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REDISCOVERY OF THE *SALVIA HAUSSKNECHTII* BOISS. (LAMIACEAE) IN KAHRAMANMARAŞ - A LOST ENDEMIC SPECIES OF TÜRKİYE

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Abstract

The type specimen of *Salvia haussknechtii* Boiss., an endemic species of Türkiye, was first collected in 1865 by C. Haussknecht and later described by E. Boissier in 1879. *Salvia haussknechtii* Boiss. was poorly described based on type specimen of Haussknecht collected in 1865. Since then it could not be collected from elsewhere until 2022, when it was found on Berit Mountain. *S. haussknechtii* is only known from quite small population from Berit Mountain. It's relationships and distinguishing characters from the closest relative *S. caespitosa* and *S. multicaulis* are discussed. The SEM shapes of pollen grains and seeds of *S. haussknechtii* are reported here for the first time. In addition, ecology, habitat, conservation status are given. For insufficient morphological structures of the type specimen, a new Topotype of *S. haussknechtii* is proposed.

Introduction

The genus *Salvia* L. belongs to the family Lamiaceae. The family is represented by 245 genera and 7886 species all over the world (Abdelhalim and Hanrahan 2021, Laface *et al.* 2023). *Salvia* is the largest genus of the Lamiaceae family with approximately 1000 species, and distributed all over the world (intensively in South America and Asia), except for the polar regions (Walker and Sytsma 2007, Wu *et al.* 2020, Casella *et al.* 2023, İlçim *et al.* 2023). The first comprehensive study on the genus *Salvia* in Turkey was conducted by Hedge (1982). As a result of different studies, it was determined that there are 104 taxa belonging to the genus *Salvia* in Turkey (İlçim *et al.* 2023). *S. haussknechtii* is endemic species to Berit Mountain in Türkiye. It was firstly collected by C. Haussknecht from Kahramanmaraş-Berit Mountain in 1865 and later described by E. Boissier in 1879 (Boissier 1879). This species is similar to *S. caespitosa* with its vegatative parts but the calyces are membranous and expanding like in *S. multicaulis*. Its taxonomic status is not clear because it is known only from the type specimen and the morphological parts are missing in this specimen (Hedge 1982). In the studies conducted on the revision of the *Salvia* genus distributed in Turkey and in the flora, studies conducted in the region, *S. haussknechtii* could not be detected anywhere, including its type locality (Yıldız 2001, Doğan *et al.* 2008, Celep 2010). It has also been stated that the herbarium specimen of this species is only in the Edinburgh and Geneva herbariums, but there are no flowers on these specimens (Celep 2010). Hedge (1982) stated in the description of the species that the corolla is not known, but the most important distinguishing characters are the pinnatifid leaves and the permanent and expanding calyx seen in the matured fruit. In a study evaluating the conservation status of *Salvia* species in Turkey, *S. haussknechtii* was reported as insufficient data (DD) because the status of *S. haussknechtii* was known only from the type sample (Celep *et al.* 2010). The present study aims to document the rediscovery of populations of *S. haussknechtii*, to provide its detailed morphological characters and descriptions, distributions and habitats, to accurately assess its conservation status.

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Materials and Methods

In the floristic research we conducted in Kahramanmaraş, a *Salvia haussknechtii* sample was collected and identified on Berit Mountain in June 2022. The specimens were gathered and prepared following standard herbarium method and photographs of the habitat and different morphological structures of the plants were taken. A dissecting microscope was used to observe and assess the morphological characters of the specimens. The species is represented by very few individuals in a narrow locality in the specified region. At first glance, it morphologically resembled with its pinnatisect leaves later *S. multicaulis* with its calyx. However, samples were cross-checked with Flora of Turkey (Hedge 1982) and the Celep (2010). Additionally different examples were compared that various specimens of the *Salvia* genus deposited at various Turkish and international herbaria (AEF, ANK, GAZI, HUB, ISTO, E, BR, G). The holotype specimen was carefully examined in Geneva Herbaria (Fig. 1). As a result it showed that these samples belong to *S. haussknechtii*. The examined plant samples are kept in the KSU Faculty of Science Herbarium (KSUH).

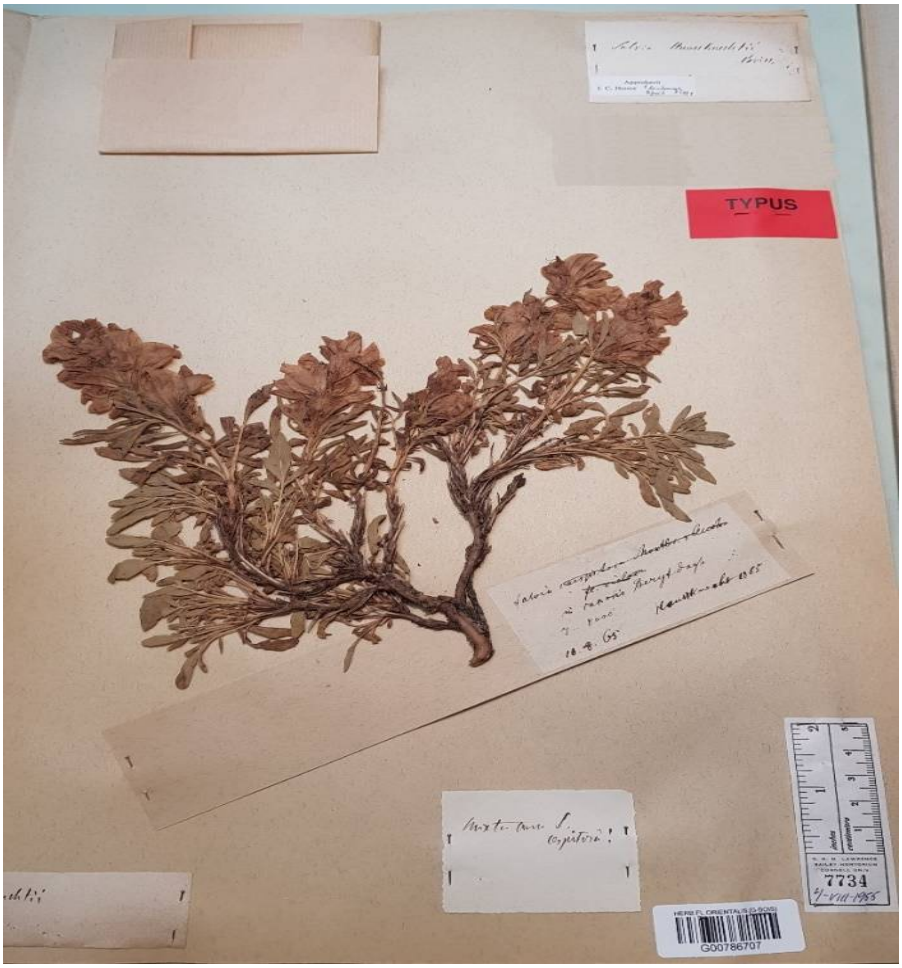

Fig. 1. *S. haussknechtii* type specimen (G!).

Results and Discussion

Taxonomy

Salvia haussknechtii Boiss., Fl. Or. 4:605 (1879).

Type: Turkey, B6 Maraş in saxosis montis Berytdagh (Berit Da.) Cataoniae, 2135-2440 m, 10 viii. 1865, Haussknecht (holotype G!).

Topotype: Türkiye, B6 Kahramanmaraş: Göksun, Berit Mountain, Kömesögüt village, 1850-2300 m, 07 vi 2023, (YZK 2615).

Perennial suffruticose herb with a woody rootstock, mats to c. 35-40 cm diam. Stems short, procumbent, leafy, 10-22 cm, with an eglandular antrorse ± lax pilose (0.6-1.5 mm) below, dense pilose (2-3 mm) above hairs and few sessile glands. Leaves pinnatisect, with a linear-oblong to narrowly obovate-elliptic terminal segment ca.(1.3-3.5×0.6-2 cm) and two pairs of lateral segments or rarely one pair, terminal segment slightly longer and broader than laterals green, margins serrulate, eglandular with antrorse short hairs and few sessile glands, margins pilose. Petiole 1-1.5 cm, slightly widened at base, lax pilose hairs. Inflorescence condensed. Exceeding leaves with 3-5 verticillasters, each verticillaster with 2-4 flowered. Bracts ovate to elliptic, acuminate, green to dark purple, c. 10×4 mm, few sessile glands and indumentum dense pilose, eglandular antrorse below, lax pilose above, shorter than calyx, bracteoles absent, floral leaves similar or dissimilar to stem leaves, pinnatisect or trisect. Pedicels c. 2.5 mm, dense antrorse hairs. Calyx campanulate 10-14 mm, up to 21 mm in fruit, green, later purplish. Fruiting calyx infundibular, membranous, with divergent lips, upper lip somewhat longer than lower, antrorse and dense pilose, few sessile glands, mucronate. Corolla 19-26 mm. violet-blue and white veined labellum tube c. 6-8 mm, slightly ventricose, upper lip straight, lax pilose and sessile glands. Stamens 2, upper theca ca. 2-3 mm, the lower theca 1.7-2 mm with violet-blue at apex, connective 4-5 mm, filaments 6-9 mm. Style glabrous 18-28 mm long, exerted from corolla lips and divided in two parts at apex and violet-blue apex. Nutlets globose, c. 2.5 × 3.5 mm, pale brown and surface slightly reticulate.

Phenology: Flowering occurs in May to June and fruiting from June to July.

Distribution, habitat and ecology: S. haussknechtii is an endemic species known only from Berit mountain in Kahramanmaraş where the species is very rare and local. *S. haussknechtii* grows on rocky mountain slopes at an altitude of 1850-2300 m. The vegetation in this area is formed of herbaceous and woody plants including. *Abies cilicica* (Ant. & Kotschy) Carr. subsp. *cilicica*, *Cedrus libani* A.Rich, *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe, *Quercus cerris* L., *Astragalus densifolius* subsp. *densifolius* Lam., *Astragalus gummifer* Labill., *Medicago radiata* L., *Potentilla speciosa* Willd., *Campanula stricta* var. *libanotica* (A.DC.) Boiss., *Anchusa azurea* var. *azurea* Mill.

Conservation status: We recommend that the threatened category of *S. haussknechtii* should be “Critically Endangered” [CR C2 a(i)] of IUCN Standards and Petitions Subcommittee (IUCN 2022). Because of the population size estimated to number fewer than 250 mature individuals and distribution area of the species has high grazing pressure.

Palynology: Pollen grains of *S. haussknechtii* are 6-colpate, prolate (P/E = 1.66), 63.58 ± 2.89 × 38.26± 2.19 µm. Colpus length (Clg) 53.45 ± 2.23 µm, width (Clt) is 1.99 ± 0.78. Exine is 1.03 ± 0.17 µm, and intine is 0.93 ± 0.09 µm. The exine ornamentation of pollen grains is bireticulate (Fig. 4).

S. haussknechtii Boiss. is endemic species and firstly collected from Kahramanmaraş-Berit Mountain in 1865, it was not collected again until 2022 although many studies conducted in the region (Yıldız, 2001, Doğan *et al.* 2008, Celep 2010). Hedge (1982) noted the deficiencies in the species taxonomic status due to the insufficiency of morphological parts in the herbarium sample and its characteristics close to *S. caespitosa* and *S. multicaulis*, and stated that the pinnatifid leaf and the membranous calyx that expands in the fruit, which are its most important distinguishing features, should be examined in sufficient samples. During the field studies we carried out in the region, *S. haussknechtii* was collected and identified, and its distinctive characters were given with a detailed description. The species of *S. haussknechtii* is morphologically similar to *S. caespitosa* and *S. multicaulis. S. haussknechtii* differs from *S. caespitosa* by its permanent and expanding calyx seen in the matured fruit and *S. multicaulis* by its pinnatisect leaves (Figs 2-3). Detailed comparison of the species is given in Table 1 (Hedge 1982, Özler *et al.* 2013, Celep 2010).

Fig. 2. Habit of *S. haussknechtii* in its natural habitat. A- General view, B- Flower, C- Herbarium specimen (Photographed by Y.Z.Kocabaş).

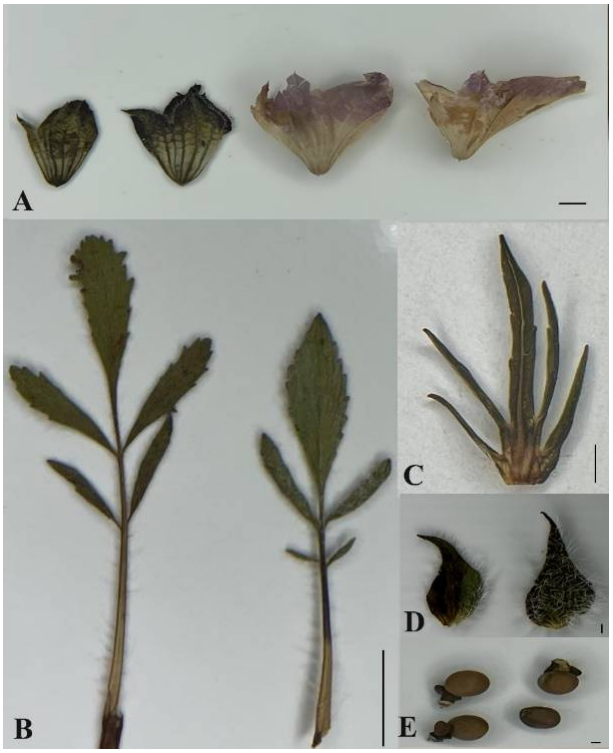

Fig. 3. *S. haussknechtii* A- Calyx, B- Leaf, C- Floral leaf, D- Bract, E- Nutlets, Scale bars: A=5 mm, B-C = 0.5 cm, D-E = 1mm.

According to this; *S. haussknechtii* differs by having on the stem and petiole eglandular retrorse hairs, additional to lacking bracteoles. Furthermore, *S. haussknechtii* can be set apart from *S. caespitosa* and *S. multicaulis* by means of the short corrola tube (c.6-8 mm) and its slightly ventricose, pollen grains is prolate (P/E=1.66) and shape of the nutlets is globose and they have reticulate surface structure (Figs 4-5).

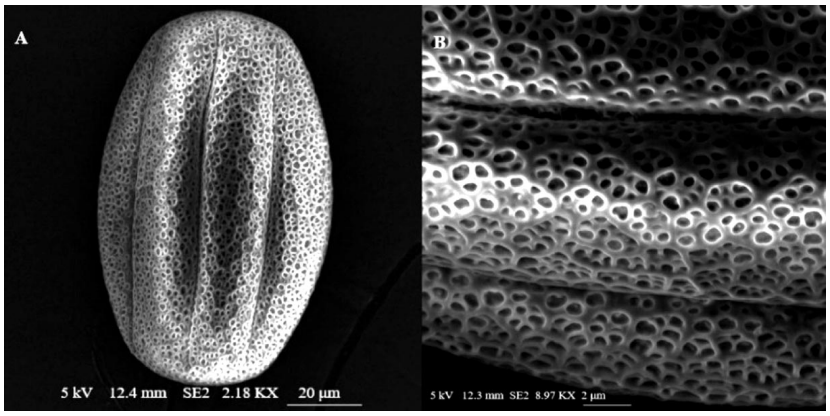

Fig. 4. Pollen grain SEM microphotographs of *S. haussknechtii* A. Equatorial view, B. Exine ornamentation.

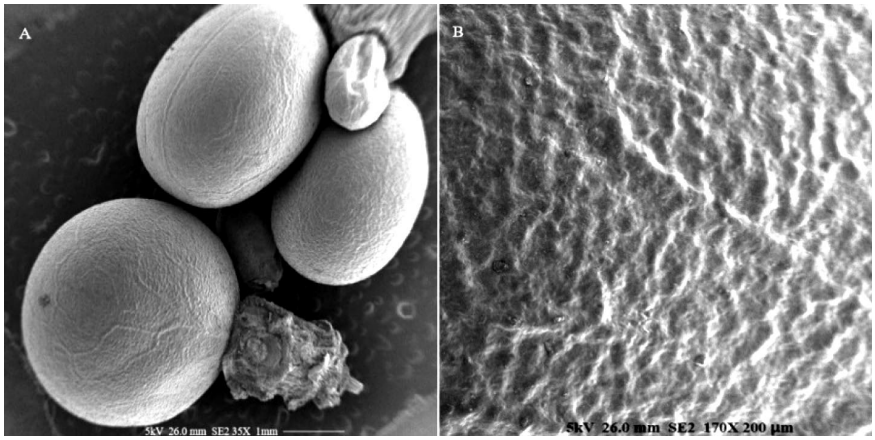

Fig. 5. Nutlets SEM microphotographs of *S. haussknechtii* A. General view, B. Nutlet surface ornamentation.

Table 1. Comparison of the diagnostic characteristics of *S. haussknechtii, S. caespitosa* and *S. multicaulis.*

Characters	*S. haussknechtii*	*S. caespitosa*	*S. multicaulis*
Stem	Procumbent, 10-22 cm Eglandular antrorse ± lax pilose (0.6-1.5 mm) below, dense pilose (2-3 mm) above hairs and few sessile glands.	Procumbent to ± erect Eglandular pubescent below, pubescent to villous above with some capitate glandular hairs.	Erect, unbranched,12-55 cm Usually glandular-pilose to -villous, especially above, rarely glabrous, occasionally with dendroid hairs.
Leaves	Pinnatisect, terminal segments linear-oblong to narrowly obovate-elliptic, (1.3-3.5x0.6-2 cm) with two pairs lateral segments.	Pinnatisect, obovate in outline, crenate, terminal segments ± lanceolate, 0.6-2 x 0.1-0.6 cm, with 2-4-pairs of lateral.	Simple, rarely with 1-2-pairs of small basal lobes, broadly ovate-elliptic to suborbicular, 2-4.5(-7) x 1-3.5 cm
Petiole	1-1.5 cm, slightly widened at base, lax pilose hairs.	0.5-2 cm, often long-ciliate.	1.5-6 cm.
Verticillaster	2-4 flowered.	2-6 flowered.	4-10 flowered.
Bracts	Ovate to elliptic, acuminate, c. 10x4 mm.	Ovate, acuminate, 11-12 x 5-8 mm.	Broadly ovate, c. 15 x 10 mm
Bracteoles	Absent	Present	Present
Pedicels	2.5 mm, dense antrorse hairs.	3-6 mm.	2-4 mm, erecto-patent.
Calyx	Campanulate 10-14 mm, up to 21 mm in fruit, green, later purplish. Fruiting calyx infundibular, membranous, antrorse and dense pilose, few sessile glands, mucronate.	Campanulate, 10-14 mm, to 15 mm in fruit, often purplish, eglandular pilose to villous with sessile glands to densely capitate-glandular.	Campanulate, c. 15 mm, to c. 17 mm in fruit and broadening, sparsely to densely glandular-pilose or –villous.
Corolla	19-26 mm, violet-blue and white veined labellum tube c.6-8 mm, slightly ventricose, upper lip straight, lax pilose and sessile glands.	18-30 mm., violet-blue to lilac-pinkish (rarely white), tube straight, 11-20 mm annulate.	c. 18 mm, purplish-violet, rarely white, tube ± straight, c. 12 mm, annulate; upper lip ±straight.
Pollens	6-colpate, prolate (P/E = 1.66), the exine ornamentation is bireticulate.	Prolate-spheroidal (P/E = 0.87), reticulate.	Prolate-spheroidal (P/E = 1.01), bireticulate.
Nutlets	Globose, c. 2.5 x 3.5 mm, pale brown and surface slightly reticulate.	Rounded trigonous, ± spherical, 3.62 x 3.05, colliculate.	Rounded trigonous, 3.5 x 3 mm, 3.12 x 2.68 colliculate.

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