VERBASCUM AKARKOEYENSE SP. NOV. (SCROPHULARIACEAE) A NEW SPECIES FROM CENTRAL ANATOLIA, TÜRKİYE

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Abstract

Verbascum akarkoeyense (Scrophulariaceae) is described as a new species from Central Anatolia, Türkiye. The diagnostic and morphological characteristics of the new species and its closest relatives V. orgyale and V. microsepulum are discussed. Pollen characters, seed morphology, conservation status and geographical distribution of the new species are also provided. V. akarkoeyense appears to be sharply different from by closest related species by unbranched stem, oblong to oblanceolate basal leaves, racemose inflorescences, outside of corolla and fruit covered with sparsely stellate hairs.

Key words: Akarköy, New species, Taxonomy, Türkiye, Verbascum.

Introduction


Verbascum genus is the center of origin in Türkiye and is generally distributed in Eastern, Southern and Central Anatolia. Iran-Turanian phytogeographic region is the general distribution area of the genus. In addition to the new species, 15 endemic Verbascum taxa are distributed in Karaman province (Huber-Morath, 1978; Ertuğrul & Tugay, 2018). The author collected an interesting specimen of a Verbascum population occurring in the south part of Akarköy village, which belonged to Kazımkarabekir municipality of Karaman province, during a walk through the nature around this village in 2016. In the subsequent years, the same population was studied thoroughly by the collection of additional specimens, bearing all the characters of the plant were obtained. After a detailed examination of the collected specimens, they were described as Verbascum akarkoeyense Çeçen sp. nov. due to the presence of morphological characters not found in other taxa in the genus.

Material and Methods

The herbarium samples were studied under stereo microscope (Olympus SZ51) and compared with various Verbascum species accounts published previously (Huber-Morath, 1960, 1971, 1976, 1978, 1981; Feinbrun-Dothan, 1978a, 1978b; Meikle, 1985; Ekim, 2000), and relevant voucher specimens were compared in ANK, BASBG, G, GAZI, HUB and KNYA (Thiers, 2024). The pollen and seed morphology of the unidentified specimens of Verbascum were studied using light microscope (LM) and scanning electron microscope (SEM). Wodehouse (1935), technique was employed to prepare the pollen samples for LM. Hereby, the pollen grains were mounted and stained with glycerin-jelly and safranin. Afterward, the pollen slides were studied and measurements for pollen grains were made under LM. At least 30 pollen grains per specimen for each morphological characteristic were investigated using an ocular micrometer. Pollen grains were dried and transferred onto stubs and then coated with gold for SEM visualization. The gold-coated pollen grains were studied and photographed using a ZEISS EVO LS10 SEM in ILTEK, Selçuk University, Konya, Türkiye. Relevant terminology was adopted from Faegri & Iversen (1992) and Punt et al., (2007). Based on the ratio of polar axis to equatorial axis (P/E), the pollen shape class was identified by using Erdtman’s system (Erdtman, 1969).

The IUCN Red List category was evaluated on the extent of occurrence (EOO), area of occupancy (AOO), and number of mature individuals according to IUCN criteria (Anon., 2022).

Results and Discussion

Verbascum akarkoeyense Çeçen sp. nov. (Figs. 1–4; Tables 1–2).

Type: Türkiye C4 Karaman: Kazımkarabekir, from Akarköy to Masdat, 7 km south of Akarköy village, Hacibaba Mountain, north of Masdatbeli, steppe, calcareous rocks, 1200–1600 m a.s.l., 06 August 2021, Ö. çeçen 6514&R. Çeçen (Holotype: KNYA; Isotype: ANK, HUB, GAZI and Karamanoğlu Mehmetbey University Biodiversity Application and Research Center).

Paratypes: Türkiye C4 Karaman: Kazımkarabekir, from Akarköy to Masdat, 7 km south of Akarköy village, Hacibaba Mountain, north of Masdatbeli, steppe, calcareous rocks, 1200–1600 m a.s.l., 28 June 2016, Ö. çeçen 5247 & M. Çeçen (ANK, HUB, GAZI and KNYA, Karamanoğlu Mehmetbey University Biodiversity Application and Research Center).
Fig. 1. *Verbascum akarkoeyense*: (a) growth habit (b) habitus (c) basal and cauline leaves (d) flowers detail (e) fruits in clusters. Scale bars: 10 mm.
Fig. 2. Illustration of *V. akarkoeyense* (a1) stem and basal leaves (a2) stem and inflorescence (b) cauline leaves (c) calyx (d) flowers ve
fruits in clusters (e1) outside surface of corolla (e2) abaxial side of Corolla (f) adnation of stamens to corolla (g1) glabrous up to outside
surface of filament anterior in 2 stamens. (g2) hairy up to outside surface of filament anterior in other stamens (h) gynoecium (i) capsule
(j) seed (k) stellate hairs (drawings by Şebnem Akyıldız).
Fig. 3. SEM photos of *Verbascum akarkoeyense* pollen grain: (a) general view and (b) exine ornamentation. SEM photos of *V. akarkoeyense* seed coat: (c) general shape and (d) seed coat surface. Scale bars: A, 2 µm; B, 1 µm; C, 100 µm; D, 10 µm.

Fig. 4. Distribution of *Verbascum akarkoeyense* (star), *V. microsepalum* (square) and *V. orgyale* (circle) in Türkiye.
Calyx 3–4 mm long, lobes lanceolate to linear, acute. Corolla yellow, 15–20 mm in diam, without pellucid glands, sparsely stellar tomentose outside. Stamens 5; anthers reniform; filaments with whitish-yellow wool up to anthers. Capsule oblong to elliptic, 4–5 × 2–3 mm, obtuse, with sparsely stellar hairs. Seeds 0.6–0.8× 0.4–0.6 mm, blackish brown, oblong to obovoid, coated by alveolate and bireticulate-rugose, irregular polygonal cells, with distinct and numerous vesicles (Figs. 1–3).

Pollen morphology: The pollen grains of *Verbascum akarkoeyense* are prolate, isopolar and radially symmetrical. The aperture type is trizonocolporate. Exine sculpturing micro reticulate at polar and equatorial regions. The pollen morphology characteristics of the new species are given in Table 1 (Fig. 3).

**Description:** Biennial, 40–70 cm long, adpressed with white stellate-tomentose, eglandular hairs. Stem robust, terete, unbranched. Basal leaves narrowly oblong to oblanceolate, 14–18 × 1.5–3 cm, obscurely crenulate to entire, acute, petiole 3–5 cm, winged, lower surface net-veined prominent. Cauline leaves lanceolate, sessile, acuminate, decurrent at the base. Inflorescence simple, erect densely racemose, with crowded clusters of 4–7 flowers. Bracts linear-lanceolate, up to 8 mm long, acuminate, lower surface glabrous. Pedicels up to 10 mm long. Bracteoles setaceous, minute. Calyx 3–4 mm long, lobes lanceolate to linear, acute. Corolla yellow, 15–20 mm in diam, without pellucid glands, sparsely stellar tomentose outside. Stamens 5; anthers reniform; filaments with whitish-yellow wool up to anthers. Capsule oblong to elliptic, 4–5 × 2–3 mm, obtuse, with sparsely stellar hairs. Seeds 0.6–0.8× 0.4–0.6 mm, blackish brown, oblong to obovoid, coated by alveolate and bireticulate-rugose, irregular polygonal cells, with distinct and numerous vesicles (Figs. 1–3).

**Table 1. Pollen morphological features of *V. akarkoeyense*.**

<table>
<thead>
<tr>
<th>Characters</th>
<th>Verbascum akarkoeyense</th>
<th>Verbascum orgyalae*</th>
<th>Verbascum microsepalum*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit and situation of hairy</td>
<td>40–70 cm long, adpressed white tomentose eglandular</td>
<td>70–200 cm long, finely adpressed greyish tomentose, glabrescent above, eglandular</td>
<td>50–200 cm long, densely adpressed white-tomentose, glabrescent, eglandular</td>
</tr>
<tr>
<td>Stem</td>
<td>robust, terete, unbranched</td>
<td>robust, terete, obtuse angled above, branched</td>
<td>robust, terete, finely striate, with numerous rod-like branches</td>
</tr>
<tr>
<td>Basal leaves</td>
<td>narrowly oblong to oblanceolate, 14–18 × 1.5–3 cm</td>
<td>lanceolate to linear-lanceolate, 10–30 × 1.5–10 cm</td>
<td>lanceolate to obovate, 10–20 ×3.5–7 cm</td>
</tr>
<tr>
<td>Cauline leaves</td>
<td>lanceolate, decurrent at base</td>
<td>upper broadly ovate to orbicular, acuminate, auriculate at base</td>
<td>middle and upper sessile, lanceolate to ovate, crenulate to entire, acuminate, auriculate and shortly (5–10 mm) decurrent at base</td>
</tr>
<tr>
<td>Inflorescences</td>
<td>simple, erect densely racemose, with clusters of 4–7 flowers</td>
<td>With numerous long slender rod-like branches, with loose clusters of 2–7 flowers</td>
<td>With slender rod-like branches, forming oblong panicle, with loose clusters of 2–7 flowers</td>
</tr>
<tr>
<td>Bracts</td>
<td>linear to lanceolate, acuminate</td>
<td>linear to lanceolate, subulate</td>
<td>cordonate-triangular to ovate-lanceolate, acuminate</td>
</tr>
<tr>
<td>Calyx</td>
<td>3–4 mm long, lobes linear lanceolate, acute</td>
<td>1.5–3 mm long, lobes linear-lanceolate, acuminate</td>
<td>1.5–3 mm long, lobes linear-lanceolate, acuminate</td>
</tr>
<tr>
<td>Corolla</td>
<td>yellow, 15–20 mm diam., without pellucid glands, outside sparsely stellate hairs</td>
<td>yellow, 15–20 mm diam., without pellucid glands, stellate-tomentose outside</td>
<td>yellow, 15–20 mm diam., without pellucid glands, stellate-tomentose outside</td>
</tr>
<tr>
<td>Capsule</td>
<td>oblong to elliptic, 3–5×2–3 mm, obtuse, with sparsely stellate hairs</td>
<td>elliptic-cylindrical, obtuse or emarginate, 3.5–5×1.5–2 mm, stellate-tomentose, glabrescent</td>
<td>elliptic-cylindrical, 5–6× 2.5–2.5 mm, obtuse tomentose, glabrescent</td>
</tr>
<tr>
<td>Habitat; elevation</td>
<td>steppe, calcareous rocks, 1200–1600 m</td>
<td>Quercus Scrub, limestone rocks, 0–1500 m</td>
<td>Quercus Scrub, fallow fields, 850–1230 m</td>
</tr>
</tbody>
</table>

*Data from Huber-Morath (1978)

**Conservation status:** *Verbascum akarkoeyense* is known from a single location; its extent of occurrence (EOO) and area of occupancy (AOO) is approximately 10 km² (criterion B1, B2); number of individuals less than 500 (D1); number of locations is only one (a), and estimated continuing decline (b) in area of occupancy (ii), quality of habitat (iii), number of mature individuals (v). Although the main threat is not preferred by animals, it is in danger due to the destruction caused by humans and animals due to the migration of plateau nomads to the region during the summer period. As a result, this new species is assessed as ‘Critically Endangered: CR, B1ab (ii, iii, v) + B2ab (ii, iii, v)’ (Anon., 2022) (Figs 1, 4).

**Taxonomic relationships:** *Verbascum akarkoeyense* belongs to “Group M” due to flowers 2 or more in the axil of each bract; clusters umbellate, sessile, bracteoles present, longest pedicels 2 × calyx or longer. Fertile
The English manuscript and finally Şebnem Akyıldız viewed the SEM photographs in Selçuk University ILTEK, Aytaç for helping to conduct field studies at different times, PhD. Zeki Karavelioğulları for allowing the study of their Verbascum morphology (Accessed 5, anthers all reniform; connective of all anthers

with adaxial surface densely papillose; filament wool whitish yellow (Huber-Morath, 1978; Davis et al., 1988). Therefore, the new species was compared with V. orgyale and V. microsepalum and the new species was first thought to be similar to V. microsepalum and V. orgyale belonging also to the “Group M”: V. microsepalum is distinguished from V. akarkoeyense by its; longer and branched stem, lanceolate to obovate of basal leaves; inflorescence panicle, capsule cylindrical oblong. V. orgyale is distinguished from V. akarkoeyense by its; longer and branched stem linear to lanceolate of basal leaves; cauleine leaves broadly ovate orbicular, acuminate, auriculate at base, inflorescence numerous long slender rod-like branches, capsule elliptic to ovate (Table 2).

Although the seeds in the Verbascum genus are quite similar, they sometimes differ. It is seen that V. cherianthifolium Boiss. and V. speciosum Schrad. Which are evaluated in “Group M” with V. akarkoeyense, exhibit similar seed shapes and surface features (Attar et al., 2007; Kheiri et al., 2009). V. akarkoeyense seeds are oblong to obovoid, as in these two species. Our results regarding the shape and surface morphology of the seed of the new species showed similar results to former studies (Juan et al.,1997; Attar et al., 2007; Cabi et al., 2011; Başer, 2021). Although pollen characters cannot be used alone to distinguish species, the use of this character in combination with other characters may help to differentiate some taxa. While the pollen shape of V. cherianthifolium and V. speciosum taxa is subprolate whereas in V. akarkoeyense it is prolate. The pollen shape and surface morphology of V. akarkoeyense have been compared with the species in the relevant literature and show similar characteristics. (Pehlivan et al., 2008; Al-Hadeethy et al., 2014; Öztürk et al., 2018; Tekin & Yılmaz, 2018; Başer, 2021).

Ecology: V. akarkoeyense usually grows on calcareous rocks in the steppe whereas V. microsepalum and V. orgyale are found in Quercus L. scrub and fallow fields. Together with the new species, in Türkiye, the taxon presence of “Group M” the number has increased to 13 and its total and endemic number has risen to 257 and 203 (Huber-Morath, 1978).

A dichotomous key to Verbascum akarkoeyense and close relative species is added (adapted by Verbascum “Group M” in Flora of Turkey (Huber-Morath, 1978);

1. Basal leaves incised-ovate or lobed or pinnatifid near base
2. Bracts ovate-cordate to lanceolate; capsule ellipsoid to subglobose, 3–4.5×2.5–3 mm …………….. V. banaticum
3. Bracts linear-lanceolate to linear; capsule oblong-cylindrical, 5–6×2–5 mm …………….. V. stenocarpum
4. Basal leaves entire
5. Capsule subacute, keeled towards apex ………………………………………………………………………………………………… josgadense
6. Capsule obtuse, not keeled.
7. Bracts linear-lanceolate, subulate ………………………………………………………………………………………………… V. orgyale
8. Cauline leaves shortly decurrent at base
9. Bracts linear-lanceolate, calyx lobes acute ………………………………………………………………………………………………… V. akarkoeyense
10. Bracts ovate to lanceolate, calyx lobes subobtuse ………………………………………………………………………………………... V. microsepalum

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References


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