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Chemotaxonomic contribution to the *Sideritis* species dilemma on the Balkans

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ABSTRACT

Forty-two samples of *Sideritis* species (*Sideritis scardica*, *Sideritis raeseri*, *Sideritis syriaca*, *Sideritis taurica* and *Sideritis lanata*) from the Balkan Peninsula were evaluated for their polyphenolic profiles in order to establish a correlation between the taxonomy, geographical location and nature and content of phenolic compounds.

Eight compounds were detected in all analyzed *Sideritis* samples: 5-caffeoylquinic acid, lavandulifolioside, verbascoside, isoscutellarein 7-*O*-allosyl(1→2)glucoside, hypolaetin 7-*O*-[6‴-*O*-acetyl]-allosyl(1→2)glucoside, isoscutellarein 7-*O*-[6‴-*O*-acetyl]-allosyl(1→2) glucoside, 3′-*O*-methylhypolaetin 7-*O*-[6‴-*O*-acetyl]-allosyl(1→2)glucoside and 4′-*O*-methylhypolaetin 7-O-[6‴-*O*-acetyl]-allosyl-(1→2)-[6″-*O*-acetyl]-glucoside). They present from 50 to 80% of total phenolic content in *S. scardica*, *S. raeseri*, *S. syriaca* and *S. taurica* and up to 90% in *S. lanata* and the similarity of their polyphenolic profiles implies that they are systematically very closely related.

Based on their polyphenolic patterns, very good differentiation between the samples of *S. lanata* (sect. *Hesiodia*) and *S. scardica*, *S. syriaca* and *S. raeseri* (sect. *Empedoclia*) was observed, that is mainly due to the very high content of 5-cafeoylquinic acid and very low amount of phenylethanoid glycosides and flavonoid glycosides.

The obtained results demonstrate considerable degree of similarity between *S. scardica*, *S. raeseri* and Bulgarian *S. syriaca* that give contribution to the dilemma that Bulgarian *S. syriaca* is very similar to Turkish *S. taurica* and suggest further verification of its taxonomic status.

1. Introduction

The genus *Sideritis* L. belongs to the family Lamiaceae Lindl., which is among the most common and diverse angiosperm families in the world. This genus is divided into two subgenera, *Sideritis* and *Leucophae* (Mendoza-Heuer, 1977), growing in

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Europe and the Macaronesian area, respectively (Fig. 1). The subgenus *Sideritis* includes four sections: sect. *Hesiodia* (Moench) Bentham, sect. *Empedoclia* (Rafin.) Bentham., sect. *Burgsdorffia* (Moench) Briquet and sect. *Sideritis*, containing approximately 125 species, most of which have a centre of distribution in the Mediterranean Europe and Northern Africa (Obón de Castro and Rivera-Núñez, 1994).

Sideritis plants are either annual or perennial xerophite, thermophyte, calciphyte, chasmophyte or heliophyte plants and grow on dry, sunny, mountainous or flat areas (Evstatieva and Vassilev, 1995). In the countries of the Balkan Peninsula the species: *Sideritis scardica* Griseb, *Sideritis raeseri* L., *Sideritis syriaca,* belonging to the section *Empedoclia* (perennial) and *Sideritis montana* L. and *Sideritis lanata* L., (sect. *Hesiodia*, annual) are encountered. *S. lanata* is a very rare species. *S. scardica* Griseb. is a Balkan endemic that occurs in Albania, Bulgaria, Greece and Republic of Macedonia. Grisebach (1844) was the first who described this taxon on the territory of present day Republic of Macedonia, on the Shara Mountain – locus clasicus. Later, the species was found also in other localities in southwest Albania, Greece and Bulgaria.

Many chemical constituents have been identified in *Sideritis* genus such as terpenes, flavonoids, essential oils, iridoids, coumarins, lignanes and sterols (Fraga et al., 1995; González-Burgos et al., 2011). These groups of secondary metabolites have been used as chemotaxonomic markers for clarifying systematic problems within the genus (Tomás-Lorente et al., 1988; Barberán et al., 1993; Fraga, 2012).

The taxonomy of the genus is rather complex because of the interspecific hybridization and therefore it has not been satisfactorily resolved. *S. syriaca* has been noted as a synonym of *Sideritis taurica* M.B and *S. raeseri* but both *S. taurica* and *S. raeseri* have been accepted as separate species for the Balkan Peninsula (Boissier, 1879). Later, *S. raeseri* has been accepted for the flora of Albania, Greece and Macedonia and *S. syriaca* as endemic for Crete (Hayek, 1924–1933). Heywood (1972) in Flora Europaea included *S. raeseri* and *S. taurica* as synonyms of *S. syriaca* once again, whereas Davis et al. (1988) differentiated *S. taurica* and *S. syriaca* as separate species in the Flora of Turkey, as well as Strid and Tan (1998), who separated *S. raeseri* from *S. syriaca*, both endemic for the Balkan Peninsula. Two Greek scientists in 1982 published a taxonomic revision of the species from the section *Empedoclia*. (Labiatae) in Greece. Despite the close similarity of *S. raeseri* to *S. syriaca* and *Sideritis euboea,* they classified it as a separate species. The same authors declared 3 subspecies of *S. raeseri* of whom *S. raeseri* ssp. *florida* has a lot of morphological similarities to *S. scardica* ssp. *scardica.* That can be an evidence of the interspecific hybridization between these species and make up their status questionable. In Bulgaria, a disputable point is the status of *S. syriaca* from Strandza Mountain so some authors claimed that it is *S. taurica* (Stojanov et al., 1967), while later Asenov (1989) reported it as the closest species to *S. syriaca*. Thus, taxonomists still have not reached a consensus on the status of this species.

Continuing our previous studies of Balkan *Sideritis* spp. (Petreska et al., 2011a; Ibraliu et al., 2015) we have here obtained and analyzed the data for the polyphenolic profiles including the nature and content of phenolic acids, phenylethanoid glycosides and flavonoids from 42 samples of four *Sideritis* species from different regions on the Balkan Peninsula collected between 2011 and 2013. The data were analyzed to reveal correlations between taxonomy of the studied species, geographical location and the nature and content of the polyphenolic compounds.

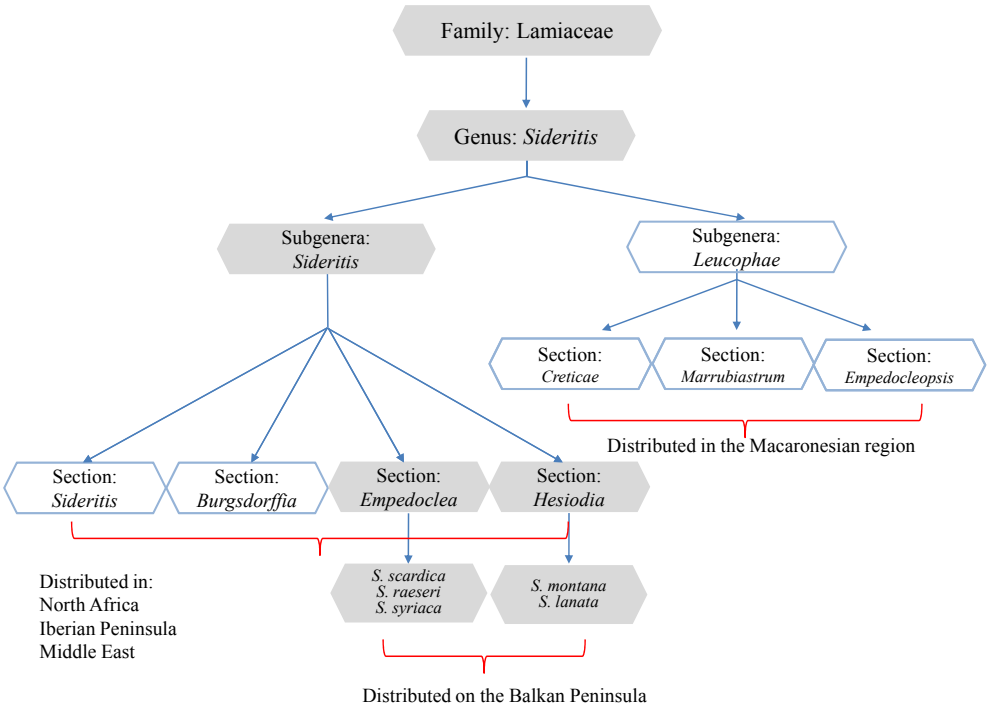

Fig. 1. Phylogenetic tree of genus *Sideritis.*