

## A new species of *Astragalus* (Fabaceae) from Turkey

Muhittin DİNÇ<sup>1</sup>, Zeki AYTAÇ<sup>2\*</sup>, Süleyman DOĞU<sup>1</sup>

<sup>1</sup>Department of Biology, Faculty of Education, Necmettin Erbakan University, Konya, Turkey

<sup>2</sup>Department of Biology, Faculty of Science, Gazi University, Ankara, Turkey

Received: 04.12.2012

Accepted: 07.06.2013

Published Online: 06.09.2013

Printed: 30.09.2013

**Abstract:** *Astragalus silifkeense* Dinç, Aytaç & Doğu, sp. nov. (Fabaceae, sect. *Astragalus* Bunge) is described as a new species from Silifke (Mersin Province), in southern Anatolia, Turkey. The new species is closely related to *A. columnaris* Boiss., endemic to Denizli in western Anatolia, and *A. gilvus* Boiss. in Ankara Province, Turkey. Taxonomic descriptions, as well as pollen and seed characters of the new species, are presented. The new species grows in an open *Abies cilicica* (Antoine & Kotschy) Carrière forest. The geographical distribution of the new species, along with that of *A. columnaris* and *A. gilvus*, is shown. The new species is compared with its relatives *A. columnaris* and *A. gilvus*.

**Key words:** *Astragalus*, Leguminosae, taxonomy, Turkey

### 1. Introduction

The genus *Astragalus* L. is one of the largest genera of vascular plants in the world and is distributed mainly around semiarid steppe regions. It is represented by approximately 3000 taxa in the world and is also the largest genus in Turkey, where it is represented by 463 taxa (including subspecies and varieties), 210 (41%) of them endemic, and is classified in 63 sections (Chamberlain and Matthews, 1970; Davis et al., 1988; Maassoumi, 1998; Aytaç, 2000; Aytaç et al. 2012; Karaman Erkul and Aytaç, 2013). On a field trip in 2011, specimens of *Astragalus* were collected from the town of Kirobası in Silifke (Mersin Province).

After comparisons with the morphologically similar taxa *A. columnaris* and *A. gilvus* (sect. *Astragalus*), it was concluded that the collected specimens represent a new species.

### 2. Materials and methods

The morphological data used in the description of the new species were directly observed from materials collected from Kirobası (near Silifke) by the authors in 2010 and 2011, using a binocular stereoscopic microscope when necessary.

The pollen morphology of the new species was examined with by light microscopy (LM) and scanning electron microscopy (SEM). For the LM, pollen grains were treated with 96% alcohol to remove oily substances

and then embedded in glycerine jelly stained with basic fuchsin (Wodehouse, 1935). In the LM studies the following parameters were measured: polar axis (P), equatorial axis (E), and exine and intine thickness. The pollen diameters measured were based on 10 samples. SEM was also used to examine the exine sculpture in detail. For the SEM study, the pollen was treated with 70% alcohol and then dried before mounting on stubs with gold. The SEM photomicrographs were taken with the JEOL JSM 6060 SEM at the Gazi University Electron Microscopy Unit. In this study, the terminology of Punt et al. (1994) was used. The specimens are deposited in the GAZI herbarium.

### 3. Species description

*Astragalus silifkeense* Dinç, Aytaç & Doğu, sp. nov. (Figures 1–4).

Sect. *Astragalus*

**Type:** C4 Mersin: Between Silifke and Hotamış, 9th km, 1380 m, *Abies cilicica* forest opening, calcareous rocks, 19.05.2011, Z.Aytaç 9779 & M.Dinç & S.Doğu (holotype: GAZI, isotypes: KNYA, ANK).

**Paratype:** C4 Mersin: between Silifke and Hotamış, 9th km, 1380 m, *Abies cilicica* forest opening, calcareous rocks, 19.05.2010, M.Dinç 3192 & S.Doğu (GAZI).

**Diagnose:** Affinis *A. columnaris* et *A. gilvus* ab *A. columnaris*, sed caulibus prostratis (non erectis), stipulis 20–25 mm longis (non 5–12 mm), bracteis 10–15 mm

\* Correspondence: zaytac@gazi.edu.tr

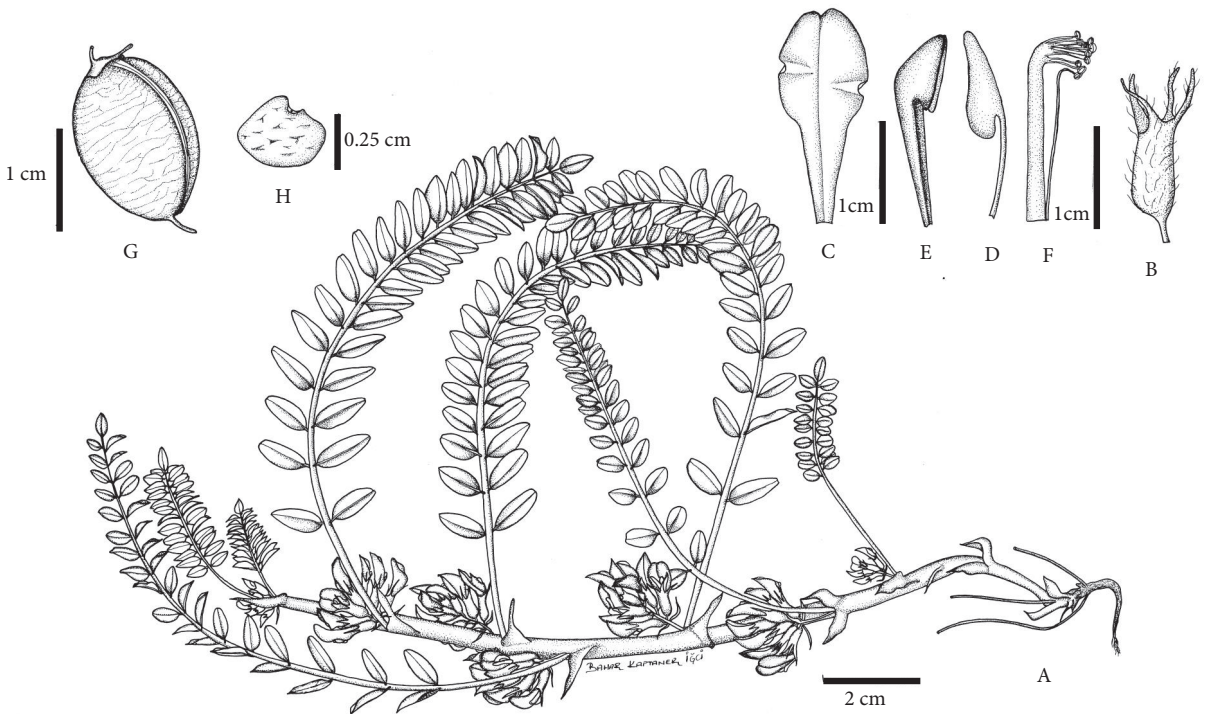


Figure 1. *Astragalus silifkeense*: A- habitus, B- calyx, C- standard, D- wing, E- keel, F- stamens, G- fruit, H- seed (Aytaç 9779 et al.).



Figure 2. *Astragalus silifkeense* in the field: A- habitus, B- flowers.

longis (non 5–7 mm), leguminibus 20–25 mm longis et rugulosis (non 12–14 mm et laevibus); A *A. gilvo*, sed caulibus prostratis (non erectis), foliis 20–30 mm longis (non 15–20 mm), vexillis 20–23 mm longis (non 28–35 mm), leguminibus 20–25 mm longis (non 25–50 mm) differt.

**Description:** Plants herbaceous, perennial, covered with simple white hairs. Stems loosely to densely branched from the base, procumbent, 20–35 cm tall, sparsely white hirsute, finally glabrescent, leafy throughout. Stipules greenish, lanceolate, acuminate, angular, 20–25 mm long, free from the petiole; margins white ciliate. Leaves

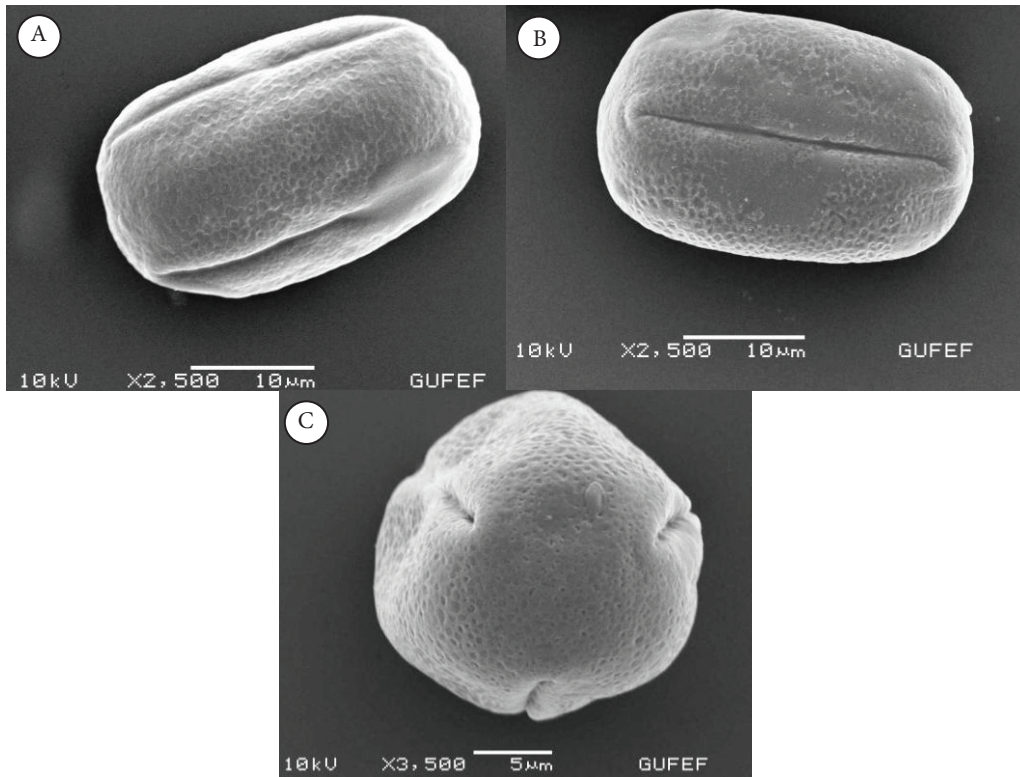


Figure 3. SEM photo of pollen grain of *Astragalus silifkeense*: A, B- equatorial view; C- polar view.

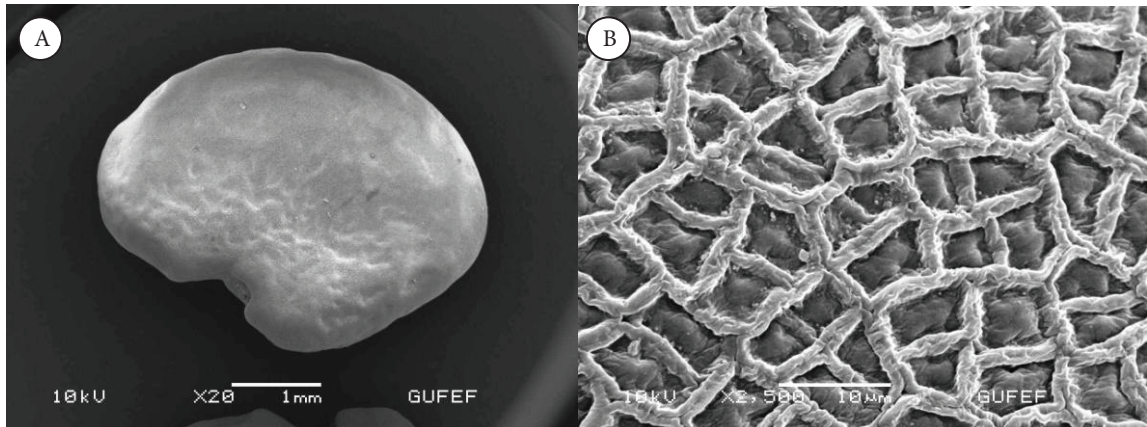


Figure 4. SEM photos of *A. silifkeense* seed: A- general appearance, B- ornamentation of seed coat surface.

imparipinnate, 20–30 cm, with 15–20 pairs of leaflets; petiole 4–7 cm long and glabrous; rachis glabrescent to white hirsute. Leaflets sessile or with a petiole shorter than 1 mm, ovate, oblong to elliptic, 1–2 × 0.5–1 cm glabrous; sometimes ciliate at margin. Racemes 5–10 flowered in axils of leaves; peduncle 3–5 mm. Bracts 10–15 mm long, linear-lanceolate, greenish with ciliate margin; as long as calyx to longer than calyx. Bracteoles linear, 5–10 mm long, ciliate at margin. Calyx tubular, gibbous at base, 10–12 mm, glabrous to sparsely long simple hairy; teeth linear-lanceolate, 4–6 mm, sparsely long simple hairy at

margin. Corolla white to cream, with yellow base; standard 20–23 × 10 mm, glabrous, oblong-elliptic, emarginate; wings 22–24 × 4–5 mm, auriculate, obtuse at base; keel 17–20 × 7–10 mm, auriculate at base, obtuse at apex. Stamens 25 mm long and at upper part free. Ovary sessile, ovate to globose, sparsely long simple hairy at base, glabrous above. Style 15–17 mm long, glabrous. Legume 20–25 × 15–17 mm, oblong to globose, rugose; beak 2–3 mm long. Seeds 2–3 per loculus, 4–5 × 2.5–5 mm, brown. *Flowering time*: 4–5, *fruiting time*: 6.

#### 4. Results and discussion

The genus *Astragalus* was added to *Flora of Turkey* by Chamberlain and Matthews (1970), and section *Christiania* Bunge was the legal name. However, section *Christiania* was reduced to a synonym of section *Astragalus* by Agerer-Kirchhoff (1978). As a result, all members of section *Christiania* were transferred to section *Astragalus*. With the addition of *A. babacianum* A.S.Ertekin as a new species in this section, the number of species reached 16 in Turkey (Chamberlain and Matthews, 1970; Ertekin, 2006). However, *A. papasianus* O.Schwarz and *A. babacianum* Ertekin were reduced to synonyms of *A. gilvus* Boiss. and *A. aleppicus* Boiss. (Aytaç et al., 2012).

The section members are perennial, herbaceous, erect (except *A. silifkeense*), leaves imparipinnate; leaflets simple-hairy. Flowers shortly peduncle and axillary racemes; flowers bracteolate or ebracteolate. Standard glabrous and legumes exceeding calyx.

Hairiness is a very important taxonomic character in the *Astragalus* L. (Mehr et al., 2012). It can be divided into 3 groups: glabrous, simple, and bifurcate (sometimes subbifurcate) hairiness. The section *Astragalus* has simple hairs.

All members of this section in Turkey are erect, except for the new species, which has procumbent stems. Otherwise, it is closely related to *A. columnaris* Boiss., but with stipules 20–25 mm long (not 5–12 mm), calyx sparsely hirsute to glabrous (not completely glabrous), and legumes 20–25 mm long and rugose (not 12–14 mm and smooth). It is also similar to *A. gilvus*, but possesses leaflets in 15–20 pairs and is completely glabrous (not 13–17 pairs and adpressed pilose), bracts 10–15 mm long (not 6–12 mm), calyx 10–12 mm long and sparsely hirsute to glabrous (not 15–20 mm and pilose), standard 20–23 mm long (not 28–35 mm), and legumes 20–25 mm long (not 25–40 mm).

The types and other specimens of these 2 species were examined from different herbaria

such as G, GAZI, MSB, and W. The specimens examined in herbaria and the collected materials from the field are given in the Appendix. The diagnostic characters useful for separation of the taxa examined are presented in the Table.

Pollen grains of *A. silifkeense* (Figure 3) are radially symmetrical and tricolporate. The polar axis is  $30.01 \pm 0.86 \mu\text{m}$  and the equatorial axis  $25.94 \pm 0.34 \mu\text{m}$ . The P/E ratio is  $1.15 \pm 0.02$ , and the pollen shape is subprolate. The amb diameter is  $25.72 \pm 0.62 \mu\text{m}$  and is semiangular in shape. Exine thickness is  $0.86 \pm 0.08 \mu\text{m}$ , ornamentation is microreticulate on equatorial and polar regions. Intine thickness is  $0.71 \pm 0.02 \mu\text{m}$ . Colpus is  $22.97 \pm 0.83 \mu\text{m}$  long and  $2.57 \pm 0.38 \mu\text{m}$  wide. It is prolongate; Plg  $7.05 \pm 0.36 \mu\text{m}$ , Plt  $9.37 \pm 0.34 \mu\text{m}$ . Apocolpium is  $15.91 \pm 0.98 \mu\text{m}$  in diameter.

Seeds are reniform and brown,  $0.34 \pm 0.02 \times 0.43 \pm 0.02$  mm. Ornamentation is reticulate (Figure 4).

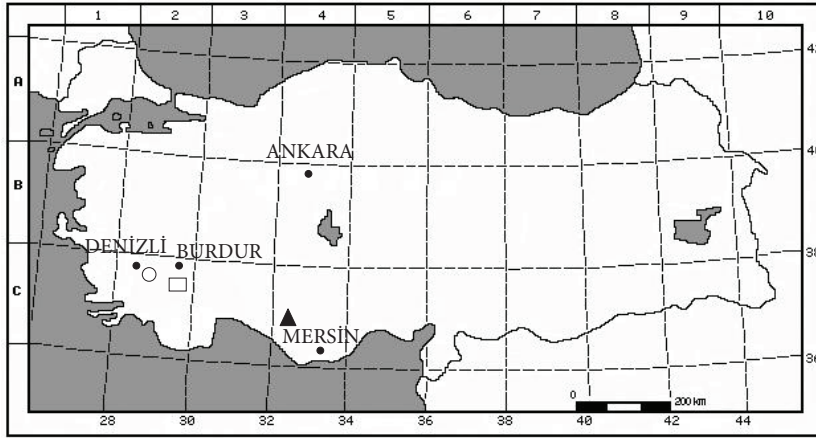
*Conservation status:* It is known only from the type locality, and the observed area of occupancy is less than 2 km<sup>2</sup>. The data gained from field studies were evaluated according to IUCN categories (Criteria B1–B2) (IUCN 2010). The status of the new species is Critically Endangered (CR).

*Ecology:* It grows in open *Abies cilicica* (Antoine & Kotschy) Carrière forest at an altitude of 1380 m with *Astragalus depressus* L., *A. tauricolus* Boiss., *A. leporinus* Boiss., *Arabis aubrietoides* Boiss., *Juniperus foetidissima* Willd., and *Silene pharnaceifolia* Fenzl.

*Distribution:* The new species is currently known only from the type locality in southern Anatolia (Figure 5). E. Medit. element, endemic.

**Table.** Comparison of diagnostic characteristics of *Astragalus silifkeense*, *A. columnaris*, and *A. gilvus*.

Characters	<i>A. silifkeense</i>	<i>A. columnaris</i>	<i>A. gilvus</i>
Stems	procumbent	erect	erect
stipules	20–25 mm long	5–12 mm long	15–25 mm long
Leaves	20–30 cm long, 15–20 pairs	10–30 cm long, 18–25 pairs	15–20 cm long, 13–17 pairs
Leaflets	1–2 × 0.5–1 cm, ovate-oblong	8–12 mm, ovate-oblong	8–15 mm, narrowly elliptic
Bracts	10–15 mm long	5–7 mm long	6–12 mm long
Calyx	10–12 mm long, glabrous to sparsely hirsute	10–13 mm, glabrous	15–20 mm, white-pilose
Standard	20–23 mm long	20–23 mm long	28–35 mm long
Legume	20–25 × 15–17 mm, rugose	12–14 × 5 mm, smooth	25–40 × 12–20 mm, rugose



**Figure 5.** Distribution of *Astragalus silifkeense* (▲), *A. columnaris* (○), and *A. gilvus* (□) in Turkey.

Diagnostic key to the species of the group.

1. Calyx glabrous.....*A. columnaris*
1. Calyx hairy, sometimes sparsely so
  2. Ovary and legume hairy
    3. Leaflets adpressed-pilose to simple sericeous below; calyx 15–20 mm..... *A. gilvus*
    3. Leaflets glabrous; calyx 10–12 mm long..... *A. silifkeense*
  2. Ovary and legume glabrous.....other species

### Acknowledgements

Thanks to Bahar Kaptaner İğci for drawing the *Astragalus silifkeense* illustration.

### Appendix: Examined specimens

***Astragalus columnaris*:** [Gruzia] in Adzharia, ad fl. Adzhariszkali, prope Kedy, 21.5.1939, *M.Popov s.n.* (Type: TBI, photo!).

***Astragalus gilvus*:** [Turkey] in valle Arguri in monte Ararat, 2.6.1856, *N. von Seidlitz s.n.* (P, photo MSB! isotype: G-BOIS MSB photo!). Turkey: Anatolien; Smyrna-Burnova; in colle calcareo “Papasian” dicto; in graminosis. 100 m.s.m. *O.Schwarz* 123. (Type of *A. papasianus* MSB photo!). C2 Burdur: Burdur plain, 950 m, 06. 07. 1961, *K. Karamanoğlu* (AEF 23773!).

### References

- Agerer-Kirchhoff C (1978). Revision von *Astragalus* L. sect. *Astragalus* (Leguminosae). *Boissiera* 25: 1–97.
- Aytaç Z (2000). *Astragalus* L. In: Güner A, Özhatay N, Ekim T, Başer KHC, editors. *Flora of Turkey and the East Aegean Islands* (Suppl. 2), Vol. 11. Edinburgh: Edinburgh University Press, pp. 79–88.
- Aytaç Z, Ekici M, Akan H (2012). *Astragalus* L. In: Güner A, Aslan S, Ekim T, Vural M, Babaç MT, editors. *Türkiye Bitkileri Listesi (Damarlı Bitkiler)*. İstanbul: Nezahat Gökyiğit Botanic Garden and Floristics Research Society.
- Chamberlain DF, Matthews VA (1970). *Astragalus* L. In: Davis PH, editor. *Flora of Turkey and the East Aegean Islands*, Vol. 3. Edinburgh: Edinburgh University Press, pp. 49–254.
- Davis PH, Mill RR, Tan K (1988). *Flora of Turkey and the East Aegean Islands* (Suppl. 1), Vol. 10. Edinburgh: Edinburgh University Press, pp. 114–124.
- Ertekin AS (2006). *Astragalus babacianum* (Fabaceae), a new species from Turkey. *Ann Bot Fennici* 43: 291–294.
- IUCN (2010). IUCN Standards and Petitions Subcommittee. Guidelines for Using the IUCN Red List Categories and Criteria. Version 8.1. Prepared by the Standards and Petitions Subcommittee. Gland, Switzerland: IUCN.
- Karaman Erkul S, Aytaç Z (2013). *Astragalus yukselii* (Leguminosae), a new species from Turkey. *Turk J Bot* 37: 836–840.

Maassoumi AA (1998). *Astragalus* in the Old World, Check-List. Tehran, Iran: Research Institute of Forest and Rangelands.

Mehr RSA, Maassoumi AA, Saidi A, Osaloo SK, Nohooji MG (2012). Morphological cladistic analysis of some bifurcate hairy sections of *Astragalus* (Fabaceae) in Iran. Turk J Bot 36: 434–442.

Punt W, Blackmore S, Nilsson S, Thomas A (1994). Glossary of Pollen and Spore Terminology. Utrecht: LPP Foundations.

Wodehouse RP (1935). Pollen Grains. New York: McGraw Hill.