

***Solenopsis annua* comb. nov., a new taxon for Cyprus**

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Abstract. – *Solenopsis annua*, formerly thought to be a Greek endemic, is recorded in Cyprus for the first time. A morphological description and information on its taxonomy, distribution and habitat, as well as its floristic status are provided. It is recommended to treat it at species rank following the currently prevailing trend of a micro-species concept in *Solenopsis*. Regarding its future Red Data Book status in Cyprus it should be characterised as “Endangered”.

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Introduction

Solenopsis C. Presl is a small genus of the former *Lobeliaceae* family, which is now included in the *Campanulaceae*. In the most recent revision of the genus published by Crespo & al. (1998) seven taxa, six species and one additional subspecies, were known to occur in the Mediterranean basin and Macaronesia, some of them restricted to the larger islands. Hadjikyriakou & Hand (in Hand 2006) described an additional micro-endemic species from Cyprus, *S. antiphonitis*. Finally, another endemic, *S. mothiana* (Brullo & al. 2013), was described from Sicily. Controversial nomenclatural issues dealing with the Balearic endemic *S. minima* have been discussed by Crespo & al. (2007). A key for all taxa of the genus has been published by Brullo & al. (2013).

In Cyprus, the perennial *S. bivonae* inhabits parts of the Troodos range and some adjacent regions. The annual *S. antiphonitis* proved to be a very rare micro-endemic, which is restricted to a small area in the northeast part of the Pentadaktylos range. In spring 2017, two of the authors (CSC & KI) found another *Solenopsis* taxon in the northeast part of the Troodos range. The current note describes the new discovery and discusses the taxonomic affiliation of the Cypriot plants.

Material and methods

The taxon has been studied in the field at all locations found in Cyprus. Herbarium material from all sites has been considered as well as the complete collections from Crete kept at the Botanic Garden and Botanical Museum Berlin-Dahlem (B; including type material).

Furthermore, a common garden experiment has been performed encompassing material from Cyprus and two places in Crete (marked with * in the specimen list below). Plants were grown in pots in the greenhouses at B under identical conditions. Living plants from these accessions have been compared.

Results

Comparison of plant material from Cyprus with plants from Crete revealed the identity with the taxon known as *S. minuta* subsp. *annua*. When comparing herbarium specimens as well as living plants, grown in the common garden experiment, no taxonomically relevant differences could be found. Plants from Cyprus also match the description by Crespo & al. (1998). However, for the sake of comparison we provide a short description based on Cypriot material only, following more or less the diagnosis structure published by these authors.

Acaulescent annual, (2–)3–7.5 cm high (Fig. 1). Leaves 3.5–14.0 × 2.5–7.0 mm, rosulate, oblong-lanceolate to broadly ovate, entire or somewhat crenulate, glabrous to sparsely hispidulous, later glabrescent, petiole 2.0–9.5 mm long. Floral pedicels 3.2–6.8 cm long, (0.8–)2.5–3.5 times longer than leaves; (1–)2 bracteoles near the middle, ciliate, 1.6–4.5 mm long. Calyx (1.5–)2.2–2.8(–3.5) mm, with lobes 1.2–1.9(–2.5) mm long. Corolla (5.4–)6.0–7.8(–9.4) mm long, white, with blue-violet lobes, having large white marking on the central part of the three lobes of the lower lip and yellowish marking at throat entrance, sometimes with dark blue spots (Fig. 2), below blue-violet with greenish-yellow margins on the lower lobes; lower lobes 2.0 mm long, upper lobes 2.3 mm long, tube 3.0 mm long; papillae scattered around the throat, 0.05–0.25 mm long. Anthers united, pointing downwards, bearded towards the tips, blue-violet. Capsule 2.0–3.3(–3.7) mm long (Fig. 3). Seeds 0.40–0.45 × 0.20–0.25 mm.

Flowering from (late April?) May to June (observations only for three years, 2017–2019).

Illustrations: Fig. 1–4; a more comprehensive photo documentation will be found in the online checklist for Cyprus (Hand & al. 2011–).

Most measurements considerably overlap with the data of Cretan material (Crespo & al. 1998). Seeds of Cypriot plants seem to be somewhat smaller but this may be the result of the limited sample of fully ripe specimens in Cypriot and possibly as well in Cretan material (sampling size not given by Crespo & al. 1998). The same applies to capsule length (somewhat longer in Cypriot plants, sample size of Cretan material in Crespo & al. 1998 rather small).

Habitat and distribution

In Cyprus, the species has been found at three neighbouring locations in the wider Filani-Machairas area. Two locations are within the watershed of Pedieos river, whereas the third one is found in a small stream at the highest parts of the watershed of Gialas river. It occurs along rivers and streams with open woody vegetation, growing on moist places with soil-pockets (Fig. 4), usually with *Juncus bufonius*, *Blackstonia perfoliata*, *Centaurium pulchellum* subsp. *pulchellum*, between 525 to 750 m of altitude. In Crete it has been found at much lower and somewhat higher altitudes; Jahn & Schönfelder (1995) give a range of 0–900 m above sea level.



Fig. 1: *Solenopsis annua*, Cyprus, Machairas National Forest Park, plant habit, 16.5.2017. – Charalambos S. Christodoulou

Conservation status

Hitherto the species has been found at three locations, which are restricted in a small area (around 8 km²) and it grows only along rivers and streams. Apart from small scale grazing, there are no other human induced changes to its habitat; however, there is potential risk of forest fires, prolonged drought and climate change. Considering the small geographical range (extent of occurrence and area of occupancy), the number of locations and the fluctuation in the population (IUCN Standards and Petitions Subcommittee 2014), it can be provisionally characterised as Endangered [EN; IUCN criteria: B1ac(iv)+2ac(iv)].



Fig. 2: *Solenopsis annua*, Cyprus, Machairas National Forest Park, flowers, 27.5.2017. – Charalambos S. Christodoulou

Remarks on the taxonomy

Crespo & al. (1998) argued in favour of a micro-species concept instead of the concept of allopatric subspecies proposed by Meikle (1977). They considered the latter alternative as inappropriate, "since populations of different subspecies (sensu Meikle) grow sympatrically in several islands". *S. minuta*, comprising two subspecies, is the sole exception in their concept but the argumentation is not fully convincing. *S. minuta* subsp. *annua* was described by Greuter & al. (1984) as a Cretan endemic giving only very short notes on this taxon. Recently, it was found on Kefallinia in the Ionian islands (Strid 2016, Hellenic Botanical Society 2019). It was treated in greater detail by Crespo & al. (1998). Both taxa occur sympatrically in W Crete but obviously not syntopically (see, e. g., Strid 2016: map 1075). They differ somewhat as regards

their altitudinal distribution and their habitat preferences (see, e. g., Jahn & Schönfelder 1995). However, they do not behave like subspecies in the classical sense, i. e. geographical-ecological vicariants which produce transitional populations in their geographical contact zone. Also, it does not make sense to treat taxa with different life-form types as subspecies of a single species. The nominal taxon is a perennial, rhizomatous plant (erroneously classified as therophyte by Dimopoulos & al. 2013, corrected in the online version, Hellenic Botanical Society 2020, following our remark) whereas subspecies *annua* is a therophyte with a thin main root. Strid (2016), often an advocate of a lumping strategy of morphologically close taxa, sometimes even in contrast to Dimopoulos & al. (2013), in a list he co-authored, sees no clear geographical separation of the two subspecies and considers them to be “taxonomically over-rated”. But obviously this is not based on detailed studies. Both taxa may be morphologically close but the differences between most taxa of the genus are rather weak. The difference in their life-form type should be given a higher weighting. We rather prefer to treat all segregates of the genus as micro-species and therefore the following combination is proposed.

***Solenopsis annua* (Greuter & al.) Hand & Christodoulou, comb. nov.**

≡ *Solenopsis minuta* subsp. *annua* Greuter & al. in Willdenowia 14: 30. 1984

By treating *S. annua* as a species we may err on the side of the splitters. However, *Solenopsis* is in need of a thorough pan-Mediterranean study with more intensive sampling to clarify such issues like the genetical structure of its highly disjunct taxa such as *S. minuta* s. str. and *S. bivonae*, as well as population genetics of the former and *S. annua* in Crete where both taxa meet. Such research may also reveal possible explanations for the evolution of the distribution areas.

Selected specimens seen

Cyprus: Division 2 (sensu Meikle 1977), Filani – Machairas, 34°57'56.42"N 3°12'29.10"E, 690 m, 16.5.2017, C. S. Christodoulou & K. Iosif (B, CYP 6568) ; ibid., 27.5.2017, C. S. Christodoulou (B, CYP 6570); ibid., 9.6.2017, C. S. Christodoulou & K. Iosif (B, CYP 6575); ibid., 16.6.2017, C. S. Christodoulou (B, CYP 6585); ibid., 16.6.2017 (seeds), acc. no. 019-01-18-10, C. S. Christodoulou, cultivation at B until 20.6.2018, leg. M. Cubr 51052 (B-garden herb.*). – Additional observation: Mantra tou Kampiou – Profitis Ilias 31.5.2018, 595 m, C. S. Christodoulou & K. Iosif.

Greece, Crete: Eparchie Rethimni, Tal des Sfakoriako S der Prasiano-Schlucht, 35°18'30"N 24°33'E, Grasflächen und Pterideten auf Schiefer, 100–120 m, 24.5.1982, J. J. Greuter & al. 19031 (B; type); ibid., S-Teil der Prasiano-Schlucht, 35°19'N 24°33'E, 30 m, Schattiger Schluchtgrund, 14.6.1982, H. Risse 628 (B). – Prasiano gorge, 2017 (seeds), acc. no. 019-03-18-40, Fournaraki, cultivation at B until 23.5.2018, leg. M. Cubr 51050 (B garden herb.*). – Ag Nikolaos, Damp ground [...], 31.5.1984, J. M. Shay 1447 (B). – Kissamos, gorge “Porfarango” c. 1.5–2 km SSW Dhelianá (N end), 35°26'N 23°44'E, dense *Platanus*-forest [...], 210–220 m, 20.5.1983, U. Matthäs

620 (B). – Prov. Chania, distr. Kydonia, a pago Kambi meridiem versus secus tramitem ad refugium Volika ducentem, 35°24'30"N 24°04'E, 600 m, 7.5.1983, *W. Greuter & al. 19701* (B). – Westkreta, Phrygana auf der Halbinsel Rodopou, zwischen Kolimbari, Afrata und Astratigos, 29.4.1996, *M. Bäßler* (B). – Marathokefala (Crete), 35°31'N 23°45'E, 150 m, pioneer location on loamy soil, 23.5.1996, *R. Gadringer & al., Soc. Ech. Pl. Vasc. Bassin Médit. 18489* (B). – Chania, Kournas lake, 7.6.2000 (seeds), acc. no. 019-02-18-40, *Fournaraki*, cultivation at B until 23.5.2018, leg. *M. Cubr 51051* (B garden herb.*).

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Fig. 3: *Solenopsis annua*, Cyprus, Machairas National Forest Park, immature capsules, 9.6.2017. – Charalambos S. Christodoulou



Fig. 4: *Solenopsis annua*, Cyprus, Machairas National Forest Park, colony in habitat, 27.5.2017. – Charalambos. S. Christodoulou