Acta Biologica Turcica, 35(4), D10:1-5, 2022 Received 23 Jan. 2022; Accepted 06 Jun. 2022; Published Online 13 Jun. 2022

ACTA BIOLOGICA TURCICA

E-ISSN: 2458-7893, http://www.actabiologicaturcica.com

Research article

Morphological and micromorphological studies on *Stachys benthamiana* Boiss. (Lamiaceae) grown in Turkey

Özal GÜNER[1,*], Ekrem AKÇİÇEK[2]

[1]Harran District Directorate of National Education, Harran, Şanlıurfa, Turkey

[2]Department of Science Education, Faculty of Education, Dumlupınar University, Kütahya, Turkey

*Corresponding author e-mail: ozalgnr57@hotmail.com

Abstract: This is the first study dealing with the morphological and nutlet micromorphology of *S. benthamiana* in Turkey. *Stachys benthamina* grows in Turkey, Iraq and Iran. The species is characterized by having densely stalked and sessile glandular hairs on the stem and calyx. It is morphologically similar to *Stachys kurdica* and *S. ballotiformis*. The nutlets of *S. benthamina* are oblong–obovoid and reticulate on surface glabrous.

Keywords: Bhattacharjee, *Fragilicaulis,* micromorphology, Lamiaceae.

Citing: Güner, Ö., & Akçiçek, E. (2022). Morphological and micromorphological studies on *Stachys benthamiana* Boiss. (Lamiaceae) grown in Turkey. *Acta Biologica Turcica,* 35(4), D10:1-5.

Introduction

Stachys L. is one of the largest genera in the family Lamiaceae with about 370 species and nearly 435 taxa in the world (POWO 2022). The genus is usually distributed in the Mediterranean region and southwestern Asia, as well as North and South America, but it is not found in Australia or New Zealand (Bhattacharjee 1974). *Stachys* is represented by 119 taxa (93 species) in Turkey, 63 of which are endemic, and Turkey is one of its centers of diversity (Akçiçek 2020, Güner at al. 2021).

Section *Fragilicaulis* Bhattacharjee includes 31 taxa belonging to two subsections *Fragiles* Rechinger and *Multibracteolatae* Bhattacharjee (Bhattacharjee 1980, Güner and Ferrer-Gallego 2021). The section species are distributed in Turkey, northern Iraq and western Iran. *Stachys benthamiana* Boiss, belonging to the section, was first collected by Kotschy in Iran and later described by Boissier (Boissier 1879). This species is also distributed in Northern Iraq. In 2022, *S. benthamiana* was given as a new record for Turkey (Özdöl et al. 2022).

An expanded description, distributions map, diagnostic key and nutlet micromorphology of *Stachys benthamiana* growing in Turkey are given here for the first time.

Materials and Methods

Morphological methods: Several specimens of *Stachys benthamiana* were collected during fieldwork in Hakkari province in 2014. The specimens were pressed and dried using standard preservation techniques. Here is the locality of this specimen collected and analyzed in Turkey*: S. benthamiana* – Hakkari: Varegöz valley, on limestone cliffs and rock crevices, 15.07.2014, Ö. Güner 2495 & Akçiçek (Herb. Ö. Güner). The specimens were cross-checked with the keys provided by Bhattacharjee (1982) in Flora of Turkey, by Rechinger (1982) in Flora Iranica and by Boissier (1879) in Flora Orientalis. They were compared with specimens carefully preserved in the following herbaria; ANK, BM, E, G, GAZI, HUB, ISTE, ISTF, K, LE, SAW, W and WU.

Micromorphological methods: Nutlet surface were examined by tabletop scanning electron microscopy (SEM). For SEM, the nutlet were fixed on aluminum stubs with double-sided adhesive. Size, shape, colour and ornamentation of nutlets were examined**.** These characters were determined according to various works (Güner et al. 2019, Karaismailoğlu and Güner 2019).

Results

***Stachys benthamiana* Boiss.,** Fl. Orient. 4: 734 (1879).

Description: Suffrutescent perennial. Flowering stems 25–40 cm long, fragile, erect to decumbent simple or branched; covered stalked and sessile glandular hairs with sparsely and retrorsely pubescent. Cauline leaves ovate to ovate-lanceolate, 1–2.3 × 0.5–1 cm, dentate to serrate at margin, acute at apex, subcordate to truncate at base, hairy as stem; subsessile to 4 mm petiolate. Floral leaves similar to cauline leaves but smaller, cordate to ovate-lanceolate, 0.5–2.2 × 0.3–1.2 cm, lowers longer than verticillasters, gradually becoming equal to calyx above, sessile to subsessile. Verticillasters remote, 4–8-flowered, upper ± approximate. Bracteoles few, setaceous to herbaceous, 0.5–2(–4) mm long, hairy as stem. Pedicels 1–1.5 mm long. Calyx ± regular, subcampanulate, 6-8 mm long, quite densely stalked and sessile gland with hirsute; teeth ± equal, 2–3 mm long, triangular-lanceolate, slightly recurved in fruit. Corolla cream yellow, 10–12 mm long; tube exceeding the calyx, annulate; limb bilabiate, upper lib 2.5 mm long; the lower lib 3-lobed, middle lobe larger than lateral 2 lobes, 5 mm long. Style not exceeding the upper lip, 7 mm long, glabrous, apex equally bifid into subulate stigmas. Stamens 4, within corolla tube; anthers dithecous, thecae divaricate. Nutlets oblong-obovoid, 2.5–3 × 1.5–2 mm, slightly winged near base, brown to dark brown, glabrous (Figure 1).

Phenology: *Stachys benthamiana* flowers in June and fruits in mid-June and July.

Ecology and Distribution: *Stachys benthamiana* grows in Varegöz Valley of Hakkari province, Southeastern Anatolia region of Turkey (Figure 2). The species grows on limestone cliffs and rock crevices, and at altitudes ranging from 1750 to 2000 m above sea level in Turkey. These localities of the species are close to the Iraqi and Iranian border. *Stachys benthamiana* is also distributed West and north-west Iran and north Iraq (Figure 3).

Figure 1. Verticillasters appearance of *Stachys benthamina*.

Figure 2. Habitat of *Stachys benthamina* in Hakkari province, Turkey.

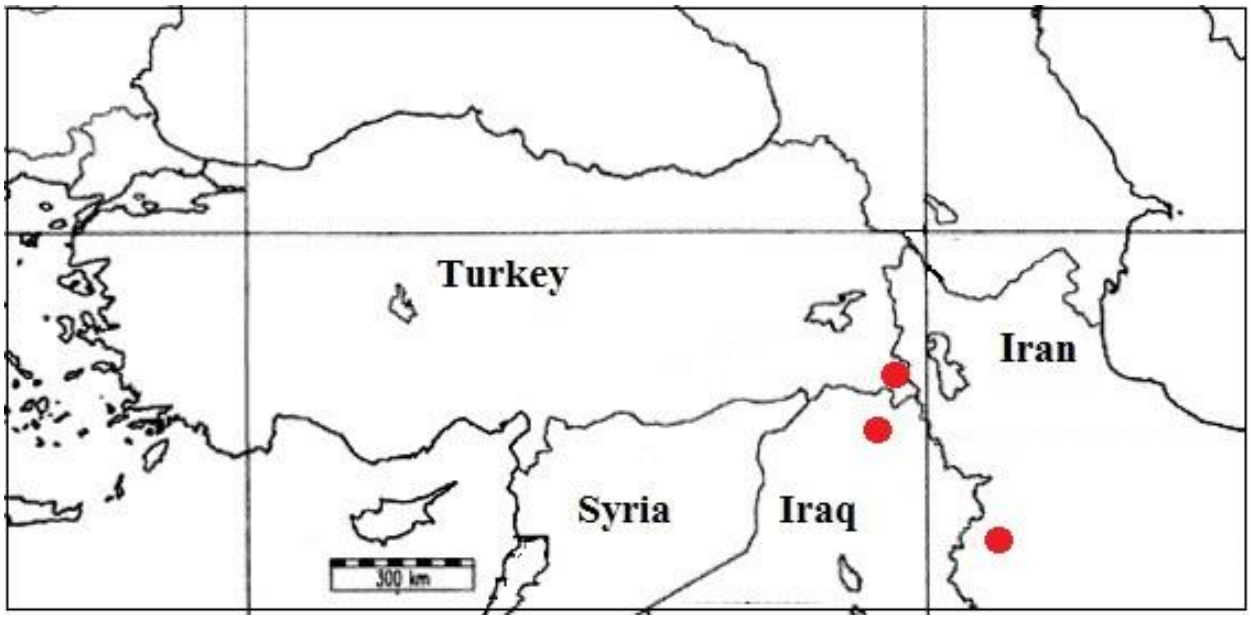

Figure 3. Distribution map of *Stachys benthamina*.

Identification key for *Stachys benthamiana* within the subsection *Multibracteolatae*

1- Flowering stems glabrous to sparsely pubescent……..2
- Flowering stems villose or densely glandular hairs with sparsely retrorse pubescent……..3
2- Verticillasters usually remote…….....*kurdica*
- Verticillasters congested .....*siirtensis*
3- Flowering stems villose; verticillasters ± congested, 1-2 remote below ……...……..……*ballotiformis*
- Flowering stems stalked and sessile glandular hairs, verticillasters approximate ……...*benthamiana*

Features of nutlets: *Stachys benthamiana*: The nutlets of this species are oblong-obovoid, 2.5–3 × 1.5–2 mm, slightly winged near at base, reticulate on glabrous surface. Its color is brown to dark brown (Figure 4).

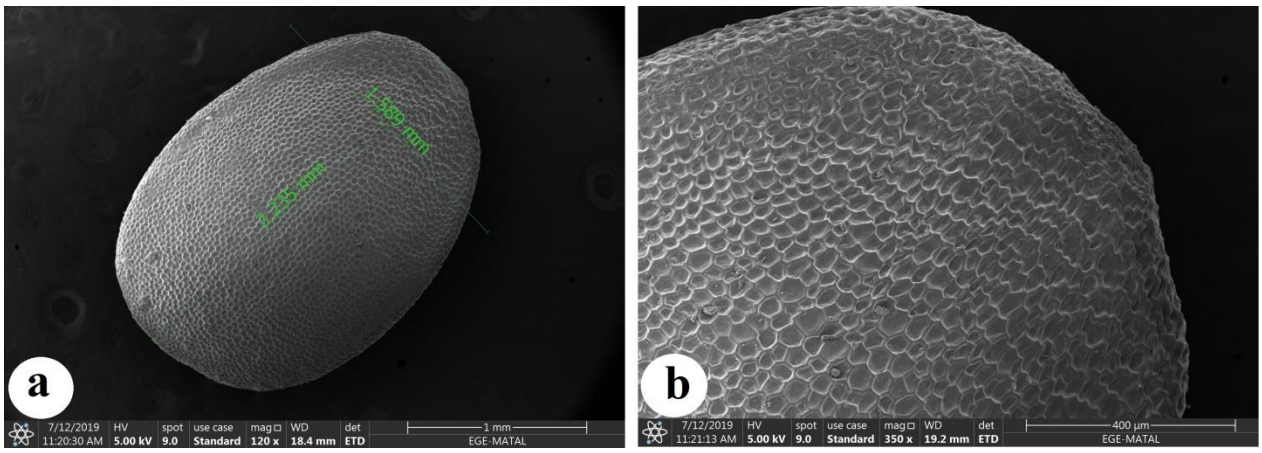

Figure 4. Nutlet micromorphology of *Stachys benthamiana,* a) dorsal appearance b) surface sculpture

Discussion

Stachys benthamiana belongs to the section *Fragilicaulis*, which is distributed in western and northwestern Iran, northern Iraq and southeastern Turkey. The species is a member of the Irano-Turanian phytogeographic region. It usually grows on limestone cliffs and rock crevices. The closest relatives of *S. benthamiana* seem to be *S. kurdica* Boiss. & Hohen. and *S. ballotiformis* Vatke, with that it shares several morphological features (Table). *Stachys benthamiana* differs from these two species in having densely stalked and sessile glandular hairs on the stem and calyx. Dense glandular hairs on the stem and calyx are a distinctive character of *S. benthamiana.*

Table. Morphological comparison of *Stachys benthamiana*, *S. ballotiformis* and *S. kurdica*.

	S. benthamiana	***S. ballotiformis***	***S. kurdica***
Flowering stems	25–40 cm long, covered densely stalked and sessile glandular hairs	18–35 cm long, villose with sparsely sessile glandular hairs	glabrous to sparsely pubescent with sometimes sessile glandular hairs
Inflorescence	remote, upper ± approximate	usually ± congested, 1–2 remote below	usually remote, 1–4.5 cm distant,
Calyx	subcampanulate, 6–8 mm long, quite densely stalked and sessile gland with hirsute; triangular – lanceolate,	campanulate, 5–8 mm long, villose with sparsely sessile glandular hairs, lanceolate	infundibular, 5–9 mm long, sparsely pubescent sessile glands; teeth subequal, broadly triangular-lanceolate
Corolla	cream yelow, 10–12 mm long, tube exserted from calyx,	lemon yellow, 10–13 mm, tube subexserted from calyx	yellow, (9–)12–17 mm, subexserted from calyx
Nutlet	oblong–obovoid, 2.5–3 × 1.5–2 mm, reticulate on surface	oblong, trigonous, 2–2,5 × 1,3–1,5 mm, reticulate on surface	obovate, 1.8–2.2 × 1.3–1.5 mm, faintly granulate on surface

The nutlets of *S. benthamiana* are usually oblong-obovoid and glabrous surfaces and brown to dark brown. In a revision of *Stachy*s taxa distributed in Iran, Salmaki et al. (2012) additionally reported a reticulate nutlet surface for *S. benthamiana*, while the *S. kurdica* nutlet differs with its faintly granulate surface.

A detailed study on *Stachys kurdica* occurring in Turkey (Güner et al. 2019) provided the stem and nutlet micromorphological characters of its infraspecific taxa (var. *kurdica* and var. *brevidens* Bornm. ex R.Bhattacharjee). According to the study, var. *kurdica* has an obovate nutlet with a reticulate surface. The nutlet of *S. kurdica* differs from that of *S. benthamiana* by having a faintly granulate surface. Nevertheless, these characters are not clear within these species of the section *Fragilicaulis*. *Stachys benthamiana*, *S. kurdica* and *S. ballotiformis* exhibit high morphological variability, due to the distributions of these species in wide geographical areas. *Stachys benthamiana,* distributed in Turkey, Iran and Iraq, is difficult to study taxonomically because of its distribution across three different countries and a resulting lack of common research.

Stachys benthamiana: Iran: Ad rupes abscissas in sept. spectantes m. Kuh-Barfi pr. u. Schiras, 03.05.1842, *Kotschy*, K. G. T., #345 & 490 (G!).

Stachys ballotiformis: Iran. in montibus Pir Omar Gudrun persicae, 1220 m, 06.1867, *Haussknecht* 806 (W!).

Stachys kurdica: N. Iraq: in rupibus montis Gara Kurdistaniae, 10.07.1841, *Kotschy* 390, (G! K! W!). Turkey: Şırnak: Köprülü – Uludere road, 26. km, passing the Süvari gate, 10.06.2013, *Ö. Güner* 2353, Akçiçek, Dirmenci; Hakkari: near Çukurca, limestone slopes, 1200 m, 10.06.2013, *Ö. Güner* 234 Akçiçek, Dirmenci; between Yüksekova and Dağlıca, Varegöz Valley, rock crevices, 09.06.2013, *Ö. Güner* 2347a, Akçiçek, Dirmenci.

Acknowledgments

I appreciate the approval and help provided by the curators of ANK, BEI, E, G, ISTE, ISTO, K, KNYA, SAW and W herbaria when conducting examination of *Stachys* specimens.

Ethical Approval

No need to ethical approval for this study.

Funding Statement

The project supported by Scientific and Technological Research Council of Turkey (TÜBİTAK–KBAG, Project No: 112T139).

Conflict of Interest

The authors declare that they have no conflict of interest.

References

Akçiçek, E. (2021). Taxonomic revision of *Stachys* sect. *Olisia* (Lamiaceae: Lamioideae) in Turkey. *Phytotaxa*, 449(2), 109-148.

Bhattacharjee, R. (1974). Taxonomic studies in *Stachys* I: New species and infra-specific taxa from Turkey. *Notes from the Royal Botanic Garden*, 33, 275-292.

Bhattacharjee, R. (1980). Taxonomic studies in *Stachys* II: A new infrageneric classification of *Stachys* L. *Notes from the Royal Botanic Garden, Edinburgh*, 38, 65-96.

Bhattacharjee, R. (1982). *Stachys*. In: Davis P.H. (ed.), Flora of Turkey and the East Aegean Islands: 7: 199–262. Edinburgh University Press, Edinburgh.

Boissier, P. E. (1879). Flora Orientalis, Vol. 4. Genève & Basileae.

Güner, Ö., Akçiçek, E., & Dirmenci, T. (2021). A new *Stachys* species from Turkey: *Stachys siirtensis* (Lamiaceae). *Phytotaxa*, 516(3), 252-262.

Güner, Ö., & Ferrer-Gallego, P. P. (2021). Nomenclatural and taxonomic notes on some *Stachys* taxa (Lamiaceae). *Turkish Journal of Botany*, 45, 69-82. https://doi.org/10.3906/bot-2010-12

Güner, Ö., Selvi, S., Altınordu, F., & Martin, E. (2019). The analysis of some biological data on *Stachys kurdica* (Lamiaceae) in Turkey. *Phytologia Balcanica*, 25(3), 271-280.

Karaismailoğlu, M. C., & Güner, Ö. (2019). Nutlet structures of subsection *Fragiles* of the genus *Stachys* (Lamiaceae) from Turkey and their systematic applications**.** *Turkish Journal of Botany*, 43, 659-672.

Özdöl, T., Güner, Ö., Sefalı, A., Akçiçek, E., Dirmenci, T., & Yıldırım, H. (2022). Three new records for the flora of Turkey: *Campanula lyrata* subsp. *icarica* (Campanulaceae), *Erysimum aureum* (Brassicaceae) and *Stachys benthamiana* (Lamiaceae). *Phytotaxa*, 531(2), 147-150.

POWO. (2022). Onward (continuously updated). *Stachys* L. plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Available from: https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:325931-2 (accessed 29 March 2022).

Rechinger, K. H. (1982). *Stachys*. In: Rechinger KH (editor). Flora Iranica. Graz, Austria: Akademische Druckund Verlagsanstalt, 354-396.

Salmaki, Y., Zarre, S., Govaerts, R., & Bräuchler, C. (2012). A taxonomic revision of the genus *Stachys* (Lamiaceae: Lamioideae) in Iran. *Botanical Journal of the Linnean Society*, 170, 573-617.