

Revision of *Astragalus* L.
sect. *Hemiphaca* Bunge (Leguminosae)
in Iran

by

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Summary:

A revision of the genus *Astragalus* L. sect. *Hemiphaca* Bunge in Iran is presented. It contains 9 species of which the following are described as new: *A. azizii*, *A. bashensis*, *A. facetus*, *A. minutulus*, *A. penetratus* and *A. regeatus*. The sect. *Brachylobium* Boiss. is put into synonymie of sect. *Hemiphaca*.

Introduction:

In the course of identification of the genus *Astragalus* based on the material in the two big Iranian herbaria (TARI and EVIN) several sections of this important genus were examined. During this work the taxonomically important characteristics of the Iranian species were compared with those of the already describes species of the section *Hemiphaca* and the related section *Brachylobium*.

Taxonomical characters

Within the section *Hemiphaca* the following characters are valuable for distinguishing the several species.

1. Stipules position.
Position and the different degree of pilosity are important. Two kinds of stipules are distinguished.
 - a) Stipules free: in this form the stipules are ± adnate to the petiole but in opposite face they are completely free from one another.

- b) Stipules joined: in this form the stipules are \pm adnate to the petiole but in opposite face they are \pm highly joined to each other and somewhat vaginate.
2. Leaflets: Number and shape of the leaflets are very important characters for separating the different taxa.
 3. Pilosity: The pilosity of different parts of the plant varies from one species to another. Beside of glabrous species there are two different kind of hairs ; namely spreading or patent hairs and appressed hairs. Also the colour of hairs, white or black mainly in the fruit is a good and constant character.
 4. Flower dissection: Floral parts of the different taxa deeply vary from one species to another. Three parts of the corolla provide us with constant characters.
 - a) Standard: The shape and the apical incision are the noteworthy characters.
 - b) Wing-petals: The relationship of the limb and claw, the shape of the limb, the apical incision and the length of the basal auricle are important.
 - c) Keel: The shape of the keel limb in the whole genus is one of the most important characters and usefull also in our species.
 5. Pods: Shape, dorsal groove, basal stipe, existance or not of an internal septum as well as density and colour of indumentum are always constant separating characters.

Taxonomical treatment

- Astragalus* L. sect. *Hemiphaca* Bunge, Mém. Acad. Impér. Sc. Saint Pétersbourg 11, 16: 20. 1868. Lectotypus: *A. hemiphaca* Kar. & Kir.
- = *Astragalus* L. sect. *Brachyglobium* Boiss., Fl.Or. 2: 210. 1872. Typus: *A. daenensis* Boiss.

Plants perennial, aculescent or with well developed stems. Stipules free from or very shortly adnate to the petiole, in opposite face free from one another or joined together. Inflorescences basal or lateral, borne on rather long peduncles, forming a dense spike or capitate. Calyx campanulate, the teeth shorter than tube. Corolla glabrous, violet or rarely whitish, standard mostly longer than wing-petals; the limb of wings usually emarginate at apex. Pods ovoid, shortly stipitate or sessile, unilocular or incompletely bilocular to fully bilocular.

Key to species

- 1a. Stipules free from one another 2
- 1b. Stipules joined to one another 3
- 2a. Leaflets 3-4 pairs, linear; fruit covered with short appressed hairs *A. penetratus* Maassoumi
- 2b. Leaflets 11-13 pairs elliptic or obovate; fruit covered with subpatent hairs *A. daenensis* Boiss.
- 3a. Fruit glabrous red spotted *A. zerdanus* Bge.
- 3b. Fruit covered with appressed or patent hairs 4
- 4a. Calyx covered with patent hairs
..... *A. minutulis* Maassoumi
- 4b. Calyx covered with appressed hairs 5
- 5a. Plant with developed stem, stem 25-30 cm long 6
- 5b. Plant stemless or with short stem, stem up to 5 cm long 7
- 6a. Fruit covered with white hairs
..... *A. facetus* Maassoumi & Podl.
- 6b. Fruit covered with black hairs
..... *A. regeatus* Maassoumi
- 7a. Fruit covered with white hairs
..... *A. minutissimus* Frey et Bornm.
- 7b. Fruit covered with black hairs 8
- 8a. Stipules glabrous *A. bashmensis* Maassoumi
- 8b. Stipules pilose, covered with black and white hairs .
..... *A. arizii* Maassoumi

1. *Astragalus azizii** Maassoumi, sp. nov.

differt ab *A. daenensis* Boiss. stipulis inter se connatis (nec liberis), folioliis 6-8 jugis (nec 11-13 jugis) ab *A. regestus* Maassoumi, statura humiliore, acaule (nec manifeste caulescentes) leguminibus minoribus ab *A. bashkensis* Maassoumi stipulis appresse pilosis (nec glabris), leguminibus majoribus 10-11 mm longis et pendulis (nec 6-7 mm longis et erectis).

Planta perennis, acaulis, 7-12 cm alta; caudex multiceps. Stipulae minutae 3 mm longae, appresse albi-nigri-pilosae, basi per 1,5 mm petiolo adnatae, inter se connatae. Folia 4-5 cm longa, petiolo 2 cm longo sicut rachis appresse albi-nigri-piloso. Foliola 7-9 juga anguste ovata 2-4 mm longa et 1-2 mm lata, apice acuta, supra marginam versus laxe et subtus dense appresse albo-pilosa. Inflorescentia solitaria, pedunculo (3-) 6-9 cm longo, sparse appresse albi-nigri-piloso; flores numerosi; pedicelli deflexi, dense appresse nigri-pilosi. Bractea minutae ca. 2 mm longae, nigri-pilosae. Calyx campanulatus 3,5-4 mm longus, dentibus ca. 1 mm longis, dense appresse nigripilosus. Corolla intense violacea (in vivo). Vexillum 8 mm longum, lamina obovata vel orbiculare, ca. 5 mm lata, apice emarginata, basi in unguem abrupte contracta. Alae 7,5 mm longae, lamina elliptica, apicem versus leviter dilatata, antice emarginata, basi auriculata, auricula ca. 1,5 mm longa, ungue lamina manifeste brevior. Carina 6,5 mm longa, lamina oblique elliptica, apice retundata, incisa, ungue laminae sequente. Ovarium dense appresse pilosum, stipite ca. 1,5 mm longo provisum. Legumen oblongum, deflexum, 12 mm longum et 4,5-5 mm altum dense appresse nigri-pilosum, apice rostratum, basi breviter stipitatum, ventre aplanatum vel breviter carinatum, dorso profunde sulcatum, uniloculare. Semina numerosa, reniformia, ca. 1 mm longa et lata.

Holotypus: Azarbayedjan, N. slope of Savaln, 3500-3800, 30.7.1987, A. JAVANSHIR 1260 (TARI; Iso: Herbarium of Agriculture college of University of Tabriz)

* Species named in the honour Prof. Aziz JAVANSHIR, ecologist, in University of Tabriz, Faculty of Agriculture, Tabriz, Iran.

2. *Astragalus daenensis* Boiss., Fl. Or. 2: 265. 1872.

Perennial, acaulescent, 7-12 cm tall, caudex divided. Stipules hairy ca. 2 mm long, at the base 0,5 mm adnate to the petiole and free from one another. Leaves 3-5 cm long, petiole 1,5-2,5 cm long, both petiole and rachis covered with short appressed hairs. Leaflets 11-13 pairs, elliptic or obovate, 5-6 mm long and 2 mm broad, on both sides with short appressed or subpatent hairs. Inflorescens a raceme in young with 10-15 flowers; peduncle 5-7 cm long covered with white appressed hairs in lower part, mixed with black hairs in upper part. Pedicels 0,5 mm long, covered with black hairs. Bracts short ovate, shorter than the pedicel, covered with black and white hairs. Calyx campanulate, covered with black hairs, ca. 4 mm long, teeth of the calyx 1/3 as long as the tube. Corolla violet, glabrous. Standard 7 mm long, the limb ovate, emarginate at apex, constricted near the claw. Wing-petals 7 mm long, the limb elliptic, round-tipped, at the base auriculate, slightly longer than the claw. Keel 6 mm long, the limb dark violet, curvate, slightly shorter than the claw. Ovary pilose sessile. Pods pendulous, 10 mm long ad 4 mm in diameter covered with white subpatent hairs, carinate ventrally straight or minutely sulcate dorsally, unilocular.

Specimens seen:

Esfahan: E. of Semiron, Kuh-e Aineh-Ghabri, 3000-3700 m, 9.8.1978 Assadi & Mozaffarian 31701.

Yazd: Deh-Bala, Shirkuh mt., 3700-4000 m, 21.6.1975, Foroughi & Assadi 17979, 17980; W. of Yazd, Tezerjan, Braf-Khaneh, 3350 m, 23.6.1975, Foroughi & Assadi 18019.

Kerman: Near the top of Kuh-e Khabr, 3500 m, 9.6.1977, Assadi & Miller 25211; S. slope of Kuh-e Khabr, 3500 m, 8.6.1977, Assadi & Miller 25157.

Fars: Kuh-e Dena, Gardaneh-e Bijan, 3000-3600 m, 2.8.1978, Assadi & Mozaffarian 31203, 31171; N. slope of Kuh-e Dena, near Ab-malakh, 2800-3600 m, 6.8.1978, Assadi & Mozaffarian 31450; Kuh-e Dena, Gardaneh-e Bijan, 3500-3900 m, 2.8.1978, Assadi & Mozaffarian 31257.

3. *Astragalus facetus* Maassoumi & Podl. spec. nov.

differt ab *A. multicaulis* Ledeb. stipulis pilosis nec marginem tantum ciliatis, foliolis utrinque pilosis et leguminibus pilosis.

Plantae perennes pilis basifixis brevissimis appressis albis in inflorescentiis insuper nigris immixtis dense obtectae. Caules nonnulli debiles elongati ad 25 cm alti internodiis foliis subaequilongis. Stipulae 3-4 mm longae, anguste triangulares actuae vel obtusiusculae extus pilosae, petiolo basi vix adnatae in facie opposito caulis ad medium inter se connatae. Folia 1,5-3 cm longa, petiolo brevissime suffulta sicut rachis dense piloso. Foliola 7-10 jugs, anguste elliptica apice rotundata, 2-5 mm longa et 0,7-2 mm lata, utrinque dense pilosa. Inflorescentiae in axillis foliorum superiorum pedunculo gracile 2-5 cm longo piloso suffultae, flores numerosi in racemas primo densiuscule deinde laxiuscule congesti. Bractea membranaceae 1-1,5 mm longae, anguste ovatae, pilosae. Flores brevissime pedicellati. Calyx 3-4 mm longus breviter tubulosus, appresse albi-nigri-pilosus, dentibus subulatis 1-1,5 mm longis. Corolla albida violacei-suffusa, glabra. Vexillum 7-9 mm longum, lamina elliptica 3-3,5 mm lata, apice rotundata, basi cuneatim angustata. Alae 6-8 mm longae lamina anguste oblonga, apice rotundata, ca. 4 mm longa et 1 mm lata basi breviter auriculata. Carina 5-6 mm long, lamina oblique oblongo-curvata 3 mm longa, breviter auriculata. Ovarium sessile, pilosum. Legumen sessile anguste ovatum basi cuneato-rotundatum apice acuminatum, ca. 7 mm longum, 3 mm altum et latum, semibiloculare, valvis tenuibus, appresse pilosis.

Holotypus: Iran, Esfahan, Borujen, Wastegan, 2280 m. 28.7. 1973, leg. M. R. RIAZI 10233 (TARI: Iso: Mb. Podl.).

4. *Astragalus minutulus* Maassoumi sp. nov.

differt ab *A. minutissimus* Freyn et Bornm. pedunculis foliis longioribus (nec brevioribus), calycibus dense patenter pilosis (nec appresse pilosis), ab *A. bashnensis* Maassoumi foliolis minoribus leguminibus dense patenter albi-pilosis (nec appresse nigri-pilosis), ab *A. zerdanus* Boiss. leguminibus pilosis (nec glabris, maculatis).

Perennis, breviter caulescens, caule ca. 3-4 cm longo, tenue appresse albi-piloso. Stipulae minutae 0,5-1 mm longae, pilosae, basi petiolo breviter adnatae, inter se connatae. Folia 7-15 mm longa, petiolo ca 2,5 mm longo, dense appresse albi-piloso. Foliola 6-7 jugs, minuta, 2 mm longa et 1 mm lata, supra in marginem versus laxe et subtus dense appresse pilosa. Inflorescentiae solitares, floribus 10-15. Bracteae pilosae 2 mm longae. Calyx campanulatus, 5-5,5 mm longus, dense patenter albi-nigri-pilosus, dentibus linearibus ca. 2 mm longis. Corolla glabra, violacea. Vexillum 7 mm longum, lamina elliptica, apice emarginata. Alae ca. 6-7

mm longae, lamina anguste elliptica, antice emarginata vel biloba. Carina 6 mm longa, lamina triangulare. Ovarium pilosum, sessile. Legumen ovoideum, 4,5-5 mm longum et 2,5 mm latum, patenter albi-pilosum, ventro dorsoque carinatum, uniloculare, oligospermum. Semina 2, reniformia 2,5 mm longa et 1,5 mm lata, atriviolacei-maculata.

Typus: Khorassan: Chenaran, Radkan, Gorou to Hezar Masjed 2500-2700 m. 19. Aug. 1977. Termez, Moussavi & Tehrani 36730 (Hol. Evin)

5. *Astragalus minutissimus* Freyn et Bornm. Bull. Herb. Boiss. 588. 1897.

Perennial, 1,5-5 cm tall, with a short stem, covered with short appressed hairs. Stipules ovate, pilose, at the base shortly adnate to the petiole and joined to one another. Leaves 1-3 cm long, petiole ca. 8 mm long. Leaflets 3-8 pairs, small, oblong-elliptic. Inflorescens capitata, 3-5 flowered, peduncle 5-15 mm long distinctly shorter than the leaves. Bracts ovate, pilose. Calyx campanulate, 3-3,5 mm long, covered with black and white appressed hairs, teeth of calyx linear 1/2 the length of the tube. Corolla violet. Standard 6,5 mm long, the limb ovate or rhomboid, emarginate at apex-ovary pilose. Pods sessile, densely covered with white hairs, 6 mm long and 3 mm high, carinate ventrally, straight or shortly sulcate dorsally.

Typus: Kerman: Kuh-e Hezar, 3000 m, Bornsdiller 3761 (n.v.)

6. *Astragalus penetratus* Haassouni sp. nov.

differt ab *A. zerdanus* Boiss. leguminibus pilosis (nec glabris maculatis), foliis linearibus (nec ovatis), ab *A. daenensis* Boiss. foliis 4 jugis (nec 6-10 jugis) inflorescentiis sessilibus (nec longe pedunculatis). Species rupestris ob vexillum, alas et carinam inter se aequantes insignis.

Planta rupicola, perennis, humilis, acaulis, ca. 3 cm alta. Caudex multiceps. Stipulae minutae, ovatae, dense appresse pilosae, basi petiolo sensim adnatae, inter se liberae. Folia 4 cm longa, petiolo 2-2,5 cm longo sicut rachis dense brevissime appresse piloso. Foliola 3-4 jugs, angusti-elliptica vel linearia, 7-10 mm longa et 2-3 mm lata, utrinque brevissime appresse pilosa. Inflorescentiae

radicales, subsessiles, 3-5 florum, pedunculo brevissimo. Bracteae minutae dense albi-appresse pilosae vel ciliatae. Pedicelli brevissimi deflexi, pilosi. Calyx 4 mm longus, campanulatus, dentibus 1/5 tubi attingentibus. Vexillum 6 mm longum, lamina obovata vel panduriforme, in parte medio leviter contracta. Alae 6 mm longae, lamina oblonga, ca. 3 mm longa, apice rotundata et dentibus minutis provisa. basi ca. 0,5 mm longe auriculata, ungue laminam sequente. Carina 6 mm longa, lamina oblongi-elliptica, curvata, apice acutiuscula, basi breviter auriculata, ungue laminam sequente. Ovarium pilosum, stipitatum. Legumen ovoideum, dense brevissime appresse pilosum, 3 mm longum et 2 mm altum latumque, basi stipite 0,5 mm longo provisum, ventre rotundatum, dorso sulcatum, semibiloculare, oligospermum.

Holotypus: Chaharnahal-e Bakhtiari: N. slope of Kuh-e Kal-lar, S. of Sibak, 2550-3200 m, 4.7.1986, Moraf-farian 57389 (TARI).

7. *Astragalus regeatus* Maassoumi sp. nov.

differt ab *A. facetus* Maassoumi & Podl. foliis apice angustatis (nec rotundatis), leguminibus basi distincte stipitatis (nec sessilibus), floribus majoribus.

Plantae perennes 23-28 cm altae. Caudex multiceps. Caulis nonnulli, brevissime appresse albi-pilosi, in inflorescentiis insuper pilis nigris immixtis. Internodia inferioria 1-2 cm longa, superiora 4-6 cm longo. Stipulae minutae anguste ovatae, 3 mm longae, glabrae vel sparse pilosae, basi leviter petiolo adnatae, inter se connatae. Folia 6-7 cm longa, petiolo ca. 1,5-2 cm longo. Foliola 9 juga, oblongi-elliptica, 8-10 mm longa et 3 mm lata, apicem versus attenuate, antice acutiuscula, basi cuneata, utrinque dense brevissime appresse pilosa. Inflorescentiae in axillis foliorum superiorum 12-14 florum, racemam laxiusculam formantes, pedunculo gracile 6-8 cm longo albi-nigripiloso suffultae. Bracteae ovatae, ca. 1 mm longae, brevissime appresse nigri-pilosae. Calyx 4-5 mm longus, breviter tubulosus dense brevissime nigri-pilosus, dentibus ca. 1 mm longis. Corolla violacea, glabra. Vexillum 9 mm longum, lamina oblongi-rhomboides, ca. 4 mm lata, apicem versus attenuata, antice insisa, basi in unguem angusta. Alae 8 mm longae, lamina oblonga, apice rotundata, vel leviter emarginata, basi auriculata, ungue dimidium laminae sequente. Carina 6 mm longa, lamina oblongi-curvata apice acutiuscula, basi leviter auriculata, ungue laminam sequente. Ovarium ovoideum, nigri-pilosum, basi stipite ca. 0,5 mm longo suffultum. Legumen breviter stipitatum, ovoideum, 5 mm longum et 1,5-2 mm altum nigri-pilosum.

Holotypus: Esfahan, Feridoun Shahr, Meydanak, protected station no. 38, 2500 m, 7.7.1983, M. Omidi 4333 (TARI).

8. *Astragalus bashmensis* Maassoumi, sp. nov.

differt ab *A. daenensis* Boiss. foliis 6-7 jugis (nec 11-13 jugis), leguminibus minoribus 5-6 mm longis (nec 10 mm longis), ab *A. zerdanus* Boiss. stipulis inter se connatis (nec libris), foliis supra appresse brevissime pilosis (nec glabris), leguminibus minoribus dense appresse nigri-pilosis (nec glabris).

Perennis, caulescens, caule abbreviato ca. 5-6 cm longo. Stipulae 1,5-2 mm longae, glabrae, basi petiolo breviter adnatae, inter se connatae. Folia 2-3 cm longa, petiolo ca. 1,5 cm longo cum rachis appresse albi-piloso. Foliola 6-7 jugs, elliptica vel ovata, 3-5 mm longa et 2-3 mm lata, utrinque appresse pilosa. Inflorescentiae axillares, multi-florae, pedunculo ca. 1-2 cm longo. Bractee minutae ca. 0,5-0,7 mm longae, nigri-pilosae vel glabrae. Calyx campanulatus, 3-4 mm longus, dense appresse nigri-pilosus, dentibus ca. 1 mm longis. Corolla glabra, violacea. Vexillum 7 mm longum, lamina elliptica vel ovata. Alae 6 mm longae, lamina anguste elliptica, apice rotundata vel leviter emarginata, basi auriculata, ungue lamina brevior. Carina 6 mm longa, lamina triangulari-curvata. Ovarium sessile, pilosum. Legumen ovoideum, basi brevissime stipitatum, 5-6 mm longum et 4 mm altum, apice breviter rostratum, dense appresse nigri-pilosum, ventre carinatum et dorso sulcatum, uniloculare. Semina 4, reniformia, 2 mm longa et 1 mm lata.

Holotypus: Semnan, Damghan, above Shahmirzad, Basha Kuh, 2500 m, 10.7.1959, Wendelbo 1335 (EVIN)

9. *Astragalus zerdanus* Boiss., Diagn. pl. or. ser. 1,2: 51. 1843.

Syn.: *A. confertifolius* Sirj. & Rech. f., Anz. math. nat. Kl. Österr. Akad. Wiss. 117: 1953.

Perennial, acaulescent, 5-10 cm tall. Stipules membranaceous, glabrous, at margin ciliate, 3 mm long, at the base 2 mm adnate to the petiole and joined to one another. Leaves 2-4 cm long, petiole short, both petiole and rachis covered with short appressed hairs. Leaflets 6-7 pairs,

obovate or elliptic, 3-4 mm long and 1-2 mm broad, upper surface glabrous, toward margin with scattered hairs, lower surface covered with short appressed hairs. Inflorescens a dense spike or capitate, with 6-7 flowers. Peduncles 4-7 cm long, covered with scattered appressed hairs. Pedicels short, deflexed, pilose. Bracts small, ovate, covered with black and white hairs. Calyx campanulate, ca. 4 mm long, covered with black hairs or mixed with white hairs, the teeth 1/3 length of the tube. Corolla violet, glabrous. Standard 9-10 mm, the limb ovate, ca. 6 mm broad, emarginate at apex, constrict near the claw. Wing-petals 8 mm long, the limb elliptic, minutely emarginate at apex, somewhat longer than claw. Keel 6 mm long, the limb dark violet, elliptic-curved, minutely longer than claw. Ovary glabrous, stipitate. Pods glabrous, stipitate, 9 mm long 3.5 mm high, scattered red spotted, carinate ventrally, straight or sulcate dorsally, unilocular.

Specimens seen:

Esfahan: N. side of Kuh-e Dena, above the village Nogho (WQ4) 3500-400 m, 16.7.1983, Assadi & Abouhanzeh 46167.

Bakhtiari: Zard kuh, Haftnan, 3550 m, 25.7.1973, Riazii 10224.

Lorestan: Ghali Kuh (E. of the pass on the road Aligodarz-shoulabad), 3100-3600 m, 1.7.1977, Runemark & Lazari 26495; Aligodarz, Shoulabad, Ghali-Kuh (US1) 2200-3500 m, 28.8.1982, Mozaffarian & Sardabi 42522.

Fars: Gardaneh Bizhan, kuh-e Dena, 3550 m, 30.7.1973, Riazii 10229; N. side of kuh-e Dena, near Ab-Malakh, 2800-3600 m, 6.8.1978, Assadi & Mozaffarian 31469.

Doubtful species:

The following species, all described by Parsa remain doubtful unless the types have been seen.

A. (Brachylobium) arakensis Parsa

A. (Hemiphragmium) borudjerdicus Parsa

A. (Hemiphragmium) bardsiricus Parsa

Species excluded:

The following species described within the section *Hemiphaca* does'nt belong here:

A. sorkhabadensis Sirj. & Rech.f. (= *Oxytropis kotschyana* Boiss. & Hohen.).

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