



Hedysarum turcicum (Hedysareae, Fabaceae), a new species from Turkey

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Abstract

Hedysarum turcicum, a new species endemic to Inner Anatolia, Turkey, is described and illustrated. The new species belongs to sect. *Multicaulia* in *Hedysarum* (Fabaceae) and it is related to *H. elegans*, *H. cappadocicum*, and *H. persicum*. Its description, images, chorology, and ecology, are provided. The diagnostic morphological characteristics, as well as a full description, ecological characteristics, and distribution data are given.

Keywords: *Hedysarum*, new species, Yozgat, Inner Anatolia, Turkey

Introduction

The genus *Hedysarum* L. (1753: 745) is located in tribe Hedysareae DC. (Fabaceae) and it is the largest genus of the tribe. Other major genera of the tribe are *Onobrychis* Mill. (1754: 970) with 130 species and *Caragana* Fabr. (1763: 421) with 70 species (Lock 2005). *Hedysarum* comprises approximately 160 species that mostly occur north of the equator in temperate Eurasia, North Africa and North America (Hedge 1970a, Vassiljeva 1987, Fedtschenko 1948, Choi & Ohashi 2003). Together with this addition, in Turkey the genus is represented by 27 species, of which 14 are endemic, so that the endemism rate is about 51%. Most of these taxa prefer dry habitats such as steppe and rock (Hedge 1970a, Hedge 1970b, Davis *et al.* 1988, Ranjbar 2007, Ranjbar 2010, Dehshiri *et al.* 2012, Dehshiri 2013, Amirahmadi *et al.* 2014, Bidarlord *et al.* 2015, Başköse *et al.* 2018).

It is very difficult to determine the taxonomic boundaries of genus *Hedysarum* in the family (Liu *et al.* 2017). In the first published study (Linnaeus 1753), many taxa contained in *Hedysarum* were later transferred to 16 different genera such as *Onobrychis*, *Alhagi* Gagnebin (1755: 59), *Desmodium* Desv. (1813: 122), *Sulla* Medik. (1787: 372) (Choi & Ohashi 2003, Jarvis 2007). These transfers are the best indicator of how confused the genus. The classification of sections of the *Hedysarum* is also quite problematic. Until recently, it includes four sections: *Hedysarum*, *Membranacea* B.Fedtsch. (1902: 229), sect. *Stracheya* (Benth.) B.H.Choi & H.Ohashi (2003: 574), *Multicaulia* (Boiss.) B.Fedtsch. (1902: 260). Even, section *Multicaulia* consists of three subsections: *Multicaulia* B.H.Choi & H.Ohashi (2003: 574), *Crinifera* (Boiss.) B.H.Choi & H.Ohashi (2003: 574), and *Subacaulia* (Boiss.) B.H.Choi & H.Ohashi (2003: 574). Subsection *Subacaulia* can be easily distinguished from others by its acaulescent habit, i.e. having undeveloped stem internodes, and radical leaves (Fedtschenko 1948).

The most prominent character of the genus *Hedysarum* taxa is that they have unopened pod (lomentum) fruit. Furthermore, the other taxonomic characters in the genus are lifetime, whether the stems, the number of leaflets, hairiness of leaflets, shape of leaflets, scape length, flower condition, calyx tube/calyx tooth ratio, corolla/calyx ratio, standard size, standard/keel ratio, pod hair type, segment number and segment length (Hedge 1970a).

Material and methods

The specimens were collected from the marly steppe in Yazıkışla village of Boğazlıyan district (Turkey, Yozgat province) in June 2017. These specimens were extensively compared with the related literature, species [*Hedysarum elegans* Boiss. & A.Huet (1856: 37), *H. cappadocicum* Boiss. (1843: 87), and *H. persicum* Bidarlord, F.Ghahrem. & V.Mozaff. (2018: 295)] and with specimens at GAZI, HUB, and ANK herbaria (Hedge 1970a, Bidarlord *et al.* 2015). The vegetative parts were measured using a ruler with 0.5 mm precision. Photographs were taken with a Canon EOS 60D digital camera.

Taxonomic treatment

As a result of the evaluation of morphological data and examination of related samples, it was decided that the specimens collected from Yozgat belong to a new species for the science world. This species was named *Hedysarum turcicum*. *Hedysarum turcicum* located in subsection *Subacaulia* under section *Multicaulia* (Choi & Ohashi 2003).

Hedysarum turcicum Hamzaoglu & Koç, *sp. nov.* (Fig. 1).

Type:—TURKEY. B5 Yozgat: Boğazlıyan, around Yazıkışla village, marly steppe, 1280 m, 39° 04'N, 35° 27'E, 6 June 2017, Hamzaoglu and Koç 2942 (holotype GAZI!, isotypes GAZI!, ANK!, HUB!).

Diagnosis:—*Hedysarum turcicum* is related to *H. elegans* in inflorescence, calyx and corolla dimensions, and pod number of segments, but can be distinguished by bracts (5–6 mm long and ovate-lanceolate versus 8–15 mm long and linear-lanceolate), bracteoles (3.5–4.5 mm long versus (7–)8–11 mm long), corolla colour (white or sometimes very pale pinkish versus purplish), and width of keels (6–8 mm versus 4–5 mm) in *H. elegans* (Table 1).

Description:—Perennial; plant 4–12 cm high, vegetatively with appressed or subappressed white hairs. **Stems** absent or very short, unbranched, suberect or ascending, stout, cylindrical, grooved, arising from a woody rootstock, like whole plant densely subappressed sericeous from white hairs. **Stipules** greenish, straw-coloured or brownish, herbaceous-membranous, 5–7.5 × 2.5–3.5 mm, lower ones longer than upper, connate from base to middle, ovate-lanceolate, sericeous, persistent. **Leaves** imparipinnate, 4–8 cm long, with 1–2(–3) pairs of leaflets; leaflets, remote, densely appressed sericeous, flat, greenish-grey above, greyish below, more densely white hairy beneath than above, usually ovate-elliptic, suborbicular or obovate, mucronulate, rounded to acute at apex, 5–20 × 4–15 mm, up to twice as long as wide, petioles 1–3.5 cm long, always densely appressed sericeous. **Inflorescences** raceme, loosely, capitate or oblong, 2–3 flowers per cm, up to 5 cm long, 2–3 cm wide, rather dense at first, later elongating, 8–16-flowered; peduncles elongate, 3–10 cm long, longer than leaves (including raceme). **Bracts** ovate-lanceolate, 5–6 mm long, longer than pedicels, nearly 1/4 as long as calyx, hairy, persistent. **Bracteoles** 2, filiform, 3.5–4.5 mm long, longer than tube. **Pedicels** thin, very short, 1–3 mm long, much shorter than flowers, densely erecto-patent hairy. **Calyx** campanulate, 10–14 mm long, greenish, densely erecto-patent white hairy; tube 2.5–3.5 mm long; teeth subequal, 7.5–10.5 mm long, up to four times as long as tube, linear, inner side sparsely hairy. **Corolla** white or sometimes very pale pinkish at first, becoming greenish-yellow to brown when dry, almost two times longer than calyx; standard glabrous, 18–21 × 10–13 mm, longer than wings, with limb obovate, emarginated at apex, broadly attenuate at base; wings 10–13 × 4–5 mm, ligulate, rounded at apex, with oblanceolate limb, auricles 1.8–2.2 mm long; keel 18–20 × 6–8 mm, ca. as long as standard, limb triangular, curved beneath at an obtuse angle, obliquely truncate, with 4.5–6 mm long claw, auricles ca. 1 mm long. **Ovary** linear, with densely appressed hairs. **Pods** moniliform, 3(–4)-jointed; joints flattened, suborbicular, 4.5–5.5 × 3.5–4.5 mm, without transverse ribs, canescens, without short bristles.

Habitat and Ecology:—*Hedysarum turcicum* belongs to Irano-Turanian phytogeographic region and is an endemic species for Inner Anatolia according to the current distribution information (Fig. 2). The species prefers marly steppes from around 1200–1400 meters. In general, these areas are under the influence of arid summers and a cold climate in winter. For now, it is estimated that it has grown in approximately 4 km² only at the type locality. On the other hand; Boğazlıyan, Yenifakılı, Çayıralan districts in Yozgat province, and Felahiye, Özvatan, Sarioğlan districts in Kayseri province have similar climate and soil areas are common. The species is very likely to grow in these areas. Therefore, it was decided that it would be appropriate to collect more data to determine the threat category of the new species.

TABLE 1. Diagnostic morphological characters of *Hedysarum turcicum*, *H. elegans*, *H. cappadocicum*, and *H. persicum*.

Characters	<i>H. turcicum</i>	<i>H. elegans</i>	<i>H. cappadocicum</i>	<i>H. persicum</i>
Leaflets	1–2(–3) pairs	2–5 pairs	3–5 pairs	1–2 pairs
Inflorescence	loosely 2–3 flowers per cm	loosely 2–3 flowers per cm	densely 3–4 flowers per cm	densely 3–4 flowers per cm
Bract	5–6 mm long ovate-lanceolate	8–15 mm long linear-lanceolate	5 mm long linear-triangular	7–10 mm long linear-lanceolate
Bracteole	3.5–4.5 mm long	(7–)8–11 mm long	5.5–8 mm long	5–7 mm long
Calyx	11–13 mm long	9–12 mm long	(11–)15–17 mm long	11–15 mm long
Corolla colour	white or sometimes very pale pinkish	purplish	crimson, pink, purple or yellowish	rose (pink and violet)
Standard	18–21 mm long	20–25 mm long	12–17 mm long	12–16 mm long
Wing	10–13 × 4–5 mm auricles 1.8–2.2 mm long	12–15 × 3.5–4.2 mm auricles 1.5–1.8 mm long	6–9 × 2.8–3.2 mm auricles 1.4–1.6 mm long	6–7 × 2.2–2.4 mm auricles 1–1.5 mm long
Keel	18–20 × 6–8 mm	18–21 × 4–5 mm	12–15 × 6–7 mm	11–15 × 6–6.5 mm
Corolla/Calyx ratio	almost two times longer than calyx	almost two times longer than calyx	as long as or shorter than calyx	slightly longer than calyx
Pod joints	3(–4)-jointed	3(–4)-jointed	(1–)2–3-jointed	3-jointed

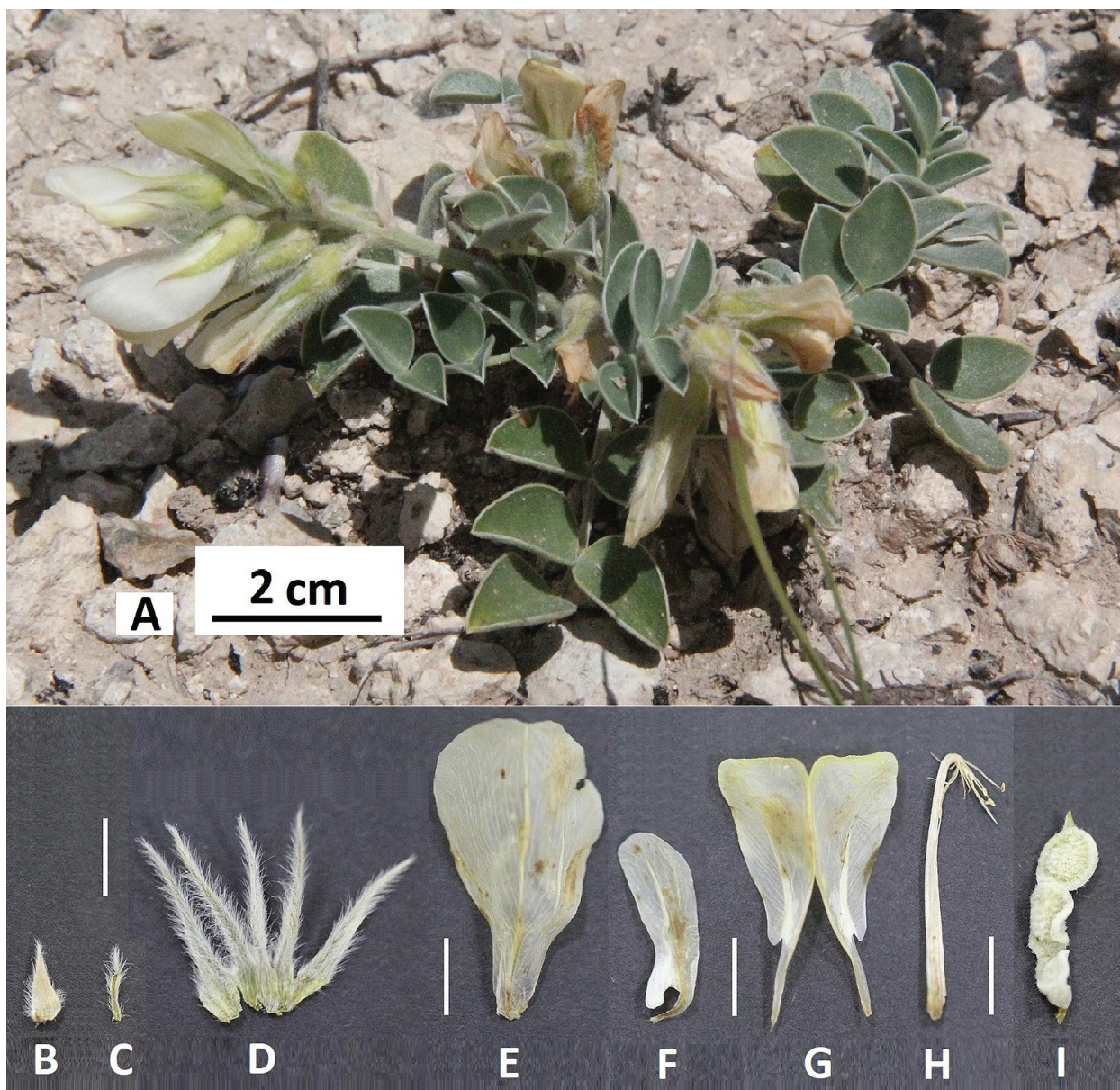


FIGURE 1. A. Habit, B. Bract, C. Bracteoles, D. Calyx, E. Standard, F. Wings, G. Keel, H. Stamens and ovary, I. Fruit (pod) (scale bar of B–I: 5 mm).

Phenology:—Flowering in May–June, and fruiting in July–August.

Proposed Turkish name for the new species:—Türk batabağı.

Specimens examined:—*Hedysarum elegans*: TURKEY. A9 Erzurum: Horasan district, ca. 1600 m, 13 June 1957, I.Hedge & P.H.Davis 29368 (ANK!); between Horasan and Karaorgan, ca. 1650 m, 7 July 1957, I.Hedge & P.H.Davis 30758 (ANK!); between Olur and Oltu, 2. km, ca. 1200 m, 13 June 2004, M.Vural 8910 (GAZI!); Olur district, Akdağ mountain, Cevizdere located, 1400 m, 26 May 1996, E.Kaya 9024 (GAZI!); *Hedysarum cappadocicum*: TURKEY. A3 Ankara: between Beypazarı and Nallıhan, 18 May 1973, Y.Akman 8863 (ANK!); B2 Kütahya: between Kütahya and Uşak, around Aslanapa, 1090 m, 24 June 2015, Hamzaoğlu & Koç 2008 (GAZI!); B3 Afyonkarahisar: Bolvadin, Emir mountain, 8 June 1987, Y.Akman 14489 (ANK!); Şuhut road, 15. km, 1100 m, 18 May 2001, E.Akçiçek 3540 (GAZI!); Eskişehir: Akbayır hill, ca. 1020 m, 2 July 1970, T.Ekim 550 (ANK!); Ankara: Polatlı, Acıkır, 750–850 m, 2 June 1982, U.Büyükkılınc, T.Ekim & Y.Akman 13354 (ANK!); between Polatlı and Sivrihisar, 18. km, Acıkır located, around Karaemin hill, 840–860 m, 4 June 1991, H.Duman & Z.Aytaç 3824 (GAZI!); B5 Nevşehir: Zelve, Akdağ, 1200–1350 m, 21 May 1989, Ü.Kol, N.Adıgüzel & M.Vural 4861 (GAZI!); *ibid.*, 1280–1500 m, 19 June 1989, Ü.Kol, N.Adıgüzel & M.Vural 5246 (GAZI!); B9 Van: Gevaş, Artos mountain, ca. 2500 m, 16 July 1954, P.H.Davis 22760 (ANK!); C4 Karaman: Ayrancı [on the label: Aksaray: Ereğli], around Böğecik village, 1100 m, 8 July 1995, L.Kurt & M.Vural 7307 (GAZI!).

Hedysarum turcicum is similar, and probably most closely related to *H. elegans* in terms of many morphological characters such as inflorescence, corolla, calyx/corolla ratio and segments number of pod. Also, it is similar to *H. cappadocicum* and *H. persicum* regarding characters such as habit, bract length, keel width, number of leaflets, and pod joints. The new species is separated from these three species concerning the shape of the bract, the length of the bracteole, the length of the wing auricle, and especially the corolla colour (Table 1).

When the distribution areas of these three species are examined, it is seen that both *H. turcicum* and *H. elegans* grows in the marly steppes while other two grows in the calcereous or gypseous steppes. However, they have fewer similarities in terms of morphological characters. According to distribution and morphological similarities, it can be said that *H. elegans*, which grew up in the northeast of Turkey, *H. turcicum* was vicariant of Inner Anatolia (Fig. 2). The identification key that can be used to distinguish *Hedysarum turcicum* from its close relatives and similar species is given below.

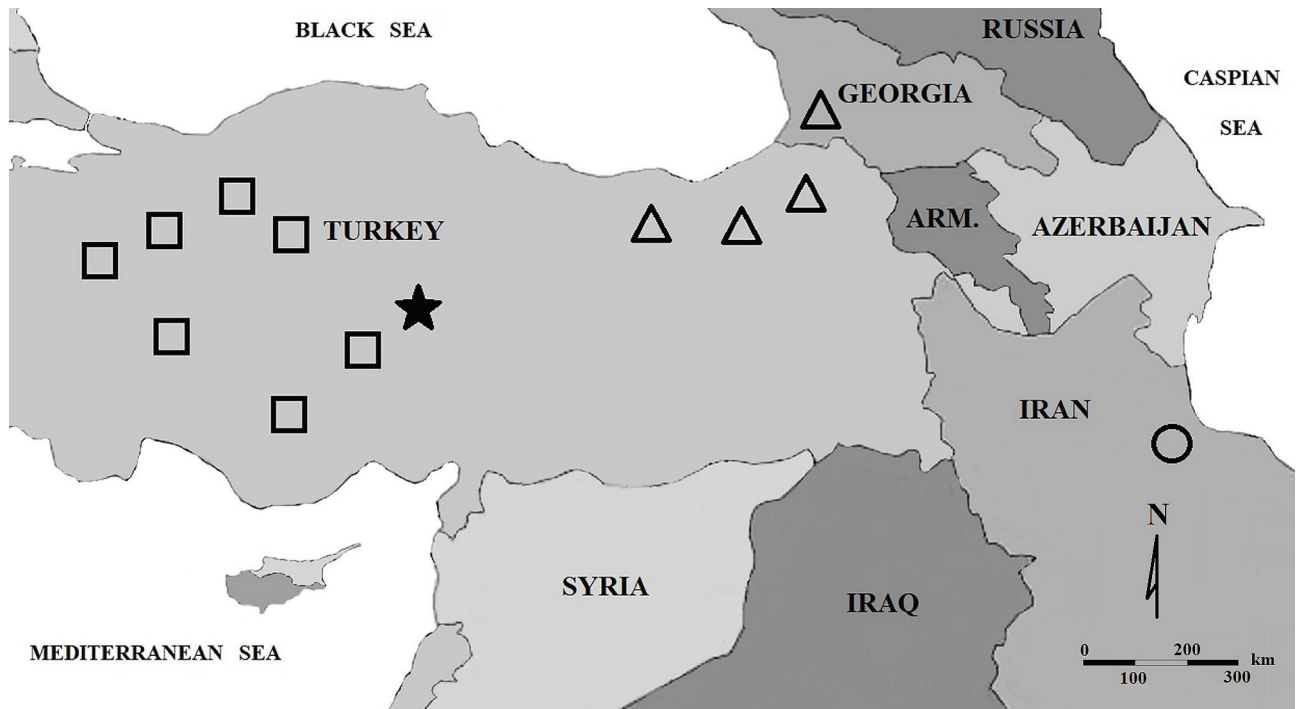


FIGURE 2. Distribution of *Hedysarum turcicum* (★), *H. elegans* (△), *H. cappadocicum* (□), and *H. persicum* (○).

An identification key of new species to most closely related taxa

- | | | |
|----|---|------------------------|
| 1. | Inflorescences loosely, 2–3 flowers per cm; standard 18–25 mm long; wing 10–15 × 3.5–5 mm, keel 18–21 mm long | 2 |
| 1. | Inflorescences densely, 3–4 flowers per cm; standard 12–17 mm long, wing 6–9 × 2.2–3.2 mm; keel 11–15 mm long | 3 |
| 2. | Bracts 5–6 mm long; bracteoles 3.5–4.5 mm long; corolla white or sometimes very pale pinkish | <i>H. turcicum</i> |
| 2. | Bracts 8–15 mm long; bracteoles (7–)8–11 mm long; corolla purplish | <i>H. elegans</i> |
| 3. | Leaflets 3–5 pairs; bracts 5 mm long; pods (1–)2–3-jointed | <i>H. cappadocicum</i> |
| 3. | Leaflets 1–2 pairs; bracts 7–10 mm long; pods 3-jointed | <i>H. persicum</i> |

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