Scilla bilgineri (Asparagaceae: Scilloideae): a new species of Scilla L. from eastern Turkey

Hasan YILDIRIM*, Yusuf ALTIOĞLU
Department of Biology, Faculty of Science, Ege University, Bornova, Izmir, Turkey

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Abstract: Scilla bilgineri Yildirim (Asparagaceae) is described here as a new species. Diagnostic morphological characters, a full description, and detailed illustrations are provided on the basis of the type specimens and observations of wild populations. The new species is characterized by whitish to very pale lilac tepals, variegated ovary; style 5–6 mm long; oblong, straw to pale yellow and cucullate seed; pale creamy-white elaiosome, which is adherent to the testa; and pinkish to reddish, fleshy bulb scales. It belongs to Scilla bifolia agg. and is related to S. bifolia and S. albinerve within. It is easily distinguished from all other species on the basis of these morphological characters.

Key words: Taxonomy, Scilla, Adıyaman, Turkey

1. Introduction
According to Govaerts (2015), the total number of Scilla L. species is 91, with distribution in Europe, Africa, and western Asia. The taxonomic status of the genus Scilla and Scilla species has been evaluated in several taxonomical studies (Speta, 1998a, 1998b; Stedje, 1998; Pfosser and Speta, 1999).

Mordak (1984) specified that the genus Scilla is represented by 14 species in Turkey. In the last checklist of Turkish plants (Yildirim, 2012), 16 Scilla species and a hybrid were reported in Turkey, and of these 17 taxa in total 6 species are endemic to Turkey (Yildirim, 2012). The status of S. persica and S. siehei (Baker) Speta was resurrected in this last check list of Turkish plants (Yildirim, 2012).

In 2013, an unusual and morphologically very different Scilla species was described, named Scilla vardaria Yildirim & Gemic. This species not only shows Scilla characters but also a relation to Puschkinia Adams, with a floral corona and reticulate seed coats (Yildirm et al., 2013). After this discovery, some new and different features were added to the morphological limitations of Scilla. Recently, 3 new Scilla species were added from northern, southern, and eastern Anatolia (Yildirim et al., 2014; Yildirim and Aslan, 2015), one of which is S. albinerve Yildirim & Gemic, which is located in S. bifolia agg.

S. bifolia is distributed in Great Britain, N and W Europe, the Balkan Peninsula, the Aegean islands, Turkey, Lebanon and Syria, Ukraine, Transcaucasia, and the North Caucasus (Speta, 1971; Govaerts, 2015). It is a very variable group. Many new species were described in this group (Speta, 1971), but most of them are evaluated as synonyms of S. bifolia (Govaerts, 2015). S. bifolia is distributed all across Europe, the Aegean islands, and the western to inner parts of Turkey. S. bifolia is characterized by blackish seed testa (rarely yellowish) and elaiosome formed by exostome and free (never adherent to the testa), and scale leaves of the bulb that are white in color (Speta, 1971, 1972). However, the seed coat of S. albinerve is yellowish; elaiosome formed by exostome and the upper side of the raphe, and adherent to the testa; and scale leaves of bulb are a reddish-pink color. On the other hand, the midrib of the tepal is always the same color or darker (bright blue to dark blue or purplish) in S. bifolia agg. However, S. albinerve has a white midrib, which is unique to S. bifolia agg (Yildirim et al., 2014).

Ali Rıza Bilginer, an amateur botanist and nature lover, collected an interesting specimen of Scilla from Gölbaşı in Adıyaman Province. He sent some interesting pictures of this interesting Scilla to the authors for identification in 2013. In the spring of 2014, the authors gathered flowering materials from this Scilla population.

The results of this study show that these Scilla samples represent a new species for science, which is included in S. bifolia agg. and is closely related to S. albinerve and S. bifolia.

* Correspondence: hasanyldrm@gmail.com

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2. Materials and methods
All of the samples were compared with many other Scilla specimens collected from different localities and deposited in various herbaria such as AIBU, ANK, E, EGE, G, GAZI, HUB, ISTE, ISTF, K, KATO, KNYA, and VANF (abbreviations following Thiers 2015). Relevant literature sources were also consulted during the identification and outlining of the specimens (Mordak, 1984; Speta, 1998a, 1998b; Pfosser and Speta, 1999; Yıldırım, 2012, 2014; Yıldırım et al., 2013, 2014; Govaerts, 2015; Yıldırım and Aslan, 2015). Features of the gross morphology of Scilla bilgineri and allied taxa were examined under a binocular stereoscopic microscope. Approximately 50 pollen grains were measured using a light microscope. For scanning electron microscopy (SEM), the selected pollen grains were placed on aluminum stubs using double-sided adhesive tape, sputter coated with gold using an Emiteck K550, and then examined using the FEI Quanta 250 FEG Scanning Electron Microscope. Photographs of the living material were taken with a Nikon D300 digital camera.

3. Results
Scilla bilgineri Yıldırım sp. nov. (Figures 1–3)
Type: Turkey. Adıyaman: Gölbaşı, Akçabel Köyü, Say Mevkii, 1152 m, Kirik kalker kayakalı yamaçlar, Quercus sp. açıklıkları, 15.03.2014, H. Yıldırım 2788 (holotype: EGE 42435, isotypes: EGE 42436, ANK, NGBB).

3.1. Diagnosis
Scilla bilgineri is related to S. bifolia and S. albinerve. It differs from S. bifolia in its reddish-pink fleshy bulb scales (not whitish); whitish to very pale lilac tepals with concolorous or sometimes slightly darker midrib at outside tepal (not bluish with bluish midrib); ovary variegated with wide dark-green to bluish-green zone and tight yellowish-green zone (not uniform bluish); bright yellow to orange; surface reticulate; elaiosome adhered to testa, whitish. It differs from S. albinerve by its whitish to very pale lilac tepals with concolorous or sometimes slightly darker midrib at outside tepal (not bluish with white midrib); variegated with wide dark-green to bluish-green zone and tight yellowish-green zone ovary (not uniform dark blue); reticulate seed testa (not smooth); whitish elaiosome (not cream white to orange).

3.2. Etymology
The new species is named Scilla bilgineri in honor of Ali Riza Bilginer, who is an amateur botanist and first collected the new species. He is also the collector of the recently described unusual species Puschkinia bilgineri Yıldırım (2014). The Turkish name of this species is given as “Akcabel Sümülü”, according to the guidelines of Menemen et al. (2013).

3.3. Description
Bulb 15–35 × 7–20 mm, subglobose to ovoid; outer tunic membranous, very thin texture, pale brown; inner scales fleshy, pinkish. Leaves usually 2(–3), 8–25 × 0.8–2.2 cm, green, mostly cuculate at apex, linear, canaliculate, sometimes margin tinged with purplish. Stem solitary, 3.5–10 cm, erect. Inflorescence a simple, 2–11-flowered raceme, bright green; scape 5–11 cm long; flowering stem 4–10 cm long. Bracts minute, 1–1.5 mm long. Pedicel 2–35 mm long in flower, 5–50 mm in fruit, erect to patent. Perianth whitish to very pale lilac, tube absent. Tepal 7–10 × 2–2.5 mm, sometimes appendiculate at apex; midrib concolorous or slightly darker outside. Anthers 1.5–3 × 0.8–1 mm, dark blue to purplish; filaments 5–8 mm long. Ovary 2–3.5 × 1.5–2.5 mm, globose to elliptic, variegated with wide dark-green to bluish-green zone and tight yellowish-green zone, 3-locular; ovules 4–5 per locule; style 4–6 mm long, variegated with slightly blue and whitish zones; stigma capitulate. Capsule 8–13 mm, slightly pyriform to globose. Seeds oblolly-globose, 2 mm long, bright yellow to orange; surface reticulate; elaiosome cuculate, without tubercules, adherent to testa, whitish.

3.4. Distribution and ecology
Scilla bilgineri is endemic to eastern Anatolia, Turkey. It is found in Gölbaşı, a district of the province of Adıyaman. It is an element belonging to the Iranian-Turanian floristic region. It occurs in clearings of Quercus brantii Lindl. at altitudes ranging from 1000 to 1200 m above sea level. Flowering and subsequently fruiting plants can be observed from April to the end of May. It grows on soils rich in humus resulting from the accumulation of dead plants on calcareous soils.

3.5. Suggested conservational status
The occupancy area (AOO) of Scilla bilgineri was calculated as 2.6 km², in which about 2000 individuals are estimated to occur. No anthropogenic or grazing effects were observed on the population. Following the criteria laid out by the IUCN (2013), the plant is categorized as ‘Vulnerable’ (VU) D 2, on account of its restricted distribution.

3.6. Pollen morphology
The pollen grain is dark purple, heteropolar, monosulcate, pollen shape prolate, polar axis 33–55 μm, equatorial axis 65–86 μm, exine ornamentation perforate (Figure 3).

4. Discussion
Scilla bilgineri is a local species distributed in the Gölbaşı district of Adıyaman Province in Turkey, belonging to the S. bifolia group. Although S. bilgineri is morphologically related to S. albinerve and S. bifolia (Figure 4), it is easily distinguished from them.
Figure 1. *Scilla bilgineri*: A. Habit, B–C. Details of flower and ovary, D. Capsule, E. Seed (illustrated by H Yıldırım: A–C. Holotype [H.Yıldırım 2788]; D–E. Specimens grown in the Ege University Botanical Garden & Herbarium Research and Application Center).
Figure 2. *Scilla bilgineri*: A. Habit, B. Flowering stem and flowers, C. Bulb with outer tunic, D. Bulb without outer tunic, E. Seeds (photos taken by H Yıldırım: A–D. on 15.03.2014 from type locality; E. on 10.04.2014 from the Ege University Botanical Garden & Herbarium Research and Application Center).
Figure 3. *Scilla bilgineri*: A–C. Details of flowers and variegate ovary (photos taken by H Yıldırım on 15.03.2014 from type locality of *S. bilgineri*); D–F. Pollen grains and details of pollen surface in SEM photos, G–I. Seed and details of seed surface in SEM photos.
The Taurus Mountain series consists of many high peaks reaching approximately 3000–3500 m. This series starts in northeastern Anatolia and ends with 2 branches, one continuing to the Lebanon border with the Amanus Mountain and the other continuing to the southwest Aegean Sea border (ending with the Babadağ Mountain near the Fethiye district in Muğla Province). The Taurus Mountain series is known as the Anatolian Diagonal. This mountain series separates Anatolia from the south to the north. Hence, the Anatolian Diagonal has led to the large geographic isolation of many plant species populations distributed in Turkey, including *S. bifolia* agg. (Yıldırım et al., unpublished data).

According to our revisional studies on the genus *Scilla* based on molecular and morphologic studies, *S. bifolia* agg. populations show two big distribution centers (Yıldırım et al., unpublished data) as western and eastern populations. The western *S. bifolia* group is distributed across Europe, the Aegean Islands, and the western to inner parts of Turkey (Figure 5). This group is characterized by seeds having mostly blackish (rarely yellowish) testa and elaiosome formed by exostome and free (never adherent to the testa), and scale leaves of the bulb that are white in color. On the other hand, the eastern *S. bifolia* group is represented from eastern Anatolia to Iran and Caucasian regions and the populations in these areas are characterized by a yellowish seed coat; elaiosome formed by exostome and the upper side of the raphe and is adherent to the testa; and fleshy scale leaves of the bulb are a pinkish color.

*S. albinerve* was the first described species in the eastern *S. bifolia* group (Yıldırım et al., 2014) (Figure 5). It is characterized by a dark blue tepal with a white midrib; yellowish seeds with elaiosome formed by exostome and adherent to the testa; and fleshy scale leaves of the bulb pinkish color.

S. bilgineri is the second new species in the eastern S. bifolia group described in this paper. It is especially characterized by reddish-pink fleshy bulb scales; whitish to very pale lilac tepals with concolorous or sometimes slightly darker midrib at outside tepal; ovary variegated with wide dark-green to bluish-green zone and tight yellowish-green zone; style variegated with slightly blue and whitish zones; ovary pyriform to globose; seed coat yellowish, reticulate; and elaiosome cucullate, smooth, cream, formed by exostome and adherent to the testa.

Morphological differences between S. bilgineri and related species are summarized in the Table.

Considering all of the studies about the genus Scilla, the Scilla species in Turkey are increased to 20 and a hybrid after adding this new species. With this new species, endemic Scilla species in Turkey are increased to

Table. Morphological differences among Scilla bilgineri and its allied species S. bifolia and S. albinerve.

<table>
<thead>
<tr>
<th></th>
<th>S. bilgineri</th>
<th>S. bifolia</th>
<th>S. albinerve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulb fleshy scales</td>
<td>Pinkish</td>
<td>Whitish to cream</td>
<td>Pinkish</td>
</tr>
<tr>
<td>Tepals</td>
<td>Whitish to very pale lilac</td>
<td>Bright blue, lilac-blue, or bluish-purple</td>
<td>Dark blue</td>
</tr>
<tr>
<td>Midrib</td>
<td>Concolorous or pale lilac on outside of tepal</td>
<td>Concolorous to darker blue</td>
<td>White</td>
</tr>
<tr>
<td>Style</td>
<td>Straight, 4–6 mm long, variegated with slightly blue and whitish zones</td>
<td>Straight, 2–4.5 mm, bluish</td>
<td>Straight or slightly geniculate, 3–4(–5) mm long, dark blue</td>
</tr>
<tr>
<td>Seed</td>
<td>Bright yellow to orange; surface reticulate</td>
<td>Blackish to dark brown, surface smooth</td>
<td>Bright yellow to orange; surface smooth</td>
</tr>
<tr>
<td>Elaiosome</td>
<td>Cucullate, without tubercules, adherent to testa, cream white</td>
<td>With tubercles, came from/to exostome, never adherent to testa, slightly whitish to colorless</td>
<td>Cucullate, without tubercules to slightly tuberculate, adherent to testa, cream white to orange</td>
</tr>
<tr>
<td>Ovary</td>
<td>Variegated with wide dark-green to bluish-green zone and tight yellowish-green zone</td>
<td>Uniformly bluish</td>
<td>Uniformly dark blue</td>
</tr>
<tr>
<td>Capsule</td>
<td>Slightly pyriform to globose</td>
<td>Globose</td>
<td>Globose</td>
</tr>
</tbody>
</table>

Figure 5. Distribution of Scilla bilgineri (○), S. albinerve (▲), and S. bifolia (★) in Turkey.
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References


