A taxonomic revision of Astragalus L. (Fabaceae) in Korea

In-Su Choi, So-Young Kim and Byoung-Hee Choi*

Department of Biological Sciences, Inha University, Incheon 402-751, Korea
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한국산 황기속의 분류학적 재검토
최인수·김소영·최병희*
인하대학교 자연과학대학 생명과학과

ABSTRACT: Korean species within the genus Astragalus have been taxonomically revised based on herbarium specimens and field examinations. In this study, we recognized the following eight species and one variety: A. laxmannii subsp. laxmannii, A. dahuricus, A. sikokianus, A. uliginosus, A. schelichowii, A. setsureianus, A. mongholicus var. dahuricus, A. mongholicus var. nakaianus, and A. sinicus. Based on recent taxonomic progress with this genus, their scientific names are being reconsidered. A Korean plant, previously recorded as A. adsurgens, is included in the polymorphic taxa A. laxmannii subsp. laxmannii. Astragalus koraiensis was initially described from Gangwon Province as an endemic species, and it is now regarded as conspecific with A. sikokianus. Furthermore, the taxonomic entities and their morphological characteristics have been clarified for A. schelichowii and A. setsureianus, both of which are not well known in Korea. We provide a key to these species and enumerate their synonymies and taxonomic notes.

Keywords: Korean Astragalus, Fabaceae, taxonomy, morphology, distribution

Astragalus L. (Fabaceae; Papilionoideae; Galegeae) is one of the largest genera of flowering plants, comprising at least 2,300 species that are distributed mainly in northern temperate regions (Polhill, 1981; Lock and Schrire, 2005). Its large size

and the lack of solid intra-generic classifications continue to cause taxonomic confusion at the global and regional levels. Recently, Podlech and Zarre (2013) revised Astragalus with keys, full descriptions, and sectional assignments for almost all of the Old World species. Although this generic framework functions on a global scale, the taxonomic entity of some regionally endemic species as well as their distributional ranges remain unclear. Likewise, the current taxonomic understanding

*Author for correspondence: bhchoi@inha.ac.kr
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of Korean Astragalus species is still far from adequate. Thus, supplementing the Korean Astragalus taxonomy is necessary if researchers are to stay apace with recent taxonomic progress in that genus. The scientific names and numbers of Astragalus species described in Korean floras have long been confused (Chung, 1957; Lee, 1980; Lee W., 1996; Lee Y., 1996; Im, 1998; Lee, 2003; Lee, 2006; Choi, 2007). The species diversity of Korean Astragalus is mostly concentrated in the high mountains of the northern regions, thereby hindering attempts to elucidate its taxonomic entity. Furthermore, the illegitimate or invalid scientific name of some Korean endemic species has made their taxonomy more problematic. Accordingly, anatomical, cytological, and medicinal studies of Korean Astragalus species have relied upon those incorrect scientific names, leading to a lack of consensus between those taxonomic characters and each of the taxa. Although some research has recently been conducted in this regard with Korean Astragalus species (Choi et al., 2013; Han et al., 2013; Song and Heo, 2014), those examinations have primarily focused upon the medicinally important A. mongolicus Bunge and/or have not taken a comprehensive approach. Consequently, the taxonomic entity of most Korean Astragalus species is not well understood.

To improve the scientific knowledge about those species, one must test the newly available taxonomic treatments for Old World Astragalus while also clarifying the morphology, scientific name, and distribution of Korean Astragalus species. Thus, we present here our investigation of Korean species and our review of other studies from a taxonomic perspective.

Materials and Methods

Field samples of Korean Astragalus species were collected from 2002 to 2015 and kept in the herbarium of Inha University (IUI). In addition, morphological examinations were conducted with dry specimens from the following herbaria: Chonnam National University (CNU); Ewha Womans University (EWH); National Institute of Biological Resources, Korea (KB); Kyungpook National University (KNU); Kangwon National University (KWNU); Korea National Arboretum (KH); Sungkyunkwan University (SKK); Seoul National University, College of National Sciences (SNU); Seoul National University, College of Agriculture Life Sciences (SNUA); the Warm-Temperate Forest Research Center, Korea (WTFRC); Tohoku University (TUS); Tokyo University (TI); The New York Botanical Garden (NY); and the Chinese Academy of Sciences, Beijing (PE). We also studied photographic slides of specimens (Lee, 2012) from the herbaria of Kyoto University (KYO) and the National Museum of Nature and Science, Japan (TNS).

All morphological examinations of these herbarium specimens were done with a dissecting microscope. Habitats, growth habits and other features of each species were observed and their photographs were taken in the field. Descriptions for each taxon were based on mature and well-developed plants. In this paper, the terminology concerning plant morphology follows that of Harris and Harris (1994), the Korea National Arboretum (2010), and Beentje (2012). The accepted names were provided according to the International Code of Nomenclature for algae, fungi, and plants (McNeill et al., 2012).

Taxonomic treatment


Korean name: 황기속 Hwang-gi-sok

Herbs or subshrubs, glabrous or hairy; hairs basifixised or medifixised. Leaves oddly pinnate; stipules membranaceous, adnate to petiole or free; leaflets entire, stipels absent. Inflorescences racemes, axillary; bracts small, membranaceous. Flowers with a distinct pedicel; calyx tubular or campanulate, with mostly hairy, 5 teeth subequal or unequal; petals glabrous or hairy, purple or yellow; standard oblong or obovate, reflexed in upper or middle part, emarginate at apex, narrowed at base; wings oblong, with distinct claw, auriculate at lamina base, adhering to keel; keel with distinct claw, obtuse at apex, shorter than wings or as long; stamens diadelphous, vexillary stamen free, remainder connate, anthers uniform; ovary sessile or stipitate, style filiform. Legumes sessile or stipitate, compressed or inflated, unilocular or bilocular, wall membranaceous or coriaceous. Seeds often reniform.

About 3,000 species (8 in Korea) in mostly temperate to boreal regions of the Northern Hemisphere.

A key to Korean Astragalus species

1. Terminal leaflet mostly elliptic to ovate, more than two times as long as wide
2. Corolla purplish
3. Plants with medifixised hairs; standard reflexed in upper part; legumes narrowly ellipsoid to narrowly oblong, straight, 8–10 mm long ........................................ 4. A. laxmannii subsp. laxmannii
3. Plants with basifixised hairs; standard reflexed in middle

**Subsp. laxmannii**

*A. adsurgens* Pallas, Sp. Astrag. P. 40 1800. Type, cited in lectotypification of Podlech (1993), (lectotype, BM seen as photo!).

Korean name: 자주개황기 Ja-ju-gae-hwang-gi

Perennial herb, pubescent with medifixed hairs; stems 15–60 (90) cm long, ascending or erect, 3–4 or more, branched, sulcate, obsoletely pubescent or glabrate. Leaves 3–7 cm long, petiole short; stipules partially connate, foliaceous, broadly acuminate, 3–4 mm long; leaflets subsessile; ovate to ovate-oblong, obtuse, thickish, 4–7 pairs, (5) 7–15 (20) mm long, 3–7 mm wide, glabrous above, sparsely covered beneath with appressed hairs. Inflorescence racemes, 2–4 cm long, 10 to 20-flowered; peduncles erect, 6–8 cm long; bracts small, linear to lanceolate, acuminate, 1.5–2.5 mm long. Calyx 3–4 mm long, campanulate, brown and white hairs, the tube 4–6 times as long as the seatecate subequal teeth. Corolla purplish, 10–12 mm long; standard 9–10 mm long, 5–6 mm broad, oblong-elliptic, reflexed in upper part, retuse at apex, the lamina covered with white hairs; wings 8–9 mm long, oblong-linear, the lamina as long as the claw; keel obtuse, ca. 8 mm long, the lamina narrow, as broad as the wing; ovary short-stipitate, linear; style naked, 5–7 mm long. Legumes erect, narrowly ellipsoid to narrowly oblong, straight, 8–10 mm long, slightly brown (black)-pubescent, bilocular, the beak divergent, cuspidate. Flowering August-September. Fruiting September-October.

Distribution: Kazakhstan, China, Russia (Far East, Siberia), Mongolia, Japan, and Korea.

Korea: Yanggang-do (Mt. Baekdu), Seoul (introduced), and Jeju-do. Bushes and meadows in forests.

Note: The scientific name of *Astragalus adsurgens* Pall. has long been applied to East Asian plants, including specimens found in Korea (Lee, 1980; Lee W., 1996; Lee Y., 1996, Im, 1998; Lee, 2003; Lee, 2006; Choi, 2007). However, recent taxonomic treatments have merged this taxon with *A. laxmannii* Jacq. (Podlech, 1993). This treatment is now broadly accepted for plants from both the Old World (Xu and Podlech, 2010; Podlech and Zarre, 2013) and the New World, i.e., North America (Barney and Welsh, 1996). Furthermore, *A. laxmannii* (= *A. adsurgens*) is now divided into three subspecies (Podlech and Zarre, 2013). The *A. laxmannii* subsp. *laxmannii* is restricted to Old World; the others, to New World. Based on such a species boundary, specimens from North Korea are similar in their gross morphology to other East Asian *A. laxmannii* subsp. *laxmannii*. This plant has also been introduced into Nanji Park in Seoul as a resource for restoration.

However, plants on Jeju Island differ from those on the Asian continent because of several external morphologies, such as leaf size (3–7 cm for Jeju Isl. vs. 5–15 cm for the Continent); leaflet number [9–15 vs. 11–27]; lengths of the inflorescence (2–4 cm vs. 3–20 cm), corolla (10–12 mm vs. 12–16 mm), and calyx (3–4 mm vs. 5–6 mm); and flowering period (Aug.-Sept. vs. Jun.-Jul.). In addition, the plants from Jeju Isl. were once separated from *A. adsurgens* and known as var. *alpinus* (Nakai, 1914) without description (nom. nud.). According to the taxonomic note for *A. caeruleus* Bunge from Podlech and Zarre (2013), the population on Jeju Isl. also might be conspecific to that species. However, wide-ranging natural populations of the species have demonstrated high plasticity of morphological characters and flowering season in East Asia (Podlech and...
Variations within this species have also been observed for cytological features (Hong et al., 1996) and in how plants are cultivated as forage crops (Fu et al., 1982). Although the Jeju population shows a distinct morphology, differences in characteristics have also been described for specimens from China, Japan, and Russia. Moreover, our preliminary DNA analysis reported previously (Kim, 2004) indicated that these plants have close affinity with A. laxmannii subsp. laxmannii. Because it is difficult to separate this variant based merely on external macro-morphology, an adequate treatment will require more abundant and detailed data including information about DNA sequences, karyotypes, and micro-morphology across its entire range of distribution. For now, we have made provisional decisions about those Jeju Isl. plants as this polymorphic species. The description and figure (Fig. 1) presented in this paper is exclusively based on Jeju Isl. plants.


Korean name: 자주황기 Ja-ju-hwang-gi

Annual or biannual herb, pubescent with basifixed hairs; stems (10) 15–55 cm long, erect, sulcate, more or less branched, covered with appressed white hairs. Leaves (3) 4–9 cm long, short-petioled or subsessile, the rachis more or less covered with spreading hairs; stipules lanceolate to lance-linear, acuminate (the upper ones subellipsoid), 4–8 mm long, covered with long hairs; leaflets subsessile, oblone-elliptic or oblone-ovate to lanceolate, short acuminate rarely rounded-obtuse, (4) 5–9 pairs, (7) 10–17 mm long, (2) 3–6 mm wide, glabrous or sparsely hairy above, more or less hairy beneath. Inflorescence racemes, 3–5 cm long, elongating in fruit (7) 10–15 cm, many-flowered; peduncles erect, (1) 2–3 (3.5) cm long, covered with black and white hairs, exceeding the leaves; bracts narrowly linear, 3–4 mm long. Calyx 5–7 mm long, campanulate, white or black hairy; teeth markedly unequal, the three lower ones setiform, 2–3 times the length of the tube, the upper two lance-linear equaling the tube. Corolla purplish; standard 11–14 (15) mm long, broadly ovate, reflexed in middle part; wings 8–9 mm long, oblong, rounded-obtuse, slightly curved, the lamina 3–4 times the length of the claw; keel 10–12 (13) mm long, the lamina broadly triangular, slightly longer than the wings, 4–5 times the length of the claw; ovary subsessile, covered with appressed white hairs. Legumes erect, on a stipe 1.5 mm long, narrowly linear, curved, 15–25 mm long, 2.0–2.5 mm broad, pubescent with appressed or ascending white hairs, bilocular, the beak 1.5–2.0 mm long. Flowering July-August. Fruiting September–October.

Distribution: China, Russia (Far East, Siberia), Mongolia, and Korea.

Korea: Yanggang-do (Mt. Baekdu), Hamgyeongbuk-do, Jagang-do, Seoul-si and Gangwon-do (introduced). Meadows and road sides on mountains of North Korea and anthropogenically disturbed areas in South Korea.

Note: This species naturally grows on mountains in the
northern part of Korea. Plants have also recently been found in Nanji Park in Seoul-si and Hwacheon-dam in Gangwon-do, possibly introduced from China as part of a seed mix used as a protective ground cover for erosion control in that newly constructed area. Most floras record the distribution of this species within Gyeongsangbuk-do of Korea (Chung, 1957; Lee, 1980; Lee W., 1996; Lee Y., 1996; Im, 1998; Lee, 2003; Lee, 2006; Choi, 2007). However, we have found no specimens in South Korea except for recently naturalized populations. This species is easily distinguished from others by its purplish flowers and curved pods.


Korean name: 강화황기 Gang-hwa-hwang-gi

Perennial herb, pubescent with medifixed hairs; stems terete, elongate, ascending above. Leaves 13–25 cm long, petiole 1–2 cm long; stipules free, membranous, lanceolate-triangular, acuminate, 7–14 mm long, sparingly covered with brown hairs; leaflets subsessile, oblounge-elliptic, ovate-elliptic, elliptic, rounded and retuse, 10-14 pairs, 15–25 (28) mm long, 6–10 (13) mm wide, nearly glabrous above, covered with appressed white hair on beneath. Inflorescence short, capitate racemes, 5–10 mm long, densely 10 to 20-flowered; flowers spreading on inflorescence; peduncles erect, 2–6 (8) cm long; bracts lanceolate, nearly as long as calyx, ca. 2 mm wide. Calyx 7–8 (10) mm long, campanulate, loosely white and black-pubescent; teeth 1/3–1/2 as long as the tube, linear. Corolla pale yellow; standard 12–14 mm long; wings 9–10 mm long; keel ca. 8 mm long; ovary sessile, somewhat hairy; style curved; androecium ca. 1.1 cm long, glabrous. Legumes spreading, sub.sessile, coriaceous, abruptly acuminate, compressed, 25–30 mm long, minutely hairy, bilocular. Flowering May-July. Fruiting June-August.

Distribution: Korea and Japan.

Korea: Incheon-si, Gangwon-do, Gyeongsangbuk-do, Jeollanam-do. Growing on seashores, roadsides, river banks, seashore embankments, streams of South Korea.

Note: Astragalus koraiensis Y.N. Lee has been confused with its congener A. sikokianus. The collection date, location, and the site of the herbarium deposit (EWH) for type specimen of A. koraiensis were initially recorded by Lee (1981) but can no longer be traced. Moreover, our attempts to find a type specimen of A. koraiensis in domestic herbaria (including EWH) and/or the exact specimen identified as A. koraiensis by Lee have been unsuccessful.

Despite the lack of a type specimen, the description and photographs of A. koraiensis published by Lee (1981) are unquestionably a match for A. sikokianus, and none of the specimens collected from Korea can be morphologically distinguished from A. sikokianus. A separate, proper taxonomic treatment will be presented in the future, using morphological and molecular evidence for A. sikokianus and related congeners (Choi et al., unpublished).


Korean name: 개황기 Gae-hwang-gi

Perennial herb, pubescent with medifixed hairs; stems 30–80 (100) cm long, erect, usually several, rather sparsely covered with short white or at the nodes mostly mixed black and white hairs. Leaves 10–20 cm long, petiole 1–4 cm long, rachis slender, thinly covered with white or mixed black and white hairs; stipules connate at base, the lower triangular, the upper lanceolate, long-acuminate, membranous, 6–10 mm long, appressed-hairy; leaflets subsessile, oblong-elliptic, obtuse or minutely mucronulate at apex, 10–14 pairs, 1–3 cm long, 0.4–1.5 cm wide, glabrous above, covered beneath with short appressed hairs. Inflorescence elongate racemes, oblong or cylindric, 3–6 cm long, densely many-flowered; flowers spreading on inflorescence; peduncles erect, 10–20 cm long, finely covered with appressed black and white hairs; bracts ovate-lanceolate, finely pointed, as long as calyx, 6–10 mm long, the lamina oval, hyaline, sparsely black-ciliate. Calyx 8–9 mm long, campanulate, covered with short appressed black hairs, short teeth. Corolla pale greenish-yellow, sometimes fading slightly reddish; standard 14–18 mm long, the lamina oval, scarcely angular at base, slightly retuse, 1.5 times as long as the claw; wings 11–14 mm long, the lamina oblong, obtuse or scarcely retuse, about as long as the claw; keel 9–12 mm long, the lamina rounded-gibbose, acutish, as long as the claw, violet-tipped; ovary sessile, glabrous. Legumes obliquely upright, sessile, coriaceous oblong-ovoid or oblong, compressed, 9–13 mm long, 4–6 mm broad, glabrous, bilocular, the beak devaricated, 1.5–2.0 mm long. Flowering June-July. Fruiting July-August.

Distribution: Kazakhstan, Mongolia, N. China, Russia (Far East, Siberia), Korea.

Korea: Yangggang-do (Mt. Baekdu), Hamgyeongbuk-do, Hamgyeongnam-do. Meadows and margins of forests.

Note: This species is distributed widely from Kazakhstan to Siberia, and grows on mountains in the northermost part of Korea.


Korean name: 긴꽃대황기 Gin-kkot-dae-hwang-gi

Perennial herb, pubescent with medifixed hairs; stems 20–40 cm long, finely covered with white hairs. Leaves 9–15 cm long, petiole 1–2 cm long; stipules connate to the middle, thinly scarious triangular, acuminate, 5–11 mm long, sparsely hairy; leaflets subsessile, elliptic to oblong-ovate, round-tipped, often emarginated, 9–12 pairs 10–25 mm long, pubescent. Inflorescence elongate racemes, 2–3 cm long (3–11 cm in fruit), densely 10 to 20-flowered; flowers spreading on inflorescence; peduncles erect, 4–11 cm long (9–15 cm in fruit), covered with hair; bracts lanceolate to ovate-lanceolate, acuminate, as long as or slightly longer than calyx, ca. 2 mm wide, finely covered with mixed hairs; pedicels ca. 1 mm long. Calyx 5–6 mm long, campanulate, black hairy; teeth subulate, 1.0–1.5 mm long. Corolla pale yellow; standard 12–14 mm long, the lamina oval, emarginate at apex; wings 10–11 mm long including the claw (claw c. 5 mm), the lamina oblong; keel 9–10 mm long including the claw (claw ca. 5 mm long); ovary subsessile, pubescent with black and white hairs. Legumes upright, subsessile, coriaceous, oblong, compressed, 10–19 mm long, covered with black and white hairs, bilocular, the beak devaricated, 2–4 mm long. Flowering May-July. Fruit July-September.

Distribution: Russia (Far East, Siberia), China (Jilin Prov.), Korea, Japan.


Note: This species is similar to *A. uliginosus* and has been
classified within the same section, *Uliginosi* A. Gray (Podlech and Zarre, 2013). A Korean distribution was first recorded by Murata (1984) and has since then been confirmed by Lee W. (1996), based on KYO specimens collected from Hamkyungbuk-do. This species is distinguished by its hairy ovaries and pods when compared with glabrous organs from *A. uliginosus* (Komarov, 1904; Shishkin, 1946; Murata, 1984) as well as by its calyces, which are shorter than those from the latter species (Podlech and Zarre, 2013). We examined specimens for these two species from PE, KYO, TNS, and domestic herbaria and found that, in addition to those ovary and pod characters mentioned above, *A. schelichowii* differs from *A. uliginosus* because a leaflet from the former has an emarginate apex and the calyx is 5–6 mm long while the latter has a mucronulate apex and an 8–9 mm-long calyx. Our investigation of various herbarium samples revealed that many specimens of *A. schelichowii* have been misidentified as *A. uliginosus* or *A. laxmannii* (=*A. adsurgens*). Although plants of *A. schelichowii* have not been recorded from China, our field survey verified several such plants in Chinese territory at Mt. Baekdu (Jilin Prov.), along the Korean border (Fig. 2). Therefore, its distribution in China requires further investigation.


![Fig. 2. Photographs of *Astragalus uliginosus* L. (A–C) and *A. schelichowii* Turcz. (D–F). A, D. Plant habit; B, E. Inflorescence; C, F. Fruits on infructescence.](image-url)

Korean name: 설령황기 Seol-ryeong-hwang-gi

Perennial herb, pubescent with basifixed hairs; stems 15–30 cm long, several stems tufted and ascending or erect, sparsely covered with hairs. Leaves 3–6 cm long, petiole short; stipules free, cauleine, green, foliaceous, triangular-ovate, subacute, 4–6 mm long, sparsely hairy especially at the margins; leaflets subsessile, elliptic, usually emarginated, 5–6 pairs, 7–11 mm long, 3–6 mm wide, glabrous above, beneath with white appressed hairs. Inflorescence racemes, 1–2 cm long, densely 5 to 10-flowered; peduncles erect, 5–9 cm long, covered with white and black hairs, sulcate; bracts narrowly lanceolate to lanceolate, shorter than calyx, 2–3 mm long, 1.0–1.5 mm wide, loosely covered with black hairs; pedicels ca. 1 mm long, black hairy. Calyx 5–6 mm long, campanulate, not oblique, loosely to rather densely covered with black hairs; teeth 1–2 mm long, narrowly triangular. Corolla yellow or pale yellow; standard 12–14 mm long, distinctly longer than other petals, the lamina elliptic, emarginate at apex, attenuate to claw, reflexed in middle part; wings ca. 9 mm long including the claw (claw ca. 3.5 mm), the lamina oblong, retuse at apex; keel ca. 8 mm long including the claw (claw ca. 4 mm long), the lamina ca. 3 mm long, subobtuse at apex; ovary subsessile, ellipsoid, glabrous. Legumes pendulous, subsessile, obovoid, rather inflated, 11–12 mm long, glabrous, nearly unilocular, 2 seeded. Flowering July-August. Fruiting August-October.


Note: Although this species was first recorded from Seolryeong Mountain of Hamgyeongbuk-do (Nakai, 1919), little is known about its taxonomic position or morphology. Initial diagnostic characters presented in the protologue for this species included ovaries that were glabrous when compared with a similar congener, *A. frigidus* (L.) A. Gray (Nakai, 1919). However, some ovaries of *A. frigidus* can be glabrous even though most are usually pubescent (Podlech and Zarre, 2013). Therefore, this character is not reliable for separating the two species. Nevertheless, *A. setsureianus* is readily distinguished from *A. frigidus* in its gross morphology, e.g., for leaflet, bract, stipule, calyx, corolla, and legume (Table 1). If one takes into account all of those different morphological combinations, we can then argue that *A. setsureianus* must be accepted as an independent species, in accordance with an earlier treatment by Podlech and Zarre (2013). Alternatively, Korean plants can be inferred as part of a speciation process represented along the distributional margins of an *A. frigidus* complex widely distributed in countries of northern Eurasia (i.e., Europe to Japan).

When describing *A. setsureianus*, Nakai (1919) stated that the keel was 15 mm long. This was also included in the Korean flora of Im (1998). In contrast, we found that the keels from type and other specimens collected from the Mt. Seollyeong measured ca. 8 mm long (Fig. 3). Other morphological descriptions for this species were also ambiguous, especially for fruit characters. This might have resulted because geopolitical positioning reduced the availability of plants that are endemic to North Korea. Therefore, we are presenting an amended full description that relies upon a limited number of specimens.


Table 1. Comparism of morphological characters of *Astragalus frigidus* and *A. setsureianus*.

<table>
<thead>
<tr>
<th>Character</th>
<th><em>A. frigidus</em></th>
<th><em>A. setsureianus</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length/width of leaflet</td>
<td>15–35/7–17 mm</td>
<td>7–11/3–6 mm</td>
</tr>
<tr>
<td>Length of bract</td>
<td>5–10 mm</td>
<td>2–3 mm</td>
</tr>
<tr>
<td>Length of stipule</td>
<td>10–20 mm</td>
<td>4–6 mm</td>
</tr>
<tr>
<td>Calyx (teeth) length</td>
<td>6–9 (10) mm</td>
<td>5–6 (1–2) mm</td>
</tr>
<tr>
<td>Hair on calyx</td>
<td>mainly on teeth</td>
<td>on entire part</td>
</tr>
<tr>
<td>Length of corolla</td>
<td>15–16 mm</td>
<td>12–14 mm</td>
</tr>
<tr>
<td>Legume</td>
<td>pubescent, rarely glabrous; stipe up to 8 mm; narrowly ellipsoid; 10–25 mm long</td>
<td>glabrous; subsessile; obovoid; 11–12 mm long</td>
</tr>
</tbody>
</table>


Perennial herb, pubescent with basifixed hairs; stems 50–100 cm long; erect, ascending, or decumbent, sparsely branched, covered with appressed long white hairs. Leaves 8–12 cm long, short petiolate; stipules free, cauline, green, foliaceous, triangular-ovate, subacute, 5–10 mm long, sparsely vested on the outside with white hairs; leaflets subsessile, narrowly ovate or narrowly oblong, obtuse to retuse or rarely mucronulate at apex, 8–10 pairs, 0.4–2.0 cm long, 5–8 mm wide. Inflorescences racemes, 4–9 cm long, densely 10 to 15-flowered; flowers unilaterally pendent on inflorescence; peduncles 6–9 cm long; bracts narrowly lanceolate to subulate, as long as or shorter than calyx, 3–6 mm long, ca. 1 mm wide, sparsely covered with white hairs on the outside; pedicels 2–3 mm long. Calyx 5–9 mm long, campanulate, strongly oblique, covered with short appressed black hairs; teeth subequal, triangular to narrowly triangular, 0.5–2.0 mm long. Corolla yellowish; standard 15–20 mm long, slightly longer or equal to other petals; the lamina obovate, retuse gradually attenuate, 3–4 times as long as the claw, reflexed in upper part; wings 17–19 mm long; the claw 1.5 times as long as the oblong obtuse lamina; keel equaling the wings, the claw 1.5 times as long as the acute lamina; ovary with a stipe 5–6 mm, hairy. Legumes pendulous, stipitate ca. 1 cm long, membranous, oblong, apex acute, inflated, 3–4 cm long, ca. 1.5 cm wide, sparsely covered with appressed minute hairs, unilocular, 5–7 seeded. stems erect; leaflets 1.5–2 cm long, both surfaces pubescent.

**Key to the varieties**

1. Stems erect; leaflets 1.5–2 cm long, both surfaces pubescent ............................................. **var. dahuricus**

1. Stems tufted and ascending or decumbent; leaflets 4–8 (9) mm long, adaxially glabrous, abaxially pubescent ............................................. **var. nakaiianus**

**Fig. 3. Astragalus setsureianus** Nakai. A. Holotype (*T. Nakai* 7188, TI); B. Fruiting specimen (*T. Nakai* 15557, TI), photo by W.T. Lee.
Type. Russia, Dahuria, without date, *Fischer s.n.* (syntype, G; isosyntype, P seen as a photo!).
Korean name: 황기 Hwang-gi
Stems erect; leaflets 1.5–2 cm long, both surfaces pubescent.

**Distribution.** China, Russia, Japan, and Korea.
Korea: Growing on high mountains of North Korea and cultivated in North and South Korea.

Note: Taxonomic study of two varieties of *A. mongholicus* (var. *dahuricus* and var. *nakaianus*) has been designated as a Korean species (Chung, 1957; Lee W., 1996; Lee Y., 1996; Im, 1998; Lee, 2006) since Nakai listed this for the Flora of Baekdu Mountain (1918). Because that first listing did not present any description or diagnostic characters, it is considered as merely a designation (i.e., nom. nud.) rather than a named species (ICN Art. 38.1, McNeill et al., 2012). Thus, we excluded this designation from the Korean *Astragalus*. Furthermore, our examination revealed that the description and illustration made for this designation by Chung (1957) do not belong to a species within *Astragalus* but instead refer to *Hedysarum vicioides* Turcz. var. *japonicum* (Fedtsch.) B.H. Choi & H. Ohashi. The investigation of Chung’s collection preserved at the SKK herbarium also confirmed that *A. membranaceus var. manshuricus sensu* Chung (1957) is in fact *Hedysarum vicioides* var. *japonicum*. Hence, the posterior Korean flora (Lee W., 1996; Lee Y., 1996b; Lee, 2006) to Chung (1957) also followed that mistake.

In the absence of a type specimen, Lee Y. (1996) described the plant with whitish flowers found at Baekdu Mountain as *A. membranaceus f. albiflorus* Y.N. Lee. Thus, this designation failed to fulfill the requirements for valid publication (ICN Art.40.1, McNeill et al., 2012). The valid publication is needed if we are to accept this plant as a new form of *A. mongholicus*. However, an examination of *A. membranaceus f. albiflorus* photographed by Lee Y. (1996; 2006) showed that the plant may not even be a member of the *Astragalus* genus. Hence, we do not acknowledge this designation as a Korean *Astragalus* species.


Korean name: 제주황기 Je-ju-hwang-gi
Stems tufted and ascending or decumbent; leaflets 4–8 (9) mm long, adaxially glabrous, abaxially pubescent.

**Distribution.** Endemic on Jejudo Isl. Alpine meadow at Mt. Halla on Jeju-do, Korea.
8. Astragalus sinicus L., Mant. Pl. 103, 1767. Type. cited in lectotypification of Van Thuân in Van Thuân et al. (1987), lectotype, LINN seen as photo!.

Korean name: 자운영 Ja-un-yeong

Annual or perennial herb, pubescent with basifixed hairs; stems 10–30 (60) cm long, slender, tufted, ascending from a procumbent branched base, covered with hairs. Leaves (2) 5–15 cm long, petiololate; stipules free to connate at base, ovate, 3–6 mm long, acute at apex; leaflets obovate to obcordate, rounded to emarginated at apex, 3–6 pairs 6–22 mm long, adaxial surfaces subglabrous, abaxial surfaces with sparsely white pubescence. Inflorescences short, capitate racemes, 5 to 10-flowered; peduncles erect, 10–20 cm long, covered with white pubescence. Flowers (1) 2.5 times as long as petals; the tube 2.5 times as long as lanceolate teeth. Corolla reddish purple, rarely white; standard 10–11 mm long, obovate; wings shorter than standard, keel longer than wings; ovary stipitate, glabrous to sparsely white pubescence. Legumes obovate; wings shorter than standard, keel longer than wings; pedicels less than 1 mm, black hairy. Calyx ca. 4 mm long, campanulate, sparsely covered with hairs. Bracts triangular-ovate, ca. 0.5 mm long, loosely covered with hairs. Fruits procumbent branched base, covered with hairs. Leaves (2) 5–10 cm long, petiolate; stipules free to connate at base, ovate, 3–6 pairs 6–22 mm long, adaxial surfaces subglabrous, abaxial surfaces with sparsely white pubescence. Legumes subsessile, erect or ascending in one direction, linear, 2–3 cm long, ca. 4 mm wide, glabrous, bilocular, gradually beaked at apex. Flowering April-June. Fruiting May-July.

Distribution: Native to China and introduced in Korea.

Note: Plants of this species are commonly introduced and cultivated as green manure in rice fields, and are mainly naturalized in southern regions of Korea.

Specimens examined: cited in Choi et al. (2013).

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