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The rediscovery of *Silene guicciardii* (Caryophyllaceae) on Mt. Parnassos (Greece) after 160 years: taxonomic re-evaluation and conservation

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Abstract

Silene guicciardii (Caryophyllaceae) was rediscovered after field surveys carried out on Mt. Parnassos (Stereia Ellas, Greece), 160 years after the type collection made by J.B. Samaritani and J. Guicciardi in 1857. Since its first collection, it has been considered either as a distinct species, a variety or a mere synonym of the SW-Asiatic *S. marschallii*. We provide a revised description of the species and we re-evaluate its taxonomic position and that of the related species. We propose to treat the taxon *guicciardii* at the subspecific rank of *S. marschallii*. A color plate of *S. marschallii* subsp. *guicciardii* and a distribution map for all subspecies of *S. marschallii* are also provided. The name *Silene guicciardii* was lectotypified on a specimen preserved at G-BOIS, while isolectotypes are at G-BOIS, B, BR, C, GOET, JE, K and WU.

Key words: distribution, extinct species, IUCN, nomenclatural change, Silenoideae, typification.

Introduction

Silene Linnaeus (1753: 416) is one of the largest genera of flowering plants. It comprises ca. 700–750 species, about half of which are distributed in the Mediterranean area (Melzheimer 1988, Bittrich 1993, Greuter 1995), while 108 species (of which 35 are endemics) occur in Greece (Dimopoulos *et al.* 2013). The southern Balkan Peninsula and SW-Asia are two of the main diversity centers for the genus (Greuter 1995).

Silene guicciardii Boissier & Heldreich in Boissier (1859: 32) is one of the most enigmatic *Silene* species in Greece. It is known only from the type collection on Mt. Parnassos (leg. J.B. Samaritani *et J. Guicciardi*, 1857). The species has not been apparently collected since 1857. *S. guicciardii* together with *S. longipetala* Ventenat (1802: 83) are the only members of the SW-Asiatic *Silene* sect. *Lasiostemones* (Boissier 1867: 574) Schischkin (1936: 631) distributed in Europe.

Mount Parnassos is one of the most floristically explored Greek mountains (Gustavsson 1978, Strid & Tan 1987, 1991, Stevanović *et al.* 2007). Almost all major researchers of the Greek flora during the 20th century have visited the mountain, collecting thousands of plant specimens distributed in several herbaria all over Europe. Many botanists, however, have focused their collection intensity in the species-rich (in terms of rare and endemic plants), high-elevation habitats of Mt. Parnassos. Low and mid-elevation areas are less explored and their flora is not currently completely known. According to the label of the type specimen, the collection locality of *Silene guicciardii* is the Lefkokastron area, above Livadi Arachovas, a mountainous plateau located on south-western part of the summit area, at 1070–1150 m a.s.l. After contacting with local residents, we concluded that the exact locality of the type collection is a small hill at the north-western part of the Livadi plateau, called Elafokastro (also called Lafokastro by the locals), an old name known only to elderly local residents. The use of the name Lefkokastro (from the Greek words *lefkon* = white, and *kastro* = castle) instead of Lafokastro (from the Greek words *elafi* = deer, and *kastro* = castle) at the label of the type specimen possibly bewildered subsequent researchers from locating the exact distribution area of *S. guicciardii*.

During June–July of 2015, two different groups of botanists visited Mt. Parnassos several times, as part of a monitoring program of the rare, endemic and threatened plant species distributed within the boundaries of the Parnassos

National Park Management Body. The rediscovery of *Silene guicciardii* was one of the main objectives of the project. *S. guicciardii* was found independently by these two research groups, in two different localities in the Livadi plateau. We visited the same areas during June 2016 and 2017, collecting several specimens of the rediscovered species.

The aim of the present study is to record the rediscovery of *S. guicciardii*. Its morphology is examined in detail and its taxonomic position, especially in relation to the closely related *S. marschallii* C.A. Meyer (1831: 214), is re-evaluated using complete specimens collected in the field. Its conservation status is also evaluated, based on population measurements and identification of the main threats that it faces.

Material and methods

Field surveys were carried out on Mt. Parnassos from 2015 to 2017. A detailed morphological study of *Silene guicciardii* was undertaken based on fresh and dried material. A morphological comparison with *S. marschallii* was also based on the examination of specimens preserved at WU and B herbaria (acronyms follow Thiers 2017+), as well as on species descriptions (Boissier 1859, Boissier & Buhse 1860, Melzheimer 1988, Yildiz & Dadandi 2010). Pertinent literature, as well as data kindly provided by Prof. K. Yildiz (Celal Bayar University, Manisa, Turkey) was also considered. Assessment of *S. guicciardii* was made according to the IUCN (2017) criteria.

Taxonomic treatment

Silene marschallii* C.A. Mey. subsp. *guicciardii (Boiss. & Heldr.) Trigas, Kokkoris & Kougioumoutzis, *comb. & stat. nov.* (Fig. 1).

Bas.: *Silene guicciardii* Boissier & Heldreich in Boissier (1859: 32).

Lectotype (designated here):—GREECE, Sterea Ellas: in rupestribus m. Parnassi, versus collem Leucocastron supra Livadi, 1050 m, 05 July 1857, Samaritani & Guicciardi 687 [G-BOIS00544441! (Fig. 2); isolectotypes G-BOIS00544441a!, G-BOIS00410008! B10-0366280! (image at <http://ww2.bgmb.org/Herbarium/specimen.cfm?Barcode=B100366280>), BR0000006981549! (image at <http://www.br.fgov.be/research/COLLECTIONS/HERBARIUM/detail.php?ID=418049>), C10009219! (image at https://www.europeana.eu/portal/en/record/11615/_DIGIT_TYPEP_UCPH_DENMARK_C10009219.html); GOET6724! (image at http://134.76.10.102/fif=/botanik/Caryoph_Silene_guicciardii.fpx&obj=UV,1.0&wid=300&page=uv9.html); JE00016233! (image at http://plants.jstor.org/stable/10.5555/al.ap.specimen.je00016233?searchUri=filter%3Dname%26so%3Dps_group_by_genus_specie%2Basc%26Query%3Dsilene%2Bguicciardii); K000725859! (image at <http://apps.kew.org/herbcat/detailsQuery.do?barcode=K000725859>); WU-Hal0073585! (image at http://131.130.131.10/djatoka/jacq-viewer/viewer.html?rft_id=wu_0073585&identifiers=wu_0073585)].

Improved description:—Caespitose perennial, with branched woody stock producing several short, compact vegetative shoots with tufted leaves and few erect, simple stems 20–45 cm long, with a rosette of often withered leaves at base; lower part of stems covered with farinose indumentum of minute eglandular papillae; upper parts glabrous but internodes viscid. Basal leaves filiform to linear, 15–60 × 0.3–1.2 mm, with a single prominent vein beneath, canaliculated, upper surface usually glabrous, lower surface and margins covered with minute eglandular papillae, rarely both surfaces minutely papillate; caudine leaves in 3–4 distant pairs, similar to basal leaves but diminishing in size upwards and the two upper pairs glabrous; bracts smaller, triangular-subulate, ciliolate, with membranous margins. Inflorescence few-flowered, symmetrical, with a terminal flower and 3–4 pairs of lateral flowers, the latter sometimes developed into 3-flowered dichasia. Flowers nodding in bud and through anthesis, erect at maturity; pedicels 2–6 mm long, glabrous to sparsely papillate. Calyx 8.5–12.0 mm long, with 10 membranous bands and raised main veins; teeth ciliolate, with membranous margins, slightly unequal, the outer ovate, rounded, the inner somewhat longer, produced into two membranous auricles, ± obcordate. Anthophore 2.0–3.5 mm long, sparsely pubescent above, ± glabrous at base. Petal claw 7–10 mm long, exserted from calyx for 1.0–1.5 mm, with 3 prominent veins and hyaline margins 0.6–0.8 mm wide above, ciliate at margins and along veins; coronal scales 1.0–1.5 mm long, irregularly dentate at apex; limb 5–6 mm long, bifid for 1/2–4/5 of its length, with narrowly oblong lobes ca. 1 mm wide, white above, yellowish-green with darker, prominent, dichotomously branched veins below. Filaments much exserted from corolla,

hirsute below and glabrous above; anthers dull yellowish-green, turned to brownish-purple after dehiscence. Capsule 10–11 × 4.5–6.0 mm, ovoid, exserted from calyx. Seeds 1.0–1.2 × 0.8–1.2 mm, ± reniform, greyish-brown, with flat or slightly tuberculate lateral testa cells and moderately tuberculate dorsal ones.

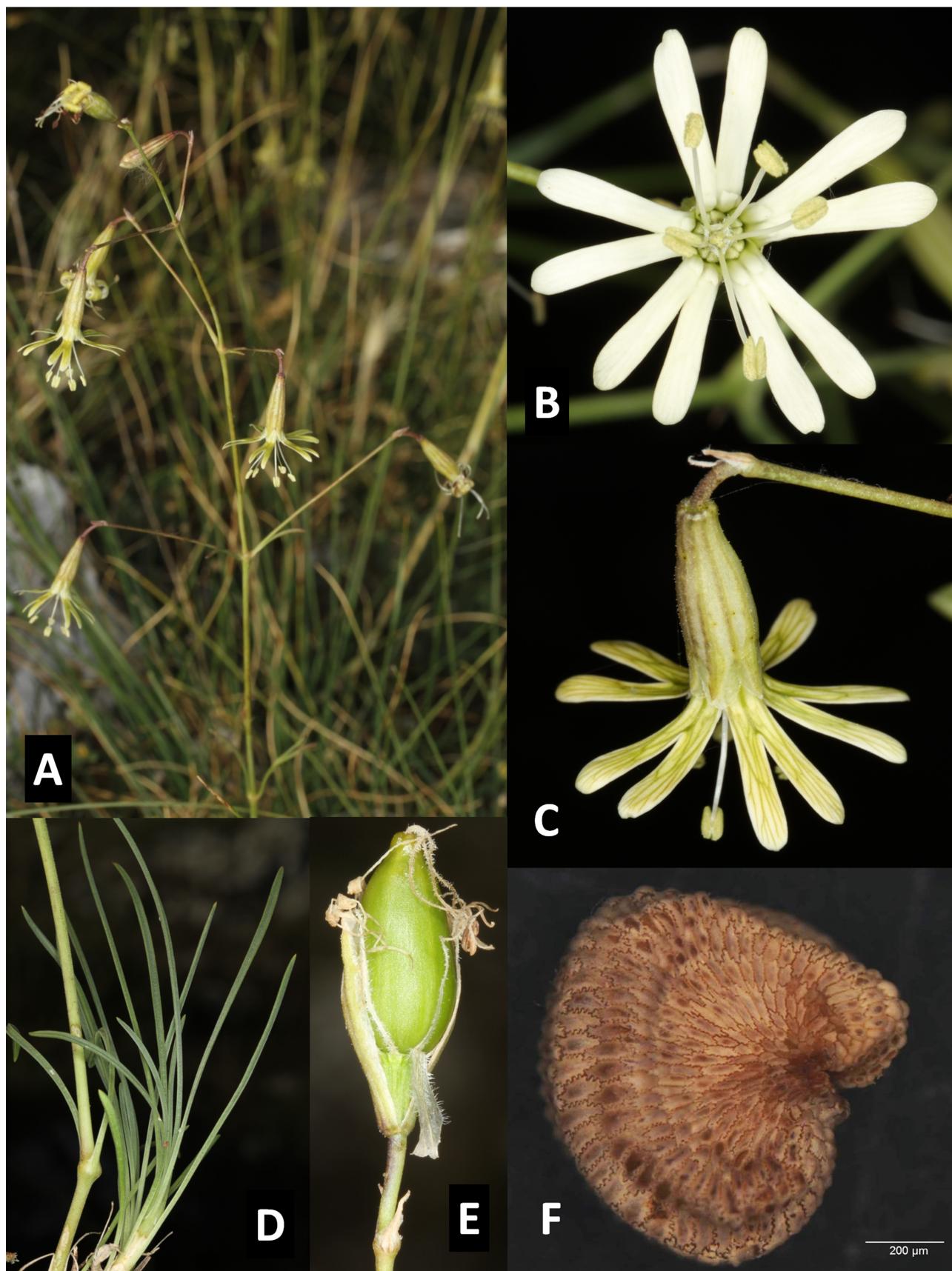


FIGURE 1. *Silene marschallii* subsp. *guicciardii*: (A) inflorescence with nodding flowers, (B) flower (face view), (C) flower (side view), (D) vegetative shoots with leaves, (E) immature capsule, showing the ciliate petal claws and the hirsute filaments and styles, (F) seed.



FIGURE 2. Lectotype of *Silene guicciardii* (G-BOIS00544441, ©: Conservatoire et Jardin botaniques de la Ville de Genève).

Typification of the name:—Boissier & Heldreich in Boissier (1859: 32) described *Silene guicciardii* through a detailed diagnosis. They have also given the provenance (“Hab. in rupestribus Parnassi versus collem Leucocastro suprà Livadi alt. 3500”), collectors (“J.B. Samaritani & J. Guicciardi”), and the citation “Heldr. H. Gr. Norm. No. 687 non Otth.”. The latter phrase clearly refers to at least one specimen. We traced ten specimens bearing plants that match Biessier’s diagnosis and labels matching with the data reported in the protologue. These specimens are syntypes (Art. 9.5 of ICN). As a consequence a lectotypification is necessary. We here designate the G00544441 specimen as lectotype, while the other nine ones are isolectotypes.

Taxonomic position and relationships:—*Silene* sect. *Lasiostemones* includes about 23 species, mainly distributed in SW-Asia. Plants are caespitose perennial with thyrsoidal or compound-dichasial inflorescences, vespertine flowers, often nodding at anthesis, glabrous or puberulous calyx with simple veins below reticulately anastomosing in the distal part, limb bifid for most of its length into narrow lobes, and staminal filaments hirsute below.

The taxonomic position of *Silene guicciardii* within *S. sect. Lasiostemones* is rather vague and there are disagreements among authors: it has been considered as a distinct species (Greuter 1997), a variety (Boissier 1867), or a mere synonym of *S. marschallii* (Coode & Cullen 1967, Yildiz & Cipri 2013, Euro+Med 2006–). As this taxon was known only from the type collection, its different proposed taxonomic classifications were based on the type which is however incomplete from the morphological point of view. Despite this fact, many researchers agree that plants from Mt. Parnassos are conspecific or closely related to *S. marschallii*.

Silene marschallii is a polymorphic species occurring in SW-Asia, from W-Turkey to C-Iran (Fig. 3). Three subspecies of *S. marschallii* are currently recognized: subsp. *marschallii* is distributed throughout the range of the species, subsp. *sahendica* (Boissier & Buhse 1860: 38) Melzheimer (1988: 388) is usually distributed on mountainous areas above 3000 m a.s.l. in Iran and NE-Iraq, and subsp. *anamasi* Yildiz & Dadandi (2010: 336) confined to two neighbouring mountainous areas at Konya Province (SW-Turkey) (Fig. 2).

The rediscovery of *Silene guicciardii* in the *locus classicus*, allowed us to observe the plant at its natural habitat and to collect complete specimens from both flowering and fruiting individuals. The detailed morphological study of the available specimens confirms the close relationship of *S. guicciardii* to *S. marschallii* as reported in literature. Plants from Mt. Parnassos, however, display some constant morphological differences from all recognized subspecies of *S. marschallii* (Table 1) that justify their recognition as a distinct taxon at the subspecific rank. The narrow, filiform to linear basal leaves and the papillate stems and leaves, the latter usually glabrous at the upper surface, are the main diagnostic characters that distinctively distinguish subsp. *guicciardii* from all other subspecies of *S. marschallii*. Subsp. *guicciardii* is further differentiated from the other subspecies of *S. marschallii* by petal, capsule and seed morphological characters (Table 1).

TABLE 1. Main morphological differences among the subspecies of *Silene marschallii*.

	<i>S. marschallii</i> subsp. <i>marschallii</i>	<i>S. marschallii</i> subsp. <i>sahendica</i>	<i>S. marschallii</i> subsp. <i>anamasi</i>	<i>S. marschallii</i> subsp. <i>guicciardii</i>
Stem	25–90 cm long, basal internodes shortly pubescent.	8–24 cm long, basal internodes shortly pubescent.	20–35 cm long, basal internodes pubescent.	20–45 cm long, basal internodes minutely papillate.
Basal leaf	27–55 × 1–6 mm, linear to lanceolate, shortly pubescent on both surfaces.	8–25 × 0.5–1.5 mm, linear to lanceolate, shortly pubescent on both surfaces.	10–35 × 1–3 mm, linear to lanceolate, shortly pubescent on both surfaces.	15–60 × 0.3–1.2 mm, filiform to linear, upper surface usually glabrous, lower surface and margins minutely papillate, rarely papillate on both surfaces.
Anthophore	± pubescent.	± pubescent.	Glabrous.	± pubescent.
Petal	Limb bifid for 1/3–1/2 of its length; coronal scales present.	Limb bifid for 1/3–1/2 of its length; coronal scales present.	Limb bifid to the base; coronal scales absent.	Limb bifid for 1/2–4/5 of its length; coronal scales present.
Capsule	5–11 × 3–4.5 mm.	4–5 mm long.	6–10 × 3–5 mm.	10–11 × 4.5–6 mm.
Seed	1.3–1.8 × 0.9–1.2 mm	Unknown	1.5–2.2 × 1.1–1.2 mm	1–1.2 × 0.8–1.2 mm

Distribution, habitat and phenology:—*Silene marschallii* subsp. *guicciardii* has a restricted distribution range on Mt. Parnassos, at 1090–1150 m a.s.l. The subspecies is currently known from two distinct localities at the north-western and south-western parts of the Livadi plateau of Mt. Parnassos, which are approximately 2.5 km apart. Its disjunct distribution, about 600 km westwards from the closest populations of *S. marschallii* subsp. *marschallii* in Anatolia, indicates a long-lasting isolation, since the Aegean Archipelago has acted as an effective biogeographical barrier,

separating European and Asian biogeographical regions (Kougioumoutzis *et al.* 2017). Flowers of *S. marschallii* subsp. *guicciardii* appear in late May–June and the mature capsules open in July. It has vespertine flowers, opening in the late afternoon or evening, a common moisture-controlled movement in several *Silene* species (Greuter 1995), also observed in the members of *S. sect. Lasiostemones*. Although, the majority of the endemic plants of Parnassos grow in rocky habitats, *S. marschallii* subsp. *guicciardii* grows in mountainous grasslands with exceptionally high species richness and a dense plant cover, predominantly consisting of herbaceous plants (pers. obs.). The associated taxa of *S. marschallii* subsp. *guicciardii* are, among others, *Ballota acetabulosa* (Linnaeus 1753: 584) Bentham (1834: 595), *Cerastium candidissimum* Correns (1909: 171), *Euphorbia myrsinifolia* Linnaeus (1753: 461) subsp. *myrsinifolia*, *Festuca* sp., *Marrubium vulgare* Linnaeus (1753: 583), *Phlomis herba-venti* Linnaeus (1753: 586), *Silene radicans* Boiss. & Heldr. in Boissier (1846: 24), *Thymus longicaulis* Presl (1826: 37) subsp. *chaubardii* (Reichenbach fil. 1857: 37) Jalas (1980: 323).

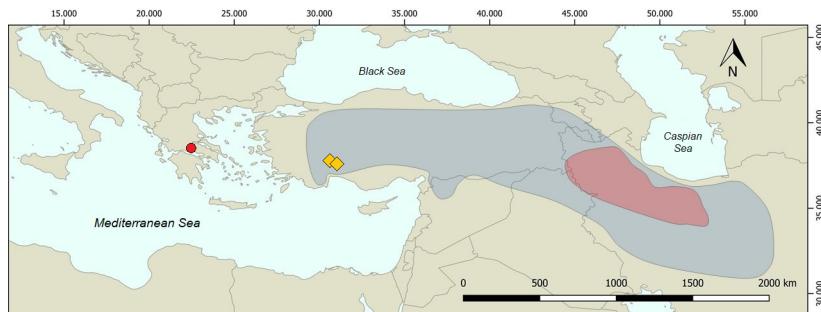


FIGURE 3. Distribution map of *Silene marschallii* subsp. *marschallii* (grey area), *S. marschallii* subsp. *sahendica* (red area), *S. marschallii* subsp. *anamasi* (diamonds) and *S. marschallii* subsp. *guicciardii* (circle).

Conservation status:—*Silene marschallii* subsp. *guicciardii* is a locally restricted taxon, currently known from two neighboring localities in Livadi plateau of Mt Parnassos. In June 2016, we counted 247 mature individuals in the northern subpopulation, occupying an area of ca. 1 ha. The southern subpopulation is estimated to include 100–200 individuals that cover an area of approximately the same size. The whole area of Livadi plateau is about 8 km² and the presence of additional subpopulations cannot be ruled out, as the habitat is common there and the individuals are easily overlooked, as they usually grow in grasslands with a dense plant cover. However, we have extensively searched a large part of the hilly areas within and around Livadi plateau, without locating any additional subpopulations.

The Livadi plateau is traditionally used for grazing of domestic animals; grazing is a serious direct threat that *Silene marschallii* subsp. *guicciardii* faces. In a random sample of 20 individuals, about 60% of the flowering stems (and thus about the same percentage of the annual seed production) were consumed by domestic herbivores, mainly sheeps and cattles. The subspecies, however, is well adapted and tolerant to grazing, as the vegetative shoots and the rosette leaves are prostrate to the ground, thus avoiding being consumed by the animals.

Mt. Parnassos is the most popular destination for winter tourism in Greece, having probably sustained the highest winter tourism development, in recent decades, among all Greek mountains. Livadi plateau belongs to the most affected areas, as numerous touristic infrastructures have been developed in the area. In a short distance from the northern subpopulation of *Silene marschallii* subsp. *guicciardii* several buildings have been built, and an extension of the construction projects could threaten the entire subpopulation directly.

Land use change and overgrazing are the main threats that *S. marschallii* subsp. *guicciardii* faces. According to IUCN Standards and Petitions Subcommittee (2017), *S. marschallii* subsp. *guicciardii* is evaluated as Endangered (EN), according to criterion C2a(i).

Diagnostic key to *Silene marschallii* s.lat.:—It follows:

1. Anthophore glabrous, limb bifid to the base, coronal scales absent *S. marschallii* subsp. *anamasi*
- Anthophore ± pubescent, limb bifid for 4/5 of its length or less, coronal scales present 2
2. Stem minutely papillate below, limb bifid for 4/5 of its length, upper leaf surface usually glabrous and lower surface minutely papillate *S. marschallii* subsp. *guicciardii*
- Stem shortly pubescent below, limb bifid for 1/3–1/2 of its length, leaves shortly pubescent on both surfaces 3
3. Stem 25–90 cm long, basal leaves 27–55 × 1–6 mm, capsule 5–11 mm long *S. marschallii* subsp. *marschallii*
- Stem 8–24 cm long, basal leaves 8–25 × 0.5–1.5 mm, capsule 4–5 mm long *S. marschallii* subsp. *sahendica*

Additional specimens examined:—*Silene marschallii* subsp. *guicciardii*. GREECE, Sterea Ellas, Mt Parnassos, meadows and rocky outcrops close to the top of a hill, SW of Livadi Arachovas plateau, 38°29.684'N, 22°30.920'E, 1150 m, 1 July 2015, *Georgiadis, Kokkoris & Tzanoudakis* 14644 (UPA!); Sterea Ellas, Mt Parnassos, meadows and rocky outcrops at the NW part of Livadi Arachovas plateau, 38°30.927'N, 22°31.872'E, 1090 m, 17 July 2015, *Trigas & Theocharopoulos* 6036 (ACA!); *ibidem*: 15 June 2016, *Trigas* 6287 (ACA!); *ibidem*: 4 June 2017, *Trigas, Strid A.* & *Strid B.* 6313 (ACA!).

Silene marschallii subsp. *marschallii*. IRAN: montes Elborz: in pylis Kandavan in pratis ad meridiem vergentibus, 36°10'N, 51°15'E, 2700–3800 m, 8 July 1977, *Soják* 7298 (B!); Kalak prope Karaj, 1934, *Gauba* 2158 (B!); Azerbaijan occidentalis, in colle argilloso SW Rezaiyeh, 1500 m, 12–13 July 1974, *Rechinger* 49332 (B!); Prov. Kurdistan, in collibus siccis et ad versuras 11 km N Saqqez, 1550 m, 8 July 1971, *Rechinger* 43111 (B!); jugi Elbursensis in subalpinis ad basin septentr. alpium Tuchal prope Shahrestanak, 2200 m, 4–12 June 1902, *Bornmüller* 6369 (WU!). Turkey: Provinz Hakkari, 40 km nordöstl. Hakkari, steppenhänge am Ostufer des Zap-Flusses, 1600 m, 6 June 1986, *Raus* 10956 (B); Erdschias-dagh (Argaeus), auf sandigen Abhängen oberhalb Tschomakly, 1800 m, 24 June 1902, *Zeberbauer* 2490 (WU!).

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