

## **Astragalus sect. Alopecuroidei (Fabaceae) in Iran, complementary notes with a key to the species**

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## ***Astragalus* sect. *Alopecuroidei* (Fabaceae) in Iran, complementary notes with a key to the species**

### **Abstract**

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New findings and a key to the 24 species of *Astragalus* sect. *Alopecuroidei* in Iran are provided. Two species, *A. neo-maassoumianus* and *A. foliosus* are described as new to science. *A. alopecurus* is a new record for the flora of Iran. *A. phlomooides* is transferred from *A. sect. Laxiflori* to sect. *Alopecuroidei*. *A. ajubensis* is reduced to a synonym of *A. macrocephalus* subsp. *finitimus* and *A. ovalifoliolatus* to a synonym of *A. kirrindicus*.

### **Introduction**

*Astragalus* sect. *Alopecuroidei* DC. forms a large central group within subgenus *Astragalus* together with several other closely related sections such as *A. sect. Astragalus* L., sect. *Chronopus* Bunge, sect. *Caprini* DC., sect. *Eremophysa* Bunge and sect. *Laxiflori* Agerer-Kirchhoff (Agerer-Kirchhoff 1987, Agerer-Kirchhoff & Agerer 1977, Becht 1978). The species of this central group are usually yellow flowered, have a more or less inflated fruiting calyx and bilocular fruits.

*Astragalus* sect. *Alopecuroidei* was taxonomically revised by Becht (1978) and treated for the “Flora iranica” by Podlech (1999). Studies focussing on *A. sect. Alopecuroidei* in Iran have been carried out by A.-A. Maassoumi and M. Ranjbar since 1991. Several new species were described (Maassoumi & Ranjbar 1994) but could not be incorporated in the “Flora iranica” treatment of the section (Podlech 1999). Also other findings have since been gained by the present authors. Hence, the purpose of this joint contribution is to complement the previous treatments of the section for Iran according to our current knowledge.

*Astragalus* sect. *Alopecuroidei* DC., Prodr. 2: 294. 1825  
= *Alopecias* Steven in Bull. Soc. Imp. Nat. Moscou 29: 143. 1856 ≡ *Astragalus* sect. *Alopecias* Bunge in Mém. Acad. Imp. Sci. Pétersbourg, ser. 7, 11(16): 58. 1868. – Typus: *Astragalus alopecuroides* L.

*Perennial*, caulescent herbs with erect, basifixed, white hairs. *Leaves* imparipinnate, stipules free, or shortly adnate to the petiole but free from each other. *Flowers* mostly large, yellow to brownish or greenish, subsessile, in sessile or pedunculate, globose or cylindrical, very dense axillary inflorescences. *Bracteoles* present or absent. *Calyx* campanulate or more rarely shortly cylindrical, somewhat inflated in fruit. *Standard* with the lamina straight or recurved, glabrous or rarely sericeous; *wings* and *keel* with claws adnate to the base of the staminal tube only; lamina of the keel often large (except *A. subsect. Microtropi*). *Pod* sessile, firm or sometimes membranous or corky, completely bilocular.

### Key to the species of *Astragalus* sect. *Alopecuroidei*

1. Calyx ebracteolate . . . . . 2
  - Calyx bibracteolate . . . . . [A. *hirrindicus* group] 20
2. Inflorescence sessile . . . . . 3
  - Inflorescence stipitate, peduncle 1-7 cm long . . . . . [A. *macrocephalus* group] 11
3. Limb of keel 10-12 mm long, 3-6 mm broad . . . . . [A. *megalotropis* group] 4
  - Limb of keel 6-8 mm long, 2.5-3.5 mm broad . . . . . [A. *alopecurus* group] 5
4. Plant covered with villose hairs; flowers often brownish, calyx teeth 9-15 mm . . . . .
  - . . . . . *A. megalotropis* C. A. Mey. ex Bunge
  - Plant densely covered with pubescent hairs; flowers yellow, calyx teeth 7-9 mm . . . . .
    - . . . . . *A. hamadanus* Boiss.
5. Inflorescence cylindrical, 6-10 cm long . . . . . 6
  - Inflorescence spherical, 3.5-4 cm long . . . . . 7
6. Standard c. 23 mm long, limb obovate; surface of leaflets glabrous . . . *A. alopecurus* Pall.
  - Standard c. 19-20 mm long, limb ovate to elliptic; leaflets hairy on both sides . . . . .
    - . . . . . *A. alopecias* Pall.
7. Stem, peduncle and rachis glabrous . . . . . 8
  - Stem, peduncle and rachis tomentose . . . . . 9
8. Leaflets up to 30 mm long; stipules 15-20(25) mm long; calyx teeth narrowly triangular, 1-2 mm long . . . . . *A. ponticus* Pall.
  - Leaflets up to 15 mm long; stipules 4-6 mm long; calyx teeth subulate, 2-4 mm long . . . . .
    - . . . . . *A. hymenocalyx* Boiss.
9. Leaflets in 10-13 pairs, broadly ovate-elliptic, emarginate at apex . . . . .
  - . . . . . *A. speciosus* Boiss. & Hohen.
  - Leaflets in 20-30 pairs, oblong to narrowly elliptic . . . . . 10
10. Standard pandurate, contracted in middle section; calyx teeth 2-3 mm . . . . .
  - . . . . . *A. foliosus* Podlech, Maassoumi & Ranjbar
  - Standard elliptic-orbicular; calyx teeth 1-2 mm long . . . . . *A. saetiger* Becht
11. Standard sericeous . . . . . *A. turbinatus* Bunge
  - Standard glabrous . . . . . 12
12. Standard elliptic, 23-27 mm long . . . . . 13
  - Standard orbicular to rectangular, shorter than 23 mm . . . . . 14
13. Stem, peduncle and rachis glabrous; leaflets orbicular-obovate . . . *A. phlomoides* Boiss.
  - Stem, peduncle and rachis densely covered with spreading hairs; leaflets ovate-elliptic . .
    - . . . . . *A. neo-maassoumianus* Ranjbar
14. Stem, leaflets, rachis and peduncle appressed-hairy . . . . . 15
  - Stem, leaflets, rachis and peduncle glabrous . . . . . 16
15. Stem, peduncle and stipule densely covered with appressed hairs; leaflets lanceolate, in up to 11 pairs; corolla yellow . . . . . *A. maabudii* Ranjbar
  - Stem, peduncle and stipule laxly covered with appressed hairs; leaflets ovate, in 11-14 pairs; corolla yellow . . . . . *A. zarjabadensis* Ranjbar
16. Peduncle shorter than capitulate inflorescence in diam. . . . . 17

- Peduncle equal with capitulate inflorescence in diam. or longer . . . . . 18
- 17. Stipules longer than 25 mm; corolla shorter than 20 mm, standard rectangular . . . . .  
     . . . . . *A. arasbaranensis* Maassoumi & Ranjbar
- Stipules shorter than 15 mm; corolla 20 mm long, standard orbicular . . . . . *A. jessenii* Bunge
- 18. Leaflets in more than 11 pairs . . . . . *A. macrocephalus* Willd.
- Leaflets in less than 11 pairs . . . . . 19
- 19. Leaflets broadly ovate, obtuse . . . . . *A. schahrudensis* Bunge
- Leaflets lanceolate, acute . . . . . *A. latianicus* Maassoumi & Ranjbar
- 20. Stem, peduncle and rachis densely covered with appressed hairs; leaflets elliptic. . . . .  
     . . . . . *A. echinops* Aucher ex Boiss.
- Stem, peduncle and rachis covered with straight hairs . . . . . 21
- 21. Inflorescence more than 4 cm in diam.; corolla longer than 20 mm . . . . . 22
- Inflorescence less than 4 cm in diam.; corolla shorter than 20 mm . . . . . 24
- 22. Leaflets in 12-16 pairs . . . . . *A. meridionalis* Bunge
- Leaflets in 7-9 pairs . . . . . 23
- 23. Leaflets orbicular or orbiculate, emarginate at apex . . . . . *A. obtusifolius* DC.
- Leaflets ovate, obtuse at apex . . . . . *A. kirrindicus* Boiss. & Noë
- 24. Leaflets hairy on both sides, pyriform; calyx teeth shorter than tube; flowers reddish . . . . .  
     . . . . . *A. sarzehensis* Ranjbar
- Leaflets glabrous above or with some scattered hairs only, orbicular to orbiculate; calyx  
   teeth equal or longer than tube; flowers yellow . . . . . *A. stepporum* Podlech

## New species

### *Astragalus neo-maassoumianus* Ranjbar, **sp. nova**

Holotype: Iran, Khorasan, Bojnoord, Garyolan, Agerghayeh to Khesht, Teloo mountain, 1200 m, 28.6.1994, *Musavi & Lotfai 3495* (TARI).

Differt ab *A. turbinato* Bunge, *A. christophii* Trautv. et *A. grisebachiano* Aitch. & Baker vexillo glabro (nec sericeo), foliolis 7-10- (nec 16-25-)jugis, caulibus dense patenter (nec appresse) pilosis.

*Plantae perennes*, 40-50 cm altae. *Caulis* erectus, densissime pilis brevissimis obtectus. *Stipulae* 10-13 mm longae, herbaceae, lanceolato-lineares, acuminatae, petiolo per 1-2 mm adnatae. *Folia* 10-15 cm longa, petiolo brevissimo, sicut rachis brevissime piloso. *Foliola* 7-10-juga, 16-24 mm longa et 11-17 mm lata, ovata ad elliptica, obtusa, saepe mucronulata, supra glabra vel sparse et imprimis marginem versus pilosa, subtus dense appresse pilosa. *Inflorescentiae* in axillis foliorum superiorum dispositae, rotundato-capitatae, 5-6 cm diametro, pedunculis 6-7 cm longis pilosis suffultae. *Bractaeae* filiformes, 11-13 mm longae, pilosae. *Bracteolae* nullae. *Calyx* 22-25 mm longus, tubulosi-campanulatus, pilis villosis densis 2-3.5 mm longis obtectus, dentibus tubum subaequantibus vel subbrevioribus. *Corolla* glabra, flava-viridula; *vexillum* 23-27 mm longum, lamina elliptica, apice integra, rotundata; *alae* 24-26 mm longae, lamina oblonga, antice rotundata, basi auriculata, 1-1.5 mm longa; *carina* c. 25 mm longa; lamina triangularis. *Ovarium* sessile, dense villosum, stylo usque medio hirtio. *Legumen* ignotum.

### *Astragalus foliosus* Podlech, A.-A. Maassoumi & Ranjbar, **sp. nova**

Holotype: Iran, Azarbayejan, Khalkhal, 18 km on the road, from Khalkhal to Kivi (protected area of Lomber), 1800-2350 m, 21.6.1986, *Maassoumi & Abouhamzeh 56921* (TARI; isotype MSB).

Differt ab *A. pandurato* Bunge foliolis 9-20 × 4-7 (nec 22-40 × 7-15) mm, pedunculis 0-0.5 (nec 2-4.5) cm longis, stipulis 10-13 (nec 16-25) mm, bracteis 7-10 (nec 6-7) mm.

*Plantae perennes*, 40-60 cm altae. *Caulis* erectus, subdensissime pilis brevissimis obtectus. *Stipulae* 10-13 mm longae et 3-4 mm latae, herbaceae, lanceolate-acuminatae, petiolo per 1-2 mm adnatae. *Folia* 15-25 cm longa, petiolo brevissimo 1-3 cm longo, sicut rachis brevissime piloso. *Foliola* 17-22-juga, 9-20 mm longa et 4-7 mm lata, oblongo-ovata vel oblonga, obtuso-rotundata vel emarginata, supra glabra vel sparse et imprimis marginem versus pilosa, subtus dense appresse pilosa. *Inflorescentiae* in axillis foliorum superiorum dispositae, rotundato-capitatae, 3-4 cm diametro, pedunculis 0-0.5 cm longis pilosis. *Bracteae* lineari-lanceolatae, 7-10 mm longae, sparse et imprimis marginem versus pilosae. *Bracteolae* nullae. *Calyx* 14-15 mm longus, tubuloso-campanulatus, pilis villosis densis 2-3 mm longis obtectus, dentibus triangulari-lanceolatis 2-3 mm longis. *Corolla* glabra, flava; *vexillum* 17-22 mm longum, lamina pandurata, apice integra, rotundata; *alae* 24-26 mm longae, lamina oblonga, apice rotundata, basi auriculata, 1-1.5 mm longa; *carina* 13-15 mm longa, lamina triangulari. *Ovarium* sessile, dense villosum, stylo usque 1/3 hirtio. *Legumen* ignotum.

### Revised position of *Astragalus phlomoides* Boiss.

*Astragalus phlomoides* Boiss. is an interesting species restricted to central Iran. For its inflorescence features it was placed in *A. sect. Laxiflori* by Agerer-Kirchhoff & Agerer (1997), with *A. baijiensis* C. Towns. as a synonym. Both species are actually clearly distinct (Table 1) and allopatric, as was already assumed by Maassoumi (1998). The placement of *A. phlomoides* in *A. sect. Laxiflori* is, moreover, doubtful; because of the dense inflorescence and the (secondarily) reticulate seed testa the species is in our opinion much better placed in the *A. macrocephalus* group of *A. sect. Alopecuroidei*. Besides, we have the impression that *A. sect. Laxiflora* is a very artificial taxon and morphologically not actually separable from *A. sect. Alopecuroidei*.

Table 1. Differential characters of *Astragalus phlomoides* and *A. baijiensis*.

<i>A. phlomoides</i>	<i>A. baijiensis</i>
inflorescence ovate to spherical, c. 5 cm	inflorescence cylindrical, c. 10 cm
leaflets in 14-17 pairs	leaflets in 20-32 pairs
standard 25-35 mm long	standard 23-25 mm long
wings and keel 28-30 mm long	wings and keel 22-24 mm long

### New record for the flora of Iran

*Astragalus alopecurus* Pall., Sp. Astrag.: 11. 1800.

= *A. maximus* Willd., Sp. Pl. 3: 1258. 1802.

Specimen seen

IRAN: AZARBAYEJAN: Arasbaran protected area, Doghroon Mts, 2200-2400 m, 24.8.1976, Runemark & Assadi 21939 (TARI); *ibid.*, 2500-2800 m, 13.7.1977, Assadi & Sardabi 24013 (TARI, det. Assadi).

*Note.* – This species was reported by Becht (1978) from the western Alps, Bulgaria, Turkey and Armenia eastwards to China. Because of its flowers and chartaceous stipules it is rather similar to *A. ponticus* Pall. but differs by the long, cylindrical inflorescences and the more or less dense indumentum.

### New synonyms

*Astragalus macrocephalus* Willd., Sp. Pl. 3: 1260. 1802.

= *A. cucullaris* Boiss., Diagn. Pl. Orient., ser. 1, 6: 39. 1846 ≡ *A. macrocephalus* subsp. *cucullaris* (Boiss.) Chamberlain in Davis, Fl. Turkey 3: 189. 1970

= *A. megalacmus* Freyn & Sint. in Oesterr. Bot. Z. 43: 419. 1893.

1. Stipules often subcordate, longer than 35 mm . . . . . subsp. *macrocephalus*  
 – Stipules narrowly triangular, shorter than 25 mm . . . . . subsp. *finitimus*

subsp. *macrocephalus*

Specimens seen

IRAN: Between Jolfa and Ahar, near Jushin, 1250 m, 20.6.1988, *Assadi & Shahsavari 65844* (TARI); Uroumiyeh, Gardaneh-e Ghooshchi, 2000 m, 16.7.1991, *Mozaffarian 70085* (TARI); Uroumiyeh, Maku-Kandi, 10.6.1981, *Tarighi, Ghafari & Amin 1355* (TARI); Salmas, Ghooshchi pass, 1800 m, 5.7.1976, *Amini 6983* (TARI); km 30 W of Uroumiyeh, Silvana, 1650 m, 26.6.1988, *Akbarzadeh 73* (TARI); Uroumiyeh, Ghooyandaghi, 1350 m, 3.6.1974, *Wendelbo, Assadi & Shirdelpur* (TARI).

subsp. *finitimus* (Bunge) Chamberlain in Davis, Fl. Turkey 3: 190. 1970 ≡ *A. finitimus* Bunge in Mém. Acad. Imp. Sci. Pétersbourg, ser. 7, 11(16): 61. 1868 in clave [& 15(1): 102. 1869].

= *A. schuschnanensis* Freyn in Bull. Herb. Boissier 6: 983. 1898.

= *A. oloricus* Manden. in Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk URSS 10: 98. 1947.

= *A. ashuricus* Parsa, Fl. Iran 9: 110. 1966.

= *A. arbelicus* Bornm. in Beih. Bot. Centralbl., B, 57: 281. 1937.

= *A. ajubensis* Bunge in Mém. Acad. Imp. Sci. Pétersbourg 11(16): 61. 1868 in clave [& 15(1): 102. 1869, **syn. nov.**

Specimens seen

IRAN: BAKHTIARI: Sharekord, E of kuh-e Jhanbain, 2100-2400 m, 9.7.1986, *Mozaffarian 57630* (TARI). — ESFAHAN: Natanz to Kashan, 1750 m, 7.6.1986, *Assadi & Bazgosha 56593* (TARI). — FARS: Shiraz, parke Bamu, 1750-2000 m, 14.6.1992, *Mozaffarian 71490* (TARI); Shiraz: 158 km N of Shiraz (Didegan) 16.6.1972, *Karimi 15162* (TARI). — HAMADAN: Yalfan village, 2030 m, 29.5.1972, *Riazi 6244* (TARI); Kabutar-Ahang, Ghohorud, Sarayjogh, kuh-e Siah, 2000-2240 m, 8.6.1988, *Mozaffarian 64642* (TARI); Hamadan to Ghahavand, Biuk-abad to Shahbodagh Mts., W of Aghdagh, 2350 m, 2.6.1988, *Mozaffarian 64463* (TARI); Taghiabad, 2070 m, 9.6.1959, *Pabot 28734* (TARI); 20 km on the road to Malayer, Ecbatan-Sad, S of Yalfan village, 16.5.1983, *Maassoumi 52095* (TARI). — KERMAN: Bardsir, near Lalezar village, 2950 m, 2.6.1982, *Sabahy & Heravi 738* (TARI). — TEHRAN: Between Arak and Khomain, 2600 m, 15.6.1984, *Mozaffarian & Maassoumi 48062* (TARI); Arak, 15 km S of Arak, Shamsabad, 30.5.1986, *Akhani 628* (TARI).

*Note.* – *Astragalus macrocephalus* is one of the most widespread species of the *A. macrocephalus* group. Its subspecies are not well separated geographically. Strong similarities in shape and size of calyx and petals, in habit and in the glabrescence of the leaves indicate a close relationship between the taxa. *A. ajubensis* Bunge perfectly matches *A. macrocephalus* subsp. *finitimus* (Bunge) Chamberlain, and cannot be maintained as a separate species.

*Astragalus kirrindicus* Boiss. & Noë, Diagn. Pl. Orient., ser. 2, 2: 32. 1856.

= *A. rudehendicus* Sirj., Rech. f. & Aellen in Anz. Math.-Nat. Kl. Oesterr. Akad. Wiss. 91: 169. 1954.

= *A. ovalifoliolatus* Maassoumi & Ranjbar in Iran. J. Bot. 7: 42. 1996, **syn. nov.**

Specimens seen

IRAN: BAKHTARAN: Mountains above Kerend, beginning of the road Dalahu, 1700-2000 m, 18.6.1987, *Assadi 60790* (TARI); 40 km from Bisetun to Songhor, E of the main road, Bakktar village, 8.6.1987, 1960 m, *Hamzeheh & Hatami 1121* (TARI). — CHAHARMAHAL-E BAKHTIARI: Lordegan, Sarkhon, Shalile to Douab-e Bazoft and Karon, 1200 m, 27.6.1986, *Mozaffarian 54904* (TARI); road from Lordegan to Brojen, Boldaji, kuh-e chiro Bagh-e chiro, 2220-2600 m, 1.7.1986, *Mozaffarian 57318* (TARI); Shahr-e Kord, Baba-Heidar, 2150-2500 m, 1.6.1986,

*Mozaffarian 54805* (TARI); top mountain of Saldaron from Deh-e Chesmeh W slope, 2200 m, 16.7.1986, *Mozaffarian 57869* (TARI). — ESFAHAN: Semirom, Padena, between Tang-e Rigan and Deh-Bid, 1950 m, 11.6.1983, *Nowroozi 2937* (herb. Esfahari). — KOHGILOUYEH & BOIRAHMAD: Neck mount, between Babameidan and Yasuj, 1800 m, 10.6.1992, *Mozaffarian 71274* (TARI); 5 km S of Sisakht on the road to Iasuj, 2400 m, 17.7.1983, *Assadi & Abouhamzeh 46219* (TARI). — KORDESTAN: c. 25 km SSE of Sanandaj, mountains above the village Narran, 2200-2600 m, 15.6.1987, *Assadi 60377* (TARI); first tunnel, of Sanandaj-Kamyaran Route, 1420 m, 15.5.1986, *Fattahi 1444* (TARI). — LORESTAN: 39 km from Khorramabad on road to Nowjian and Kashvar, 2150 m, 27.6.1977, *Runemark & Lazari 26015* (TARI); 45 km on road from Khorramabad to Nowjian and Kashvar, 1850 m, 27.6.1977, *Runemark & Lazari 26086* (TARI); Khorramabad, 1400 m, 1.7.1970, *Reihani 25142* (TARI); 55 km from Arak to Malayer, 2100 m, 15.6.1984, *Mozaffarian & Maassoumi 48079* (TARI); Oshtorankuh, above the village Tihun, 2000-2500, 12.7.1981, *Assadi & Mozaffarian 37088* (TARI). — HAMADAN: on road of Malayer from Siahkamar to Kordkhorod, Gheshlage Abhenhou, 1900 m, 9.6.1988, *Mozaffarian 64648* (TARI); Nahavand, Borzol, Gian, kuh-e garrin, 1970-2700 m, 14.7.1988, *Mozaffarian 65078* (TARI); Lalejin to Taherlu, Jamshidabad and gonbadan, 1900 m, 8.6.1988, *Mozaffarian 64579* (TARI). — TEHRAN: Arak, Shahzand, Souroneh, 2000-2650m, 17.7.1984, *Mozaffarian 48281* (TARI); 23 km N of Qazvin, Abdollah-abad, protected area, 1680 m, 1.7.1972, *Foroughian 15254* (TARI); Markazi, Qarehchay terzahah, 55 km, NW of Tafresh, 9.6.1974, 1300 m, *Amin & Bazargan 18799* (TARI); Arak, Slope of kuh-e Rasvand from Baba-Khodadad, 2100-2750 m, 10.7.1985, *Mozaffarian 64057* (TARI); Arak, Hesar, kuh-e Rasvand, 2000-3000 m, 18.7.1984, *Mozaffarian 48329* (TARI); Arak to Mahallat, Late-dar, Late-dar Mts, *Mozaffarian & Maassoumi 47966* (TARI); Arak, Toureh, besri, NE of slope kuh-e Aladagh, 2100-3100 m, 11.7.1985, *Mozaffarian 64066* (TARI); Arak, Shahzand, Hafteh-o Emarat, Alimabad, kuh-e Alvand 2100-2800 m, 8.7.1985, *Mozaffarian 63875* (TARI). — ZANJAN: 133 km from Zanzan on the road to Bijar, 1750 m, 17.7.1974, *Assadi & Amini 13581* (TARI).

*Note.* – *Astragalus kirrindicus* is the most variable and widely distributed species in the section. It is known from western, northern and central Iran. Plants with large leaflets were separated previously as *A. ovalifoliolatus* but further studies led us come to the conclusion that plants with large leaflets are connected by numerous intermediates with typical *A. kirrindicus*, making a separation of two species impossible.

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