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Contribution to the flora of Mt Symvolos in the Kavala regional unit (NE Greece)

Abstract

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Mt Symvolos is in the Kavala Regional Unit in North-Eastern Greece. This contribution to the flora of the study area consists of 777 taxa, which belong to 386 genera and 92 families. The most species-rich families are: *Asteraceae*, *Fabaceae*, *Poaceae*, *Brassicaceae*, *Lamiaceae*, *Caryophyllaceae* and *Rosaceae*, whereas 28 families contribute with only one taxon. The most species-rich genera are: *Trifolium*, *Vicia* and *Euphorbia*, and 230 genera have only one taxon. Most of them are therophytes (329 taxa), followed by hemicryptophytes (254 taxa), phanerophytes (82 taxa), geophytes (81 taxa), chamaephytes (30 taxa) and aquatics (1 taxon). The high percentage of therophytes reflects the mediterranean character of the flora. Most of the taxa (356 taxa) are Mediterranean (175 taxa Mediterranean, 81 taxa Mediterranean-European, 62 taxa Mediterranean-SW Asian, etc.), followed by the Widespread unit with 327 taxa (156 taxa European-SW Asian, 47 taxa Paleotemperate, etc.) and the Balkan unit with 65 taxa (31 taxa Balkan-Anatolian, 24 taxa Balkan, etc.).

Key words: chorology, life-forms, Mediterranean, Widespread, therophyte.

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Introduction

The area of Greece is of great interest from a floristic and phytosociological perspective. A total of 7,992 taxa makes up the country's flora, of which a very large percentage are native or endemic species according to the fifth edition of the Flora of Greece Web site (<http://portal.cybertaxonomy.org/flora-greece>, 03/10/2024), while the endemism rate amounts to 22%. These indicators are particularly high given the small area of this European and Mediterranean country (Strid & Tan 1997, 2002; Tan & Iatrou 2001; Thompson 2005; Georgiou & Delipetrou 2010).

The above have contributed to an increased interest in the flora and vegetation in Greece, while remarkable progress has been made in their study in recent years. However,

there are many areas that have not been explored and studied to a satisfactory degree, while many data regarding the distribution of species in the Greek area and the co-ecological relationships between them remain unknown (Dimopoulos & al. 2012).

The area of Mount Symvolο in the Regional Unit of Kavala, in Eastern Macedonia, is among those areas that have not been adequately studied.

The aim of this study is to contribute to the knowledge of the flora of Mount Symvolο. For this reason, after recording the data and extracting the results, a comparison was made with other regions of Greece.

Material and methods

Study area – Mount Symvolο is located in the Kavala Regional Unit of the Region of Eastern Macedonia and Thrace, comprising a total area of 307 km². Its starting point is Paralia Ofryniou near the mouth of Strymonas River in the West and Nea Peramos and Nea Iraklitsa in the East, while from the North the Pieria Basin (a valley drained by the Marmaras River) and the Egnatia Motorway separate it from Mt Pangaeο which runs parallel to it and in the South, it is washed by the Aegean Sea (Fig. 1). The latitude of the research area is defined between 40.885539° and 40.717941° N of latitude, while its longitude is defined between 23.882872° and 24.340909° E. It is a low mountain with its higher peak being Agriada or Tsali (694 m). It has a relatively poor road network in its interior, nevertheless its proximity to the sea and its position on the road axis between Thessaloniki and Kavala, make access to the area relatively easy.

Geologically, the area is part of the Rhodopi massif (Mountrakis 1985). The substrate consists mainly of igneous and metamorphic rocks of the Mesozoic Age and especially of the Triassic Period, while there is a lack of sedimentary rocks. The lack of sedimentary rocks results in relatively unclear stratigraphy in this zone. Particularly important is the presence of acidic igneous rocks, plutonites and volcanic rocks.

The climate can be characterized as Csa Mediterranean climate with relatively hot dry summers and moderate winters (Flokas 1997). The bioclimate can be characterized as having a strong mid-mediterranean character, with higher altitudes belonging in the humid bioclimatic layer with cold winter and lower altitudes in the semi-arid bioclimatic layer with cold winter (Mavrommatis 1980).

The area is of great importance to the local population. Apart from the fact that there are many villages and settlements in the area, there is also presence of cultivated land, mainly olive groves and vineyards. The effects of grazing are also evident on it.

According to a management study for the Public Forest Complex of Mount Symvolο, the forests and woodlands of the research area form about 53.6% of the total area and are comprised of evergreen broadleaves at a rate of 36.89%, partially forested areas of evergreen broadleaves comprise 12.77%, mixed forest of *Quercus* species and other broadleaves comprise 3.94%. About 38.39% are agricultural lands, 2.82% reforestation with *Pinus pinaster* Aiton, 1.58% settlements, 1.43% grasslands and 0.59% barren lands (Tsitsonis & Kontos 2019).

Data collection and analysis – The research was based on field collections, carried out during the years 2017-2021, as well as on herbarium specimens (TAUF). All specimens are



Fig. 1. Map of the study area.

deposited in the herbarium of the Aristotle University of Thessaloniki, Greece (TAUF). For the identification, Strid & Tan (1991, 1997, 2002), Tutin & al. (1968–1980, 1993), Strid (1986) and Pignatti (1982) were used. The nomenclature is in accordance with Dimopoulos & al. (2013, 2016) as well as the 6th Version of “The Flora of Greece web”. Families, genera, species and subspecies are assorted in alphabetical order within the major groups of vascular plants such as *Pteridophyta*, *Gymnospermae*, *Angiospermae* (*Dicotyledones* and *Monocotyledones*). Life-form categories are presented in accordance with Raunkiaer’s classification system as was modified by Dimopoulos & al. (2013) as well as the 6th Version of “The Flora of Greece web”. Chorological categories of taxa are in accordance with Dimopoulos & al. (2013) and derive from the 6th Version of “The Flora of Greece web”.

Results & Discussion

Floristic analysis – As a result of this research, 777 specific and subspecific taxa (760 species and for 194 is given the rank at subspecific level) belonging to 386 genera and 92 families have been identified in the study area (Table 1). The most taxa-rich family is *Asteraceae*, which accounts for 93 taxa (11.97% of all taxa), followed by: *Fabaceae* (82 taxa), *Poaceae* (77 taxa), *Brassicaceae* (52 taxa), *Lamiaceae* and *Caryophyllaceae* (with 38 taxa each), *Rosaceae* (24 taxa), *Apiaceae*, *Orchidaceae* and *Boraginaceae* (with 20 taxa each), whereas

Table 1. Numbers of plant families and genera in the four main taxonomic groups of the vascular flora studied.

	Families	Genera	Species ¹	Subspecies	Taxa ²
Pteridophytes	3	3	7	2	7
Gymnosperms	3	3	4	2	4
Angiosperms - Dicotyledons	70	301	607	142	620
Angiosperms - Monocotyledons	16	79	142	48	146
Total	92	386	760	194	777

1. are comprised of (a) species that have no subspecies and (b) species that have one or more subspecies.

2. taxa are defined as comprising a) subspecies and b) species that have no subspecies.

26 families are represented by only one taxon. The ten most taxa-rich families together include 464 taxa comprising 59.72% of the total flora of the area. The first five families appear in a slightly different order among the six most species-rich families for the entire Greek flora (Dimopoulos & al. 2013). A similar or even the same order in the richest families was also observed in other regions (Dimopoulos 1993; Karetos 2002; Chochliouros 2005; Dimitrellos 2005; Vlachos 2006; Chasapis 2017). The first six families have the same order as those found by Mermigas (2021) on Mount Saitas. The most taxa-rich genera are *Trifolium* (17 taxa), *Vicia* (13 taxa), *Euphorbia* (11 taxa), *Medicago* (11 taxa), *Silene* (10 taxa), *Anthemis* (9 taxa) and *Allium*, *Alyssum*, *Bromus* (with 8 taxa each) and *Carex* (7 taxa), which account for 13.13% of the total species of the study area, whereas 230 genera contribute with only one taxon. Of those ten genera, all but *Medicago*, *Alyssum* and *Bromus*, belong to the 20 most taxa-rich genera of the total flora of Greece as presented by Dimopoulos & al. (2013).

Life-form spectrum – The life-form spectrum shows that therophytes prevail (42.34%) followed by hemicryptophytes (32.69%), phanerophytes (10.55%), geophytes (10.42%), chamaephytes (3.86%) and aquatics (0.13%) (Table 2). The prevalence of therophytes reflects the Mediterranean character of the flora, while the high percentage of hemicryptophytes reflects a strong temperate influence (Emberger 1967). An increase in the percentage of therophytes in

Table 2. Life-form spectrum of the vascular flora of the study area.

Life-form	Taxa	
	Number	Percentage (%)
Therophytes (T)	329	42.34
Hemicryptophytes (H)	254	32.69
Phanerophytes (P)	82	10.55
Geophytes (G)	81	10.42
Chamaephytes (C)	30	3.86
Aquatics (A)	1	0.13
Total	777	100.00

the life-form spectrum, due to human activities, has been found by many researchers worldwide such as: Barbero & al. (1990), Dogan & al. (2004), Malik & al. (2007), Manhas & al. (2009), Schmidt (2012). Various researchers have found similar results with therophyte prevalence and high percentages of hemicryptophytes (Konstantinidis 1997; Mermýgkas 2021; Zikos 2023,). Those mountains have a significantly higher altitude but are located in Southern Greece.

Chorology - The analysis of the chorological spectrum (Table 3) shows that the most prevalent chorological group of plants are the Mediterranean taxa (356 taxa – 45.81%), followed by the Widespread (327 taxa – 42.08%) and the Balkan taxa (65 taxa – 8.37%). Although the percentage of Greek endemics (0.64%) is considered very low, this can be reasonably explained, according to Dimopoulos & al. (2013), because the research area is at a great distance from the most important centers of endemism located in Southern and insular Greece (Médail & Quézel 1997; Georghiou & Delipetrou 2010). Finally, the high rate of 3.1% which is recorded for the Alien taxa (Table 3) can be explained by the intense human activities in the area (settlements, roads, crops, grazing). As far as the Mediterranean taxa and their prevalence are concerned, the greatest similarities of Mount Symvoló (45.81%) have been observed with the mountains of Saitas (Mermýgkas 2021) in which Mediterranean taxa comprise 47.3% of its flora, and Kyllini (Dimopoulos 1993) with a percentage of 47.01%. Both mountains have a much higher altitude (1814 m and 2376 m respectively) than Symvoló (694 m), but they are much further south, both located in the Northern Peloponnese.

Endemism - In the research area, 5 endemic taxa have been identified, which constitute 0.64% of the total area’s flora. The percentage is small compared to mountains such as

Table 3. Chorological spectrum of the vascular flora of the study area. The chorological categories are classified into 5 wide chorological groups.

Chorological group/category	Taxa	
	Number	%
1. Widespread taxa	327	42.08
European-SW Asian (EA)	156	20.07
Paleotemperate (Pt)	47	6.04
Cosmopolitan (Co)	40	5.15
Euro-Siberian (ES)	34	4.38
European (Eu)	22	2.83
Circumtemperate (Ct)	14	1.80
Subtropical-Tropical (ST)	7	0.90
Cosmopolitan / European-SW Asian (Co EA)	5	0.64
Cosmopolitan / Euro-Siberian (Co ES)	1	0.13
Cosmopolitan / Paleotemperate (Co Pt)	1	0.13
2. Mediterranean taxa	356	45.81
Mediterranean (Me)	175	22.65
Mediterranean-European (ME)	81	10.42

Table 3. continued.

Mediterranean-SW Asian (MS)	62	7.98
East Mediterranean (EM)	30	3.86
Mediterranean-Atlantic (MA)	8	1.03
3. Balkan taxa	65	8.37
Balkan-Anatolian (BA)	31	3.99
Balkan (Bk)	24	3.08
Balkan-Italian (BI)	6	0.77
Balkan-Central European (BC)	4	0.51
4. Endemic taxa		
Greek endemic (●)	5	0.64
5. Alien taxa	24	3.1
[North American] (N-Am.)	11	1.41
[South American] (S-Am.)	3	0.39
[Neotropical] (neotrop.)	3	0.39
[South African] (S-Afr.)	2	0.26
[West Asian] (W-As.)	1	0.13
[Arabian] (Arab.)	1	0.13
[Central Asian] [East Asian] (C-As.) (E-As.)	1	0.13
[West Mediterranean] [Central Mediterranean] (W-Med.) (C-Med.)	1	0.13
[South West Asian] [Central Asian] (SW-As.) (C-As.)	1	0.13
Total	777	100.00

Panachaiko (Kokkoris 2014), Saitas (Mermygkas 2021), Erymanthos (Maroulis 2003) and Kyllini (Dimopoulos 1993) with percentages 9.53%, 8.25%, 8.27% and 12.34% respectively. All the above-mentioned mountains have a much higher altitude and a wide presence of the mountain-Mediterranean vegetation floor. In addition to the altitude and the presence of more layers of vegetation in the above mountains, an important factor for the presence of endemic taxa is the presence of specific habitats, since some of them are particularly rich in endemic taxa (Georgiou & Delipetrou 2010; Mermygkas 2021). Endemic taxa are strong phytogeographical indicators due to their limited distribution, in contrast to taxa that show a large geographical distribution (Iatrou 1986; Carlström 1986; Konstantinidis 1997).

Range-restricted taxa - Range-restricted taxa are considered to be those whose most distant populations are separated by a linear distance equal to or less than 500 km. This concept was first used for the Greek flora, under the term “range restricted” (Dimopoulos & al. 2013) and examines the distribution of taxa with purely geographical criteria, regardless of national borders or administrative division limits. 15 range-restricted taxa have been recorded in the flora of Mount Symvolos (including the 5 Greek endemics) (Table 4).

Table 4. Range-restricted taxa.

Taxon	Range-Restricted	Greek endemic
<i>Alyssoides utriculata</i> subsp. <i>bulgarica</i> (Sagorski) Hartvig	+	
<i>Anthemis wernerii</i> Stoj. & Acht.	+	+
<i>Asperula aristata</i> subsp. <i>nestia</i> (Rech. f.) Ehrend. & Krendl	+	
<i>Berteroa orbiculata</i> DC.	+	
<i>Campanula scutellata</i> Griseb.	+	
<i>Cerastium decalvans</i> subsp. <i>orbelicum</i> (Velen.) Stoj. & Stef.	+	
<i>Digitalis lanata</i> subsp. <i>leucophaea</i> (Sm.) Werner	+	
<i>Erysimum calycinum</i> Griseb.	+	
<i>Festuca rubra</i> subsp. <i>thessalica</i> Markgr.-Dann.	+	+
<i>Galium aegeum</i> (Stoj. & Kitan.) Ančev	+	
<i>Ophrys sphegodes</i> subsp. <i>epirotica</i> (Renz) Gölz & H.R. Reinhard	+	
<i>Scabiosa balcanica</i> Velen.	+	
<i>Taraxacum extimum</i> Kirschner & al.	+	+
<i>Verbascum cylincrocarpum</i> Griseb.	+	+
<i>Veronica chamaedrys</i> subsp. <i>chamaedryoides</i> (Bory & Chaub.) M.A. Fisch.	+	+

Conclusion

Mount Symvolos comprises a small and low area, heavily affected by human activities. The vascular flora identified inside the investigated area consists of 777 taxa, which belong to 386 genera and 92 families. The most taxa-rich family of the vascular flora is *Asteraceae*, which consists of 93 taxa (11.97% of all taxa). The most taxa-rich genus is *Trifolium* with 17 taxa. Therophytes and hemicryptophytes are the most abundant plant life forms with 42.34% and 32.69% respectively, while the most abundant chorological group consists of the Mediterranean plants with 356 taxa belonging to this group.

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