

## COMPARATIVE MORPHOLOGICAL INVESTIGATION OF *SIDERITIS* SPECIES II: *S. CILICICA* BOISS.&BAL. & *S. NIVEOTOMENTOSA* HUB.-MOR.

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### Abstract

*Sideritis* species are widely used in traditional medicine for their beneficial and curative effects. Two rare Turkish endemic *Sideritis* species, *S. cilicica* Boiss. & Bal. and *S. niveotomentosa* Hub.-Mor. which are growing in Southern Anatolia are very close to each other by means of taxonomic features. In this study we have explained detailed morphological characteristics of these two *Sideritis* species, which belong to Section *Empedoclia* (Rafin) Bentham, along with their conservation status, chorology, habitat and etymology of the plant names. Diagnostic morphological features were illustrated and given comparatively.

**Key Words:** Labiatae, *Sideritis*, *S. cilicica*, *S. niveotomentosa*, morphology, endemic, Turkey

### *Sideritis* Türleri Üzerinde Karşılaştırmalı Morfolojik Araştırma II: *S. cilicica* Boiss.&Bal. & *S. niveotomentosa* Hub.-Mor.

*Sideritis* türleri geleneksel tıpta yararlı ve iyileştirici etkilerinden dolayı yaygın bir şekilde kullanılmaktadır. Güney Anadolu'da yetişen, Türkiye'ye endemik ve nadir bulunan iki *Sideritis* türü, *S. cilicica* Boiss. & Bal. ve *S. niveotomentosa* Hub.-Mor., taksonomik özellikleri bakımından birbirlerine oldukça yakın türlerdir. Bu çalışmada, *Empedoclia* (Rafin) Bentham seksiyonuna ait bu iki *Sideritis* türünün detaylı morfolojik özelliklerini koruma statüleri, yayılışları, habitatları ve bitki isimlerinin kökenleri ile beraber açıkladık. Teşhiste kullanılan morfolojik özellikler çizimlerle gösterilmiş ve karşılaştırmalı olarak verilmiştir.

**Anahtar Kelimeler:** Labiatae, *Sideritis*, *S. cilicica*, *S. niveotomentosa*, morfoloji, endemik, Türkiye

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## INTRODUCTION

Worldwide the *Sideritis* L. (Labiatae) genus is represented by more than 150 species, distributed in an area stretching from Bahama's to Western China and from Germany to Morocco, but it grows primarily in Mediterranean area (1).

*Sideritis* is an important genus in Turkey because of the high percentage of endemism and the wide use of its members as herbal tea in traditional medicine. In the Flora of Turkey and the East Aegean Islands, 38 *Sideritis* species were reported (2). Since then, 6 species and 2 new records (3-5) have been described in the flora of Turkey and the number of *Sideritis* species reached to 46. According to Huber-Morath, the genus *Sideritis* comprises two sections in Turkey. Section *Hesiodia* (Moench) Benthams, which is known with reliable taxonomic characters, includes 4 annual species. 42 species belong to Section *Empedoclia* (Rafin) Benthams which shows a high level of endemism and reported with few clear-cut species. *S. cilicica* and *S. niveotomentosa*, which belong to Section *Empedoclia*, are local endemic species and are reported as very similar to each other in the Flora of Turkey and the East Aegean Islands (2).

A comprehensive revision of Turkish *Sideritis* has been undertaken, and a large number of the specimens have been collected from all over the Turkey and studied taxonomically (6). In this revision, apart from taxonomy in the Flora of Turkey and the East Aegean Islands (2), annual *Sideritis* species were evaluated according to Briquet (7) and grouped into two sections, Sect. *Burgsdorfia* (Moench) Briquet and Sect. *Hesiodia* (Moench) Benthams. Additionally, two new species and two subspecies were described, taxonomic status of five taxa were changed, two species were regarded as synonyms. Consequently, the genus *Sideritis*, which was split into 3 sections, comprises 44 species, and 55 taxa according to last revision (6). As a part of this project (6), and in a continuation of our reports on the taxonomy of *Sideritis* species growing in Turkey (8,9), in this paper, morphological features of two rare, endemic and closely related *Sideritis* species, *S. cilicica* and *S. niveotomentosa*, were studied comparatively in order to provide detailed descriptions. Moreover, we evaluate the distribution and habitat, and discuss the Red List status according to IUCN (10).

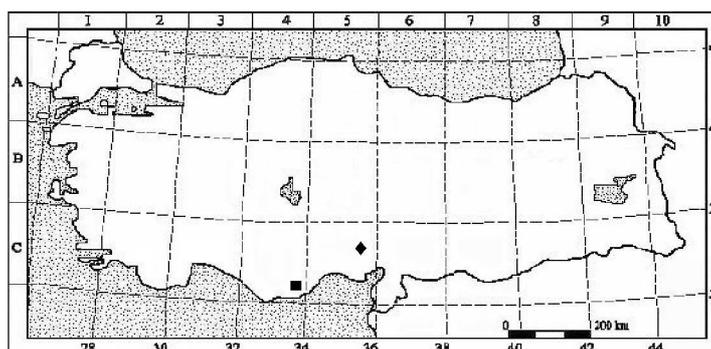
## EXPERIMENTAL

### Plant Material

Plant materials were collected at flowering time in Southern Anatolia and the voucher specimens have been deposited at the Herbarium of Faculty of Pharmacy, Hacettepe University, Ankara, Turkey (HUEF) and Herbarium of Gazi University, Ankara, Turkey (GAZI). Herbarium specimens and freshly collected material were investigated by means of morphological properties. Measurements were made on herbarium materials. Taxonomical descriptions of the plants were carried out according to Huber-Morath (2) and also confirmed by the herbarium samples of the examined species in the HUEF, GAZI, ANK, AEF. The distribution of both species, according to the localities where we found specimens, herbaria records and Flora of Turkey and the East Aegean Islands (2), is shown in Figure 1.

**Figure 1.** Distribution of *Sideritis cilicica* and *Sideritis niveotomentosa*

- ◆ *S. Cilicica*
- *S. tomentosa*



## RESULTS

### 1. *S. cilicica* Boiss. & Bal..

Type: [Turkey C5 İcel] in Cilicica littorali inter pagos Bouloukli et Alla dagh prope Mersina, [5 vi 1855] Balansa [504] (holo. G iso. W).

Perennial, herbaceous, woody at base. Stem erect, 45-95 cm, simple or branched, densely long adpressed white-pannose and sparsely  $\pm$  long glandular below,  $\pm$  sparsely eglandular and densely long glandular above. Cauline leaves sessile, upper and lower short glandular, upper adpressed puberulent, lower erect puberulent; lower leaves oblanceolate, 6-7.5 x 1.2-1.8 cm, acute, serrate-crenate, obtus at base; middle cauline leaves oblong-lanceolate, 3.5-5 x 1-1.7 cm, subobtus, acute, crenate-serrate, amplexicaul-cordate at base; upper leaves ovate-lanceolate, 3-4.2 x 1.5-2.3 cm, acute, serrate, amplexicaul at base, middle and upper leaves sometimes mucronate, mucro 0.5 mm. Internodes 4-6.5 cm, shorter below. Inflorescence branched. Verticillasters 10-22, 6-flowered, 3.5-4.5 cm distant lower, crowded (upto 1 cm distant) above. Bracts puberulent and glandular; lower bracts cordate, 2.2-3.5 x 2.2-2.6 cm, acute, sometimes tiny mucronate, minutely crenate-serrate, reniform at base; middle bracts orbicular-reniform, 1.7-2 x 1.8-2.2 cm with acumen (6-8 mm), entire or minutely crenate-serrate,  $\pm$  amplexicaul at base; upper bracts ovate-orbicular, 1-1.5 x 0.5-1.5 cm with acumen (4-5 mm), entire or minutely crenate,  $\pm$  amplexicaul at base (Figures 2,3). Calyx (8-9-12 mm; tube 7-8 mm, outer densely glandular, throat with a uniform ring of hairs inside; teeth spatulate, 3-3.5 x 1.5 mm, 3 teeth longer, with rounded sinus, outer long spreading white eglandular and glandular hairs, inner densely glandular. Corolla yellow, (11-)12-14 mm, longer than calyx, upper part of tube and outer of lobes densely short white eglandular, lobes inner side glabrescent; outer side of tube tiny glandular, inner side long hairy at throat and between lobes, with a uniform ring of hairs inside under filaments. Upper lobe with or without brown striae inside (Figures 2,4). Nutlet ovate-triangular, c. 2 mm, brown, tuberculous.

Fl.: 6-7.

Habitat: Open *Pinus brutia* forest, calcareous rocks, limestone slopes, 600-1400 m.

Phytogeographic region: Endemic. East Mediterranean element.

Examined specimens: C5 Adana: Feke, Akkaya village, 910 m, 10.7.2000, open *P. brutia* forest, calcareous rocks, F.P. Şahin, H. Duman (HUEF 00244!), H. Duman 8351(GAZI!), Kozan-Feke, Horzum, Çobancık Plateou, 800-900 m, 22.6.2001, macchie, calcareous rocks, H. Duman 8585 (GAZI!), Feke, Belen village, 600 m, P.H. Davis, (ANK 35483!), Süphandere, Belen village, 900 m, P.H. Davis, 2.7.1952, (ANK 35484!) (Figure 1).

Conservation status: This species could be categorized "Endangered" (criterion B1 a, B2 ) for its known extent of occurrence which is not more than 5000 km<sup>2</sup>; area of occupancy estimated to be less than 500 km<sup>2</sup> and known fewer than 5 fragmented locations.

Etymology: The spesific epithet taken from the Latin cilicius, a province in southern Asia Minor, in reference to its distribution in Southern Anatolia.



Figure 2. Habitat and floral part of *S. cilicica* (photo. Hayri DUMAN)

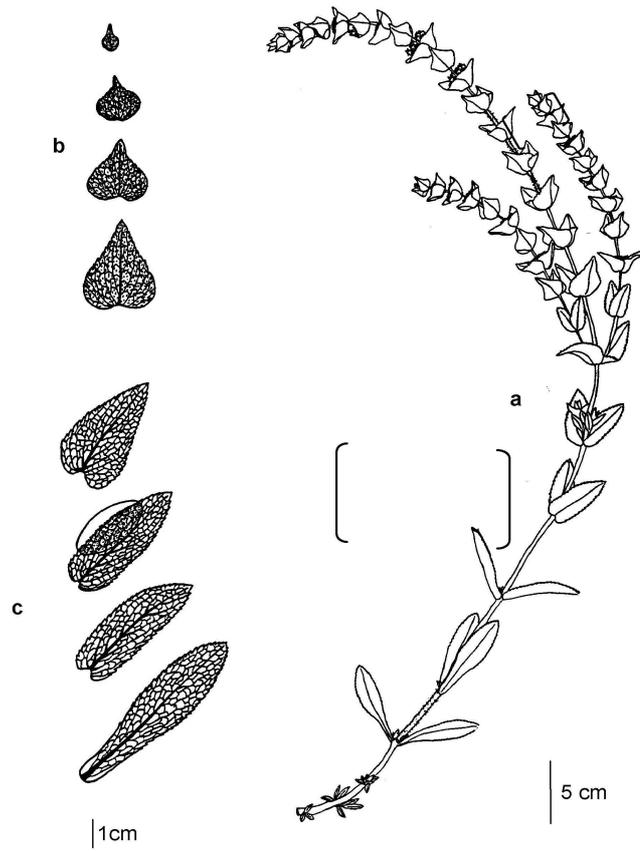


Figure 3. *S. cilicica* , a. gross appearance, b. bracts, c. leaves

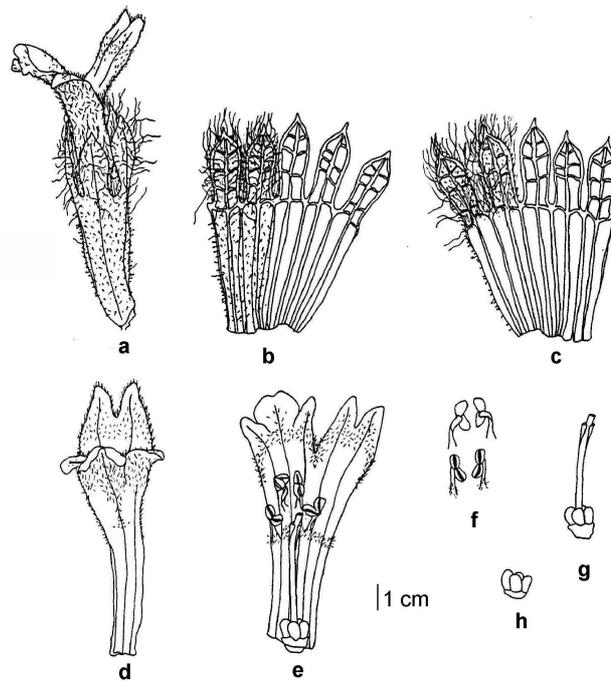


Figure 4. Floral parts of *S. cilicica* , a. general appearance, b. calyx outer side, c. calyx inner side, d. corolla outer side, e. corolla inner side, f. stamens, g. gynaecium, h. Ovary

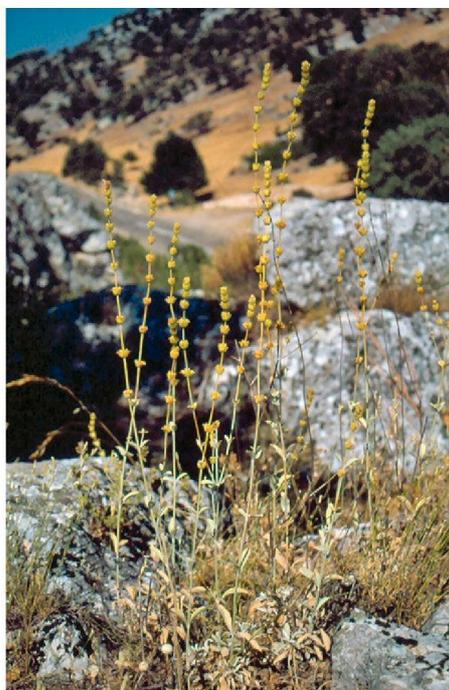
2. *S. niveotomentosa* Hub.-Mor.

Type: Turkey C4 İçel: distr. Gülnar, Gülnar-Silifke, Quersetum 23 km westlich von Gülnar, 970 m, 9 vi 1950, A. Huber-Morath 10116 (holo. Hb. Hub.-Mor.).

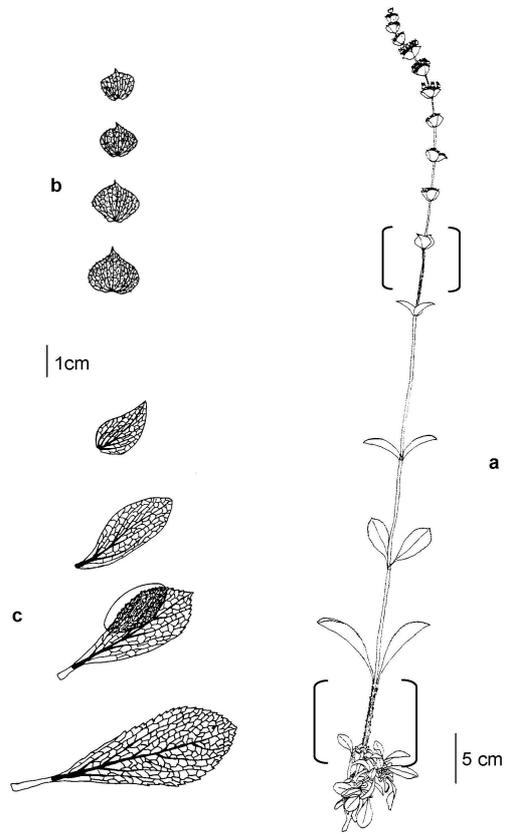
Perennial, herbaceous, woody at base. Stem erect, 45-90(-103) cm, simple, densely adpressed white-tomentose below, looser short white-tomentose above. Leaves densely white-tomentose; lower leaves with 1-1.5 cm petiole, lamina obovate, rotundate, oblanceolate, 4-6.5 x 1.2-2.4 cm, obtus (-mucronate), entire to serrate, cuneate at base; middle cauline leaves sessile or with 0.1-1.5 cm petiole, lamina oblanceolate, oblong or elliptic, 3-5.2(-6) x 1-2 cm, acute-mucronate, entire to serrate, attenuate at base; upper leaves sessile, lamina ovate-lanceolate, 2.2-3.3 x 1-1.3 cm, acute-mucronate, entire or sparsely serrulate, cuneate at base,  $\pm$  amplexicaul. Leaves shorter than internodes. Internodes 6-12.5 cm, middle internodes distant. Inflorescens simple. Verticillasters 6-22, 6-flowered, 4-7.5 cm distant below, crowded (upto 1 cm distant) above. Bracts yellowish green, outer short eglandular and glandular, inner glabrescent; lower bracts broadly ovate-lanceolate, orbicular, 1.5-3 x 1-1.4 cm, acuminate with 2-4 mm acumen; middle and upper bracts orbicular-reniform, 1.5-2.1 x 1.7-2.2 cm with acumen (1-3 mm); all bracts entire, cordate-amplexicaul at base (Figures 5,6). Calyx 9-11 mm; outer long spreading white eglandular, densely glandular; tube 6-8 mm, throat sparsely short eglandular hairs; teeth triangular-lanceolate, 2.5-3.5 x 1 mm,  $\pm$  equal, sparsely long white eglandular inside. Corolla yellow, 11-13 mm, longer than calyx; outer of tube and lobes densely short white eglandular and tiny glandular, inner of lobes glabrescent; inner part tube sparsely hairy at throat and between lobes, interruptedly hairy under filaments; upper lobe with or without brown striae inside (Figures 5,7). Nutlet triangular, c. 3 mm, brown.

Fl.: 6-7.

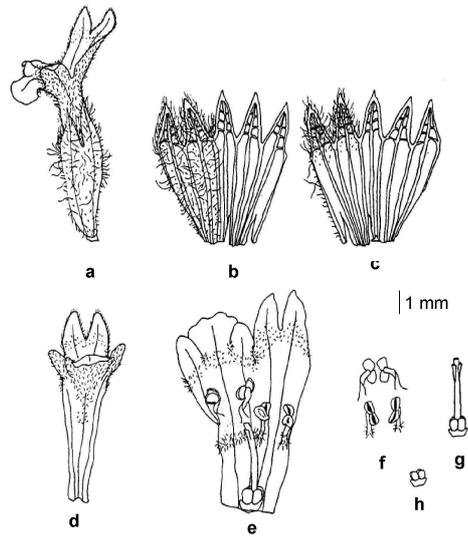
Habitat: Open *Pinus brutia* ve *Juniperus* forest, *Quercus macchie*, calcareous rocks, 960-1,050 m.



**Figure 5.** Habitat and floral part of *S. niveotomentosa* (photo. Hayri DUMAN)



**Figure 6.** *S. niveotomentosa*, a. gross appearance, b. bracts, c. leaves



**Figure 7.** Floral parts of *S. niveotomentosa*, a. general appearance, b. calyx outer side, c. calyx inner side, d. corolla outer side, e. corolla inner side, f. stamens, g. gynaecium, h. ovary

Phytogeographic region: Endemic. East Mediterranean element.

Examined Specimens: C4 İçel: Gülnar-Silifke, 20. km, 1000 m, 15.7.2000, Open *Quercus* macchie and *Juniperus* forest, calcareous rocks, F.P. Şahin, H. Duman (HUEF 00261), H. Duman 8378 (GAZI!), Gülnar to Silifke, 29. km, 960m, 30.7.1993, F. Çalış (GAZI!) (Fig 1).

Conservation status: This species is known from a single locality (criterion B2 a), with an area of occupancy estimated to less than 10 km<sup>2</sup> (criterion B2), so that it should be classified as “Critically Endangered”.

Etymology: The spesific epithet refers to white-tomentose eglandular hairs of the plant, derived from Latin; niveus meaning snow white, tomentum meaning wooly hairs.

## DISCUSSION

In the Flora of Turkey and the East Aegean Islands (2), it has been reported that *S. cilicica* is closely allied to *S. niveotomentosa*. In this study we have described detailed morphological characters of both species (Figures 2-7) and showed different diagnostic characteristics in Table 1. According to our results, *S. cilicica* was mainly differentiated from *S. niveotomentosa* by its crenate-serrate or crenate bracts and spatulate, unequal calyx teeth with rounded sinus. These characters, which are also diagnostic value in the genus *Sideritis*, could be used in the identification key.

Some morphological features of these two species such as nutlets, inflorescens, internodes, upper and lower leaves and bracts which were not given previously in The Flora of Turkey (2) are determined in this study for the first time and given with details of the stem, middle leaves and bracts, calyx and corolla. As seen in Table 1, these morphological features are very useful diagnostic tools to differentiate these closely related species. Moreover, the findings were also compared with those in The Flora of Turkey and some differences were determined. In The Flora of Turkey it was reported that stem of *S. cilicica* was cobwebby-woolly above, middle bracts were 1.2-2 x 1-2.5 cm with 2-5 mm acumen, calyx teeth were equal and linear-lanceolate. In our study, we have detected that stem is not cobwebby-woolly above but also ± sparsely white pannose, middle barcts are 1.7-2 x 1.8-2.2 cm with 6-8 mm acumen, calyx teeth are spatulate and unequal. According to Huber-Morath (2), *S. niveotomentosa* was branched, verticillasters were 13-15 and distant, middle barcts were 0.7-1.5 x 1.2-2 cm. Contrary to these findings, *S. niveotomentosa* is simple, verticillasters are 6-22 and dense upto 1 cm above, middle barcts are 1.5-2.1 x 1.7-2.2 cm. Additionally, corolla of both species were reported with brown striae inside, however, during our studies we have determined that some samples were with brown striae and some were not.

In the Flora of Turkey (2), *S. cilicica* and *S. niveotomentosa* occurs between 600-950 m and 960-970 m, respectively. During our field and herbarium studies we found that *S. cilicica* and *S. niveotomentosa* are growing between 600-1400 m and 960-1050 m, respectively.

*Sideritis* species are usually named Ada çayı (Island tea), Dağ çayı (Mountain tea), Yayla çayı (Plateau tea) in Turkey (11,12). During our floristic studies we have determined that a local name, Dokuz düğmeli (with nine buttons), is also used for *S. niveotomentosa* and reflects its button-like verticillasters and long spike morphology.

*S. cilicica* and *S. niveotomentosa* were classified as Endangered [EN] and Lower Risk (conservation dependent). [LR (cd)], respectively, by Ekim et al. (13). According to new IUCN Red List Category (10), species are classified based on the “extent of occurrence, area of occupancy, number of locations or subpopulations, number of mature individuals”. *S. cilicica* could be evaluated as “Endangered (EN)” again. *S. tomentosa* could be regarded as “Critically Endangered (CR)”.

**Table 1.** Comparison of morphological characteristics of *S. cilicica* and *S. Niveotomentosa*

	<i>S. cilicica</i>	<i>S. niveotomentosa</i>
<i>Stem</i>	simple or branched, densely long adpressed white-pannose and sparsely ± long glandular below, ± sparsely eglandular and densely long glandular above	simple, denseley adpressed white-tomentose below, looser short white-tomentose above
<i>Leaves</i>	upper and lower short glandular, upper adpressed puberulent, lower erect puberulent	densely white-tomentose
	lower cauline leaves sessile, lamina oblanceolate, 6-7.5 x 1.2-1.8 cm, acute, serrate-crenate, obtus at base	lower cauline leaves petiolate, petiole 1-1.5 cm, lamina obovate, rotundate, oblanceolate, 4-6.5 x 1.2-2.4 cm, obtuse (-mucronate), entire to serrate, cuneate at base
	middle cauline leaves sessile, lamina oblong-lanceolate, subobtus, acute (-mucronate), crenate-serrate, amplexicaul-cordate at base	middle cauline leaves sessile or with a short petiole ( to 1,5 cm), lamina oblanceolate, oblong or elliptic, acute-mucronate, entire to serrate, attenuate at base
	upper cauline leaves 3-4.2 x 1.5-2.3 cm, lamina serrate, amplexicaul at base	upper cauline leaves 2.2-3.3 x 1-1.3 cm, entire or sparsely serrulate, cuneate, ± amplexicaul at base
<i>Internodes</i>	4-6.5 cm	6-12.5 cm
<i>Inflorescence</i>	branched	simple
<i>Verticillasters</i>	10-22, 3.5-4.5 cm distant below	6-22, 4-7.5 cm distant below
<i>Bracts</i>	inner puberulent and glandular	inner glabrescent
	lower bracts cordate, 2.2-3.5 x 2.2-2.6 cm, acute, with a tiny mucro or not, minutely crenate-serrate, reniform at base	lower bracts broadly ovate-lanceolate or orbicular, 1.5-3 x 1-1.4 cm, acuminate, acumen 2-4 mm, entire, cordate-amplexicaul at base
	middle bracts orbicular-reniform, 1.7-2 x 1.8-2.2 cm, with acumen 6-8 mm, entire or minutely crenate-serrate, ± amplexicaul at base; upper bracts ovate-orbicular, 1-1.5 x 0.5-1.5 cm, with acumen 4-5 mm, entire or sparsely crenate, ± amplexicaul at base	middle and upper bracts orbicular-reniform, 1.5-2.1 x 1.7-2.2 cm, with acumen 1-3 mm, entire, cordate-amplexicaul at base
<i>Calyx</i>	(8-)9-12 mm; teeth spatulate, 3-3.5 x 1.5 mm, the upper 3 longer than the lower 2, with rounded sinus, inner densely glandular; tube outer part densely glandular	9-11 mm; teeth triangular-lanceolate, 2.5-3.5 x 1 mm, ± equal, without rounded sinus, inner sparsely long white hairy; tube outer part with spreading eglandular and sparsely glandular
<i>Corolla</i>	inner uninterruptedly hairy under filaments	inner interruptedly hairy under filaments
<i>Nutlets</i>	ovate-triangular, c. 2 mm, tuberculous	triangular, c. 3 mm

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