae*. The lifeform spectrum of Sifnos endemics shows a predominance of hemicryptophytes (30%), followed by therophytes (27.5%) and geophytes (25%). The high percentage of hemicryptophytes is linked to natural disturbances, such as the strong winds, which are typical of the island and to the phryganic nature of Sifnos characterized by poor soils that are affected by human impact. The high rate of therophytes is due to extended drought periods. The good rate of geophytes indicates rather dry, poor soil resulting in a decrease in grazing (Snogerup & Snogerup 1987; Bergmeier & Dimopoulos 2003; Panitsa & al. 2008).

Sifnos equally shares most endemic taxa with the phytogeographic region of Peloponnisos (Pe) (20 taxa) and with the phytogeographic region of Kriti and Karpathos (KK) (20 taxa), followed by the phytogeographic regions of the East Aegean Islands (EAe) and the West Aegean Islands (Wae) with 16 taxa. According to Georghiou & Delipetrou (2010), the phytogeographical area of Kiklades is chorologically closer to the Eastern Aegean Islands. However, the presence of six biregional endemics unique to Kik and KK - *Hymenonema graecum* (L.) DC., *Campanula laciniata* L., *Nepeta melissifolia* (Fig. 2a) Lam., *Ophrys sphegodes* subsp. *gortynia* H. Baumann & Künkele, *Limonium oligotrichum* Erben & Brullo and *Limonium sitiacum* Rech. f. - and only one taxon, *Erysimum hayekii* (Ják. & Rech. f.) Polatschek exclusive to Kik and EAe, suggests that Sifnos is phytogeographically closer to KK, than to EAe. The close palaeogeographical distance between the Southern Kiklades and Kriti during the Messinian salinity crisis favoured the spread of many endemic taxa from south to north (Strid & Tan 1997; Kougioumoutzis & al. 2014). This aspect had already been highlighted by Kougioumoutzis & al. (2014) for some Cycladic islands such as Anafi, Kimolos and Folegandros which host several endemics that occur exclusively in Kik and KK, which constitute the "Cardaegean" (Greuter 1971, 1972; Kougioumoutzis & al. 2012, 2014, 2015).

However, evaluating the overall distribution of the endemics occurring on Sifnos, it seems phytogeographically closer to the Peloponnese and in a broader sense to central

Fig. 2. a) *Nepeta melissifolia*, Herronisos (Sifnos); b) *Centaurea raphanina* subsp. *mixta*, Ilias Mt. (Sifnos); c) *Gagea pseudopeduncularis*, Xsero Ksylo (Sifnos); d) *Galanthus ikariae*, Xsero Ksylo (Sifnos).

Fig. 3. a) *Campanula heterophylla*, Xsero Ksylo (Sifnos); b) *Allium tzanoudakisianum*, Kapsalos (Sifnos); c) *Symphytum creticum*, Profitis Ilias Mt. (Sifnos); d) *Gagea rigida*, Kapsalos (Sifnos).

Table 4. Greek endemic taxa occurring on Sifnos Island (data extrapolated from Dimopoulos & al. 2018).

Family	Taxon	IoI	NPi	SPi	Pe	StE	EC	NC	NE	NAe	WAe	Kik	KK	EAe
Amaryllidaceae	*Allium apolloniensis* Biel & al.											*		
	Allium tzanoudakisianum Brullo, Pavone & Salmeri				*						*	*		*
	Galanthus ikariae Baker										*	*		*
Asteraceae	*Anthemis scopulorum* Rech. f.				*							*	*	*
	Anthemis werneri Stoj. & Acht.				*		*			*	*	*		
	Carthamus leucocaulos Sm.				*						*	*	*	*
	Centaurea laconica subsp. *linearriloba* (Halácsy & Dörfl.) E. Gamal-Eldin & Wagenitz											*		
	Centaurea raphanina subsp. *mixta* (DC.) Runemark				*	*					*	*		*
	Crepis neglecta subsp. *graeca* (Vierh.) Rech. f.			*	*	*	*	*		*	*	*		
	Echinops graecus Mill.				*	*	*				*	*		
	Filago cretensis Gand. subsp. *cretensis*				*					*	*	*	*	*
	Filago cretensis subsp. *cycladum* Wagenitz											*	*	*
	Hymenonema graecum (L.) DC.											*	*	
	Scorzonera araneosa Sm.											*		
	Scorzonera cretica Willd.				*							*	*	*
Boraginaceae	*Anchusella variegata* (L.) Bigazzi & al.	*			*	*	*				*	*	*	*
	Symphytum creticum (Willd.) Greuter & Rech. f.				*						*	*	*	
Brassicaceae	*Erysimum hayekii* (Jáv. & Rech. f.) Polatschek											*		*
	Erysimum senoneri (Reut.) Wettst. subsp. *senoneri*										*	*		
Campanulaceae	*Campanula celsii* A. DC.				*	*	*				*	*		
	Campanula heterophylla L.											*		
	Campanula laciniata L.											*	*	
Caryophyllaceae	*Dianthus fruticosus* L. subsp. *fruticosus*											*		
	Silene sartorii Boiss. & Heldr.				*	*						*	*	
Fabaceae	*Trigonella corniculata* subsp. *rechingeri* (Širj.) Lassen				*	*					*	*	*	*
Hyacinthaceae	*Muscari cycladicum* Guss.											*		
	Muscari pulchellum subsp. *clepsydroides* Karlén											*		
Iridaceae	*Crocus laevigatus* Bory & Chaub.				*	*				*	*	*	*	*
	Crocus tournefortii J. Gay				*							*	*	*
Lamiaceae	*Nepeta melissifolia* Lam.											*	*	
Liliaceae	*Gagea pseudopeduncularis* J.-M. Tison				*	*						*		
Orchidaceae	*Ophrys holoserica* subsp. *andria* (P. Delforge) Faurh.											*		
	Ophrys sphegodes subsp. *gortynia* H. Baumann & Künkele											*	*	
Plumbaginaceae	*Limonium aegaeum* Erben & Brullo				*	*					*	*	*	*
	Limonium ocymifolium (Poir.) Kuntze				*							*		*
	Limonium oligotrichum Erben & Brullo											*	*	
	Limonium proliferum (d'Urv.) Erben & Brullo					*					*	*	*	*
	Limonium sitiacum Rech. f.											*	*	
Ranunculaceae	*Nigella degenii* Vierh. subsp. *degenii*											*		
	Nigella doerfleri Vierh.				*					*		*	*	

Greece and the Western Aegean Islands. Indeed, most endemic taxa occurring on Sifnos, such as *Anthemis werneri* Stoj. & Acht., *Centaurea raphanina* subsp. *mixta* (DC.) Runemark (Fig. 2b), *Crepis neglecta* subsp. *graeca* (Vierh.) Rech. f., *Echinops graecus* Mill., *Erysimum senoneri* (Reut.) Wettst. subsp. *senoneri*, *Campanula celsii* A. DC., *Gagea pseudopeduncularis* J.-M. Tison, have a more western distribution, including the Peloponnese, Sterea Ellas and Western Aegean Islands. This may be due to the paleogeographic connection between the Cycladic unit and the Peloponnese which occurred during the Messinian salinity crisis, and the LGM when the distance between the Kiklades and the Peloponnese was shorter than today (ca. 85 km) (Kapsimalis & al. 2009). The presence of *Erysimum senoneri* subsp. *senoneri* on Sifnos underpins the paleogeographic connection between the Kiklades and the Western Aegean Islands that lasted until the Pliocene (Sfenthourakis & Triantis 2017). Interestingly, the discovery of *Gagea pseudopeduncularis* (Fig. 2c) on Sifnos widens its distribution area to the phytogeographical region of the Kiklades, whereas it had only been found previously in Sterea Ellas (Mt. Parnitha) (Tison & al. 2013) and the Peloponnese (Aegina Island) (Tan & Issigoni 2015). As for other endemics, it is worth mentioning: *Galanthus ikariae* Baker (Fig. 2d), whose range was previously restricted to Ikaria (Eastern Aegean Island), Skyros (Sporades), Andros and Naxos (Kiklades). Also, *Campanula heterophylla* L. (Fig. 3a), which belongs to a small group of late-flowering chasmophytes, a local endemic of Kriti and Kiklades, has a restricted range in the central Aegean islands, occurring on Keros, Donoussa, Amorgos, Sikinos, Folegandros and other small islands. *Allium apolloniensis* Biel & al., an autumn-flowering *Allium* species, is the only autumn-flowering member of *A*. sect. *Codonoprasum* discovered in the Kiklades and this supports the hypothesis that species with this life-cycle are Tertiary relicts of an old Mediterranean flora which were present before the fragmentation of the Aegean landmass (Biel & al. 2006). Autumn-flowering *Allium* species belonging to Sect. *Codonoprasum* as *A*. *archeotrichon* Brullo & al. (Brullo & al. 1999), *A*. *platakisii* Tzanoud. & Kypriot., *A*. *symiacum* Galanos & Tzanoud. and *A*. *tardans* Greuter & Zahar., are characterized by a very long vegetative phase and a very short dormancy phase. This vegetative feature could be an indication that these are relict species of the Tertiary period, since the relatively undifferentiated species life cycle could be indicative of more consistent climatological conditions that prevailed during the late tertiary (Messinian) period in the Mediterranean area (Greuter 1972, 1979; Tzanoudakis & Kypriotakis 1993).

Finally, also worth mentioning among the endemic species with a wider distribution that also includes the Eastern Aegean Islands are: *Allium tzanoudakisianum* Brullo, Pavone & Salmeri, *Anthemis scopulorum* Rech. f., *Filago cretensis* subsp. *cycladum* Wagenitz and *Erysimum hayekii* (Jáv. & Rech. f.) Polatschek.

Allium tzanoudakisianum (Fig. 3b), belongs to the *A*. *cupani* group, a species complex of the subgenus *Allium* which is quite critical taxonomically. *A*. *tzanoudakisianum* occurs in the Aegean area and more precisely on Naxos, Donoussa, Syros, Sifnos, Amorgos, Paros and Serifos (central Kiklades), Lesbo (Eastern Aegean Island) and in E Peloponnese (Brullo & al. 2015). It could be argued that the reduction of geographical distance during the Messinian salinity crisis and the eustatic sea-level changes during the Pleistocene enabled a linkage between the Cycladic Unit and the Eastern Aegean Islands.

Conclusions

In this work, 19 new taxa have been added to the flora of Sifnos: five endemic taxa (*Galanthus ikariae*, *Campanula heterophylla*, *Gagea pseudopeduncularis*, *Limonium oligotrichum* and *Limonium sitiacum*); four species with a mediterranean distribution (*Hellenocarum multiflorum* (Sm.) H. Wolff, *Diplotaxis viminea* (L.) DC., *Rhamnus alaternus* L. and *Kickxia elatine* subsp. *crinita* (Mabille) Greuter); one eastern mediterranean species (*Lamium moschatum* Mill.); and several alien taxa. Five of these new records, along with many other Sifnos endemics, have been found at a single site (Ksero Ksylo) characterized by north facing limestone inland cliffs at a fairly high altitude (648 m a.s.l.). Sifnos, with is predominately hilly terrain, lacks extensive limestone cliffs, but the presence of very localized, restricted and undisturbed areas characterized by cliffs and rocky slopes, has allowed many endemic plants to be preserved (Georghiou & Delipetrou 2010). Regarding the flora of Kitriani Islet, seven new records have been added following the collections by Runemark & Snogerup in 1958 and Runemark, Bentzer & Hansen in 1967: two endemic taxa (*Allium tzanoudakisianum* and *Limonium proliferum* (d'Urv.) Erben & Brullo); three taxa with a mediterranean distribution (*Erica manipuliflora* Salisb., *Teucrium capitatum* L. and *Rhamnus lycioides* subsp. *oleoides* (L.) Jahand. & Maire); two eastern mediterranean species (*Allium staticiforme* Sm. and *Paronychia macrosepala* Boiss.). All these species were already known on the main island with the exception of *A. staticiforme*, which was reported only for several central Cycladic islands.

The low number of taxa in Malakates' checklist is mirrored in the Serifos florula, also drawn up by Malakates (1928). For Serifos, the author listed only 286 taxa, a number which after in-depth research rose to 680 (Livaniou-Tiniakou 2003). According to Livaniou-Tiniakou (2003) the lower number of taxa included in Malakates' flora of Serifos is probably not due to observation gaps but to more intensive human activities during that period. Moreover, 26 of the 286 taxa recorded by Malakates on Serifos have no longer confirmed, perhaps overlooked due to their seasonality or their unsuccessful establishment on the island. It seems unlikely that islands of ca. 75 km^2, such as Serifos and Sifnos, would have such a low number of flora species at the beginning of the 1900s, even considering significant human impact during that time. The data may more accurately reflect a lack of research. The objective environmental and climatic changes that have occurred on the island over the years, have led to a loss of species linked to wetter environments while at the same time the reduction of agriculture due to water scarcity has led to the expansion of *Juniperus turbinata* maquis vegetation. Sifnos is rich in many elements with a Mediterranean-SW Asian and East Mediterranean distribution, likely introduced through colonization by long-distance dispersal and human translocation. However, thanks to the presence of undisturbed sites on the island, part of the native flora has been preserved.

Acknowledgments

We would like to thank those who helped us in different ways in the correct identification of different species such as Prof. Lorenzo Peruzzi for the genus *Gagea*, Dr. Matthias Erben for the genus *Limonium*, Prof. Spyros Tsiftsis for the genus *Ophrys*, Prof. Werner Greuter and Prof. Thomas Raus for the genus *Filago*. Furthermore, we would like to sincerely thank Prof. Arne Strid for providing

us data on Kitriani, Dr. Maria Troullinou from the Central Library in Rethymno for kindly providing us with the missing parts of Malakates' work, Prof. Augusto Cattaneo for the useful information regarding the flora of Sifnos and the anonymous reviewer for the helpful revision of the text.

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