

Description of *Astragalus barnasariformis* sp. nov. from Iran

توصیف گونه جدید *Astragalus barnasariformis* از ایران

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چکیده

گونه *Astragalus barnasariformis* از جنس گون (تیره باقلاییان) برای نخستین بار برای فلور ایران شرح داده می‌شود. این گونه انحصاری استان زنجان در شمال غرب ایران است. ویژگی‌های مورفولوژیکی قرار گرفتن این گونه را در بخش *Trachycercis* تایید می‌کند. دو گونه *A. barnasari* و *A. chalilovii* نزدیکترین گونه‌ها به گونه جدید هستند.

واژه‌های کلیدی: استان زنجان، تیره بقولات، زیرجنس سرسیدوتریکس، گونه انحصاری

Abstract

A new species of *Astragalus* is described: *Astragalus barnasariformis* sp. nov., Maassoumi, F. Ghahrem. & Bagheri. It is endemic to Zanjan province in northwestern Iran. Morphological evidence supports taxonomic placement of the new species in *Astragalus* sect. *Trachycercis*. The species appears to be most closely related to *A. barnasari* Grossh. and *A. chalilovii*.

Keywords: *Astragalus* subgen. *Cercidothrix*, endemic species, *Fabaceae*, *Leguminosae*, Zanjan province

Introduction

Astragalus L. (*Fabaceae*) with nearly 3000 species is probably the largest genus of flowering plants (Lock & Simpson 1991). Iran with 850 species represents a major biodiversity centre of the genus (Maassoumi 1998). Bifurcate hairy *Astragalus* species are located in subgen. *Cercidothrix* Bunge (Bunge 1868), which seems do not form a monophyletic group (Kazempour Osaloo *et al.* 2003, 2005). The subgenus in its old concept includes nearly 900 species in the Old World. It is characterized by perennial growth and presence of bifurcate hairs.

Among different sections assigned to this subgenus, sect. *Trachycercis* Bunge with about 77 species is characterized by caespitose form usually acaulescent, free stipules, short peduncles, few-flowered inflorescence, cylindrical or campanulate calyx, sessile and usually asymmetrical pod. In habit they resemble to sect. *Caprini* DC. Species of sect. *Trachycercis* are distributed mainly in China, Mongolia and Central Asia. In Iran there are about seven species of this section growing at altitudes between 900 and 3500 m (Ghahremaninejad 2004). One centre of diversity of this section is the Turkestanian and Mongolian floristic provinces (Takhtajan 1986) of the Irano-Turanian region. This section has four species. In this paper a new species of *Astragalus* sect. *Trachycercis* from Zanzan province (Iran), is described.

Astragalus barnasariformis Maassoumi, F. Ghahrem. & Bagheri, **sp. nov.** (Figs 1 & 2).

Typus: Iran, Zanzan province: 29 km on the road from Dandi to Tekab, 2500 m, 8 July 2009, Bagheri 8994 (Holo. TARI; Iso. FAR, TARI).

Similis *A. barnasari* Grossh. sed differt planta elatiore ca 20 cm longa (nec 3–6 cm), Stipulis 9–12 longis (nec 5–8 mm), foliis ca 8–17 cm (nec 5–8 mm), petiolis longis ca 4–8 cm (nec 0.5–2.5 cm), foliolis numerosis, 8–17 jugis (nec 8–9), Pedunculis ca 0.5–2 cm (nec sessilibus) dense sericeo pilosis (nec villosis).

Plants acaulescent, ca 20 cm tall, white bristelle to subrigid hairy. Stipules white-membranous, 9–15 mm long, narrowly triangular, adnate to the petiole for ca 3–5 mm, rather densely covered with asymmetrically bifurcate or at the margins basifixed, ascending hairs ca 1–1.5 mm long. Leaves 8–17 cm long; petiole 4–8 cm long, like the rachis loosely to rather densely covered with mostly asymmetrically bifurcate, ascending hairs 1–3 mm long. Leaflets in 8–13 pairs, elliptic or ovate, 8–15 × 3–8 mm, obtuse to subacute at the tip, on both

sides rather densely to densely covered with strongly asymmetrically bifurcate, subappressed to ascending hairs up to 2–3 mm long. Racemes 3–5 flowered. Peduncle ca 5–2 cm long, covered with spreading hairy. Bracts membranous or greenish, 8–12 mm long, narrowly triangular, sparsely hairy, at the margins with basifixed hairs up to 3 mm long. Calyx 9–15 mm long, tubular, obliquely cut at the mouth, rather densely covered with symmetrically to asymmetrically bifurcate, straight, ascending to spreading only white hairs 1–1.5 mm long; teeth narrowly triangular, 2–4 mm long. Petals yellowish. Standard 25 cm long; blade 8 mm wide, oblong-pandurate, emarginated at tip, below the middle distinctly constricted, at the base angularly passing in to the short, cuneate claw. Wings ca 18 mm long; blades narrowly oblong, at the apex sublaterally, obliquely notched, ca 13–3 mm long; auricle ca 1.5–2 mm long, claw 11–12 mm long. Keel 17 mm long; blades obliquely obovate, with widely curved lower edge and slightly concave upper edge, subacute at the tip, 7 × 3 mm; auricle short, claw 11–12 mm long. Ovary sessile, white hairy; style glabrous. Legumes sessile, obliquely oblong, ca 10 mm long, 3–4 mm high, ca 5 mm wide, with a beak ca 3 mm long; valves straw-colored, densely covered with strongly asymmetrically bifurcate, ascending straight hairs 1–2 mm long.

This endemic species has been known only from the type localities. Recently the type specimen is collected from Zanzan province, Iran.

Morphologically, the closest relative of this species are *A. barnasari* Grossh and *A. chalilovii* Grossh.; but the new species differs from these species in having longer habit (up to 20 not 3–6 cm long), longer stipules (9–15 not 5–10 mm long), longer leaves (8–17 not 5–8 cm long), longer petioles (4–8 cm long not 0.05–2.5 cm long), more leaflets (8–13 not 8–9 pairs), longer peduncle (0.05–2 cm not nearly sessile), sericeous calyx (not villosous).



Fig. 1. Type locality of *A. barnasariformis* (●).



Fig. 2. Holotype of *Astragalus barnasariformis*.

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***Anthracoidea songorica* sp. nov. on *Carex songorica* from Iran**

توصیف گونه جدید *Anthracoidea songorica*، عامل سیاهک *Carex songorica* از ایران

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Abstract

A new *Anthracoidea* species, *A. songorica*, is described on *Carex songorica* (subgen. *Carex*, sect. *Paludosae*) from Iran.

Keywords: *Cyperaceae*, Golestan National Park, new species, smut fungi, *Ustilaginomycetes*

Introduction

The genus *Anthracoidea* Bref. is a natural group in the *Anthracoideaceae* (Denchev 1997) of the order *Ustilaginales*, parasitising members of *Cyperaceae* in *Carex*, *Carpha*, *Fuirena*, *Kobresia*, *Schoenus*, *Trichophorum* and *Uncinia* (Vánky 2002, Vánky & Salo 2011). Sori are formed around the ovaries as black, globose, agglutinated spore masses with powdery surface, when young covered by a silvery fungal membrane. Spores are formed singly, pigmented (dark-brown), usually ornamented with spines,

چکیده

گونه جدیدی از جنس *Anthracoidea* تحت نام *A. songorica* روی *Carex songorica* از زیرجنس *Carex* بخش *Paludosae* برای نخستین بار از ایران به جهان علم معرفی می‌شود. ضمن ارایه شرح و تصاویر میکروسکوپ نوری و الکترونی از گونه مورد بحث، کلید شناسایی برای گونه‌های *Anthracoidea* روی اعضای *Carex*, subgen. *Carex*, sect. *Carex* s. lat. ارایه می‌گردد.

واژه‌های کلیدی: پارک ملی گلستان، گونه جدید، قارچ‌های مولد سیاهک، *Cyperaceae*, *Ustilaginomycetes*

warts or granules, rarely smooth, often with internal swellings or light-refractive areas. Spore germination results in two-celled basidia forming one or more basidiospores on each cell (Kukkonen 1963, 1964). There are ca 100 *Anthracoidea* species known (Vánky 2012), most of them morphologically only slightly different “small species”, adapted to one or several host plant species belonging to the same or closely related sections (see Nannfeldt 1979, Vánky 1979), rarely to not closely related sections. A smut fungus that produces black sori around some ovaries in the inflorescence of *Carex songorica* (*Cyperaceae*, subgen. *Carex*, sect. *Paludosae*), possessing densely, prominently verrucose spores, was collected by the junior author in Iran, Golestan National Park in 1991. The fungus turned out to be a new species and is described here. No smut fungus was reported earlier on *Carex songorica* from Iran (see Ershad 2001, 2009). However, on this sedge, widespread in temperate Asia, four other smut fungi are known: 1. *Anthracoidea subinclusa* (Körn.) Bref., 2. *Farysia thuemenii* (A.A. Fisch. Waldh.) Nannf., 3. *Schizonella melanogramma* (DC.) J. Schröt. and 4. *Urocystis fischeri* Körn. ex G. Winter (see Vánky 2012). All are differing from the new Iranian smut fungus.

Materials and Methods

The specimen studied in this paper was collected on *Carex songorica*, in Iran, Golestan province, Gorgan, Golestan National Park, 22.7.1991, leg. M. Abbasi, HUV 21968, IRAN 11642-F.

Sorus and spore characteristics were studied using dried herbarium specimens. For light microscopy (LM) the spores were suspended in a small droplet of lactophenol, covered with a cover glass, gently heated to boiling point to rehydrate the spores and expel air bubbles from the preparation, and studied at 1000× magnification. For scanning electron microscopy (SEM), spores were placed on double-sided adhesive tape, mounted on a specimen stub, sputter-coated with gold-palladium, ca 20 nm, and examined in a SEM at 10 kV.

Results

A study of the morphology of the spores of *Anthracoidea* on *Carex songorica* and a comparison of it with *Anthracoidea* species on *Carex*, subgen. *Carex*, sect. *Carex* s. lat. (including sect. *Paludosae*, *Pseudocypereae* and *Vesicariae*), showed that the smut on *Carex songorica* differs from all known *Anthracoidea* species. It is described as:

Anthracoidea songorica Vánky, sp. nov.

MycoBank 563564

Typus in matrice *Carex songorica* Kar. & Kir., Iran, Golestan Prov., Gorgan, Golestan National Park, 37°38'32.5" N, 56°20'59.6" E, alt. 1100 m.s.m., 22 Jul. 1991, leg. M. Abbasi, holotypus HUV 21968, isotypus IRAN 11642-F.

Anthracoidea songorica distincta ab *A. lasiocarpa* B. Lindeb. ex Kukkonen [Ann. Bot. Soc. Zool.-Bot. Fenn. 'Vanamo' 34(3): 85, 1963] sporis atrioribus, crassitunicatis, prominenter magis verrucosis. Sporae in *A. lasiocarpa* 20–30 µm longae, flavidobrunneae, paries 1–2(–2.5) µm crassus, leniter verruculosus, imago obliqua sporae laevis. Idem in *A. songorica* sporae 19–27(–30) µm longae, atro-rubrobrunneae, paries 1–3.5(–5.5) µm crassus, prominenter dense verrucosus, imago sporae sinuata usque ad leniter serrulata.

Sori (Fig. 1) forming black, globose or ovoid, hard bodies in some ovaries in the inflorescence, powdery on the surface, 1.5–2.5 mm in diameter. Spores (Figs 2–4) globoid, broadly ellipsoidal, subpolyhedrally irregular, occasionally elongated, with a subacute or acute tip, 13.5–22.5 × 19–27(–30) µm, dark reddish brown; wall uneven, 1–3.5(–5.5) µm thick, thickest at the angles, no internal swellings, light refracting spots occasionally present, surface densely, prominently verrucose, spore profile wavy to finely serrulate. Spore germination unknown.

On *Cyperaceae*: *Carex* (subgen. *Carex*, sect. *Paludosae*), *C. songorica* Kar. & Kir. Known only from the type locality.

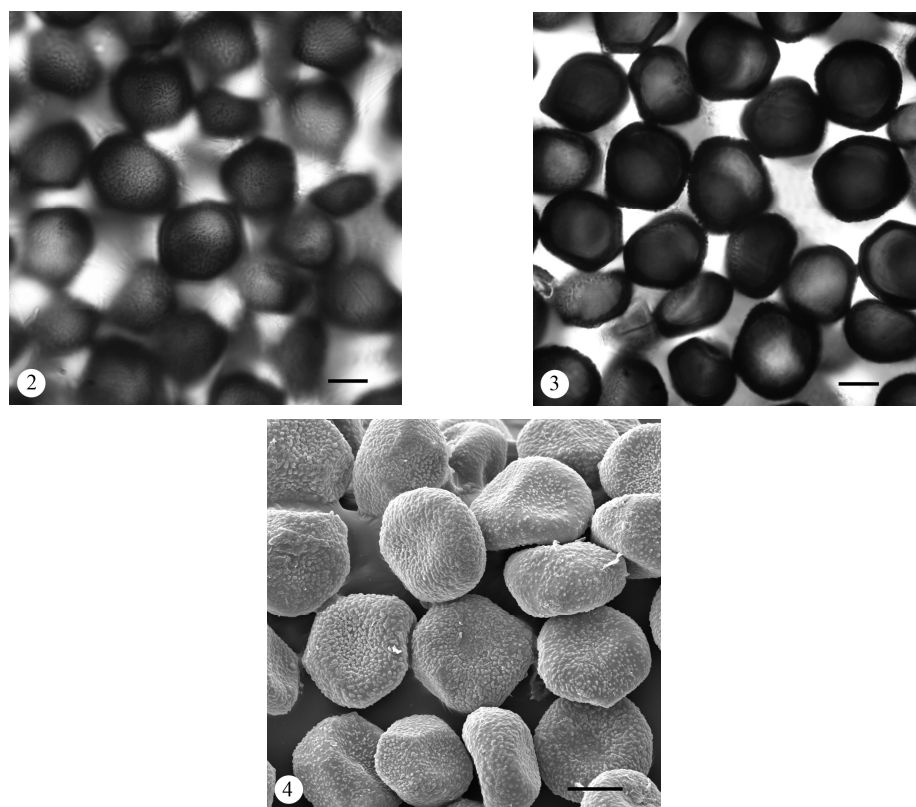
Discussion

On members of *Carex*, subgen. *Carex*, sect. *Carex* s. lat. (including sect. *Paludosae*, *Pseudocypereae* and *Vesicariae*) there are six *Anthracoidea* species known (Vánky 2012: 11). Of these, four species (*A. americana*, *A. inclusa*, *A. intercedens* and *A. subinclusa*) have echinate spores, and two (*A. angulata* and *A. lasiocarpa*) have verrucose spores. A comparison of *Anthracoidea songorica* with the last two species showed that in *A. lasiocarpa* B. Lindeb. ex Kukkonen (type on *Carex lasiocarpa* Ehrh., subgen. *Carex*, sect. *Carex*), the

spores are paler (yellowish to medium dark reddish-brown), the wall is thinner [$1-2(-2.5) \mu\text{m}$ thick], finely punctate-verruculose, the spore profile is smooth. In *A. angulata* (Syd.) Boidol & Poelt (type on *C. hirta* L., subgen. *Carex*, sect. *Carex*), the spores are smaller [$16-26(-28) \mu\text{m}$ long], angular to irregular, the wall is uneven, $1.5-5 \mu\text{m}$ thick, thickest at the angles, protuberances, light-refractive spots and internal swellings common.



Fig. 1. *Anthracoidea songorica* on *Carex songorica* (type): Sori in some ovaries of an inflorescence. Habit and enlarged two sori, a young, partly still covered by a silvery fungal membrane, showing between the ruptured utricle and a mature, black one. Below a healthy spikelet (Bars = 1 cm for habit and 2 mm for detail drawings).



Figs 2–4. *Anthracoidea songorica* on *Carex songorica* (type): Spores in LM and in SEM, showing the prominently, densely verrucose surface and the unevenly thick spore wall with undulate or finely serrulate spore profile (Bar = 10 μ m).

**Key to the species of *Anthracoidea* on *Carex*, subgen. *Carex*, sect *Carex* s. lat.
(incl. *Paludosae*, *Pseudocypereae* and *Vesicariae*)**

1. Spores verrucose 2
- Spores echinate 4
2. Spores 16–26(–28) μ m long, irregular; wall uneven, 1.5–5 μ m thick, protuberances, light-refractive spots and internal swellings common *A. angulata*
- Spores 20–30 μ m long, more regular; wall thin or thick, protuberances, light-refractive spots and internal swellings absent or uncommon 3
3. Spores dark reddish-brown; wall uneven, 1–3.5(–5.5) μ m thick, coarsely verrucose, spore profile wavy to finely serrulate *A. songorica*
- Spores yellowish or medium dark reddish-brown; wall 1–2(–2.5) μ m thick, finely punctate-verruculose, spore profile smooth *A. lasiocarpa*
4. Spores with 2–4 distinct internal swellings *A. americana*
- Spores without internal swellings 5
5. Spines only rarely exceeding 1.0 μ m in height, rather densely spaced; surface between the warts apparently smooth *A. inclusa*
- Spines higher, less densely spaced; surface between the warts not smooth 6
6. Spines stout, up to 2 μ m high, apically flattened, widely spaced and easily broken; surface between the warts distinctly striate rugulose *A. subinclusa*
- Spines up to 1.5 μ m high, more closely spaced, less easily broken; spore surface wrinkled between the spines *A. intercedens*

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