Contributions to Genus Astragalus (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 tupa-ekinium was reduced to synonym of Astragalus chamaeaphaca (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 dağılış gösteren ve endemik olan üç Astragalus türü için yapılan yeni düzenlemeler sunulmuştur. Astragalus physodes subsp. acikirensis tür seviyesine çıkarılmış, Astragalus darendensis türü Astragalus scabrifolius’un ve Astragalus tupa-ekinium türü Astragalus chamaeaphaca’nın sinonimleri kabul edilmiştir. İlgili taksonlar yeniden toplanan örnekler ve tip örneklerinin incelenmesiyle taksonomik konular hakkında yorumlar yapılmıştır.

Anahtar kelimeler: Cystium, Incani, Macrosemium, yeni düzenlemeler.

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 (Poldech & 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, capose or not; pairs of leaflets numbers; leaflet shapes and pubescence (simple, furcate, subbiifurcate, 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 species 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: Polathi, 18 km west of Polathi, Ackır district, 840- 850 m, steppe, 25.5.1990, Z. Aytac 3031 & H. Duman (Holotype GAZI; Isotypes GAZI, and ANK); Kırkikale: 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, Hamzaoglu 7665 (GAZI).

Astragalus chamaeaphaca: Turkey, Akyonkarahisar: Bayat, around Meliktepe, ca. 1300 m, 27,04,2017, Vural
Astragalus acikirensis: 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 *Proselsia* 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 | *A. physodes* | *A. acikirensis* |
|-----------------|--------------|------------------|
| Leaflets        | hairy on both surfaces | glabrous above |
| Flowers color   | purple        | pale lilac to white |
| Standards       | 15–20 mm      | 15–20 mm         |
| Fruit           | glabrous      | appressed bifurcate pilose |
| Distribution    | Euro-Siberian | Irano-Turanian (Turkey) |

Description of the section based on Turkish members:

Section *Cystium*: Herbaceous, subaculeal, 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 chamaephalca* Freyn, Oesterr. Bot. Z. 40 (11): 402 (1890) (sect. Macrosemium Bunge). Fig. 2.

Syn.: *Astragalus tuna–ekimi* Adigüzel, 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 chamaephalca* and *A. paradoxus* Bunge (Chamberlain & Matthews 1970). *A. chamaephalca* 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* (Adğüzêl, 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 | *A. chamaephaca* | *A. tuna-ekimii* |
|-----------------|-----------------|-----------------|
| 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 cm, yellow |
| Ovary           | sessile, glabrous to hairy | sessile, hairy |

3.3. *Astragalus scabrifolius* Boiss., Diagn. Pl. Orient. ser. 1, 2: 81 (1843) (sect. *Incani* 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 (P00622821, 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
A 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. scabriolus. For these reasons, A. darendensis is reduced to the synonym of A. scabriolus.

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

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

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

| Characteristics | *A. scabriolus* | *A. darendensis* |
|-----------------|----------------|------------------|
| 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 leaflet, 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 mm, oblong-obovate |
| Ovary           | with a stipe, ca. 1 mm, hairy | sessile, hairy |
| Legume          | nearly sessile (unripe), pendulous, narrowly elliptic, acuminate, with hairy | unknown |

**Acknowledgements:** We would like to thank Dr. Hans-Joachim Esser (Curator and Research Scientist, Botanische Staatssammlung München).

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