

## THREE NEW TRAGACANTHIC SPECIES OF THE GENUS *ASTRAGALUS* (FABACEAE) FROM TURKEY

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Three new tragacanthic representatives of the genus *Astragalus* L. are described. They are compared with their closest relatives. The line drawing illustrations of the floral parts and a distribution map are given for each species.

*Keywords.* Flora of Turkey, new species, thorny species of *Astragalus*, tragacanthic *Astragalus*.

### INTRODUCTION

In the course of a monographic revision of tragacanthic species of *Astragalus* (by S. Zarre) it was established that using the generic rank for this group of thorny astragali would be impractical (Zarre & Podlech, 1997). Although the members of this group exhibit mostly the same pattern of inflorescence morphology, they cannot be considered to belong to a separate genus (sometimes previously known as *Astracantha* Podlech). Therefore we use the informal name 'tragacanthic astragali' for these phenotypically similar species.

Turkey, with more than 50 species of tragacanthic astragali (from a world total of about 130 species), of which 32 are endemic, is one of the most important centres of diversity for the group (Zarre, own data). Regarding Turkey, there are only a few works on the taxonomy of the group since the treatment of *Astragalus* in *Flora of Turkey* (Chamberlain & Matthews, 1971). The two last authors added many new species to the tragacanthic astragali, e.g. *A. cymbibracteatus* Hub.-Mor. & D.F. Chamb., *A. gevashensis* D.F. Chamb. & V.A. Matthews, *A. patnosicus* D.F. Chamb. & V.A. Matthews, *A. pennatulus* Hub.-Mor. & D.F. Chamb., *A. roseocalycinus* V. A. Matthews, *A. yueksekovae* V.A. Matthews (Chamberlain & Matthews, 1969). However, because of the special geographical situation of Turkey, further species could be expected to occur. Indeed, Ekim (1984) and Duman & Vural (1990) have described *A. elazigensis* Ekim and *Astracantha marashica* Duman & Vural as new species, respectively. Here, we describe another three new species from Turkey, and more new species will surely be found in future.

Some species of the group exhibit a great range of variability, so that the extreme morphs of a given species seem to be separate taxa. However, there is often a continuous range, and it is not possible to delimit these taxa. Therefore, in many cases it is necessary to reduce some existing names to synonymy. Such a treatment

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must be done, for example, in the *A. condensatus*, *A. thracicus*, and *A. microcephalus* complexes (Zarre, own data).

Because of the many problems associated with the delimitation of sections within tragacanthic *Astragalus*, we have not assigned our new species to formal sections.

Names of herbaria, with two exceptions, are abbreviated according Holmgren *et al.* (1990). The abbreviation MSB is used for the herbarium of the Institut für systematische Botanik der Universität München, and GAZI for the herbarium of the Gazi University, Ankara.

***Astragalus barboides* Zarre & Duman, sp. nov. Fig. 1A.**

Differt ab *A. barba-jovi* DC. foliolis tomentosis (nec appresse sericeis), (2-)3(-4) jugis (nec 4-5 jugis), vexillo 12-15mm longo (nec 16-21mm).

Plantae suffruticosae, ad 25cm altae. Stipulae membranaceae, 4-12mm longae. Folia ad 2cm longa. Foliola 3-9mm longa et 1.5-3mm lata, oblongo-elliptica vel oblanceolata. Calyx fissilis, 11-14mm longus, dentibus 6-9mm longis. Petala rosea. Vexillum 12-15mm longum, lamina 7.2-8.5mm longa et 3-6mm lata. Alae 11.5-15mm longae, lamina 4-5mm longa et 1-2mm lata. Carina 11.5-13.5mm longa. Fructus lateraliter compressus, 4-5mm longus.

Type: Turkey, B6 Sivas, 10km N Zara, 1700m, 12 vii 1971, *Andersen et al.* 2202 (holo. E!; iso. C!).

Dwarf cushion-forming subshrub, 12-25cm tall, loosely branched at the base. *Hairs* on petiole and leaflets 0.1-1.5mm, on the calyx up to 3.5mm long. *Stem* up to 22cm long, ascending, growing 0.5-6cm per year, in first year 1-2.5mm diam., densely appressed hairy below stipules, later glabrescent. *Stipules* yellowish white, thinly membranous, hyaline at margins, with 5-8 parallel nerves in free part, 4-12mm long, ovate-triangular, acute or shortly acuminate at tip, adnate to petiole for a length of 3-8mm, otherwise free from each other, sparsely appressed villose, soon glabrescent, ciliate. *Leaves* 0.6-2cm long; rachides  $\pm$  remote, thick, rigid, straight, obliquely erect to horizontal, densely tomentose, later glabrescent; petiole c.  $\frac{1}{3}$  of length of rachis (0.2-0.7cm long); terminal thorn  $\frac{1}{3}$ - $\frac{2}{3}$  of length of uppermost leaflets; leaflets in (2-)3(-4) pairs, greyish green, flattened to weakly complicate, 3-9mm long and 1.5-3mm wide, oblong-elliptic, sometimes oblanceolate, obtuse or acute, with a mucro 0.5-1.2mm long, both surfaces densely appressed tomentose, later glabrescent. *Inflorescence* 1.5-4cm long and 1.5-2.5cm wide, globose to oblong, composed of 2-3-flowered axillary clusters. *Bracts* thinly membranous, hyaline at margins, whitish, 6-8mm long and 0.5-1.5mm wide, linear to narrowly oblong, sometimes navicular, shortly acuminate, densely lanate at tip and on midrib, otherwise glabrous. *Bracteoles* absent. *Calyx* yellowish white, tubular-turbinate, splitting with age, 11-14mm long, with 12-17 parallel nerves, densely appressed long hairy becoming villous, hairy at base; teeth 6-9mm long, filiform from a triangular base,  $\pm$  as long as or up to 1.5-2.5 times longer than tube. *Petals* with yellowish white claws and pink to red limbs, claws of wings and keel c. 3mm adnate to staminal

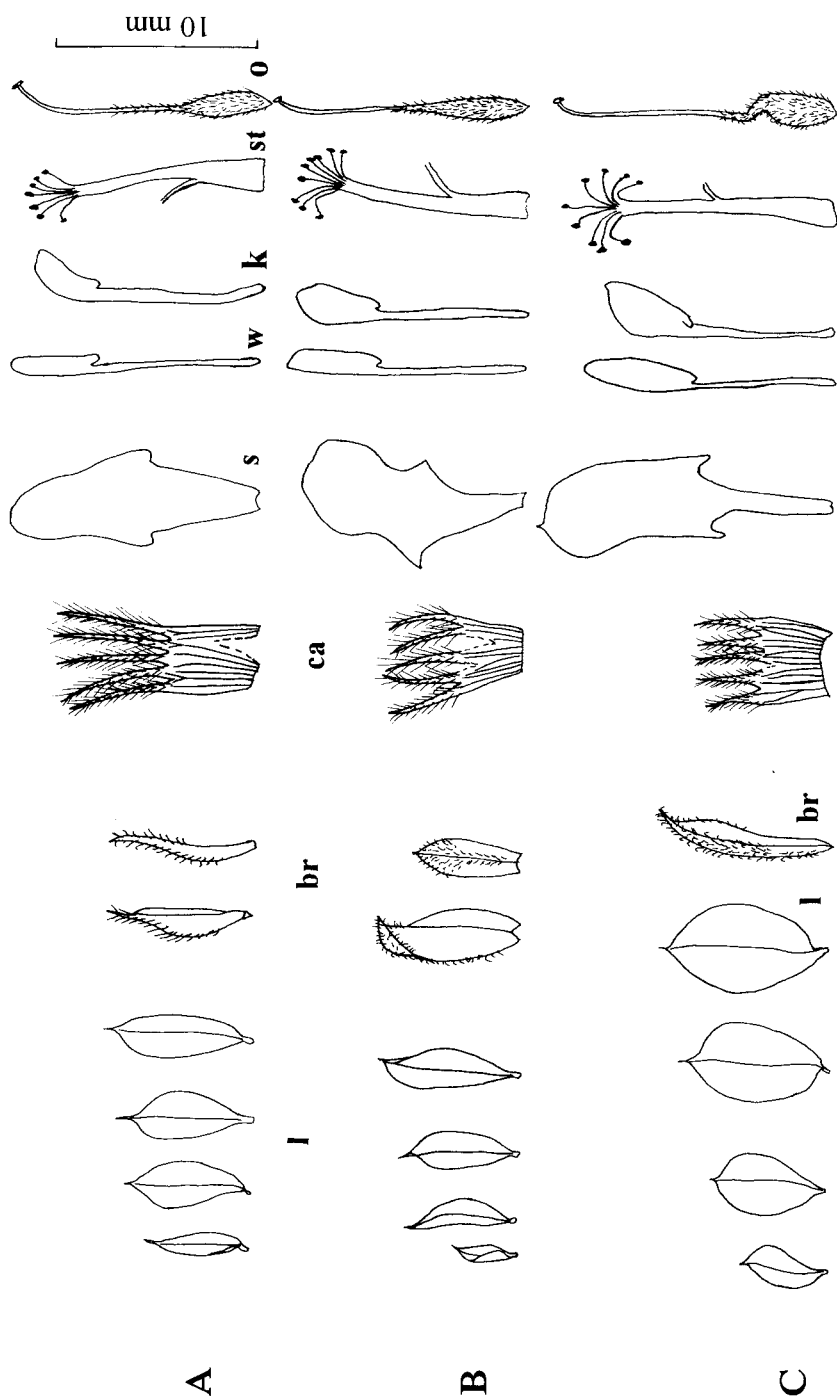


FIG. 1. Leaflets (l), bracts (br), calyx (ca), standard (s), wing (w), keel (k), staminal tube (st) and ovary (o) in the new species. A. *A. barboides*, holo. (E); B. *A. ekimii*, holo. (ANK); C. *A. nydeggeri*, *Sümbül* 3025 (E).

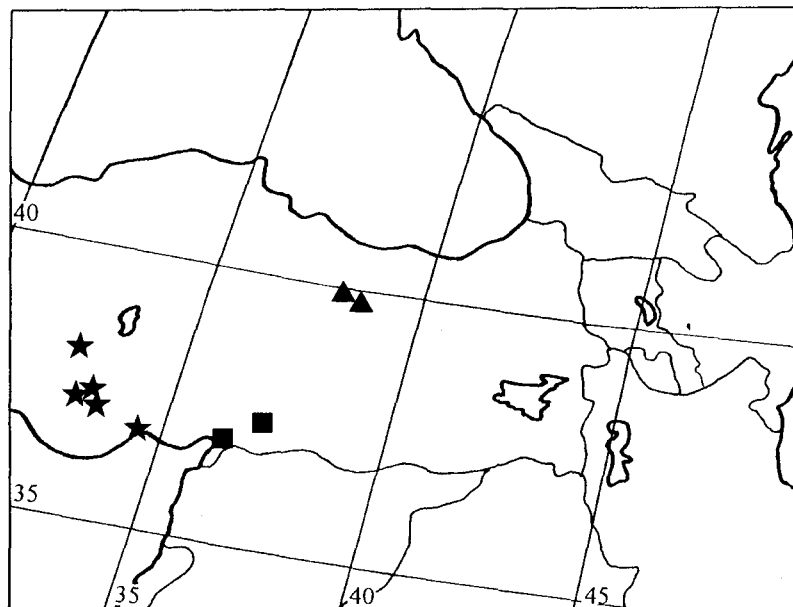


FIG. 2. Distribution map of *A. barboides* (▲), *A. ekimii* (■) and *A. nydeggeri* (★).

tube. *Standard* 12–15mm long; limb 7.2–8.5mm long and 3–6mm wide, oblong-pandurate, shallowly constricted at middle, obtuse or retuse at tip, acutely dilated at base; claw 4–6.5mm long. *Wings* 11.5–15mm long; limb 4–5mm long and 1–2mm wide, oblong, obtuse; auricle 0.2–0.4mm long; claw 7.7–10.3mm long. *Keel* 11.5–13.5mm long; limb 3.5–4.5mm long and 1.5–2mm deep, elliptic, obtuse or rarely minutely mucronulate at tip, with broadly recurved lower edge and concave upper edge; claw 7.5–9mm long. *Stamens* 11–13mm long, free from each other on upper 2–3mm. *Ovary* 11.5–14mm long; style 8–11mm long, lower half hairy. *Fruits* laterally compressed, 4–5mm long, 2.5–3mm high and c.2mm wide, elliptic in lateral view, sparsely appressed short hairy at the base, densely appressed villous further up; beak 0.5–1mm long, hooked. *Seeds* light brown, without black spots, 2.8–3.2mm long and 1.8–2mm wide, ellipsoid, pitted.

*Specimens seen* (see fig. 2). B6 Sivas: 42km W Refahiye, 30km E Imranli, 2160m, Kizildağ geçidi, 3 viii 1987, Ehrendorfer et al. 787-170-16 (WU); in jugo Kizil Dagh inter Imranli et Refahiye, 2150m, 3 viii 1971, Rechingner 44429 (MSB, W); Gipssteppe bei Sivas, 19 viii 1971, Volk 7½/95 (MSB).

*A. barboides* is closely related to *A. barba-jovis*, but differs from it in having shorter leaflets, bracts and smaller flowers. Moreover, the leaves of the new species have typically 3 pairs of leaflets (there are only some exceptions with 2- or 4-paired leaves), whereas *A. barba-jovis* only rarely has 3 leaflet pairs and is mostly 4–5-paired. The tomentose hairy leaflets of *A. barboides*, in contrast to the sericeous hairy leaflets of *A. barba-jovis*, can also be used to separate the two species.

***Astragalus ekimii* Zarre & Duman, sp. nov. Fig. 1B.**

Valde affinis *A. cymbostegi* Bunge, sed differt calyce brevi (6–7mm longo, nec 8–15mm), dentibus 3–4mm longis (nec 6–9mm), vexillo 11–16mm longo (nec 17–22mm).

Plantae suffruticosae, ad 15cm altae. Stipulae firme membranaceae, 4–8mm longae. Folia ad 3.5cm longa. Foliola 3–6 juga, 3–8mm longa et 1.5–2.5mm lata, oblonga. Calyx 6–7mm longus, dentibus 3–4mm longis. Petala rosea vel rubra. Vexillum 12–16mm longum, lamina 7.2–8.5mm longa et 3–6mm lata. Alae 11.5–16.5mm longae, lamina 4.5–7mm longa et 1.5–1.8mm lata. Carina 11–15mm longa. Fructus immaturus.

Type: Turkey, C6 Kahramanmaraş, Engizek Dağı, Dehlizyürdü, 1500–1700m, 25 vi 1988, *H. Duman* 4102 (holo. GAZI!; iso. E!, MSB!)

Dwarf cushion-forming subshrub, 10–15cm tall, densely branched from the base. Hairs on petiole and leaflets 0.1–1.5mm, on the calyx up to 4.5mm long. *Stem* up to 13cm long, prostrate, growing 0.5–5cm per year, in first year 1–2.5mm diam., densely appressed lanate below stipules, later glabrescent. *Stipules* yellowish, ± membranous, with 1–3 parallel nerves at free part, 4–8mm long, lanceolate-ovate, acuminate at tip, adnate to petiole for a length of 3–8mm, otherwise free from each other, densely appressed pilose, later glabrescent, ciliate. *Leaves* 0.7–3.5cm long; rachides dense, ± thin, rigid, straight, obliquely erect to subhorizontal, densely covered with appressed or rarely patent hairs, later glabrescent; petiole c.  $\frac{1}{3}$  of length of rachis (0.2–1cm long); terminal thorn as long as or up to 3 times longer than uppermost leaflets; leaflets in 3–6 pairs, greyish green, complicate, becoming flattened, 3–8mm long and 1.5–2.5mm wide, oblong, obtuse, with a mucro 0.1–1mm long, both sides sparsely spreading hairy, soon glabrescent. *Inflorescence* 1.5–4cm long and 1.5–2.5cm wide, globose to oblong, composed of 3–4-flowered axillary clusters. *Bracts* membranous, hyaline at margins, whitish yellow, 6–8mm long and 2–6mm wide, oblong to ovate, navicular, shortly acuminate at tip, sometimes bilobed at tip, densely appressed tomentose at tip and on midrib, otherwise glabrous. *Bracteoles* absent. *Calyx* yellowish white, red at teeth, turbinate, splitting, 6–7.5mm long, with 12–15 parallel nerves, densely appressed hairy becoming villous, hairy at base; teeth 3.5–4mm long, filiform from a triangulate base, ± as long as or up to 1.5 times longer than tube. *Petals* with yellowish white claws and pink or blue limbs, claws of wings and keel 4–5mm adnate to staminal tube. *Standard* 12–16mm long; limb 7.5–8.5mm long and 4.5–5.5mm wide, oblong-pandurate, shallowly constricted at middle, hastate at base; claw 4.5–6.5mm long. *Wings* 11.5–16.5mm long, as long as standard; limbs 4.5–7mm long and 1.5–1.8mm wide, oblong, obtuse; auricle 0.2–0.5mm long; claw 7.8–10mm long. *Keel* 11–15mm long; limb 4–6mm long and 2–2.5mm deep, elliptic, obtuse; claw 7–9mm long. *Stamens* 11–16mm long, free from each other in upper 2–3mm. *Ovary* 10.5–16.5mm long; style 8–13mm long, lower half hairy. *Fruits* and *seeds* immature.

*Specimens seen* (see fig. 2). C6 Hatay: Amanus, 1700m, 30 vi 1973, *Cartier* IV6 (E).

This new species can be compared to *A. amblelepis* Fisch. and *A. cymbostegis*. It

differs from *A. amblolepis* mainly in having sparsely spreading hairy leaflets (not densely double hairy), 3–4 flowers in each lateral inflorescence (not more than 5), a shorter calyx 6–7.5mm long (not 8–11mm) and a shorter standard 12–16mm long (not 15–20mm). From *A. cymbostegis* it differs in its shorter calyx (6–7mm long, not 8–15mm) and smaller petals (standard 11–16mm long, not 17–22mm).

Short-flowered forms of *A. cymbostegis*, known in the *Flora of Turkey* as *A. plumosus* Willd. var. *akardaghicus* (Eig) D.F. Chamb. & V.A. Matthews, can be mistaken for our new species, but they have calyces at least 8mm long, whereas those of *A. ekimii* do not exceed 7mm. Moreover, the calyx teeth are 6–9mm long in the former and 3–4mm in the latter. The species is named in honour of Prof. Dr Tuna Ekim, the director of the botanical department of Gazi University, Ankara.

***Astragalus nydeggeri* Zarre & Duman, sp. nov. Fig. 1C.**

Valde affinis *A. gossypino* Fisch. et *A. prusiano* Boiss., sed differt inflorescentiis lateralibus 1–2 floribus (nec multifloris), inflorescentia angustiore (ad 1.5cm lata, nec 1.5–3cm), petalis aureis (nec roseis vel rubris).

Plantae suffruticosae, ad 15cm altae. Stipulae chartaceae, 4–11mm longae. Folia ad 3.5cm longa. Foliola 2–4(–5) juga, 3–10mm longa et 2–5mm lata, obovato-elliptic. Calyx 6.5–7.5mm longus, dentibus 3–3.5mm longis. Petala aurea. Vexillum 12.5–14.5mm longum, lamina 7.2–8.5mm longa et 3–6mm lata. Alae 12.5–14mm longae, lamina 4–5.5mm longa et 1–1.5mm lata. Carina 11–13mm longa. Fructus immaturus.

Type: C4 Konya: Karaman-Bozkir, 3km E Belören, 1330m, 28 vii 1992, *Nydegger* 46876 (holo. MSB!; iso. E!)

Dwarf cushion-forming shrublet, 10–15cm tall, densely branched from base. *Hairs* on petiole and leaflets 0.1–1mm, on the calyx up to 2mm long, very thin, often curled. *Stem* up to 8cm long, ascending, with a growth of 1–7cm per year, in first year 1–3mm diam., very densely lanate below stipules, later glabrescent. *Stipules* chartaceous, yellowish white, often red at tip, with 3–5 parallel nerves at free part, with only one main nerve at tip, 4–11mm long, ovate, acuminate, adnate to petiole for a length of 3–6mm, otherwise free, younger ones densely tomentose, later glabrescent, ciliate or not. *Leaves* 0.7–3.5cm long; rachides loose or dense, straight, obliquely erect to horizontal, younger ones densely covered with short tomentose hairs and between them some long thick subappressed straight ones, later glabrescent; petiole  $\frac{1}{3}$ – $\frac{2}{3}$  of length of rachis (0.3–1.7cm long); terminal thorn 1–2 times longer than uppermost leaflets; leaflets 2–4(–5) pairs, whitish green to silvery green, 3–10mm long and 2–5mm wide, broadly obovate to elliptic, flattened to weakly complicate, obtuse, with a mucro 0.5–1.5mm long, both surfaces very densely tomentose, late glabrescent. *Inflorescence* remotely flowered, distributed along the current year's shoots, 2–6cm long and c.1.5cm wide, composed of 1–2-flowered axillary clusters. *Bracts* chartaceous, yellowish, green or red at tip, 6–9mm long and 1.5–3mm wide, narrowly oblong to oblong, navicular, densely lanate except for glabrous base

and lower margins. *Bracteoles* absent. *Calyx* 6.5–7.5mm long, turbinate, splitting with age, yellowish white with green teeth that become reddish brown, with 10–14 parallel nerves, very densely appressed hairy, becoming woolly; teeth 3–3.5mm long, subulate, as long as or slightly shorter than tube. *Petals* yellow throughout, claw of wings and keel 3–6.5mm, adnate to the staminal tube. *Standard* 12.5–14.5mm long; limb 7–8.5mm long and 3.5–5mm wide, oblong-pandurate, auriculate at base, narrowing toward tip, minutely mucronulate at apex; claw 5.5–6.5mm long, narrowly cuneate. *Wings* 12.5–14mm long; limbs 4–5.5mm long and 1–1.5mm wide, narrowly oblong, obtuse, sometimes minutely mucronulate at tip; auricle 0.3–0.8mm long; claw 7.5–9.8mm long. *Keel* 11.5–13mm long; limb 4–5mm long and 2–2.2mm deep, elliptic, narrowing towards tip, with broadly recurved lower edge and straight to concave upper edge, minutely mucronulate at tip; claw 6.5–9mm long. *Stamens* 12–13mm long, free from each other in the upper 2–3mm. *Ovary* 13–14mm long; style 11–13mm long, hairy in lower  $\frac{1}{5}$ – $\frac{1}{2}$ . *Fruits* and *seeds* unknown.

*Specimens seen* (see Fig. 2). C4 Vilayet İçel (Mersin): Aydıncık, Kalkfelsen am Strand, 10m, 19 v 1986, *Dorn* 540 (M); C4 Konya: Karaman-Hadım, 10km N Hadım, 1340m, 29 v 1992, *Nydegger* 46882 (MSB); Ermenek, Kazançi Kasabas, çivar, 650–850m, 21 vi 1984, *Sümbül* 3025 (E); Ermenek, Kazançi Kasabas, Yesil köy, Göksu, nehri boyunca, 700m, 12 x 1983, *Sümbül* 2550 (E); Konya, c.250km S Ankara, c. 1000m, 15 vii 1965, *Ledingham et al.* 4348 (E).

This species is closely related to *A. gossypinus* and *A. prusianus*, but differs from both in having 1–2-flowered axillary clusters (not more than 3) and narrower inflorescences (up to 1.5cm diam. not 1.5–2.5cm). Moreover the petals have yellow limbs in this new species, but they are often pink or blue to violet in both the other species. The specimens in E were previously determined as *A. gossypinus*, which is known from Iran, Iraq and the eastern borders of Turkey.

*A. nydeggeri* is named in honour of Mr Max Nydegger, whose excellent *Astragalus* collection from Turkey, has played a important part to increase our knowledge about the region.

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