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The Ecological and Floristic Characteristics of Populations of Sideritis scardica Griseb. in Olympus Mts., Greece

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Abstract. *Sideritis scardica* Griseb. (Section *Empedoclia*, Lamiaceae) is a valuable medicinal perennial plant and a species of high conservation value. It is a Balkan endemic and it is distributed only in Albania, Bulgaria, Greece and Macedonia. The natural localities are threatened with extremely vulnerable populations. However, the species status in Greece is considered the most conserved. The current study provides information about the population state and structure, vegetation dynamics and the place of the species in habitats in Olympus Mts. Three localities (Karya, Kokkinopilos and Sparmos) of the species are investigated. Anthropogenic pressure is recorded in all three localities – flowering stems of most plants were harvested by the end of August. The localities near Karya and Sparmos are easily accessible due to well-developed road network. A list of diversity of vascular plants is made for each locality. The taxonomic structure of the flora and the ecological and biological characteristics are defined. The main geographical elements are those with Mediterranean origin.

Key words: Olympus tea, conservation, population characteristics.

Introduction

Genus *Sideritis* (Lamiaceae, Lamioideae) comprises more than 150 species distributed in the temperate and tropical area of the Northern hemisphere (BARBER *et al.*, 2000; 2002). It is taxonomically very complicated genus, subdivided into four sections. The section *Empedoclia* (Raf.) Bentham consists of perennial plant species, occurring in the eastern part of the Mediterranean region. A typical characteristic of the *Sideritis* species of section *Empedoclia* is their high percentage of endemism (HUBER-MORATH, 1982; AYTAÇ & AKSOY, 2000), with more than 80 % of the species being endemics to the Asian part Turkey and several other species endemic to the Balkan Peninsula in Europe. *Sideritis scardica* is a Balkan endemic occurring in the high mountains in Bulgaria, Greece, Macedonia, and Albania. There are some reports in the literature about its occurrence in Serbia and in Turkey (PETROVA & VLADIMIROV, 2010). *S. scardica* is the most popular and the most used species of genus *Sideritis* on Balkans. It is used as herbal tea and/or in the phytotherapy since the ancient times (ANEVA *et al.*, 2018; TODOROVA & TRENDAFILOVA, 2014).

Besides its useful characteristics as medicinal plant, *S. scardica* is a species of high conservation value. It is listed in the Red Data Book of Bulgaria (EVSTATIEVA,

2015) and its extensive use as medicinal plant resulted in substantial anthropogenic pressure on its natural populations. Therefore, it was prohibited for collecting from its natural localities since (Order of the Minister of Environment and Water of Bulgaria of 16 March 2016) and today the market demand is being met by the rapidly increasing area of cultivation (KOUTSOS & CHATSOPOULOU, 2009). As a result of prohibition of collection from natural localities, the populations of the species are expected to recover its favorable conservation status.

A comparison among the different countries and populations of the species in Balkan Peninsula could help to identify the major threats affecting the natural localities and populations of the species. The preliminary observations revealed that the populations in Greece tend to be in better state than these in Bulgaria and the factors leading to that are of substantial interest. Therefore, a study was initiated to compare the Bulgarian populations from Pirin and Slavyanka Mts with the Greek populations growing in similar environmental conditions – in the mountains in the northern part of Greece - Olympus, Falakron, Pangaion and Menikion (KARAGIANNIKIDOU & KOKKINI, 1987, 1988; KARAGIANNIKIDOU *et al.*, 1995; STRID *et al.*, 2003). There are still some controversies concerning the taxonomic status of Olympus plants. PAPANIKOLAOU & KOKKINI (1982) treated the plants growing on Olympus as *S. raeseri* subsp. *florida* (Boiss. & Heldr.) Papanicolaou & Kokkini. Their treatment is not implicitly accepted and in the present work we consider the Olympic plants as *S. scardica*.

The objective of the present study was to provide a general description of the populations of *S. scardica* from Olympus Mts. and to make a preliminary assessment of their status.

Materials and Methods

Three localities (Karya, Kokkinopilos and Sparmos) of the species were investigated (Fig. 1). The field observations took place in the period May-September 2018. Full floristic inventory was performed in two plant communities – Karya and Sparmos, and in the third locality only the nature conservation status and nature habitats were scored. Geobotanic description and full floristic inventory was performed in the localities of Karya and Sparmos. Taxonomic treatment followed ASSYOV & PETROVA (2012) and EuroPlusMed database (2018).

Phytogeographic affinity of the species was determined according to WALTER (1985), summarized by ASSYOV & PETROVA (2012), and the life forms – according to RAUNKIAER (1934).

Results and Discussion

Floristic composition

Altogether sixty-four species were recorded in the two observation plots; 48 of them – in the first locality, and 31 – in the second locality. There were 15 species common for both localities, and Sorencen-Dice similarity coefficient is 0.38. This indicates a substantial difference between the two localities, which reflects the fact that first locality was at the edge of a plant community close to a water stream and with presence of different shrub species, while the second one was an open area on a southern slope. It should be noted that probably some species belonging to the spring spectrum

The most numerous were the perennial species – 46, or 72 % of all recorded species (Table 1). There were also six shrub species and 3 species of trees. Two species were transitional, occurring both as trees and shrubs, and two species were sub-shrubs (fruticose plants). There were also three annual species and two species occurring as both annual and biennial plants. These patterns of distribution of biological types are more or less typical for the plant communities situated in the harsh environmental condition above the alpine timber line in the high mountains.

Corresponding to the classification of biological types, the life forms following RAUNKIAER (1934) are represented by 43

hemicryptophytes, 11 phanaerophytes, 5 therophytes, 4 chamaephytes and 1 geophyte (Table 1).

Analysis of the phytogeographic origin (floristic elements) revealed that the dominant role played the species with Mediterranean component of origin – there were 6 Mediterranean and 14 sub Mediterranean elements (Fig. 1). Balkan endemics and sub-endemics (with a Balkan component) were 9 species, and the species with at least partly European origin were 18. The remaining phytogeographic elements were represented by a smaller number of species, and there was one species (*Alyssum handelii*) endemic to Greece.

The spectrum roughly corresponds to the figures presented by STRID (1995).

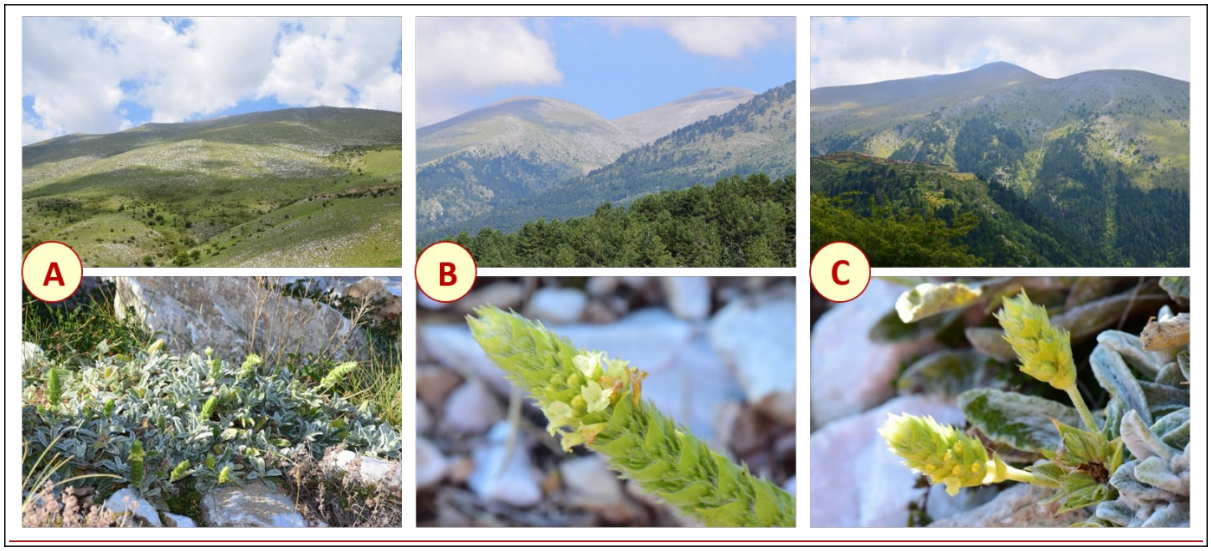

Fig. 1. Studied natural localities of *Sideritis scardica* in Olympus Mts. (A. Karya; B. Kokkinopilos; C. Sparmos).

Table 1. Species composition, biological type, life form and floristic elements of the species recorded.

Taxon	Locality 1	Locality 2	Biological type	Life form	Floristic element
POLYPODIOPHYTA					
POLYPODIOPSIDA					
Aspleniaceae					
Asplenium trichomanes L.	+		P	H	*Kos*
Ceterach officinarum DC.	+		P	H	*subMed*
Hypolepidaceae					
Pteridium aquilinum		+	P	H	*Kos*
MAGNOLIOPHYTA					
PINOPHYTINA					
PINOPSIDA					
Cupressaceae					
Juniperus deltoides R.P. Adams	+		S	Ph	*Eur-Med*

Pinaceae					
Abies cephalonica Loudon		+	T	Ph	*Med*
MAGNOLIOPHYTINA					
MAGNOLIOPSIDA					
Apiaceae					
Eryngium amethystinum L.	+	+	P	H	*Med*
Heracleum sibiricum L.	+		P	H	*Eur-As*
Physospermum cornubiense (L.) DC.	+		P	H	*Eur-Med*
Asteraceae					
Achillea holosericea Sm.	+	+	P	H	*subMed*
Bellis perennis L.		+	P	H	*Eur-As*
Carlina acaulis L.		+	P	H	*Eur*
Carlina vulgaris ssp. *intermedia* (Schur) Hayek		+	A	Th	*Eur-Med*
Cirsium candelabrum Griseb.	+		P	H	*Carp-Bal*
Cirsium ligulare Boiss.	+		A-B	Th	*Med*
Hieracium pannosum gr.	+		P	H	*Bal-Anat*
Hieracium pilosella L.		+	P	H	*Eur-Med*
Betulaceae					
Ostrya carpinifolia Scop.	+		T	Ph	*subMed*
Brassicaceae					
Alyssum handelii Hayek	+	+	P	H	*Gr*
Arabis turrita L.	+		A-B	Th	*subMed*
Iberis sempervirens L.		+	S	Ch	*Bal-Anat*
Buxaceae					
Buxus sempervirens L.	+		S	Ph	*Med*
Campanulaceae					
Campanula persicifolia L.	+		P	H	*Eur-Sib*
Caryophyllaceae					
Dianthus haematocalyx Boiss. & Heldr.	+	+	P	H	*Bal*
Silene vulgaris (Moench) Garcke	+		P	H	*Eur-As*
Crassulaceae					
Sedum anopetalum DC.	+		P	H	*subMed*
Euphorbiaceae					
Euphorbia cyparissias L.	+		P	H	*Eur*
Euphorbia myrsinites L.	+	+	P	H	*subMed*
Fabaceae					
Astragalus angustifolius Lam.	+	+	S	Ch	*subMed*
Lotus corniculatus L.		+	P	H	*Eur-Med*
Melilotus altissimus Thuill.	+		P	H	*Eur*
Trifolium alpestre L.	+		P	H	*Eur-Sib*
Geraniaceae					
Geranium macrorrhizum L.	+		P	H	*Eur-Med*
Geranium subcaulescens DC.	+	+	P	H	*Med*
Hypericaceae					

Hypericum perforatum L.	+		P	H	*Kos*
Lamiaceae					
Acinos alpinus (L.) Moench		+	P	H	*Alp-Carp*
Clinopodium vulgare L.	+		P	H	*subBoreal*
Marrubium thessalum Boiss. & Heldr.	+	+	P	H	*Bal*
Sideritis scardica Griseb.	+	+	P	Ch	*Bal*
Teucrium chamaedrys L. subsp. *olympicum* Rech. f.	+	+	P	H	*subMed*
Teucrium montanum L.		+	P	Ch	*subMed*
Plantaginaceae					
Plantago lanceolata L.	+		P	H	*Kos*
Plantago major L.	+		P	H	*Boreal*
Ranunculaceae					
Thalictrum minus L.	+	+	P	H	*Eur-Sib*
Rhamnaceae					
Rhamnus alpinus L.	+		S	Ph	*Med*
Rosaceae					
Cotoneaster nebrodensis (Guss.) C. Koch	+		S	Ph	*subMed*
Fragaria vesca L.	+		P	H	*subBoreal*
Potentilla micrantha Ramond ex DC.	+		P	H	*Eur-subMed*
Prunus spinosa L.		+	S	Ph	*Pont*
Rosa canina L.	+		S	Ph	*subMed*
Rubus sanguineus Friv.	+		S	Ph	*Pont-Med*
Sanguisorba minor Scop.	+		4	H	*subBoreal*
Sorbus graeca (Spach) Kotschy	+		T	Ph	*Pont-Med*
Rubiaceae					
Asperula purpurea (L.) Ehrend	+	+	P	H	*subMed*
Saxifragaceae					
Saxifraga sempervivum C. Koch	+		P	H	*Bal-Anat*
Scrophulariaceae					
Euphrasia salisburgensis Funck	+		A	Th	*subMed*
Odontites glutinosa (M. Bieb.) Benth.	+		A	Th	*Pont-Med*
Verbascum longifolium Ten.	+	+	P	H	*Eur-Med*
Thymeleaceae					
Daphne oleoides Schreb.		+	S	Ph	*subMed*
LILIOPSIDA					
Liliaceae					
Scilla autumnalis L.		+	P	G	*Pont-subMed*
Poaceae					
Alopecurus gerardii Vill.		+	P	H	*Alp-Ap-Bal*
Dactylis glomerata L.		+	P	H	*Eur-As*
Festuca valesiaca Scheicher ex Gaudin	+	+	P	H	*Pont*
Poa alpina L.	+	+	P	H	*Boreal*
Sesleria korabensis (Kümmerle & Jáv.) Deyl		+	P	H	*Bal*

Legend:
Biological type: A – annual; A-B – annual to biennial; B – biennial; P – perennial; S – shrub; T – tree.
Life form: Th - therophyte; H - hemicryptophyte; Ch - chamaephyte; Ph – phanerophyte.
Floristic element: Alp-Ap-Bal - Alpine-Appenine-Balkan; Alp-Carp - Alpine-Carpatic; Bal – Balkan; Bal-Anat - Balkan-Anatolian; Boreal; Carp-Bal - Carpatic-Balkan; Eur – European; Eur-As - Euro-Asian; Eur-Med - Euro-Mediterranean; Eur-Sib - Euro-Siberian; Gr - Greek; Kos – cosmopolitan; Med– Mediterranean; Pont – Pontic; Pont-Med – Pontic- Mediterranean; Pont-subMed - Pontic- Submediterranean; subBoreal; subMed - Submediterranean.

Habitats and conservation status

Most of the habitats where *Sideritis scardica* occurs are diverse but the localities studied belong to the habitat of European significance 4090 Endemic oro-Mediterranean heaths, or 31.7A according to the classification of Palaearctic habitats. These habitats are classified as class *Daphno-Festucetea:* alliance *Astragalo-Seslerion* plant communities (HORVAT *et al.*, 1974; STRID *et al.*, 2003).

The nature conservation status of the localities can be estimated as good. The field observation showed that there is a substantial anthropogenic pressure on the natural populations. In August, about 80 % of the mature individuals were found only with basal leaves and without flowering stems. Doubtless, the flowers had been already harvested, either for personal use (most probably) or for commercials purposes.

However, having in mind the very favorable conditions in the studied localities, we could hypothesize that the few individuals that remain unharvested in the nature, are sufficient for at least partly successful natural regeneration. The comparison between the Olympus populations of *S. scardica* with the Bulgarian ones from Slavyanka and Pirin Mts. (Aneva, 2016 – pers. comm.) revealed the better status of Olympus populations. A possible explanation is that on the one hand, the anthropogenic pressure on the Greek populations is lower due to the larger size of the natural localities and resources. An important fact is also that *S. scardica* is not the only species suitable for collection in Greece, but there are at least six species of section *Empedoclia* (PAPANIKOLAOU & KOKKINI, 1982), which reduces the pressure to this taxon.

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References

ANEVA I., P. ZHELEV, E. KOZUHAROVA, K. DANOVA, S.F. NABAVI. 2018. Genus *Sideritis,* section *Empedoclia* in Southeastern Europe and Turkey – studies in ethnopharmacology and recent progress of biological activities. - *DARU Journal of Pharmaceutical Science*: 1-15. [DOI]

ASSYOV B., A. PETROVA (Eds.). 2012. *Conspectus of the Bulgarian Vascular Flora. Distribution Maps and Floristic Elements.* Bulgarian Biodiversity Foundation, 489 p.

AYTAÇ Z., A. AKSOY. 2000. A new *Sideritis* species (Labiatae) from Turkey. - *Flora Mediterranea*, 10: 181-184.

BARBER J.C., J. FRANCISCO-ORTEGA, A. SANTOS-GUERRA, A. MARRERO, R.K. JANSEN. 2000. Evolution of endemic *Sideritis* (Lamiaceae) in Macaronesia: Insight from chloroplast DNA restriction site analysis. - *Systematic Botany*, 25: 633-647.

BARBER J.C., J. FRANCISCO-ORTEGA, A. SANTOS-GUERRA, K.G. TURNER, R.K. JANSEN. 2002. Origin of Macaronesian *Sideritis* L. (Lamioideae: Lamiaceae) inferred from nuclear and chloroplast sequence datasets. - *Molecular Phylogenetics and Evolution*, 23: 293–306.

EuroPlusMed database. 2018. Available at: [bgbm.org]. Retrieved 31.10.2018.

EVSTATIEVA L. 2015. *Sideritis scardica* Griseb. - In: Peev D. (Ed.) *Red Data Book of Bulgaria. Vol. 1. Plants and Fungi*, IBER-BAS and MoEW, Sofia, 607 p.

HORVAT I., V. GLAVAČ, H. ELLENBERG. 1974. *Vegetation Südosteuropas*, Gustav Fischer Verlag, Stuttgart, 412 p.

HUBER-MORATH A. 1982. *Sideritis* L. - In: Davis P.H. (ed.). *Flora of Turkey and the East Aegean Islands*, vol. 7, Edinburgh, UK: Edinburgh University Press, pp. 178-199.

KARAGIANNIKIDOU V., S. KOKKINI. 1987. The flora of Mount Menikion in North East Greece. - *Phyton*, 27(2): 267-283.

KARAGIANNIKIDOU V., S. KOKKINI. 1988. Vegetation and altitudinal zones of Mount Menikion, NE Greece. - *Botanica Helvetica*, 98(2): 149-160.

KARAGIANNIKIDOU V., M. KONSTANTINOU, K. PAPADEMETRIOU. 1995. Floristic and phytogeographic research on the upper montane and the subalpine grassland flora of East Macedonia, Greece. - *Feddes Repertorium*, 106(3-4): 193-213.

KOUTSOS T.V., P.S. CHATZOPOULOU. 2009. *Sideritis* species in Greece: the current situation. - In: Lipman, E. (Ed.). *Report of a Working Group on Medicinal and Aromatic Plants. Second Meeting, 16-18 December 2004, Strumica, Macedonia FYR / Third Meeting, 26–28 June 2007, Olomouc, Czech Republic*, 112-114. Bioversity International, Rome, Italy.

PAPANIKOLAOU K., S. KOKKINI. 1982. A taxonomic revision of *Sideritis* L. section *Empedoclia* (Rafin.) Benntham (Labiatae) in Greece. - In: Margaris N., A. Koedam, D. Vokou (Eds.), *Aromatic Plants: Basic and Applied Aspects*, Martinus Nijhof Publ., The Hague, pp. 101-128.

PETROVA A., V. VLADIMIROV. 2010. Balkan endemics in the Bulgarian flora. - *Phytologia Balcanica*, 16(2): 293-311.

RAUNKIAER C. 1934. *The Life Form of Plants and Statistical Plant Geography*. Clarendon Press, Oxford, 104 p.

STRID A. 1995. The Greek mountain flora, with special reference to the Central European element. - *Bocconea*, 5: 99-112.

STRID A., A. ANDONOSKI, V. ANDONOVSKI. 2003. The High mountain vegetation of the Balkan Peninsula. - In: Nagy L., G. Grabherr, Ch. Körner (Eds.). *Alpine Biodiversity in Europe*, Springer-Verlag Berlin Heidelberg, pp. 113-121.

TODOROVA M., A. TRENDAFILOVA. 2014. *Sideritis scardica* Griseb., an endemic species of Balkan Peninsula: traditional uses, cultivation, chemical composition, biological activity. - *Journal of Ethnopharmacology*, 152(2): 256-265.

WALTER H. 1985. The Vegetation of the Earth and Ecological Systems of the Geo-biosphere. 3rd ed., Springer Verlag, Berlin, 302 pp.

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