

Astragalus nallihanicus (sect. *Caprini*, Fabaceae), a new species from Türkiye

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Abstract – Some interesting *Astragalus* L. (Fabaceae) specimens that have short stems, long stipules and short yellow petals were collected from Nallihan, Ankara. In the careful examination made, it was seen that the specimens resemble *Astragalus ovinus* Boiss., *A. fabaceus* M.Bieb. and *A. angustiflorus* K.Koch belonging to the section *Caprini*, but it was determined that there is a difference due especially to some generative characters. After comparison with the closest taxa, it was decided that it is new for science and was named *Astragalus nallihanicus*. It grows at altitudes between about 850–1050 meters a.s.l. in a pine forest clearing. The size of some morphological features such as stipules (lower ones 17–22 mm long), calyx teeth (8–9 mm long), standards (19–22 mm long), wings (16–18 mm long), legumes (8.3–10.5 mm wide) and the dimensions of the seeds (3.5–4.1 × 2.1–2.5 mm), allow *Astragalus nallihanicus* to be distinguished from the closest taxa. Here, a description of the new species, comparison with similar taxa, informative photographs, and some ecological preferences have been given.

Keywords: Ankara, *Astragalus*, new species, taxonomy, Türkiye

Introduction

Fabaceae is one of the largest families in the world and includes approximately 650 genera and 18,000 species (Ke 2010). *Astragalus* L. is the richest genus of the family and includes approximately 3,000 taxa (Xu and Podlech 2010). *Astragalus* is also the genus that includes the most taxa in Türkiye and has become mostly adapted to the steppe habitat, as represented by 490 taxa connected to 63 sections (Polhill 1981a, b). Approximately 43% of these taxa are endemic (Chamberlain and Matthews 1970, Davis et al. 1988, Aytaç 2000, Duman and Akan 2003, Taeb and Uzunhisarcıklı 2012, Dinç et al. 2013, Karaman Erkul and Aytaç 2013, Ekici et al. 2015, Çeçen et al. 2016, İlçim and Behçet 2016, Dönmez and Uğurlu Aydın 2018, Aytaç et al. 2020, Tunçkol et al. 2020, Hamzaoğlu 2020).

Some interesting *Astragalus* specimens were collected during a student observation trip in 2022 within the scope of the forest flora and fauna. The short stems, long stipules and short yellow petals are the attributes of the specimens that first draw the attention. Specimens of the plants with flowers and fruits, adapted to the dry, pine forest openings, were collected around the end of June. It was decided at the conclusion of the investigation conducted, taking into consideration the most recent revision studies and the *Flora of Turkey and the East Aegean Islands* (here section *Myobroma*

(Steven) Bunge), that the specimens are a new species for the section *Caprini* DC. (Chamberlain and Matthews 1970, Aytaç 2000, Podlech and Zarre 2013).

Caprini (incl. sect. *Myobroma*) is the largest section of the genus including a total of 273 species, a majority of which are grown in South, Central and East Europe to Middle Asia, Siberia, Mongolia and China, North Africa, Türkiye, Near East to Pakistan and North India. The plant is usually herbaceous; basifixed hairy; stipules adnate to the petioles; imparipinnate leaves; inflorescence usually sessile or sometimes long-pedunculate, 1-many-flowered; bracts are mostly whitish-membranous; almost never has bracteoles; the calyx is short to long tubular, symmetrical base, ruptured by the legume as it grows; the petals are glabrous or more rarely hairy, whitish to mostly yellow, rarely red to dark violet from the beginning; the style is glabrous, at least in the upper part; the legume is very variable, sessile or with a distinct stipe, unilocular or incompletely to completely bilocular, and the valves are thin to strongly coriaceous in the species included in the section. The section is represented in Türkiye by 26 species (Chamberlain and Matthews 1970, Podlech 1988, Aytaç 2000, Podlech and Zarre 2013). Together with the new species described here, the number of species of the section *Caprini* in Türkiye has risen to 27.

Materials and methods

Specimens belonging to the new species were collected in June from the surroundings of Karacasu Village, in Nallıhan District of Ankara Province, in Türkiye. The related literature (Chamberlain and Matthews 1970, Podlech 1988, Aytaç 2000, Podlech and Zarre 2013.), specimens in the GAZI and ANK herbaria, and high-resolution photographs in the Conservatoire et Jardin Botaniques de la Ville de Genève (G), Royal Botanic Garden Kew (K), Royal Botanic Garden Edinburgh (E), Naturhistorisches Museum Wien (W), and Muséum National d'Histoire Naturelle Paris (P) herbaria were utilized in the identification and evaluation of the specimens (Thiers 2023). A Leica EZ4 stereo microscope and a Samsung A33 5G mobile telephone were used in the examination of the specimens and the taking of photographs, and a ruler with a sensitivity of 0.5 mm was used in the measurements.

Results

Taxonomic treatment

The first comprehensive information in Türkiye about the genus *Astragalus*, section *Caprini* (as section *Myobroma*) was included in Volume 3 of the work titled *Flora of Turkey and the East Aegean Islands* (Chamberlain and Matthews 1970). *Astragalus ovinus* Boiss., *A. fabaceus* M.Bieb. and *A. angustiflorus* K.Koch (incl. subsp. *angustiflorus* and subsp. *anatolicus* (Boiss.) D.F.Chamb.) are three of the 15 species of the section known from Türkiye. The validity of these species was also accepted in the later revision studies of the section *Caprini* and the genus *Astragalus*. These species are very similar to each other in habit because they are acaulescent or short caulescent, their petals are yellow and their calyces are tubular. On the other hand, these species differ

from each other by the shape of their leaflets and the pubescence of their legumes. The distribution areas of these species are also very close to each other and apart from in Türkiye are also known from Iraq, Iran, Armenia, Georgia, Azerbaijan, Russia and Greece. According to the latest data, 26 species of the section *Caprini* grow in Türkiye (Podlech 1988, Podlech and Zarre 2013, Aytaç 2000).

Astragalus ovinus, *A. fabaceus* and *A. angustiflorus* differ slightly from each other (in, for example, leaflet shape, legume hairiness). However, *Astragalus nallıhanicus* (Fig. 1.) can be distinguished from these species by more obvious differences. When the descriptions and herbaria specimens were examined, it was understood that *Astragalus nallıhanicus*, especially with respect to flower characters, was different from *A. ovinus*. For example: calyx teeth 8–9 mm long (not 3–6 mm), standard 19–22 mm long (not 24–32 mm), and keel 15–17 mm long (not 19–25 mm). It is also similar to the new species *A. fabaceus*. However, the calyx tube is glabrous and its teeth are 8–9 mm long (not hairy and teeth 2–5 mm long), wings are 16–18 mm long, the auricle is 1.4–1.8 mm long, and the claw is 8–9 mm long (not 20–24(–29) mm long, auricle 2.5–3 mm long, and claw 11–16 mm long), the keel is 15–17 mm long and the claw is 8–9 mm long (not 18–21(–26) mm long and claw 11–16 mm long). It is also similar to *A. angustiflorus*, but lower stipules are 17–22 mm long (not 10–14 mm long), calyx teeth are 8–9 mm long (not 5–7 mm long), claw of standard is 6–7 mm long (not c. 2 mm long), blades of wings are 8–9 mm long (not 11–16 mm long); seed dimensions are 3.5–4.1 × 2.1–2.5 mm (not c. 5 × 4 mm) (Tab. 1, Fig. 1, Fig. 2, Fig. 3, Fig. 4).

Discussion

The works titled “Revision von *Astragalus* L. sect. *Caprini* DC. (Leguminosae)” and “A taxonomic revision of the



Fig. 1. *Astragalus nallıhanicus* Hamzaoglu. A – habitat, B – habit, C – inflorescence and flowers, D – inflorescence and legumes.

Tab. 1. Comparison of diagnostic characters of *Astragalus nallihanicus* and related species.

Diagnostic characters	<i>A. nallihanicus</i>	<i>A. ovinus</i>	<i>A. fabaceus</i>	<i>A. angustiflorus</i>
Stipules	Adnate to petiole for 2–3 mm, lower ones 17–22 mm long	Adnate to petiole for (3–)5–7 mm, lower ones 8–10 mm long	Adnate to petiole for 2–3 mm, lower ones up to 17 mm long	Adnate to petiole for (1–)2–5 mm, lower ones 10–14 mm long
Leaves	Entirely glabrous	Glabrous or only lower surface hairy	Only rachis and lower surface hairy	Entirely glabrous or hairy
Petioles	2–6 cm long	7–17(–24) cm long	(3–)5–6(–9) cm long	(5–)8–11(–15) cm long
Racemes	9–12-flowered	3–8-flowered	6–10-flowered	4–15-flowered
Calyx	Tube glabrous, teeth 8–9 mm long	Tube glabrous, teeth 3–6 mm long	Tube hairy, teeth 2–5 mm long	Tube glabrous or hairy, teeth 5–7 mm long
Standard	19–22 mm long, claw 6–7 mm long	24–32 mm long, claw 8–9 mm long	21–31 mm long, claw 8–10 mm long	18–32 mm long, claw c. 2 mm long
Wings	16–18 mm long, blade 8–9 mm long, auricle 1.4–1.8 mm long, claw 8–9 mm long	21–27(–29) mm long, blade 11–13 mm long, auricle c. 1 mm long, claw 15–17 mm long	20–24(–29) mm long, blade 8–15 mm long, auricle 2.5–3 mm long, claw 12–16 mm long	16–22(–25) mm long, blade 11–16 mm long, auricle 1–1.5 mm long, claw 7–10 mm long
Keel	15–17 mm long, claw 8–9 mm long	19–25 mm, claw c. 15 mm long	18–21(–26) mm long, claw 11–16 mm long	14–18(20) mm long, claw 7–10 mm long
Style	Sparsely hairy at apex	Glabrous	Glabrous	Glabrous or hairy in basal part
Legumes	Hairy, 25–35 × 8.3–10.5 mm	Glabrous or rarely hairy, 25–45(–55) × 12–15(–20) mm	Glabrous or rarely hairy, (22–)25–40 × 10–12 mm	Hairy or rarely glabrous, 15–23(–35) × 6–10 mm
Seeds	3.5–4.1 × 2.1–2.5 mm	5–6.5 × 3–4 mm	5–6 × 4 mm	c. 5 × 3 mm

genus *Astragalus* L. (Leguminosae) in the Old World” prepared by Podlech (1988) and Podlech and Zarre (2013), are broadly based studies that include all the species of the



Fig. 2. Flower parts of *Astragalus nallihanicus*. A – calyx, B – standard, C – wings, D – keel, E – stamens, F – pistil. Scale bars: 3 mm.

section *Caprini*. In these studies, a total of 273 species belonging to the section were given. In addition, many sections are synonymous, including *Myobroma*. The moment *Astragalus nallihanicus* was seen for the first time, the most interesting aspect was that it was short-stemmed, had long stipules and short yellow petals. When compared with *A. ovinus*, *A. fabaceus* and *A. angustiflorus* specimens, *A. nallihanicus* was still most strikingly different from these species in the characters mentioned above (Tab. 1, Fig. 1, Fig. 2, Fig. 3, Fig. 4).



Fig. 3. Fruit and seed of *Astragalus nallihanicus*. A – long hairs on immature fruit, B – mature fruit, C – inside of mature fruit and septum, D – seed. Scale bars: B and C – 10 mm, D – 2 mm.

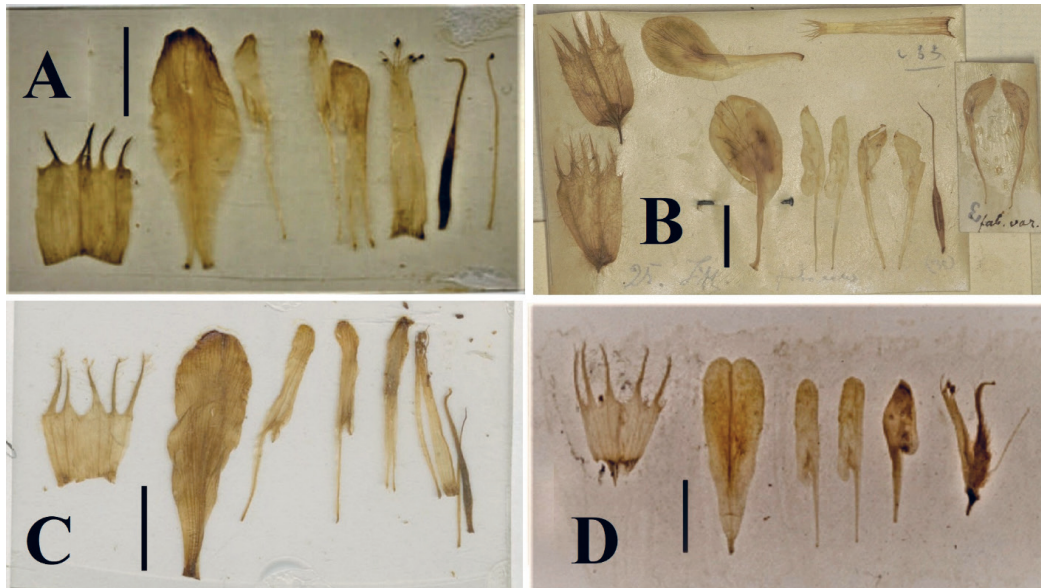


Fig. 4. Flower parts. A – *Astragalus ovinus* (Aucher-Eloy 1316, G00386166), B – *Astragalus fabaceus* (Kolenati 2342, P02915711), C – *Astragalus angustiflorus* subsp. *angustiflorus* (Aucher-Eloy 4467, P00609624), D – *Astragalus angustiflorus* subsp. *anatolicus* (Aucher-Eloy 1320, K000911370). Scale bars: 10 mm (The names of the flower parts are as given in Fig. 2).

***Astragalus nallihanicus* Hamzaoğlu, sp. nov.** (Fig. 1, Fig. 2, Fig. 3)

Type. Türkiye, Ankara, Nallihan, south of Karacasu village, the road to Uyuzsuyu Waterfall, 950 m a.s.l., pine forest clearing, 24 June 2022, Hamzaoğlu 7981 (**holotype** GAZI!, **isotypes** GAZI!, ANK!, HUB!).

Diagnosis. *Astragalus nallihanicus* is related to *A. ovinus*, *A. fabaceus*, and *A. angustiflorus*. It differs from *A. ovinus*, mainly by stipules adnate to petiole for 2–3 mm long (not adnate to petiole for (3–)5–7 mm), and lower ones 17–22 mm long (not 8–10 mm long); calyx teeth 8–9 mm long (not 3–6 mm long); standard 19–22 mm long (not 24–32 mm long); wings 16–18 mm long and claw 8–9 mm long (not 21–27(–29) mm long and claw 15–17 mm long); keel 15–17 mm long and claw 8–9 mm long (not 19–25 mm long and claw c. 15 mm long); legumes 8.3–10.5 mm wide (not 12–15(–20) mm wide). Also, it differs from *A. fabaceus*, mainly by calyx tube glabrous and teeth 8–9 mm long (not hairy and teeth 2–5 mm long); wings 16–18 mm long, auricle 1.4–1.8 mm long, and claw 8–9 mm long (not 20–24(–29) mm long, auricle 2.5–3 mm long, and claw 11–16 mm long); keel 15–17 mm long and claw 8–9 mm long (not 18–21(–26) mm long and claw 11–16 mm long). And also, it differs from *A. angustiflorus*, mainly by lower stipules 17–22 mm long (not 10–14 mm long); calyx teeth 8–9 mm long (not 5–7 mm long); claw of standard 6–7 mm long (not c. 2 mm long); blade of wings 8–9 mm long (not 11–16 mm long); seeds 3.5–4.1 × 2.1–2.5 mm (not c. 5 × 4 mm).

Description. Plants 15–35 cm tall, short caulescent. Rootstock up to 15 mm thick, slightly branched, subterranean stolons sometimes furnished with 4–6 mm, highly up connate stipules without leaves. Stems 5–12 cm, angular-sulcate, glabrous. Stipules whitish-membranous, adnate to

petiole for 2–3 mm, lower ones 17–22 mm, ovate-triangular, acute, upper ones 15–20 mm, narrowly triangular, glabrous. Leaves (10–)15–25(–32) cm, glabrous; petiole 2–6 cm, like rachis straw-colored, up to 3 mm thick. Leaflets in (8–)10–13(–15) pairs, green, remote, elliptic, (10–)13–26(–32) × (4–)7–12(–15) mm, rounded, minutely mucronulate, at base rounded, glabrous. Racemes with a peduncle 2.5–8.5 cm, 9–12-flowered, prostrate to ascending. Bracts white-membranous, 8–13(–16) × 2–3 mm, linear-triangular, at margins and apex with sparsely spreading 1–1.5 mm long simple hairy. Pedicels 3–5 mm, glabrous, sometimes slightly thickened in fruiting. Bracteoles absent. Calyx 15–17 mm, yellowish-green, glabrous, tubular; tube 7–8 mm long; teeth linear-subulate, 8–9 mm. Petals glabrous, yellow. Standard 19–22 mm; blade 13–15 × 8–10 mm, obovate, emarginate, gradually narrowed into claw; claw 6–7 mm long. Wings 16–18 mm long; blade oblong, rounded at apex, 8–9 × 2.7–3.2 mm; auricle ovate-orbicular, 1.4–1.8 mm long; claw 8–9 × 0.7–1.1 mm. Keel 15–17 mm long; blade oblique-triangular, obtuse, 7–8 × 3.7–4.3 mm; auricle 0.7–0.9 mm long; claw 8–9 × 1.1–1.6 mm. Stamens 15–16 mm long; tube 13–14 mm long, obliquely cut at mouth. Pistil 16–20 mm long; ovary sessile, 8–11 mm long, ellipsoid, loosely white, long, hairy; style 8–9 mm long, sparsely long hairy at apex. Legume sessile, oblong-cylindrical, 25–35 × 8.3–10.5 mm, keeled, with indistinct nerve ventrally, widely rounded to flattened, more rarely shallowly widely grooved dorsally, with a rigid, straight beak 4–6 mm long, incompletely bilocular (septum up to 2/3(–3/4) of fruit's height); valves coriaceous, rugulose to rugose, pale brownish, with loosely 2–3 mm long spreading white hairs. Seeds 3.5–4.1 × 2.1–2.5 mm, pale brownish.

Etymology. The type locality of the species, which is from Nallihan (Ankara, Türkiye), inspired the name of the new species.

Proposed vernacular name. Nallihan Geveni (Turkish), Nallihan Milkvetch (English).

Flowering time. June to July.

Distribution and habitat. Specimens of *Astragalus nallihanicus* were collected from the surroundings of south of Karacasu village. It is estimated that the species grows in pine forest openings of northwest of Nallihan, approximately between 850 and 1050 m a.s.l. It is probable that the species also grows in Göynük, Mudurnu, and Seben Districts (Bolu Province, Türkiye), but there are still no data about this. Consequently, at present, the species is an endemic of Türkiye and when the area of distribution is considered, it is an element of the Euro-Siberian phytogeographic region.

IUCN Conservation assessment. According to the existing data, *Astragalus nallihanicus* is a species only known from the type locality. Approximately 50 individuals having independent roots were counted in the type locality. The species grows in pine forest openings south of Karacasu village (Nallihan, Ankara). There are settlements and small agricultural areas in the close surroundings of the individuals belonging to the species. On the other hand, the locality is formed of rather dense pine forest and there is a very low probability of these areas becoming completely settled or devoted to agriculture in the future. There is also only a rather slight probability that domestic animals will be put out to pasture in the area due to the density of the pine forest. When the areas where the species could be grown are considered, it is estimated that *A. nallihanicus* showed a distribution on an area smaller than 100 km². When the existing or envisaged threats were evaluated together, with the species being known from only one location at present (area of life less than 10 km²) and the breadth of the area of distribution was calculated (less than 100 km²), it was decided that it would be suitable to propose the classification Vulnerable [VU: D2] for the extinction risk of the species (IUCN Standards and Petitions Committee 2019).

Additional specimens examined

***Astragalus ovinus*. Türkiye.** In Mte. Taurus, *Aucher-Eloy 1916* (K, K000911383!); In Mte Tauro, Reçu en 1837, *Aucher-Eloy 1316* (G, G00386165!); [Elâzığ], Bakker Maden, Majo in alpebus, 1852, *Noë 859* (G-BOIS, G00792962!); Hakkari: Zap gorge, 9 km from Hakkari to Van, 1200 m, 14.06.1966, *Davis 44932* (E, E00347578!); Adana: Saimbeyli, c. 1450 m a.s.l., black pine forest, 11.06.1976, *Akman 6104* (ANK!; E, E00347571!); Prov. Van: Dist. Gevas, Artos Dağ, 3150 m, 16.07.1954, *Davis 22776* (E, E00347577!); Kahramanmaraş: Engizek Mount, around Engizek neighbourhood, 1400–1500 m a.s.l., 15.06.1987, *Duman 3336* (GAZI!); Kahramanmaraş: Öksüz Mount, 1400–1500 m a.s.l., 14.07.1987, *Duman 3279* (GAZI!). **Iran.** Prov. Hamadan: Faghire prope Hamadan, *Sabeti 627* (W, W19730012154!); Kuh-e-Hamzeh arab, between Bijar and Hamadan, 01.07.1971, *Lamond 4347* (E, E00340415!); In arivis schistofis Mesgivon, 2400 ped. [732 m a.s.l.], 18.06.1862, *Kotschy 295* (W, W0025302!); prope Ssof et inter Ssof et Kohrud, 05.1859, *Bunge s.n.* (P,

P00607781!); Perse australe, in argillosis m. Kuh-Daëna, 14.07.1842, *Kotschy 643* (P, P00607766!); Seidabad, 10.06.1859, *Bunge s.n.* (P, P00607773!); Prov. Khamseh: Manjil to Zanjan, Tarom pass, c. 33 km from Tashvir, 02.06.1971, *Lamond 3598* (E, E00340416!); 48 km W.N.W. of Sanandaj towards Marivan, 17.05.1966, *Archibald 1960* (E, E00347572!). **Iraq.** Pl. allep. Kurd. moss; m. Gara [Kursts.], 07.1841, *Kotschy 417-A* (K, K000911410!); In summo jugo m. Gara Kurdist., 07.1841, *Kotschy 417-B* (P, P00607778!).

***Astragalus fabaceus*. Türkiye.** Malatya: Darende, Akçatoprak, 1000 m a.s.l., 26.05.2006, *Uzunhisarcıklı & Bilgili 2143* (GAZI!); Kars: 3–5 km E of Aralık, Aras valley, 850 m a.s.l., 26.05.1966, *Davis 43673* (E, E00347491!); Van: 2 km E of Hoşap, 2100 m a.s.l., 09.06.1966, *Davis 44562* (E, E00347488!); **Georgia.** Tiflis, *Kolenati 2342* (P, P02915711!); In montosis Georg. Cauc. Unio itiner., 1838, *Hohenacker s.n.* (G, G00792970!); **Iran.** Azerbaijan Garbi: ad urbem Khoi ad pagum Seichadzi, 06.1828, *Szovits 26* (P, P02915707!; G, G00792971!); Azerbaijan Sharoi: Moghan, Eyvaz village, c. 3 km SE Aslanduz, c. 250 m a.s.l., 22.05.1971, *Lamond 3204* (E, E00347492!); Moghan, 25 km S Alireza-Abad on road to Sarband, 200?250 m, 23.05.1971, *Lamond 3208* (E, E00347489!).

***Astragalus angustiflorus* subsp. *angustiflorus*. Türkiye.** Ağrı: NE slope of Ağrı Dağı, below Serdar Bulak, 1500 m a.s.l., 27.05.1966, *Davis 43695* (E, E00347417!); Bitlis: Ahlat, 1750 m a.s.l., 21.05.1966, *Davis 43391* (E, E00347416!); Hakkari: Nehil Çayı, 48?55 km from Hakkari to Yüksekova, 1600?1700 m a.s.l., 14.06.1966, *Davis 44907* (E, E00347411!); Mardin: Mardin, 09.06.1888, *Sintenis 976* (E, E00347406!); Mardin castle, 1200 m a.s.l., 20.05.1957, *Davis 28343 & Hedge* (E, E00347412!); Van: 5 km S of Bendimahi (Erciş-Van), 1750 m a.s.l., 03.06.1966, *Davis 44210* (E, E00347410!); **Azerbaijan.** In Armenia et Aderbidjan, *Aucher-Eloy 4412* (P, P00584412!); **Iran.** Prov. Bakhtiari: Bakhtiari, c. 2130 m a.s.l., 21.05.1890, *Sawyer 13161* (E, E00347415!); Prov. Khamseh: Manjil to Zanjan, south side of Tarom pass, c. 42 km from Tashvir, 02.06.1971, *Lamond 3615* (E, E00347399!); Esfahan: Ispahan, *Aucher-Eloy 4467* (P, P00609624!); Kordestan: c. 108 km from Zanjan on road to Bijar, 1700 m a.s.l., *Lamond 4319* (E, E00347403!); 16 km N of Husianabad between Sanandaj and Saqez, 2340 m a.s.l., 20.05.1966, *Archibald 2094* (E, E00347419!). ***Astragalus angustiflorus* subsp. *anatolicus*. Türkiye.** [Çanakkale]: İter trojanum, Renkoei [Erenköy], prope Dumbrek (Dümrek), 22.04.1883, *Sintenis 91* (E, E00347390!); Gallipoli [Gelibolu], Angadere, Biyick Yakajik Tepe Büyük Yakacık Tepe], 250 m a.s.l., 29.04.1923, *Ingoldby 29* (K, K000895539!); ibid., *Ingoldby 119* (K, K000895540!); Angadere, 22.–24.7.1923, *Ingoldby 443* (K, K000895541!); Gallipoli [Gelibolu], Kilia, 24.04.1924, *Durham 101* (K, K000895542!); İçel [Mersin]: Akardja bei Mersina, 750 m a.s.l., 15.05.1912, *Siehe 389* (E, E00347396!); Manisa: Mte. Sypilo Manisa Dağı], *Aucher-Eloy 1320* (P, P00584401!; G, G00386971!); In montibus Cariae, *Aucher-Eloy 1319* (G, G00386969!).

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