

NOTES ON ASTRAGALUS SECT. AMMODENDRON (FABACEAE) IN IRAN

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Astragalus borujenensis Ranjbar & Maassoumi (*Fabaceae*) is described from Iran and illustrated in line drawings. It belongs in *Astragalus* sect. *Ammodendron* and resembles *A. podolobus*, from which it differs mainly in its stipe, color and type of pod indumentum and pod arrangement. Seed coat surfaces of *A. borujenensis* and *A. podolobus* are displayed in SEM photographs. Also *A. filifoliolatus* is transferred from *A. sect. Onobrychoidei* to *A. sect. Ammodendron*.

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یادداشت‌هایی در خصوص تاکسونومی بخش *Astragalus* sect. *Ammodendron* در ایران

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گونه *Astragalus borujenensis* از ایران به عنوان گونه جدید شرح داده شده و به تصویر کشیده می‌شود. این گونه متعلق به بخش *Ammodendron* و شبیه گونه *A. podolobus* است، اما با آن در پایک، رنگ، نوع کرک و آرایش نیام تفاوت دارد. تصویر SEM سطح دانه گونه‌های *Astragalus borujenensis* و *A. podolobus* نشان داده می‌شود. گونه *Astragalus filifoliolatus* از *A. sect. Onobrychoidei* به *A. sect. Ammodendron* منتقل می‌گردد.

Introduction

As the largest genus of vascular plants, *Astragalus* L. (*Fabaceae*) consists of 2500-3000 species (Lock & Simpson 1991; Yakovlev et al. 1996; Ranjbar & Karamian 2002) and more than 250 sections in the angiosperm family of *Fabaceae*. It is distributed mainly in arid and semiarid mountainous regions of the Northern Hemisphere and South America. The genus is especially diverse in southwest Asia (ca. 1000-1500 spp.). Bifurcate haired *Astragalus* were classified under subgen. *Cercidothrix* Bunge in the essential work of Bunge (1868-1869). This subgenus is containing 43 sections and 677 species. The sections are largely distributed in former Soviet Union, Middle East and West Asia (Maassoumi 1998). Like to the species with simple trichomes, those with bifurcating ones are distributed in many sections. Some of the sections are taxonomically very complex and contain numerous species such as *A. sect. Incani*, *A. sect. Ammodendron*,

A. sect. Dissitiflori and *A. sect. Onobrychoidei* and need to be thoroughly revised. In the course of the work on bifurcate haired, *Astragalus* species particularly of the *A. sect. Ammodendron* in Iran have been investigated (Rechinger et al. 1961; Podlech & Zarre 2003; Ghahremaninejad 2004; Ghahremaninejad 2005; Karamian & Ranjbar 2005). The first author collected some flowering and fruiting specimens of an *Astragalus* species during an excursion in May 2004 and determined the systematic status of them. After examining the specimens carefully, we concluded that they belong to *A. sect. Ammodendron*. The specimens were compared with data obtained from literature and the morphologically fairly similar species of *A. podolobus*, the only taxon of *A. sect. Ammodendron* in Iran, and which was collected from near the type locality by the first author. We came to the conclusion that our specimens represented a hitherto undescribed species.

Materials and methods

This study is mainly based on herbarium material. Several sheets have been examined for each species, received on loan from the following herbaria: Research Institute of Forests and Rangelands (TARI), Herbarium of Ferdowsi University of Mashhad (FUMH) and Esfahan, Herbarium of Research Centre of Natural Resources and Animal Affairs of Mashhad, Esfahan, Shiraz, Semnan, Tabriz, Kerman and Zahedan. Moreover, during several excursions in Iran, some of the species were studied in the field by authors.

The seed morphology of 5 Iranian species was examined in a Cambridge 360 scanning electron microscope. Most seeds were mounted as they came from the herbarium specimens. Some were soaked in a drop of water to try to remove the adherent outermost layer. But this treatment, made very little difference to the appearance of the seed under the SEM. The seeds were mounted on stubs using sticky tabs and sputter-coated with gold.

Astragalus borujenensis Ranjbar & Maassoumi, sp. nova. (Fig. 1).

Differt ab *A. podolobus* Boiss. vexillo 15–16 (nec 17–20) mm longo, leguminibus erectis (nec pendulis) pilis longissimis ad 4 (nec ad 3) mm longis, chrysinigri-pilosis (nec albi-pilosis), stipitibus 5–6 mm (nec 2–3.5 mm) longis.

Plants 30–50 cm tall. Caudex branched. Stem several, 10–25 cm long, erect to ascending, branched at the base, parts of the current year up to 20 cm long, slightly angular-sulcate, sometimes with very short, few-leaved brachyblasts in the axils of lower leaves, densely covered with \pm symmetrically to asymmetrically bifurcate, appressed, white hairs 0.5–0.7 mm long. Stipules hyaline membranous, 2–3 mm long, adnate to the petiole for up to 1–2 mm, behind the stem distinctly vaginate-connate, sometimes for the whole length, the free tips shortly triangular, glabrous or rarely sparsely with white hairs. Leaves 2–3 cm long; petiole up to 1 cm long, like the rachis slender, rather densely to sparsely hairy like the stem. Leaflets in 1–2 pairs, oblong-elliptic or narrowly obovate, 10–26 \times 3–4 mm, acute, on both sides nearly densely covered with appressed, symmetrically to asymmetrically bifurcate, white hairs 0.4–1 mm long. Peduncles 8–13 cm long, hairy like the stem but toward the raceme sometimes with some black hairs mixed with. Racemes 7–15 cm long, laxly 8–15-flowered, strongly elongated in fruit. Bracts hyaline-membranous, 1–1.5 mm long, narrowly

triangular, sparsely black hairy, at the margins sometimes also with basifixed hairs. Pedicels 1.5–2 mm long, predominantly black hairy. Calyx 6–6.1 mm long, tubular, nearly densely covered with predominantly short black and mixed with white, appressed, symmetrically to asymmetrically bifurcate hairs; teeth narrowly triangular to subulate, 0.5–0.6 mm long. Corolla blue, in dried state purplish-violet. Standard 15–16 mm long; blade 4–5 mm wide, oblong-elliptic, angularly narrowed into the short cuneate claw, at the apex widely rounded. Wings 14–14.5 mm long; blades oblong, rounded at the apex, 6–7 \times c. 1.5 mm; auricle indistinct. Keel 12–12.5 mm long; blades obliquely narrowly oblong-obovate, with straight lower edge and distinctly concave upper edge acutish at the apex, 6–6.5 \times 2 mm; auricle very short; claw 6–7 mm long. Stamen-tube obliquely cut at the mouth. Ovary with a stipe ca. 2 mm long, white hairy; style glabrous. Pods erect to ascending, oblong-elliptic, with a slender stipe 5–6 mm long, narrowly linear straight, 8–9 mm long, 3–5 mm thick, at the apex abruptly narrowed into a acuminate and recurved beak, 2–3 mm long, fully bilocular; valves straw-colored to pale brown, densely covered with very thin, asymmetrically bifurcate, villous and cream to light yellow hairs up to 4 mm long, curly subappressed black hairs 0.5–0.8 mm long. Seeds one in each locule, 2–3 \times 1.5–2 mm, dark brown. *Typus*. C Iran, Prov. Chaharmahal-e Bakhtiari, Borujen protected area, 1100 m, 30.5.2002, Ranjbar 7235 [holotypus BASUH (acronym for Bu-Ali-Sina University Herbarium, Hamadan); isotypus TARI]. –paratypus. C Iran, Prov. Chaharmahal-e Bakhtiari, Lordegan and Shahr-e kord bifurcate, 30.5.2005, Ranjbar 7189 (BASUH).

The specific epithet is named after the type-locality, “Borujen”, Prov. Chaharmahal-e Bakhtiari, Iran.

Revised position of *Astragalus filifoliolatus* Maassoumi

Astragalus filifoliolatus Maassoumi is an interesting species restricted to southwestern Iran. For its flower features it was described in *A. sect. Onobrychoidei* by Maassoumi (2005). The placement of *A. filifoliolatus* in *A. sect. Onobrychoidei* is doubtful; because of the laxe inflorescence and the (secondarily) glabrous pod the species is in our opinion much better placed in *A. sect. Ammodendron*. This species is closely related to *A. darrehbidensis* Podlech & Zarre in *A. sect. Ammodendron*, because glabrous ovary and pod.



Fig. 1. *Astragalus borujenensis*. – A: Habit (with fruit). – B: Calyx. – C: Standard. – D: Wings. – E: Keel. – F: Pod. Scale bar A = 2 cm, B–C and F = 0.6 cm, D–E = 1 cm.

Table 1. Morphological comparison of *Astragalus borujenensis* and *A. podolobus*.

Taxa	<i>A. podolobus</i>	<i>A. borujenensis</i>
Standard [length mm]	17–20	15–16
Color of pod hairs	villous, white hairs	villous, cream to light yellow with mixed short curly black hairs
Length of pod hairs [length mm]	up to 3	up to 4
Pod arrangement	pendulous	erect
Stipe of pod [length mm]	2–3.5	5–6

Taxonomic importance of testa micromorphology

The surface sculpturing of the seed of *Astragalus* has little been studied on the past especially in the Old World. The basic pattern of the seed testa in Iranian *Astragalus* species is remarkably heterogeneous particularly intersection. Variation arises from differences in both size and shape of the whole seed. The shape of the seed is reniform, ovoid, orbicular or square. Its color is light or dull brown. The shape of the seed in *A. sect. Ammodendron* is usually reniform. The surface of the seed is usually rough, which is only easily observable with the SEM. The results have shown micromorphological diversity, indicating some potential taxonomic value of these features. The seed surface in some species of *A. sect. Ammodendron* such as *A. macrobotrys* (Fig. 2A), *A. squarrosus* (Fig. 2B) and especially *A. podolobus* (Fig. 2C) which possess stiptiate pods resemble those of some species of *A. sect. Caraganella* such as *A. stocksii* (Fig. 2D) by having reticulate pattern. The seed coat surface of *A. borujenensis* has a special sculpturing as depth unevenly canaliculated with a densely rugose-striate pattern thickened arrangement (Figs. 2E and F). This species differs from all species of *A. sect. Ammodendron* in Iran by especial reticulate pattern of seed coat surface.

Taxonomical, ecological and distribution remarks

Astragalus borujenensis was seen in the field by the first author and known only from seven specimens deposited in BASUH. The new species occurs in the Bakhtiari province. It is endemic to W Iran and known only from two gatherings. It was collected from the dry-steppe and stony clay zone in southeastern of Sharekord. Two populations are in good condition and many specimens grow in the protected area. This new species is closely related to *A. podolobus*, especially because of the presence of similar habit and few leaflet pairs. However stipe, color and type of pod indumentum and pod arrangement in cited material are the most feature characterizing new species, which is

rather an isolated taxon within *A. sect. Ammodendron* (table 1).

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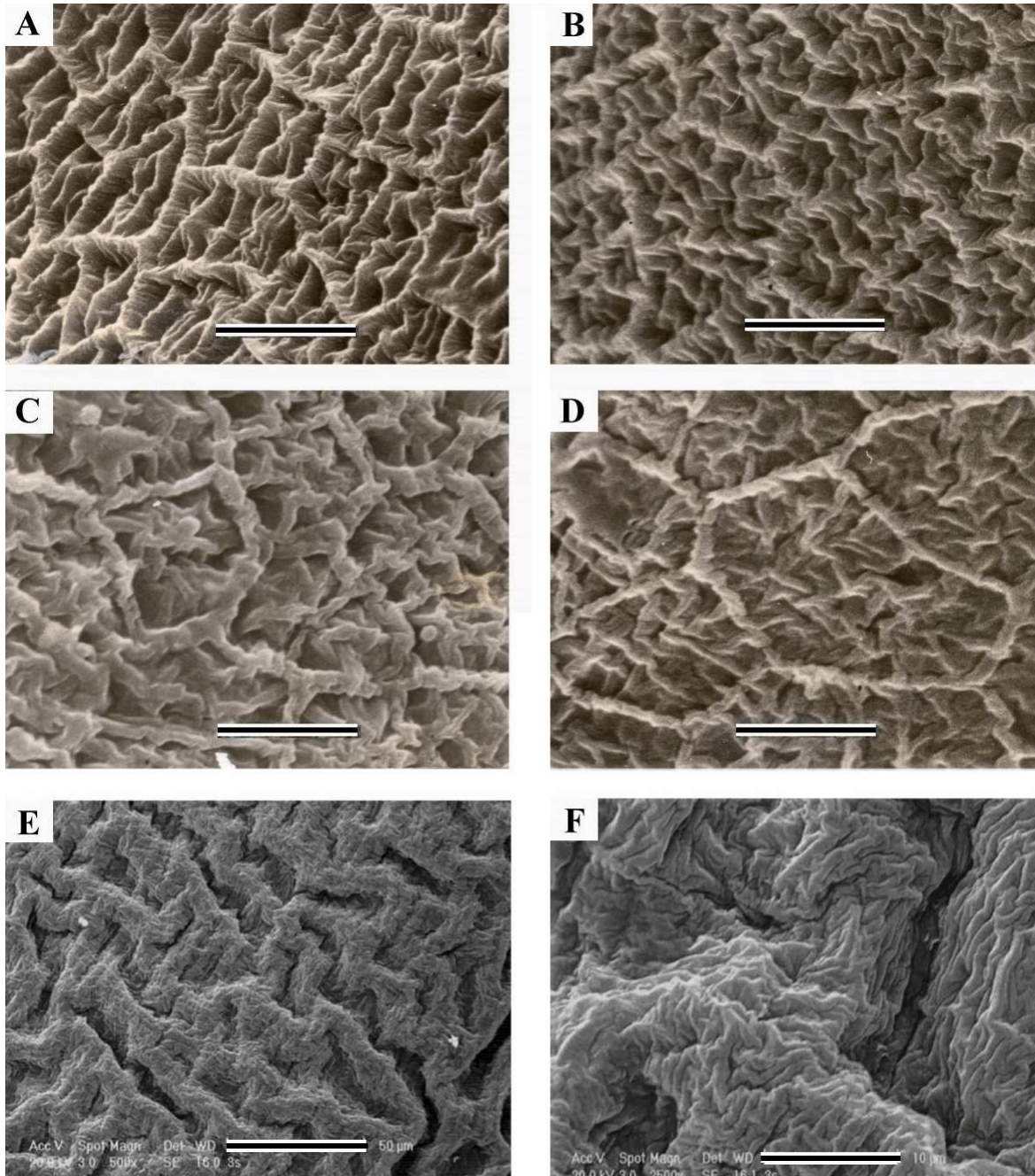


Fig. 2. SEM micrographs of *Astragalus* sect. *Ammodendron* seed coats: A: *A. macrobotrys* (Assadi & Ranjbar 4461), B: *A. squarrosus* (Ranjbar 3855), C: *A. podolobus* (Assadi & Ranjbar 4475), D: *A. stocksii* (Sandoghbaran s.n.), E and F: *A. borujenensis* (Ranjbar 7235). Scale; A–E = 50 μm; F = 10 μm.