

Astragalus bahcesarayensis (Leguminosae-Papilionoideae), a new species of section *Alopecuroidei* DC. from Turkey

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Astragalus bahcesarayensis H. Akan, M. Fırat & M. Ekici (Leguminosae-Papilionoideae) from Turkey is described and illustrated. It is compared with *A. dipsaceus* Bunge and *A. panduratus* Bunge. The geographical distributions of the new species and related species are mapped. © 2008 The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2008, 156, 439–444.

ADDITIONAL KEYWORDS: *Alopecias* – Fabaceae – systematics – taxonomy.

INTRODUCTION

Astragalus L. (Leguminosae-Papilionoideae) is one of the largest genera of vascular plants, including nearly 2500 taxa (Maassoumi, 1998). It is also the largest genus in Turkey, with nearly 450 species in 62 sections (Chamberlain & Matthews, 1970; Davis, Milli & Kit, 1988; Özhatay, Kültür & Aksoy, 1994, 1999; Podlech, 1999a, 2001; Aytaç, 2000; Akan & Civelek, 2001; Ekici & Aytaç, 2001; Ergin & Kurt, 2002; Duman & Akan, 2003; Akan & Aytaç, 2004). About 48% of the Turkish species are endemic. The largest number of *Astragalus* species occur in the steppe regions of Turkey, where they show adaptation to the high mountain steppes.

Chamberlain & Matthews (1970) suggested that section *Alopecuroidei* DC. (= *Alopecias* Bunge) was in need of revision. The Turkish species in this section were revised by the first author (Akan, 2000), who recognized 21 species rather than the 22 suggested by Chamberlain & Matthews (1970).

The second author collected a specimen of *Astragalus* (*M.F.* 2948) around Karabel Pass, Bahçesaray (Van) in 2000, although it remained unidentified. The same plants were collected again in the following year by Akan (*HA* 2256) and Ekici, and identified using the

Flora of Turkey and the monograph of Becht (1978), when it was decided that the specimens belonged to section *Alopecuroidei*.

Section *Alopecuroidei* is closest to sections *Argeus* Boiss. and *Grammocalyx* Bunge. The members of *Alopecuroidei* are caulescent, the stipules are free from one another and from the petioles, and the calyx is not inflated in flower. In section *Grammocalyx*, the stipules are joined at the base and the calyx becomes inflated. In section *Argeus*, the stipules are adnate to the petiole. The present specimens are erect-caulescent, the inflorescence is many flowered, the calyx with simple white hairs is inflated in fruit, and the stipules are free. These are characteristics of section *Alopecuroidei*. After comparison with the apparently similar taxa *A. dipsaceus* Bunge and *A. panduratus* Bunge of section *Alopecuroidei*, it was concluded that the present specimens represent a hitherto undescribed species.

MATERIAL AND METHODS

Material was collected from Bahçesaray, Van (Turkey) between the years 2000 and 2004, and the specimens were deposited at GAZI, VANF, and Harran University, Biology Department, Şanlıurfa, Turkey. They were compared with material of allied taxa at ANK,

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BM, BRNM (photograph), CUM, K (photograph), G (photograph), GAZI, ISTE, ISTF, HUB, MSB (photograph), and OXF (photograph).

DISCUSSION

Astragalus bahcesarayensis resembles *A. dipsaceus*, another Turkish endemic. It is also similar to *A. panduratus*, as indicated by the key to section *Alopecuroidei* DC. in Turkey (Chamberlain & Matthews, 1970). However, according to Becht (1978), *A. panduratus* has leaflets that are densely hairy below but glabrous above. However, Akan (2000) found that the leaflets of *A. panduratus* were adpressed-pilose below and sparsely pilose above. In addition, according to the *Flora of Turkey*, *A. panduratus* has leaflets that are densely hairy below but glabrous above (Chamberlain & Matthews, 1970) (Table 1). However, in the key of Becht (1978), the new species keys out as *A. obtusifolius* DC. Nevertheless, there are many differences between *A. bahcesarayensis* and *A. obtusifolius*: for example, the length of the calyx teeth, calyx indumentum, and peduncle.

The location of the new taxon is in the far east of Turkey, and it was considered whether the new taxon might belong to a species already described from Iran or Iraq. The new species is closest to *A. foliosus* Podlech, Maassoumi & Ranjbar in Iran and *A. obtusifolius* DC. in Iraq. However, the new species differs from *A. foliosus* in having longer stipules (12–27 mm vs. 10–13 mm), a longer calyx (15–20 mm vs. 14–15 mm), and longer calyx teeth (4–9 mm vs. 2–3 mm). Moreover, the new species differs from *A. obtusifolius* in its shorter peduncle (0–0.2 cm vs. 3–5 cm) and the

absence of bracteoles. The species were compared with each other, and after a thorough study of the pertinent specimens and literature (Chamberlain & Matthews, 1970; Townsend & Guest, 1974; Becht, 1978; Maassoumi & Ranjbar, 1994, 1996; Podlech, 1999b; Ranjbar, Maassoumi & Podlech, 2002; Duman & Akan, 2003; Ranjbar & Karamian, 2003; Akan & Aytac, 2004), it was realized that the specimens represented a new species.

ASTRAGALUS BAHCESARAYENSIS H. AKAN, M. FIRAT & M. EKICI, SP. NOV.

Sectione *Alopecuroidei* DC. Pertinens. *A. dipsaceo* Bunge et *A. pandurato* Bunge similis sed ab *A. dipsaceo* foliolis 9–14-jugis (non-21–26) in paginis ambabus patenti-pilosis differt; ab *A. pandurato* foliolis 9–13-jugis (non-18–30), bracteis 7–14 mm (non-6–8 mm) longis distinguenda.

Type: Turkey. B9 Van: Bahcesaray, Karabel (Kirapit) pass, 3200–3400 m, stony places, 5.viii.2004, *M. Firat 4221* (holotype GAZI, isotypes E, W, MSB).

Description: Perennial herb. Stem 22–55 cm tall, covered with whitish, spreading, long simple hairs. Leaves 10–27 cm, petiole 1.5–7 cm, leaflets 9–14 pairs, elliptic, acute, 10–40 × 3–9 mm, densely spreading covered with hairs below, sparsely spreading hairs above. Stipules narrowly triangular, foliaceous, acuminate at apex, 12–27 mm long, spreading-pilose. Peduncles 0–20 mm. Inflorescence globose to oblong, 2.5–6 × 2–3.8 cm, with sessile flowers. Bracts linear, 7–14 mm, with dense spreading long hairs.

Table 1. Comparison of the diagnostic characteristics of *Astragalus bahcesarayensis* with those of its two closest allies

Characteristic	<i>A. bahcesarayensis</i>	<i>A. dipsaceus</i>	<i>A. panduratus</i>
Plant height	22–55 cm	50–70 cm	40–50 cm
Leaflets	Elliptic, 10–40 × 3–9 mm, densely spreading simple-pilose below, sparsely spreading-pilose above	Narrowly oblong-elliptic, 12–35 × 3–7 mm, glabrous above, simple-pilose below	Narrowly elliptic, 16–30 × 2–6 mm, obtuse, adpressed-pilose below, sparsely pilose above
Pairs of leaflets	9–14	21–26	18–30
Stipules	Narrowly triangular, 12–27 mm long, spreading-pilose	Lanceolate, 17–40 mm long, long-pilose	Narrowly triangular-lanceolate, 14–18 mm long, densely pilose
Calyx	Densely villous, 15–20 mm long, teeth triangular from base, linear (or subulate), 4–9 mm long	Densely pilose, 13–18 mm, teeth linear, 3–7 mm long	Densely pilose, 11–14 mm, teeth narrowly triangular, 2–4 mm long
Bracts	7–14 mm long, densely spreading long hairs	10–18 mm long, pilose	6–8 mm long, ciliate on margins
Standard	18–20 × 6–8 mm	17–22 × 7–9 mm	15–18 × 7–8 mm

KEY TO TURKISH SPECIES OF *ASTRAGALUS* SECTION *ALOPECUROIDEI*

- 1. Peduncles 3–10 cm, inflorescence globose
 - 2. Bracteoles present; calyx densely villousv.....*A. echinops*
 - 2. Bracteoles absent; calyx long-setose or ±glabrous
 - 3. Standard 25–35 mm; bracts 17–70 mm.....*A. macrocephalus*
 - 3. Standard c. 22 mm; bracts c. 10 mm.....*A. ajubensis*
- 1. Peduncles 0–3 cm, if more than 2 cm then inflorescence cylindrical
 - 4. Calyx 7–18 mm
 - 5. Leaflets hairy on both sides
 - 6. Leaflets 20–30-jugate.....*A. panduratus*
 - 6. Leaflets 9–14-jugate.....*A. bahcesarayensis*
 - 5. Leaflets glabrous on both sides or only hairy beneath
 - 7. Bracts 2–7 mm; bracteoles sometimes present
 - 8. Bracteoles present; leaflets glabrous.....*A. gymnalopecias*
 - 8. Bracteoles absent; leaflets adpressed-pilose below.....*A. ponticus*
 - 7. Bracts 7–40 mm; bracteoles absent
 - 9. Standard 23–30 mm; inflorescence lax, cylindrical
 - 10. Calyx teeth 11–13 mm; inflorescence with peduncles 1–3 cm.....*A. edmondii*
 - 10. Calyx teeth 5–6 mm; inflorescence sessile.....*A. bracteosus*
 - 9. Standard 16–25 mm; inflorescence globose to cylindrical, lax or dense
 - 11. Standard 16–18 mm; peduncles 2–3 cm.....*A. trichocalyx*
 - 11. Standard 18–23 mm; peduncles at most 2 cm, or inflorescence sessile
 - 12. Leaflets 8–12-jugate; calyx teeth c. 9 mm.....*A. stojanii*
 - 12. Leaflets (9–)14–31-jugate; calyx teeth 1–7 mm
 - 13. Inflorescence globose to ovoid, 1–1.2 times as long as broad
 - 14. Stipules c. 30 mm; bracts c. 20 mm.....*A. uhlwormianus*
 - 14. Stipules 8–25 mm; bracts 9–15 mm
 - 15. Leaflets adpressed-pilose below; calyx teeth 3–5 mm
 - 16. Plant 50–90 cm tall; leaves 19–36 cm long; stipule hairy.....*A. elatus*
 - 16. Plant 10–35 cm tall; leaves 6–18 cm long; stipule glabrose.....*A. aytatchii*
 - 15. Leaflets spreading-pilose below; calyx teeth 5–7 mm.....*A. dipsaceus*
 - 13. Inflorescence usually cylindrical at maturity, sometimes ±oblong when young, (1.15–)1.4–2.4 times as long as broad
 - 17. Calyx teeth 1–4 mm; calyx often tinged with purple
 - 18. Calyx tinged with purple; inflorescence lax, 10–25-flowered
 - 19. Leaflets 7–20 mm, simple-pilose below.....*A. erythrotaenius*
 - 19. Leaflets 25–50 mm, glabrous on both sides.....*A. ovabaghensis*
 - 18. Calyx not tinged with purple; inflorescence dense, 50–70-flowered.....
.....*A. maximus*
 - 17. Calyx teeth 4–9 mm; calyx not tinged with purple
 - 20. Leaflets glabrous, 13–20-jugate.....*A. oocephalus*
 - 20. Leaflets sparsely spreading-pilose below, 20–25-jugate.....*A. crinitus*
- 4. Calyx 20–25 mm
 - 21. Leaflets 12–24-jugate, adpressed-pilose on both sides or glabrous; standard 15–26 mm
 - 22. Leaflets narrowly elliptic, 10–50 × 4–19 mm, glabrous on both sides.....*A. oocephalus*
 - 22. Leaflets oblong-lanceolate, 12–30 × 4–8 mm, adpressed-pilose on both sides.....*A. ekicii*
 - 21. Leaflets 25–35-jugate, pilose below; standard 25–30 mm.....*A. decurrens*

As can be seen from Table 1, *A. bahcesarayensis* differs from *A. dipsaceus* Bunge by its leaflets that are spreading-pilose on both surfaces and the smaller number of leaflet pairs (9–14 vs. 21–26), and from *A. panduratus* Bunge by the longer bracts (7–14 mm vs. 6–8 mm) and smaller number of leaflet pairs (9–14 vs. 18–30).

Bracteoles absent. Calyx tubular to campanulate, densely long-villous, tube inflated in fruit, 15–20 mm (including teeth); teeth triangular from base, linear (or subulate), 4–9 mm, densely pilose. Petals yellow;

standard 18–20 × 6–8 mm, glabrous; wing 16–17 × 2–3 mm; keel 16–18 × 2–4 mm. Filaments 15–17 mm, glabrous; anthers yellow, dorsifixed. Ovary ovoid, 6–8 × 2–3 mm, densely white-villous, style 12–13 mm

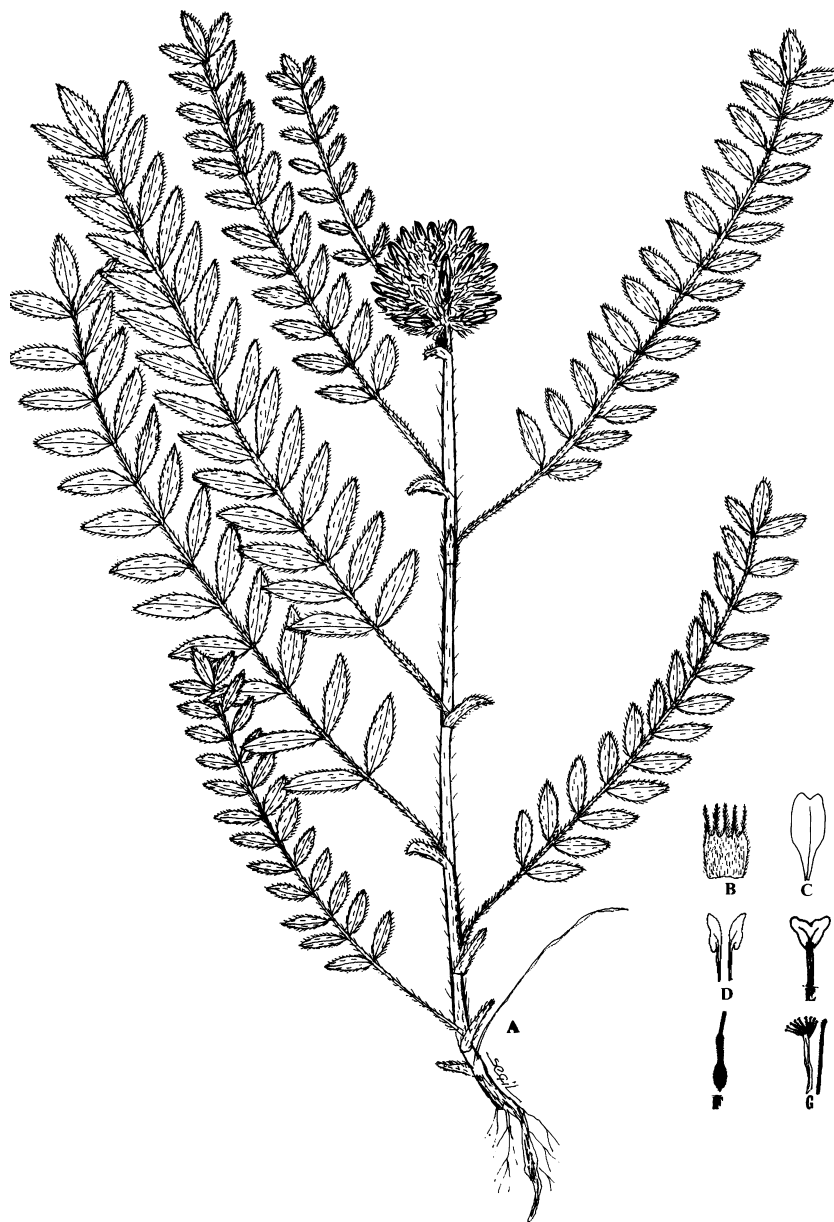


Figure 1. *Astragalus bahcesarayensis* (from holotype). A, habit; B, calyx; C, standard; D, wings; E, keel; F, stamen; G, ovary.

long, hairy at the base, stigma globose. Legume included within the calyx, ovoid-oblong, 8–10 × 5–6 mm, densely spreading-pilose. Seed ± reniform, smooth, brownish, 3–4 × 2–3 mm (Figs 1A–G, 2).

Phenology: Flowers and fruits between July and August.

Habitat: Stony and rocky places, steppe of high mountains; snow scree, 2500–3400 m.

Material examined (paratypes): Turkey. B9 Van: Bahcesaray, Karabel (Kirapit) pass, 3200 m, stony places, 22.vii.2000, M. Firat 2948 (VANF); *ibid.*, between Yukari Narlica and Karabel pass, 38°09.21'N, 43°00.45'E, 2500 m, stony slopes, 7.vi.2001, H. Akan 2256 & M. Ekici (GAZI, HRU).

Etymology: The plant was collected from Bahcesaray, town of Van, east Anatolia, and the species is named after the district.

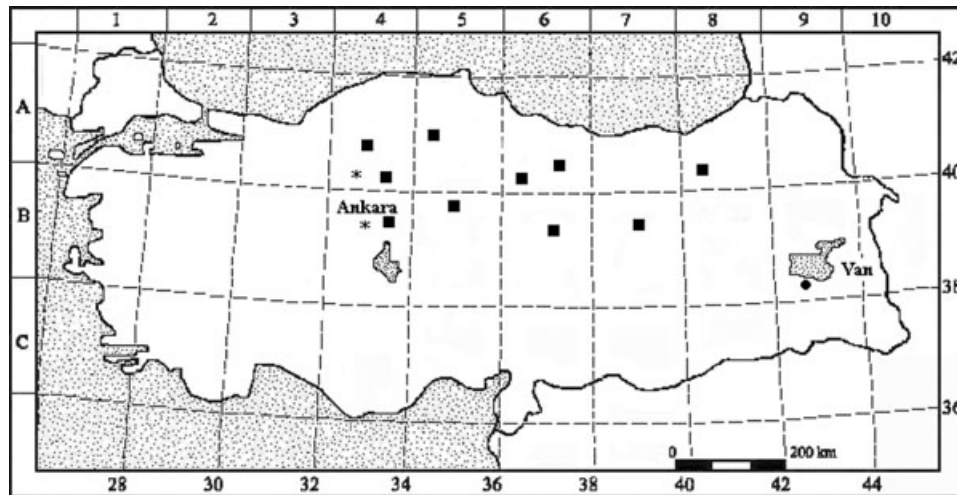


Figure 2. Distribution of *Astragalus bahcesarayensis* (●), *A. dipsaceus* (■), and *A. panduratus* (*) in Turkey.

Distribution and suggested conservation status: The new species is endemic to Turkey, more precisely to south-east Anatolia, and belongs to the Irano-Turanian element. It is known from Bahçesaray, from three localities, c. 2.5–3 acres in total area. The population is in good condition and more than 500 individuals are present in the distribution area. It should therefore be regarded as Endangered (EN) (Ekim *et al.*, 2000; IUCN, 2001).

Ecology: This new species grows in high mountain steppes, rocky places, and slopes, associated with species such as *Anchonium elichrysofolium* (DC.) Boiss. ssp. *villosum* Cullen & Coode, *Erysimum alpestre* Kotschy ex Boiss., *Astragalus gymnalopecias* Rech. f., *Vicia cracca* L. ssp. *cracca*, *Lathyrus nivalis* Hand.-Mazz., *Potentilla speciosa* Willd. var. *speciosa*, *Ferula haussknechtii* Wolf ex Rech. f., *Valeriana dioscoridis* Sm., *Inula thabsoides* (Bieb. ex Willd.) Sprengel ssp. *australis* Grierson, *Erigeron caucasicus* Stev. ssp. *caucasicus*, *Tanacetum kotschyi* (Boiss.) Grierson, *Campanula bornmuelleri* Náb., *Campanula ledebouriana* Trautv., *Scutellaria orientalis* L. ssp. *virens* (Boiss. & Kotschy) Edmondson, *Lamium album* L., *Nepeta italica* L., *Nepeta transcaucasica* Grossh., *Thymus fallax* Fisch. & C. A. Mey., *Salvia candidissima* Vahl ssp. *candidissima*, *Euphorbia grisophylla* M.S. Khan, and *Allium anacoleum* Hand.-Mazz.

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REFERENCES

- Akan H.** 2000. The revision of the section *Alopecuroidei* DC. of the genus *Astragalus* L. (Leguminosae) of Turkey. Unpublished DPhil Thesis. Ankara: Gazi University.
- Akan H, Aytaç Z.** 2004. *Astragalus ovabaghensis* (Fabaceae), a new species from Turkey. *Annales Botanici Fennici* **41**: 209–212.
- Akan H, Civelek Ş.** 2001. *Astragalus aytatchii* (Fabaceae), a new species from Anatolia, Turkey. *Annales Botanici Fennici* **38**: 167–170.
- Aytaç Z.** 2000. *Astragalus* L. In: Güner A, Özhatay N, Ekim T, Başer KHC, eds. *Flora of Turkey and the East Aegean Islands*, 11 (Suppl. II). Edinburgh: Edinburgh University Press, 79–88.
- Becht R.** 1978. Revision der Sektion *Alopecuroidei* DC. der Gattung *Astragalus* L. *Phanerogamarum Monographiae*. **10**: 1–227.
- Chamberlain DF, Matthews VV.** 1970. *Astragalus* L. In: Davis PH, ed. *Flora of Turkey and the East Aegean Islands*, 3. Edinburgh: Edinburgh University Press, 49–254.
- Davis PH, Milli RR, Kit T, eds.** 1988. *Astragalus* L. In: *Flora of Turkey and the East Aegean Island*, 10 (Suppl. I). Edinburgh: Edinburgh University Press, 166–169.
- Duman H, Akan H.** 2003. New species of *Astragalus* (sect. *Alopecuroidei*: Leguminosae) from Turkey. *Botanical Journal of the Linnean Society* **143**: 201–205.
- Ekici M, Aytaç Z.** 2001. *Astragalus dumanii* (Fabaceae), a new species from Anatolia, Turkey. *Annales Botanici Fennici* **38**: 167–170.

- Ekim T, Koyuncu M, Vural M, Duman H, Aytaç Z, Adıgüzel N. 2000.** *Red data book of Turkish plants (Pterodophyta and Spermatophyta)*. Ankara: Turkish Association for the Conservation of Nature and Van Centennial University.
- Ergin H, Kurt L. 2002.** *Astragalus duranii* (Fabaceae), a new species from central Anatolia, Turkey. *Annales Botanici Fennici* **38**: 89–91.
- IUCN. 2001.** *IUCN red list categories and criteria*. Gland: IUCN.
- Maassoumi AA. 1998.** *Astragalus L. in the world, check-list*. Tehran: Jahad-e Sazandgi Research Institute of Forest and Rangelands.
- Maassoumi AA, Ranjbar M. 1994.** Two new species of the genus *Astragalus* (Papilionaceae) from Iran. *Iranian Journal of Botany* **6**: 251–253.
- Maassoumi AA, Ranjbar M. 1996.** Notes on the genus *Astragalus* sect. *Alopecuroidei* DC. in Iran. *Iranian Journal of Botany* **7**: 39–43.
- Özhatay N, Kültür Ş, Aksoy N. 1994.** Check list of additional taxa to the Supplement Flora of Turkey. *Turkish Journal of Botany* **18**: 497–514.
- Özhatay N, Kültür Ş, Aksoy N. 1999.** Check list of additional taxa to the Supplement Flora of Turkey. *Turkish Journal of Botany* **23**: 155–156.
- Podlech D. 1999a.** New *Astragali* and *Oxytropis* from North Africa and Asia, including some new combinations and remarks on some species. *Sendtnera* **6**: 135–171.
- Podlech D. 1999b.** *Astragalus* section *Alopecuroidei* DC. K.H.Rechinger. *Flora Iranica* **174**: 131–148.
- Podlech D. 2001.** Contribution to the knowledge of the genus *Astragalus* L. (Leguminosae) VII–X. *Sendtnera* **7**: 163–201.
- Ranjbar M, Karamian R. 2003.** *Astragalus neo-assadianus* (Fabaceae), a new species in sect. *Alopecuroidei* from Iran. *Botanical Journal of the Linnean Society* **143**: 197–200.
- Ranjbar M, Maassoumi AA, Podlech D. 2002.** *Astragalus* sect. *Alopecuroidei* (Fabaceae) in Iran, complementary notes with a key to the species. *Willdenowia* **32**: 85–91.
- Townsend CC, Guest E. 1974.** *Astragalus* L. In: Townsend CC, Guest E, eds. *Flora of Iraq*, 3. Baghdad: Ministry of Agriculture and Agrarian Reform, 231–442.