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Reaearch Paper

A new species of *Astragalus* sect. *Malacothrix* from Northwestern Iran, with emendations on some species from other sections in Iran

Ali Asghar Maassoumi *
Professor, Botany Research Division, Research Institute of Forests & Rangelands, Agricultural Research, Education and Extension Organization (AREEO), Tehran, Iran
maassoumi@yahoo.com

Adel Ramezani
MSc, Mountain Environment Protection Society (MPES), No. 34, Darband, Tehran, Iran
adelramezani35@yahoo.com

Abstract
In this study, a new species, *Astragalus carbaatiae* Maassoumi & Ramezani, is described from Northwestern Iran, which belongs to *A.* sect. *Malacothrix*. The species is distinguished by unique morphological characteristics and ecological adaptation. It is known only from the type locality on moderately saline hills, and due to habitat threats such as grazing and land-use change, it is assessed as Critically Endangered (CR) under the IUCN criteria. In addition, taxonomic notes along with morphological emendations are provided for several other species from different sections of the genus *Astragalus* in Iran, based on recent field collections and herbarium studies.
Keywords: Fabaceae; Iran; new species; sect. *Malacothrix*; species description; taxonomy.

Introduction

The genus *Astragalus* L. (Fabaceae) is recognized as the largest genus of flowering plants, with over 3,000 species reported worldwide (Podlech & Zarre, 2013; Maassoumi et al., 2022). A major center of diversity has been identified in Iran, where this genus represents approximately 10.5% of the national flora (Ghahremaninejad et al., 2012; Maassoumi & Ashouri, 2022). Within this giant genus, A. sect. *Malacothrix* Bunge has been delineated to include species characterized by distinct morphological traits and ecological preferences. However, the monophyly of this section has been challenged by molecular phylogenetic analyses, which have underscored the need for further investigation to refine its taxonomic boundaries and elucidate interspecific relationships within the section and with related taxa in the Hypoglottis clade (Kazempour Osaloo et al., 2003; Bagheri et al., 2023). Recent botanical surveys in northwestern Iran have resulted in the collection of a previously undescribed species from the Hashtrood region in East Azerbaijan Province. Found on clay soils, this species appears closely allied to *A. eriopodus* Boiss., yet exhibits several distinguishing characteristics, including slender stems, narrower leaflets, short triangular stipules, and a distinctly elongated fruiting stipe. These morphological differences, combined with its unique ecological niche, justify its recognition as a new species. This paper provides a formal description of the new species *Astragalus carbaatiae* Maassoumi & Ramezani, together with taxonomic notes and morphological emendations for several additional species from other sections of the genus *Astragalus* in Iran. These findings contribute to a deeper understanding of the taxonomy and floristic diversity of *Astragalus* in Iran.

Materials and Methods

Field investigations were conducted in the Hashtrood region of East Azerbaijan Province, northwestern Iran, within the Irano-Turanian floristic region. The study area, located near Maryam village at an elevation of approximately 1920 m (36°56′N, 47°00′E), is characterized by clay soils and a semi-arid climate. Botanical surveys were carried out during the flowering season, and specimens of

*Corresponding author
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the newly encountered taxon were collected for morphological and taxonomic examination. Voucher specimens were prepared and are deposited in the herbarium of the Research Institute of Forests and Rangelands (TARI). Morphological assessments were performed on both freshly collected and herbarium-preserved materials. Key diagnostic characters, including stem thickness, leaflet shape, stipule form, and fruiting stipe length, were measured and compared with those of *A. eriopodus* using standard references such as Flora Iranica (Podlech et al., 2012) and Flora of Iran (Maassoumi, 2018). In addition, taxonomic notes and morphological emendations were developed for several other species from different sections of the genus *Astragalus*, based on recent field observations and re-examination of herbarium specimens housed at TARI and related collections.

Results and Discussion

Taxonomic Treatment

Astragalus carbaatiae Maassoumi & Ramezani, sp. nov. *A.* sect. *Malacothrix* (Figure. 1)

Diagnosis

Astragalus carbaatiae differs from *A. eriopodus* by having shorter stems (10–20 cm vs. 20–30 cm), narrower leaflets (8–10 × 4–5 mm vs. 6–23 × 4–8 mm), and significantly shorter stipules (ca. 4 mm vs. 8–18 mm). It also exhibits a longer and more distinct fruiting stipe (10–15 mm vs. 4–5 mm), a shorter calyx (8–9 mm vs. 11–13 mm), and a paler violet corolla, in contrast to the typically pink to violet flowers of *A. eriopodus*.

Description

Plant perennial, ca. 30–40 cm tall, much divided at the base, prostrate or subascendent. Stem ca. 10–20 cm long; vegetative parts covered with spreading basifixed hairs, 0.5–1.5 mm in length. Stipules triangular, ca. 4 mm long, shortly adnate to the petiole at the base, free from each other on the upper side, hairy. Leaves 8–10 cm long; petiole 2–3 cm long, covered with subappressed to spreading basifixed hairs; leaflets 6–8 pairs, elliptic to narrowly ovate, ca. 8–10 mm long and 4–5 mm wide, obtuse at the apex, both surfaces covered with appressed to spreading hairs. Peduncle 2–5 cm long, with spreading hairs; raceme many-flowered, flowers remote from one another; bracts narrowly triangular, ca. 3 mm long, with black and white spreading hairs; pedicels ca. 2 mm long, appressed hairy. Calyx tubular, ca. 8–9 mm long; teeth ca. 2 mm, with spreading black and white hairs. Corolla pale violet; standard ca. 15 mm long, rhomboid, ligulate toward the apex; wings and keel ca. 12 mm long. Ovary hairy, long stipitate. Pods ellipsoid to narrowly ovate, covered with long ascending hairs ca. 0.25 mm long, densely covered with both long spreading and very short hairs; stipe ca. 10–15 mm long, bilocular, carinate ventrally, sulcate dorsally. Seeds numerous.

Holotype: Iran, East Azerbaijan Province, Hashtrood, Charoymakh Towni toward Pir Sagha, Cheshmeh Maryam village, 1920 m, 36°56′N, 47°00′E, 29.05.2024, Ramezani 110831(TARI!).

Etymology: The species is named in honor of Yolanda Carbaat from the Netherlands, in recognition of her long-standing interest in and support for environmental NGOs.

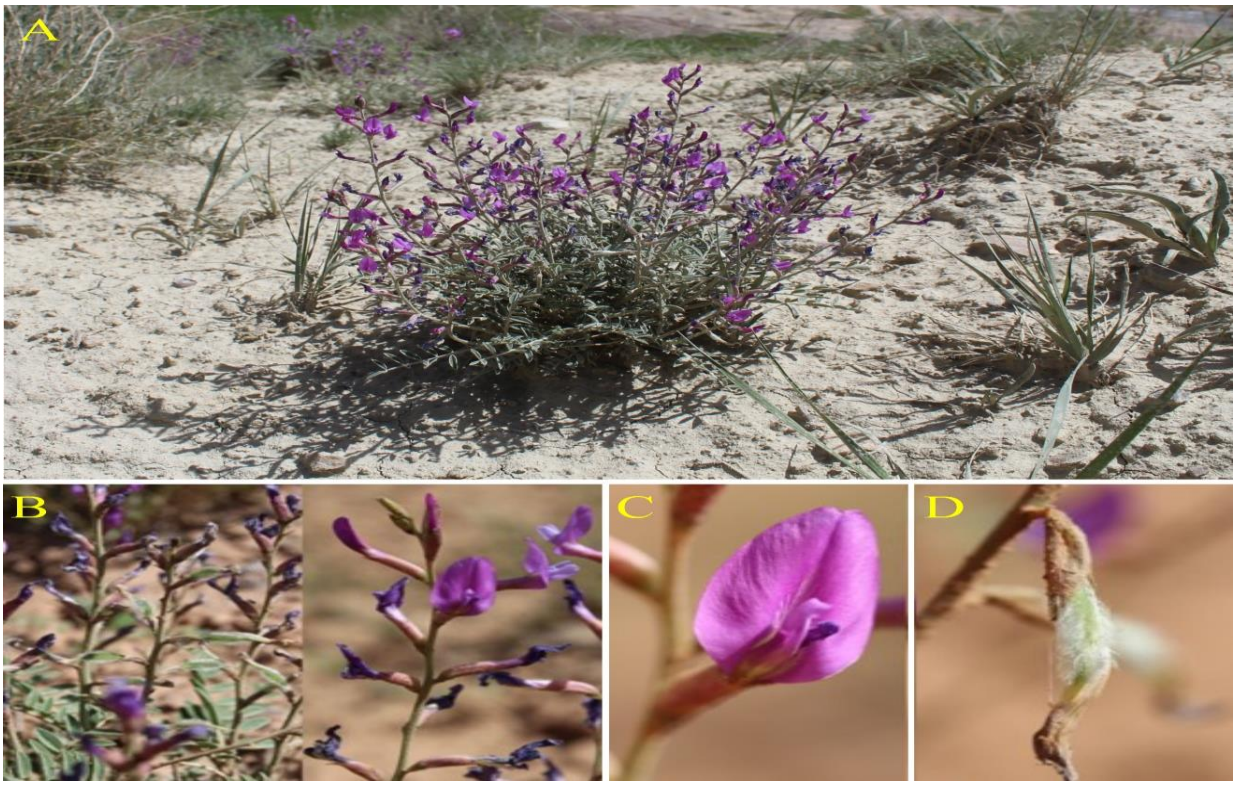

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Figure. 1. *Astragalus carbaatiae*. A. General view of the plant in its natural habitat; B. Inflorescence with developing and open flowers; C. Close-up of the standard petal; D. Deflexed pod with stipe. (photo by A. Ramezani).

Conservation status:

The species is currently known only from its type locality in East Azerbaijan Province, Iran (Figure. 2). The extent of occurrence (EOO) is estimated to be less than 100 km² and the area of occupancy (AOO) less than 10 km². It is represented by a single population restricted to moderately saline hills, where it constitutes a characteristic component of the vegetation. Field observations suggest that the habitat is exposed to intensive grazing, land-use change, mining development, and road construction, which together pose serious threats to the long-term persistence of the population. According to the IUCN Red List Categories and Criteria (IUCN Standards and Petitions Committee, 2022), the species is therefore classified as Critically Endangered (CR, B1ab(i,ii,iii)+2ab(i,ii,iii)).

Figure. 2. Distribution of *Astragalus carbaatiae* in Iran. The type locality is marked in Hashtrood, East Azerbaijan Province.

Taxonomic notes and emended descriptions

Among the 155 distinct sections recognized within *Astragalus* (Podlech & Zarre, 2013; Maassoumi et al., 2022), *A.* sect. *Ammodendron* Bunge is undoubtedly one of the most complicated sections in Southwest and Central Asia. It is considered a medium-sized section, comprising 81 species, 79 of which are narrowly distributed across the Asian continent (Maassoumi, 2023). Within Southwest Asia (primarily Iran and Afghanistan), 40 of the 52 species are endemic, while in Central Asia, 26 of the 29 species are confined to the region, highlighting it as a significant center of diversity and endemism. Approximately 15 species are shared with other parts of the Old World (Maassoumi & Ashouri, 2022). Species within this section are typically adapted to hot, arid desert environments and exhibit diverse growth forms ranging from small subshrubs to taller shrublets, often flowering from mid to late spring. However, taxonomic evaluations have been hindered by the poor quality of herbarium specimens, which often consist of young shoots from the current or preceding year, bearing only a few racemes, flowers, or pods. This lack of informative material is attributable to several factors: (a) During specimen collection, field botanists usually focus solely on the terminal shoots with flowers and fruits, neglecting to record critical details such as stem thickness, bark color and texture, or the morphology of older branches. As a result, herbarium labels lack essential diagnostic information, (b) due to overgrazing in desert habitats with limited forage, livestock tend to consume not only the current shoots but also older woody parts, leaving behind incomplete individuals that regenerate with atypical morphology. These regenerating parts are often collected and misrepresent the plant's true growth form. and (c) repeated handling of herbarium specimens by botanists causes further degradation, particularly of fragile structures such as racemes and pods, rendering the material unsuitable for detailed morphological analysis. This has led to discrepancies between descriptions in the literature and actual field observations, particularly in terms of plant size and habit. In light of these challenges, this study proposes emended descriptions for several *Astragalus* species in *A.* sect. *Ammodendron* and *A.* sect. *Dissitiflori* DC., including updated information on growth forms and distribution based on recent fieldwork and herbarium re-evaluation in Iran.

1. *Astragalus pseudoarvatensis* Podlech & Sytin, Willdenowia 33: 346 (2003). (Figure. 3)

Plant perennial, erect, shrubby, stout; caudices strongly branched, up to 100–130 cm tall. Old stems thick, ca. 15 cm in diameter, covered with dark brown, longitudinally splitting bark. Branches of the preceding year situated at the ends of main branches, ligneous, ca. 10 cm long, fairly stout, whitish gray. Branches of the current year ca. 10 cm long, slender, with short to long peduncles and lax racemes, covered with short grayish to silvery medifixed appressed hairs.

Specimen seen: Gorgan, Maraveh Tappeh, Khaled Naby historic cemetery, 08.04.2024, 800 m, A. Ramezani 110874 (TARI!).

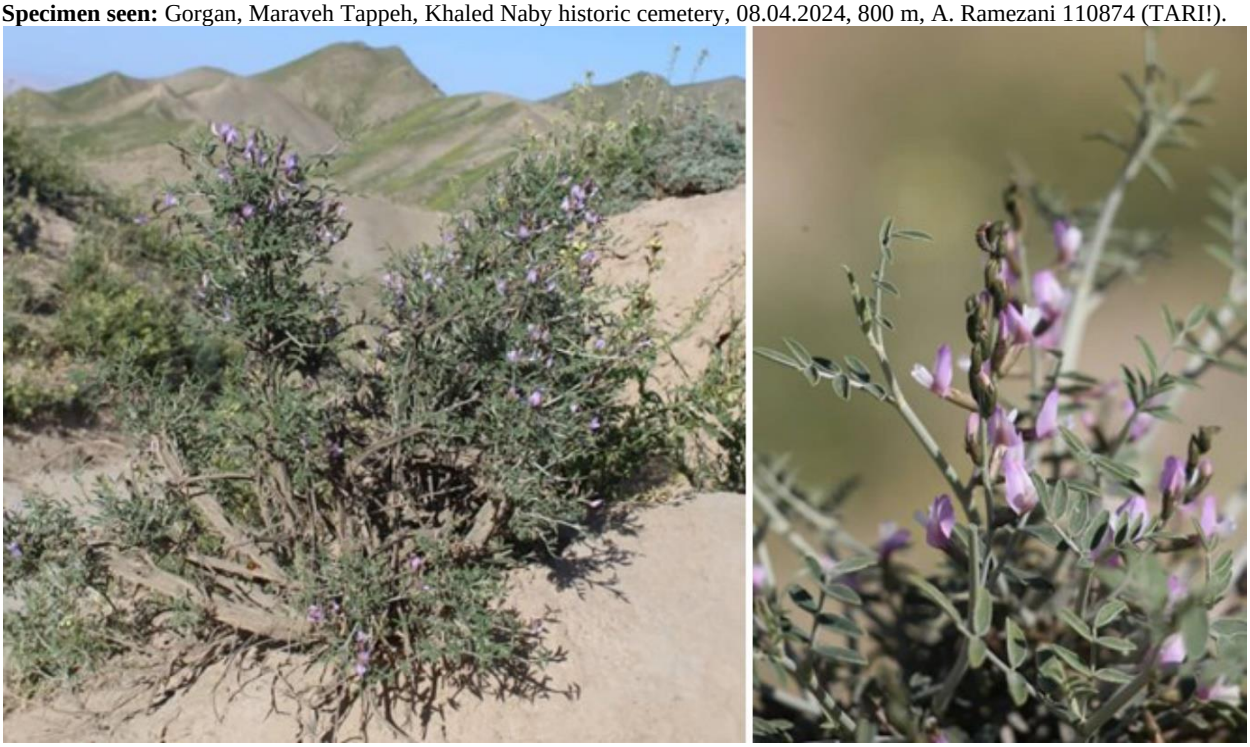

Figure. 3. Growth form of *Astragalus pseudoarvatensis* in its natural habitat, not reflected in the original description. (photo by A. Ramezani).

2. *Astragalus strictissimus* Podlech & Zarre, Willdenowia 33: 347 (2003). (Figure. 4)

According to Podlech & Zarre (2003), this species belongs to *A.* sect. *Ammodendron*, which was collected from the Azerbaijan area, beyond the normal distribution range of all known species of the section. However, due to its peculiar leaf characteristics and locality, it was considered to be placed in *A.* sect. *Onobrychoidei* DC. (Maassoumi, 2018). The species was recently recollected from the Gorgan area, near Khaled Naby cemetery by the second author (A. R). Based on this new collection, it can be concluded that the distribution range of this species extends from Azerbaijan to Gorgan.

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Figure.4. *Astragalus strictissimus* Podlech & Zarre, (photo by A. Ramezani).

3. *Astragalus kharvanensis* Ranjbar, Nordic Journal of Botany 24: 526 (2007). (Figure. 5)

Plant perennial, erect, shrubby, with a woody base; caudices branched at the base, up to 120 cm tall. Old stems thick, ca. 5 cm in diameter, covered with pale brown bark, longitudinally splitting. Branches of the preceding year situated at the ends of main branches, ligneous, ca. 50 cm long, fairly stout, whitish gray. Branches of the current year ca. 30 cm long, slender, with long peduncles and dense, lax, umbellate racemes. Young shoots covered with short, silvery, medifixed appressed hairs.

Figure. 5. *Astragalus kharvanensis* Ranjbar (photo by A. Ramezani)

4. *Astragalus juladakensis* Maassoumi, Iranian Journal of Botany13: 79 (2008). (Figure. 6)

Plant perennial, erect, shrubby, with a woody base; caudices divided at the base, up to 100 cm tall. Old stems thick, ca. 7 cm in diameter, covered with dark brown, longitudinally splitting bark. Branches of the preceding year situated at the ends of main branches, ligneous, ca. 60 cm long, fairly stout, whitish gray. Branches of the current year ca. 40 cm long, slender, with long peduncles and lax spike-like racemes. Young shoots covered with short gray to silvery medifixed appressed hairs.

Figure. 6. *Astragalus juladakensis* Maassoumi (photo by Sh. Kazempour)

5. *Astragalus viridis* Bunge, Mem. Acad. Imp. Sci. St. Petersbourg 11(16): 135 (1868) et l.c. 15(1): 231 (1869).

Plant perennial, erect, with a woody base; caudices divided at the base, up to 90 cm tall. Old stems thin, ca. 4 cm in diameter, with dark brown color, longitudinally splitting bark. Young branches situated at the ends of main stems, sub-ligneous, ca. 40 cm long, fairly stout, dark gray. Branches of the current year ca. 40 cm long, slender, with long peduncles and lax spike-like racemes. Young shoots covered with short gray medifixed appressed hairs.

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