

Contributions to Genus *Astragalus* L. (Fabaceae) in Turkey

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Abstract: In this study, new arrangements are given for three *Astragalus* species that are endemic in Turkey. *Astragalus physodes* subsp. *acikirensis* (sect. *Cystium*) was raised to the species level; *Astragalus darendensis* was reduced to synonym of *Astragalus scabrifolius* (sect. *Incani*) and *Astragalus tuna-ekimii* was reduced to synonym of *Astragalus chamaephaca* (sect. *Macrosemium*). Comments are provided on the relevant taxa about their taxonomic positions by examining the recollected samples and the type samples.

Keywords: *Cystium*, *Incani*, *Macrosemium*, new arrangement.

Türkiye'deki *Astragalus* L. (Fabaceae) Cinsine Katkılar

Öz: Bu çalışmada Türkiye'de dağılışı gösteren ve endemik olan üç *Astragalus* türü için yapılan yeni düzenlemeler sunulmuştur. *Astragalus physodes* subsp. *acikirensis* tür seviyesine çıkartılmış, *Astragalus darendensis* türü *Astragalus scabrifolius*'un ve *Astragalus tuna-ekimii* türü *Astragalus chamaephaca*'nın sinonimi olarak kabul edilmiştir. İlgili taksonlar yeniden toplanan örnekler ve tip örneklerinin incelenmesiyle taksonomik konumları hakkında yorumlar yapılmıştır.

Anahtar kelimeler: *Cystium*, *Incani*, *Macrosemium*, yeni düzenleme.

1. Introduction

The genus *Astragalus* L. is the largest genus of vascular plants with approximately 2900 species, which has two main centers of distribution in the world, Eurasia (Old World) and America (New World). Most of the species are located in the Old World (ca. 2400 species.) whereas ca. 500 species are restricted to the New World (Chaudhary, Rana, & Anand, 2008, Zarre & Azani, 2013).

Astragalus is the largest genus in the world in terms of the number of taxa (Podlech & Zarre, 2013). It is also the most confusing group in terms of morphological structures. The identification of this genus uses many characteristics such as annual or perennial, spiny or not, herbs or shrub; stipule structures, adnate or notto the petiole, membranous or leathery; caulescent, acaulous, scape or not; pairs of leaflets numbers; leaflet shapes and pubescence (simple, furcate, subbifurcate, black or white hairs); with or without bracts and bracteoles, structure of bracts and bracteoles; with pedicellate flowers or not; calyx inflated or not; legumes shape (ovate, oblong, linear), hairy or glabrous, unilocular or bilocular.

One of the important factors in species identification within the genus is the correct identification of the sections of the genus using the characters given above. One of significant mistakes is that it can be defined as a new species if the section to which the specimen belongs is defined inaccurately.

Since most of the section members are distributed over wide areas, they may morphologically show

ecological differences in their structures. If there are not enough and different samples collected from them, taxonomists may make a mistake and describe these ecological variances as different taxa.

In the light of all this information, it was inevitable to make some status and combination changes regarding *Astragalus* in Turkey. Some of these findings are given below.

2. Material and Methods

The study materials consist of the information obtained as a result of examining type samples collected from field or examined in herbaria. ANK, GAZI, HUB, MSB, G, E, LE, and K herbaria were visited, and the type specimen's images on the digital herbaria (P, BR, BASBG) were examined (Thiers, 2020). Original materials were examined, especially holotypes and isotypes. The status of taxa has been changed in the light of the acquired information.

Specimen examined:

A. acikirensis: Turkey, Ankara: Polatlı, 18 km west of Polatlı, Acıkır district, 840- 850 m, steppe, 25.5.1990, Z. Aytaç 3031 & H. Duman (Holotype GAZI!; Isotypes GAZI!, and ANK!); Kırkkale: Delice 4 km S of Delice, 650 m, A.A. Dönmez 1822 (HUB!), Yozgat, Sekili, Sekili salt mine, 800 m, 7.05.2020, in gypsum steppe, Hamzaoğlu 7665 (GAZI!).

Astragalus chamaephaca: Turkey, Afyonkarahisar: Bayat, around Meliktepe, ca. 1300 m, 27.04.1975, Vural

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115 (GAZI!), Bayat, east of İnazarcık, ca. 1250 m, 26.04.1975, Vural 115a (GAZI!); Amasia: prope Khaonsa, in declivibus regionis calidae nec non montanae, 03.05.1889, Bornmüller 99 (Lectotype PH00005234!) (URL 1); Bitlis: Tatvan, Mount Nemrut, below Şahmıran village, 1900 m, 28.05.1972, Peşmen 2915 (Holotype, GAZI!) (Syn. *A. tuna-ekimii*); Samsun: 350–500 m, 5.05.1988, Duman 1989 (GAZI); Van: Tatvan–Van, 5 km, ca. 1800 m, 24.06.1983, Ekim 7616 (Paratype, GAZI!) (Syn. *A. tuna-ekimii*).

Astragalus scabrifolius: Turkey, Malatya: Darende-Hekimhan, 33 km E of Darende, 1220 m, 04.06.1987, M. Nydegger 42631 (Holotype MSB004034! (URL 3), Isotype BASBG00000031! (URL 4).

3. Results and Discussion

3.1. *Astragalus acikirensis* (Ekim) Aytaç & Hamzaoğlu (sect. *Cystium* Bunge). **com. et stat. nova.** Fig. 1.

Syn.: *Astragalus physodes* L. subsp. *acikirensis* Ekim, *Thaiszia* 1: 23 (1992).

One herbaceous *Astragalus* specimen was collected around Polatlı district of Ankara (Turkey) in 1991. With inflated fruit and white flowers, it was identified as a new subspecies: *A. physodes* subsp. *acikirensis* (Ekim, Aytaç, & Duman, 1991). When the taxon was published, it was defined as a subspecies of *A. physodes*, which grows in Northern Europe, Crimea, and Kazakhstan because of its bifurcate fruit and white flower.

In the original article, *Astragalus physodes* subsp. *acikirensis* was evaluated in the section *Proselius* Bunge (Ekim et al., 1991). However, it was transferred to section *Cystium* by Podlech (Podlech & Zarre, 2013). The section *Cystium* was a new taxon for Flora of Turkey (Podlech & Zarre, 2013). In 2007, Dural, Tugay, Ertuğrul, Uysal and Demirelma described a new species, *A. turkmenensis*

Dural, Tugay and Ertuğrul, in this section (Dural et al., 2007). According to Podlech and Zarre (2013), the corolla color of this section members are yellow or violet, legumes mostly glabrous or with appressed or spreading hairy.

The white corolla color and bifurcate legume structure were added to the sectional features (Table 1). Therefore, its description was expanded and rewritten.

Table 1. Comparison of the *Astragalus physodes* and *A. acikirensis*

Characteristics	<i>A. physodes</i>	<i>A. acikirensis</i>
Leaflets	hairy on both surfaces	glabrous above
Flowers color	purple	pale lilac to white
Standards	15–20 mm	15–29 mm
Fruit	glabrous	appressed bifurcate pilose
Distribution	Euro-Siberian	Irano-Turanian (Turkey)

Description of the section based on Turkish members:

Section *Cystium*: Herbaceous, subcaulescent, covered bifurcate hairs; stipules adnate to the petiole. Racemes globose to ovoid and with short to long pedunculate. Bracteoles absent or rarely present. Calyx tubular, mostly black or predominantly black hairy. Petals yellow, violet to white. Legumes mostly glabrous, with appressed to spreading bifurcate hairy.

After re-examining type specimens and other specimens, it was revealed that the color of flowers in *A. physodes* subsp. *acikirensis* is pale lilac and white (not violet), the fruits bifurcate (not glabrous) and sometimes longer standard (15–29 mm, not 15–20 mm), leaflets sparsely hairy to glabrous as above.

As a result, the subspecies were elevated to species level. Comparative data of taxa are presented in Table 1.

This section is represented with *Astragalus acikirensis* and *A. turkmenensis* in Turkey. These two taxa are endemic for Turkey.



Figure 1. Habit of *Astragalus acikirensis* a. Flower, b. Fruit (Photographed by E. Hamzaoğlu).

3.2. *Astragalus chamaephaca* Freyn, *Oesterr. Bot. Z.* 40 (11): 402 (1890) (sect. *Macrosemium* Bunge). Fig. 2.

Syn.: *Astragalus tuna-ekimii* Adıgüzel, *Ann. Bot. Fenn.* 36(4): 231 (1999), **syn. nova.**

According to Flora of Turkey and the East Aegean Islands, the section *Macrosemium* is represented by *Astragalus chamaephaca* and *A. paradoxus* Bunge (Chamberlain & Matthews 1970). *A. chamaephaca* is endemic but it is very common in Turkey and *A.*

paradoxus is common to Iran, Turkey, Azerbaijan, and Armenia (Chamberlain & Matthews, 1970; Podlech & Zarre, 2013). A sample collected from Bitlis-Tatvan area in 1972 (Peşmen 2915, type in GAZI!) was identified as a new species in the same section as *A. tuna-ekimii* (Adıgüzel, 1999). Therefore, its ecological variations are also quite many. After examining the type specimens of *A. chamaephaca* and *A. tuna-ekimii* species and numerous samples collected from different locations, it is

understood that the samples of these two species are the same. Therefore, *A. tuna-ekimii* is reduced to the synonym of *A. chamaephaca*, based on nomenclatural rules (Turland et al., 2018). According to Podlech and Zarre (2013), *A. chamaephaca* can turn black when its flowers dry. Such a blackening has not been observed in either the type sample or the other analyzed samples. Comparative data of taxa are presented in Table 2.



Figure 2. a. Lectotype specimen of *Astragalus chamaephaca* (B, URL 1), b. Holotype specimen of *A. tuna-ekimii* (GAZI).

Table 2. Comparison of *Astragalus chamaephaca* and *A. tuna-ekimii*

Characteristics	<i>A. chamaephaca</i>	<i>A. tuna-ekimii</i>
Stipules	10–20 mm, membranous, adnate to petiole	10–20 mm, membranous, adnate to petiole
Leaves	5–12 cm, erect to prostrate, sparsely white hairs, otherwise glabrous	10–16 cm, sparsely white hairs
Leaflets	(7–) 9–11 pairs, 7–15 × 2–6 mm, narrowly elliptic to elliptic, subacute to narrowly rounded, glabrous	13–15 pairs, 6–16 × 3–4 mm, narrowly elliptic to lanceolate, glabrous
Peduncle	absent to 0.5 mm, glabrous or loosely covered with subappressed hairs	up to 4 mm, glabrous or loosely covered with subappressed hairs
Raceme	2–3 flowered	2–3 flowered
Bracts	4–10 mm, narrowly ovate to nearly orbicular, glabrous or very shortly ciliate it upper part	7–8 (–10) mm, narrowly ovate-lanceolate, glabrous or very shortly ciliate it upper part
Pedicels	0.5–1 mm glabrous to sparsely hairy	up to 3.5 mm
Calyx	13–20 mm, tubular, glabrous	13–16 mm, tubular, sparsely hairy
Calyx teeth	4–7 mm, sparsely to rather densely hairy	4–6 mm, sparsely to loosely white hairy
Standard	32–42 mm, yellow to pinkish	ca. 35 mm, yellow
Ovary	sessile, glabrous to hairy	sessile, hairy

3.3. *Astragalus scabrifolius* Boiss., *Diagn. Pl. Orient. ser. 1*, 2: 81 (1843) (sect. *Incarni* DC.).

Syn.: *Astragalus darendensis* Podlech & Ekici, *Feddes Repert.* 119(1-2): 26 (2008), **syn. nova**.

Astragalus specimens were collected by Nydegger (Nydegger 42631, MSB004034, Fig. 3b) and described as a

new species, *A. darendensis*, by Podlech & Ekici in 2008. However, the earlier samples collected from the same area by Aucher 1339 (P00623281, Fig. 3a) were described as a new species, *A. scabrifolius*, by Boissier in 1843. While examining the material of *A. darendensis* and type materials of *A. scabrifolius*, it was observed that *A. darendensis* is described from an insufficient sample. The

grazing sample also seems to be insufficient. The peduncle in the original article is called "2–5 cm straight or curved", but these features do not appear to be of the type (Fig. 3b). It looks like grazing. The samples have the

same properties as *A. scabrifolius*. For these reasons, *A. darendensis* is reduced to the synonym of *A. scabrifolius*.

The comparison of *Astragalus darendensis* and *A. scabrifolius* is given in Table 3.



Figure 3. a. Type specimen of *Astragalus scabrifolius* (P, URL 2) and b. *A. darendensis* (MSB, URL 3)

Table 3. Comparison of *Astragalus scabrifolius* and *A. darendensis*

Characteristics	<i>A. scabrifolius</i>	<i>A. darendensis</i>
Stipules	narrowly triangular, 6–7 mm	narrowly triangular, 8–12 mm
Leaves	8–14 cm	3–8 cm
Leaflets	1–2 pairs, 2–15 (–30) × 2.5–6 (–8) mm, narrowly ovate to narrowly elliptic, primary leaves reduced to the terminal leaflets in lower part, 4–6 (–8) pairs in upper part	one leaflets, 30–40 × 9–17 mm, narrowly ovate-triangular in lower part
Peduncle	5–16 cm, appressed, white hairy	2–6 cm, densely hairy
Raceme	5- to many flowered	up to 10 flowered
Bracts	whitish, narrowly triangular, 2– 3 mm, hairy	whitish, narrowly triangular, 4–5 mm, hairy
Calyx	8–12 mm tubular, obliquely gibbous at base, white to white–black hairy	12–14 mm, tubular, obliquely gibbous at base, densely hairy
Calyx teeth	2–4 mm, subulate	3–4 mm, subulate
Standard	15–18 mm, oblong elliptic	ca. 20 cm, oblong-obovate
Ovary	with a stipe, ca. 1 mm, hairy	sessile, hairy
Legume	nearly sessile (unripe), pendulous, narrowly elliptic, acuminate, with hairy	unknown

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